How Cool Is Your Schoolyard?™

Student Scientists Explore School Ground Microclimates

In this hands-on, place-based activity, students learn about the ways that outdoor building materials affect local microclimates and people's comfort and health. Classes use infrared thermometers to study the microclimates on their school grounds on hot days and collect surface and air temperature data. Students analyze their data, discuss their findings, and propose tree planting and other design solutions to cool their school grounds where it is most needed.

GRADES 4–12 | SCIENCE, MATH | FIELDWORK | TOOLS REQUIRED

Introduction

Is your schoolyard a comfortable place for children and adults when the weather is warm? How can your school community take action to shade and protect students from rising temperatures due to climate change?

This activity provides a framework for students to study the microclimate conditions on their own school grounds and reflect on the ways in which different building and plant materials shape their experience of temperature outdoors. Students measure temperatures on their campus, analyze their data, and then propose tree planting locations and other design ideas to cool their school grounds where it is most needed.

How Cool Is Your Schoolyard?™ frames climate change and urban heat island-related concepts in a way that 4th to 12th grade students can understand—and at a scale that they can influence. The activity emphasizes their first-hand experiences with schoolyard temperatures and is intended to empower students to see themselves as capable scientists and changemakers who can work together to come up with solutions to address the problems they observe.

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Image caption. *Many materials commonly used on school grounds get incredibly hot when air temperatures rise. Rubber "safety" surfaces made from recycled tires are among the hottest, as shown in the image above.*

This activity is a useful, student-centered design tool for schools that plan to plant a schoolyard forest or create outdoor classrooms and living schoolyards. It is also a good fit for classes that are studying climate change and wish to connect what they learn to temperatures in their own neighborhood.

This activity is designed for 4th through 12th graders (ages 8–18) and can be conducted with varying levels of complexity. Each student research team includes three students. Data can be collected in a single session by one class or span multiple sessions and/or classes.

Rationale

Why school ground temperatures matter

Shifting climate. Many school campuses are already hot and are likely to experience increasing temperatures in the future.

Large-scale impact. School districts are one of the largest land managers in almost every city and town across the United States and around the world. Choices made by schools and school districts about how they manage their land impact the environment and generations of local residents whose perspectives are shaped through daily, outdoor experiences at school.

Health and wellbeing. Almost 50 million K-12 students attend more than 98,000 public schools on an estimated 2 million acres of public land across the United States. Most of these school grounds are covered in asphalt and other materials that heat up in the sun, and they generally lack shade in outdoor areas students use during the school day. This combination leaves vulnerable students unprotected from rising temperatures due to climate change and decreases the wellbeing of students, their communities, and the environment.

Location. Since school grounds sit right outside the classroom door, they are an ideal and convenient laboratory for students to study. They are also at a scale that students can help to change if they find conditions that are not ideal.

Tree canopy equity. Most schools can use more trees—but adding additional shade is particularly urgent in places that have the hottest present and future climates, campuses with the fewest existing trees, and in underserved communities.

Background

Campus design choices influence temperature

Material choices matter. Some materials in our environment capture and store heat from the sun more than others. Many synthetic surfaces, such as asphalt, concrete, rubber, plastic, and metal are among those that trap and store a substantial amount of heat. Some natural materials, such as stone, sand, and soil, also absorb and store heat effectively. By contrast, live vegetation—such as garden plants, trees, bushes, and grass—and dried vegetation—such as wood and bamboo—do not warm up in the sun as much.

Shade matters. Shadows cast by trees, buildings, shade canopies, or other structures block some of the sun's heat and light and reduce the amount of heat that objects absorb from the sun. It is possible to cool surface and air temperatures in outdoor environments by adding shade in strategic locations.

Tree placement matters. Trees are special because they not only provide shade, but they also transpire (give off water vapor through the stomata on their leaves), further cooling temperatures in the area below their branches. It is particularly important to plant trees where students can access them and benefit from them during the school day. This includes outdoor spaces used during their lunch breaks, at recess, and during outdoor instruction. Trees can also be placed where they will provide shade to cool adjacent indoor classrooms.

Three students collaborate to find their team's research locations, measure schoolyard surface temperatures, and record their data.

Many school grounds are covered in acres of asphalt and other materials that heat up in the sun and do not have any shade that students can access during the school day. This is a serious problem that needs to be addressed as the climate warms and extreme heat becomes more common.

Urban heat islands

In urban areas, the materials that absorb the most heat from the sun are also used the most often to cover our landscapes. Asphalt and concrete pave our streets, sidewalks, parking lots, and playgrounds. Rubber, plastic, and metal are used to create benches, railings, play structures, playground fall surfaces, and plastic grass.

When these materials are unshaded, they absorb the sun's heat and then release it back into the air. This process makes our cities warmer than the surrounding rural areas, where the environment is less paved and where living plants more often shade the ground. This urban warming process is called the "urban heat island effect." Places that experience this problem are referred to as "urban heat islands."

Urban heat islands are particularly important to understand as the effects of climate change become more pronounced around the world and temperatures in our cities continue to rise. If we make better choices about the materials we use in our urban environments in the future, we can reduce urban heat island effects and cool our cities. This concept can be put into practice on a small scale on our school grounds, in a way that children can understand, explore, and influence.

Climate oases for schools

The National Schoolyard Forest System℠ envisions a future in which all PreK-12 school grounds include biodiverse forest groves that act as climate oases on hot days—directly shading and protecting students from extreme heat and rising temperatures due to climate change. We invite you to join us in this important initiative! Use the techniques on the pages that follow to conduct research about your campus and take the first step toward a cooler future for your students, school, and community!

For more information about the Schoolyard Forest System℠, please visit our website: greenschoolyards.org/schoolyard-forest-system

Clustering trees together can create a shady, cool schoolyard oasis.

Left: An instructor introduces the activity to the class, showing students a large copy of the Main Map and pointing out the areas they will be studying. Above: Clipboards, maps, data sheets, and thermometers were prepared for the students before the class started.

Materials

For instructors

- 1 large copy of the **Main Map** of the school grounds, printed in color for use outdoors during the activity, as shown above (24” x 36” or larger)

  Use the vertical or horizontal template (linked here) to create a customized version of this Main Map for your own school, as shown in Figure 1 on page 6. If possible, include the whole school property, the immediately adjacent street(s), a north arrow, and a scale bar. Consider laminating the map so it will last throughout the study. Google Earth is one place to obtain an aerial view of your school grounds. Your school districts’ facilities department may also have a base map to use.
- 1 large piece of **cardboard** at least as big as the Main Map, with 4 binder clips to attach it to the cardboard or 1 very **large clipboard** designed for 24” x 36” paper
- 1 set of small assorted **sticker-dots in 10 colors**, ½- to ¾-inch size, to apply to the Main Map. If possible, match the stickers’ colors to the map key in the template.
- 1 fine-tip black **permanent marker** to write on stickers
- **Camera(s)** to record the conditions at each of the research locations and document the data collection process in action

For each team of three students

- 1 **handheld infrared thermometer** for measuring surface temperatures (e.g., the Etekcity Infrared Thermometer 774)
- 1 copy of the **Main Map** of the school grounds with the yellow dots (as in the example above, right), printed in color on 11” x 17” paper. This is the same map used by the instructor, printed at a smaller size for each team.
- 1 copy of the double-sided **Data Sheet** to record findings. The template for the Data Sheet is included on pages 13–14 of this document.
- 2 clipboards
- Writing materials

For the class to share

1 per class (minimum)

- 1 **handheld thermometer** for measuring air temperatures and/or an online app with reliable air temperature readings for your city/neighborhood
- 1 **hygrometer** for measuring humidity

Instructions

Step 1. Identify the research locations

Choose a warm sunny day to walk around the school grounds, visiting outdoor areas typically used by students during the school day.

Identify 30 or more specific “research locations” to measure surface temperatures during the activity. Mark these locations on the Main Map using sequential numbers (1, 2, 3...). (See the yellow dots in Figure 1.)

Include research locations in a variety of microclimates onsite, with a wide range of ground surface materials (e.g., grass, asphalt, rubber). For each type of surface material, select research locations in different microclimates to enable students to analyze how the materials perform under different conditions. Be sure to include some places that receive full sun during the hottest part of the day and other places that stay shaded the whole day.

Spread the research locations around the schoolyard, including some close to the school buildings and play structures and others in the middle of paved areas or sports fields. If your school grounds are large, the research locations may be grouped by “zone,” with different teams of students or classes assigned to study each zone (e.g., the front entrance yard, the main playground, the central courtyard).

Try to include research locations for each type of surface material on your grounds, and designate those locations in pairs so students will be able to contrast temperature readings for each material when it is located in “full sun” versus “full shade.” For example:

- **Pavement:** asphalt, concrete, brick, stone, decomposed granite (packed sand)
- **Play surfaces:** rubber safety surfaces, plastic grass, play structure elements (e.g., slide, platform, etc.)
- **Natural materials:** lawn (natural grass), bare soil, wood chips, mulch, vegetated ground surfaces

If working with students to identify the research locations, observe and discuss the materials onsite. Ask students for their hypotheses and rationale about which places will be warmest versus coolest on a hot day. Students may wish to select additional surface materials and designate new locations to be studied.

When selecting places to study, it is helpful to include adjacent research locations that have the same surface material but different microclimates, in order to study and quantify the difference shade makes on your own school grounds. In the images above, the lawn (top) and the asphalt (bottom) present this type of adjacent sun-shade contrast.

Measure surface temperatures for the materials used in and around play structures, benches, and other permanent site furniture that students use on a daily basis. Measure examples in full sun and full shade, if possible.

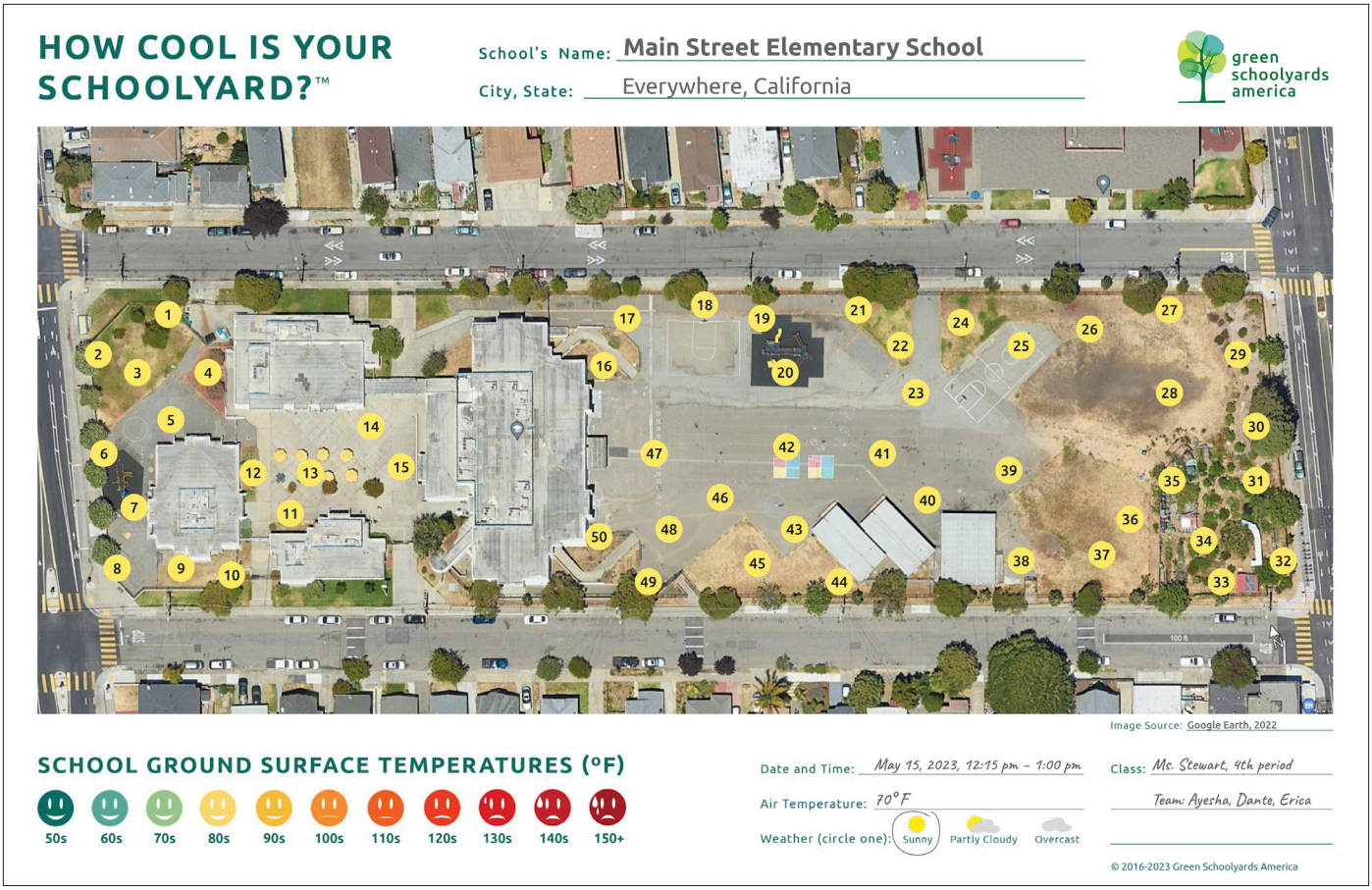


Figure 1. In the sample Main Map above, the yellow circles indicate the numbered research locations across the school grounds. They are shown superimposed on an aerial photograph of the school property. Use the link in the Materials list above to access our templates and create a customized map for your own school. The templates are provided in horizontal and vertical formats and include detailed directions.

Step 2. Establish a data collection period

For a one-session activity, try to plan your data collection period with the students at the hottest time of the day, between 12 noon and 3 p.m., during one of the hottest months of the school year.

If you are able to conduct this research with multiple classes or with one class multiple times, establish fixed intervals for measuring the temperatures at each research location and decide on the overall length of your study. For example, you could decide to take measurements in the same locations once per hour from 9 a.m. to 4 p.m. for a week during the hottest month of the school year. Or, you might decide to take repeated measurements in the same locations, at the same time of day, on days with different kinds of weather (e.g., hot sunny days versus cold overcast days). After-school programs can be included in the research program to extend the study beyond the bell.

Step 3. Prepare the materials

Equip each research team, composed of three students, with the same set of materials, including: one printed copy of the double-sided, standardized data sheet (see pages 13–14), one 11" x 17" printed copy of the Main Map customized for your schoolyard (see pages 15–22), and one infrared thermometer.

Assign research locations (numbered yellow dots) to each student team by filling out the first column on the student data sheets before class begins. We recommend giving each team five to ten research locations. Avoid assigning the same research locations to multiple teams in the same class.

Check the directions on your infrared thermometers at this stage of the preparation process since some models require setup time. If you will be using adjustable thermometers, we recommend setting the emissivity level to 0.95 since that is appropriate for most materials typically measured on school grounds.

Step 4. Begin the study

DEMONSTRATE HOW TO MEASURE SURFACE TEMPERATURES

Show students how to measure surface temperatures. To demonstrate, hold the infrared thermometer at arm's length, pointed down toward the ground surface material you wish to measure. Position the tool within 2 feet of the surface and pull the trigger to take the temperature. Repeat three times at each location and average the results. Ask the class to stand back slightly to avoid measuring their shadows or shoes.

Most tools carry a warning that their beams are harmful to eyes. Remind students not to point infrared thermometers at other people. Be sure to follow all safety directions as outlined in the tools' directions.

Note: The standard infrared thermometer listed in the Materials section on page 4 does not measure white or reflective (metal) surfaces as accurately as other surface types. To measure those surfaces, use a tool with adjustable emissivity settings.

MEASURE HUMIDITY

Use the hygrometer to measure humidity with the class. Record this information on the students' data sheets.

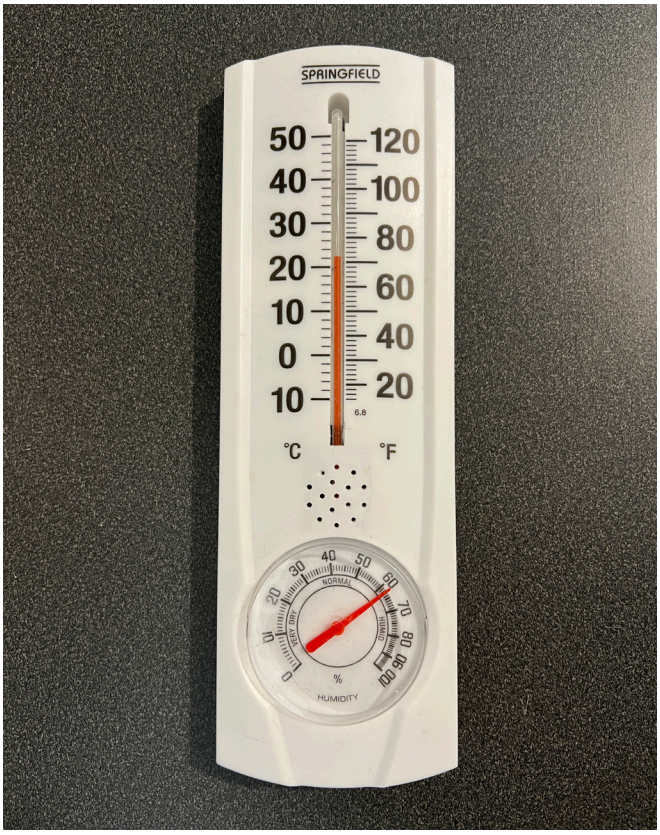
MEASURE AIR TEMPERATURE

We recommend collecting air temperatures from two sources. As the class begins their data collection, use a standard weather app to look up the current temperature for your location. Record this temperature and the information source on the students' data sheets.

We also recommend using a standard thermometer to get a site-specific air temperature measurement for your school grounds. Place a standard thermometer in the shade (not in the sun). Wait a full 10 to 15 minutes before recording the air temperature reading. Record this temperature and the information source on the students' data sheets. Use the same location for air temperature measurements each time the class goes outside to conduct their research. For example, you might decide to always measure the air temperature in the shade outside the school's office.

Above: Students use infrared thermometers to measure surface temperatures on their school grounds.

Below: There are many types of tools that can be used to measure air temperature and humidity, including the inexpensive model below.



Students work in teams of three to gather temperature data at their assigned research locations.

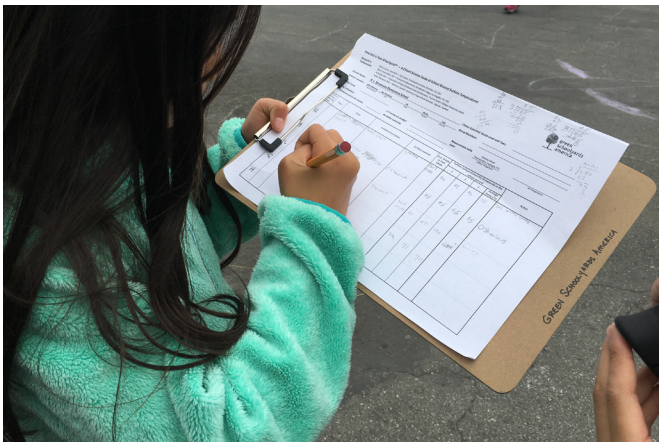
Step 5. Collect data

Organize students into teams of three. One student will carry the Main Map and identify the research locations while the team is outdoors. The second student will use the infrared thermometer to measure surface temperatures at each research location. The third student will record the temperatures and other information on the data sheet.

Students will take readings in five to ten different locations, following the points assigned by their instructor, noted on their team's data sheet. They will take three surface temperature readings at each location since the data may vary slightly each time. These measurements will be averaged later during the data analysis step. Younger students may need an adult to accompany them while they collect data. Older students may be able to collect data on their own.

When they have completed their assigned research, encourage the students to engage in independent inquiry by identifying and testing additional research locations that pique their curiosity. Students can add their new data points to their Main Map and data sheet, labeling them with letters (e.g., A, B, C) to distinguish them from the assigned, numbered research locations.

Above: Students work with their team members to find their next research location. Below: A student records the team's data.



Step 6. Analyze the findings

CALCULATE AVERAGE TEMPERATURES

After students have collected all of their data, they will calculate the average surface temperature for each research location and record those average temperatures on the data sheet.

ANALYZE THE DATA

Gather the class in a comfortable location outdoors near the areas you are studying. Place the instructor's Main Map (24" x 36" copy) in a location that is clearly visible to all of the students.

Begin to compile the data from all of the student research teams by applying color-coded sticker dots to the Main Map, noting the temperatures the students found on each one. (See the example in Figure 2.) When all of the data are on the map, discuss any visible patterns with the students. Take a photograph of this dot-covered map to record the class's results. This is particularly important if you plan to remove the dots and use the same map for the next group of students.

A student works on their team's data sheet during an outdoor session.

For further analysis, use the discussion prompts on the next page to help students better understand their data and consider the ways their findings could be useful for the school. After identifying initial themes and patterns, students may use age-appropriate charts and graphs to analyze and visualize the data more deeply. When their analysis is complete, ask students to summarize their findings in a written report to share with the school community.

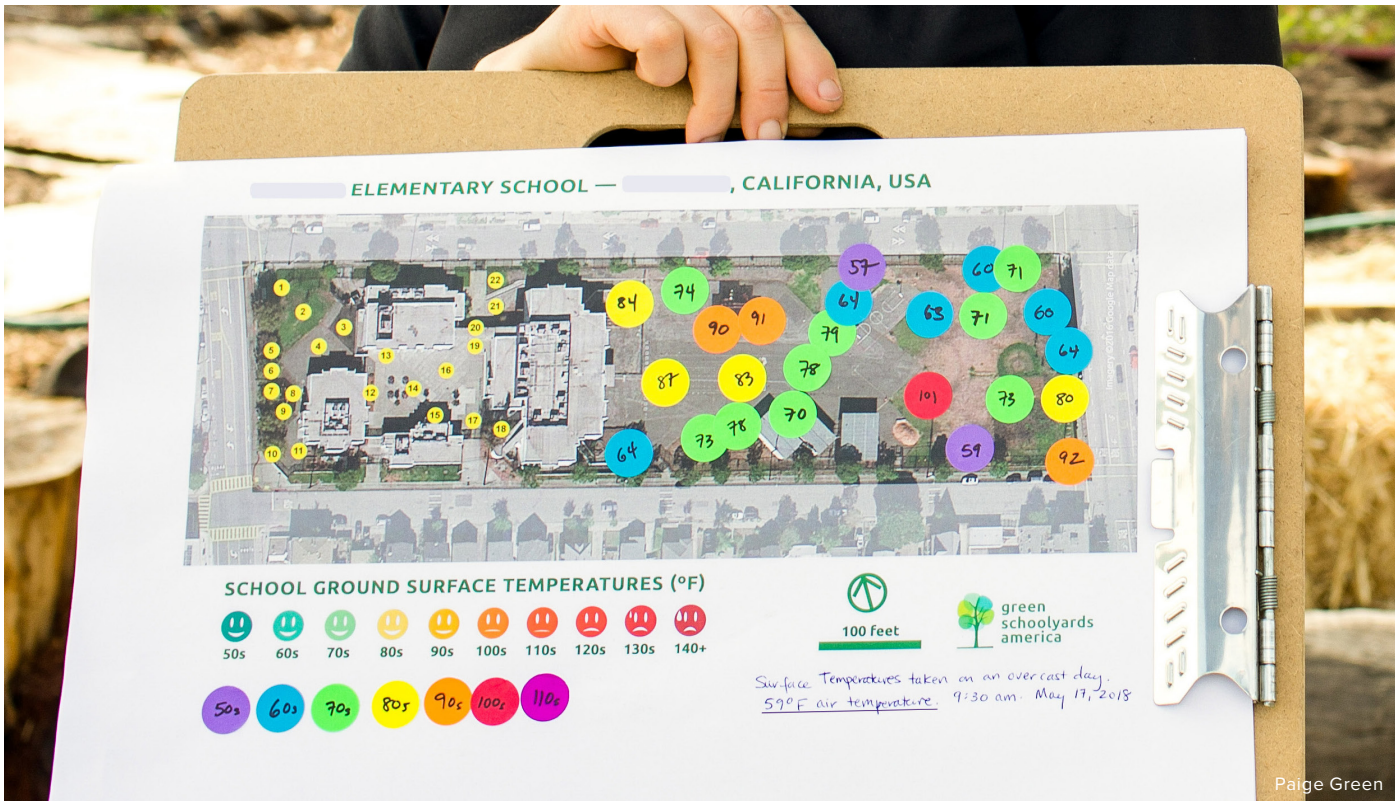


Figure 2. *This is an example of a Data Summary Map, created with color-coded sticker dots placed on top of the original Main Map (with yellow dots). Each colored sticker corresponds to a temperature bracket and includes the hand-written temperature that was recorded by the student research teams for each research location. The map shown here was created with students outdoors on the school grounds, immediately following the data collection process. Recording the students' findings this way provided an immediate, visual representation of the aggregated data the whole class had gathered while they worked in separate teams, and it encouraged a lively discussion that led to deeper understanding of the lesson.*

CLASS DISCUSSION PROMPT SUGGESTIONS

- Which areas of the school grounds were the warmest? Which areas were the coolest?
- Which types of ground surface materials and conditions were consistently the warmest? Coolest? Which materials were warmer (or cooler) than the air temperature?
- What was the widest range of temperatures students found during a single data collection period? For example, if the ground temperature under a tree was 58°F and the rubber safety surface was 140°F at the same time, then the range in temperature for those materials was 82°F.
- Were any of the research locations students measured unpleasantly or dangerously hot? Ask students to describe their experiences in those locations. Was it comfortable to spend time there?
- Why might there be variability in the three measurements at each research location?
- How do the same materials perform under different types of conditions? (e.g., sun versus shade, sunny versus cloudy weather)
- Can you quantify the value of shade/tree canopy for your school grounds? On average, how much cooler were asphalt surfaces when shaded by tree canopy versus exposed to full sun?
- Did temperatures under the tree canopy differ in any way from the temperatures on the same ground surface materials under artificial shade structures? Does the shade feel different?

Step 7. Propose design solutions

As a concluding activity, ask students to generate ideas about how to cool the hottest temperatures on their school grounds.

- What would it take to ensure that the whole school ground has a comfortable climate?
- Which places on the school grounds do students feel should be the highest priority for adding shade to reduce areas with extreme heat?
- What do they suggest that the school do to cool the hot spots?

If possible, invite students to present their data and findings to the school principal and school district administration, along with a proposal for potential solutions to address the problems they identified.

Tip: Ensure that the students' design proposal identifies a range of locations that they agree are high priorities for shade, based on their findings, and includes their recommendations for targeted tree planting efforts to create or increase a schoolyard forest climate oasis onsite.

There are often hidden constraints (e.g., fire truck emergency access lanes, underground utility lines) that school and district leaders must work with as they consider changing outdoor infrastructure, so providing multiple options makes it easier for them to say "yes" and implement (at least some of) the students' recommendations.

Planting shade trees is an excellent way to reduce temperatures on school grounds across the country. This is a solution that works in all climates.

Step 8. Follow up

ONGOING DATA COLLECTION

This temperature measurement study can be repeated annually with new groups of students to teach the overall concepts. The activity is also intended to be used to track the progress of tree planting efforts or other design solutions that are implemented over time.

In an ideal situation, school and district leaders will take students' findings about high temperatures seriously and will decide to act on the students' recommendations to reduce temperatures in the hottest locations onsite.

If new trees are planted as a result of students' research findings, it is particularly important to repeat this activity on an annual basis, visiting the same research locations, to track their solution's progress toward a cooler schoolyard as trees grow over time and other heat-reduction actions are taken.

SHARE YOUR RESULTS

When your school ground study is complete, please consider sharing your results with Green Schoolyards America. We would love to see what you found. Please let us know, too, if participating in this activity is helpful for your school! We are particularly interested in hearing about any progress toward cooling the surface temperatures the students found during their research.

Contact: howcool@greenschoolyards.org

ADDITIONAL RESOURCES

- Green Schoolyards America, *Schoolyard Forest System℠ Resource Library*
- U.S. EPA, *Heat Island Effect*
- U.S. EPA, *Using Trees and Vegetation to Reduce Heat Islands*

NEXT GENERATION SCIENCE STANDARDS

Disciplinary Core Ideas

- Earth's Systems
- Earth and Human Activity
- Energy
- Matter and Its Interactions

Crosscutting Concepts

- Cause and Effect
- Patterns
- Structure and Function

Science and Engineering Practices

- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Observing, Evaluating, and Communicating Information

NATIONAL SCHOOLYARD FOREST SYSTEM℠

The National Schoolyard Forest System℠ seeks to create schoolyard forests across PreK-12 public school grounds nationwide to directly shade and protect students from extreme heat and rising temperatures due to climate change. This initiative was founded by Green Schoolyards America, and launched with California as the first state in partnership with the California Department of Education, the California Department of Forestry and Fire Protection, and Ten Strands.

For more information, visit:
greenschoolyards.org/schoolyard-forest-system

National Schoolyard Forest System℠

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Appendix

DATA SHEET TEMPLATE

PAGES 13–14

The Data Sheet Template includes two pages that are intended to provide teachers with some flexibility with regard to the number of research locations they assign to each student team. Classes with young students or limited time for data collection may decide to use the first page alone, while others with older students or more time may elect to print both data sheets for each team.

INTERACTIVE MAP TEMPLATES

The Interactive Map Templates for *How Cool Is Your Schoolyard?*™ are available online via the links listed below. The templates are provided in both horizontal and vertical formats to accommodate school properties with different shapes. Please select the format that is the best fit for the school ground you are studying. This PDF document includes reference copies of the Interactive Map Templates but we recommend using the online versions to customize the map for your school.

HORIZONTAL FORMAT

PAGES 15–18

- Click here to access the online Interactive Map Template: Horizontal Format

VERTICAL FORMAT

PAGES 19–22

- Click here to access the online Interactive Map Template: Vertical Format

How Cool Is Your Schoolyard?™ — Data Sheet

Students' Names: _____

School's Name: _____

School's Location: _____
City *State* *Country*

Air Temperature: _____ Humidity Level (%): _____
(In shade)

Today's Weather:


Sunny


Partly Cloudy


Overcast

_____
Weather Notes

Today's Date: _____

Grade Level/Class: _____

Start Time: _____

Types of Measurement Tools Used Today:

_____
Surface Temperature Tool

_____
Air Temperature Tool

_____
Humidity Tool

Research Location Number	Time	Research Location Description or Name (e.g., playground, garden, kindergarten yard)	Type of Surface Material on the Ground	Exposure: Full Sun or Full Shade	Surface Temperatures (°F) at Each Research Location				Notes
					1	2	3	Average Temp (°F)	

How Cool Is Your Schoolyard?™ — Data Sheet

Students' Names: _____ Today's Date: _____

Research Location Number	Time	Research Location Description or Name (e.g., playground, garden, kindergarten yard)	Type of Surface Material on the Ground	Exposure: Full Sun or Full Shade	Surface Temperatures (°F) at Each Research Location				Notes
					1	2	3	Average Temp (°F)	

How Cool Is Your Schoolyard?™

Directions for Customizing the Online Interactive Map Template

This online map template is a key component of Green Schoolyards America's *How Cool is Your Schoolyard?™* activity, intended for students in grades 4–12. The template is designed to allow educators to add their own school ground map, titles, and other information needed to conduct a schoolyard temperature study.

THIS IS A REFERENCE COPY OF THE ONLINE TEMPLATE. PLEASE USE THE ONLINE VERSION.

NOTES

Click here to download a complete copy of *How Cool Is Your Schoolyard?™*.

There are two versions of the online Interactive Map Template. This document is the **Horizontal Template**, designed to be used with school ground maps that have a long, narrow, landscape orientation. If your school ground map is square or is oriented vertically, we recommend that you use the **Vertical Template** instead.

The Interactive Map Templates are in Google Slides format, so we refer to the pages of each template as "slides". Since these templates are read-only, please download your own copy before you enter data about your school.

TABLE OF CONTENTS FOR THIS TEMPLATE

Directions

1. **Decide whether to use the Horizontal or Vertical Interactive Map Template.** Select the template that provides the best fit for the shape of your school grounds and the map or aerial photo you will use. Download a copy of the template you select in Google Slides format.
2. **Review the examples** on Slides 2 and 3 to better understand the two maps you can produce with this template.
3. **Use the blank template on Slide 4 to begin customizing** your "Main Map" with your school's name and location.
4. **Add a school ground base map**, aerial photograph, or an accurate diagram of the grounds by clicking on the grey box in the center of the template on Slide 4. The image size that works best for the horizontal template is: 16" x 7.25" or 3200 x 1450 pixels. Resize and/or crop the image after you add it, if needed.
5. **Add the image credit/source** at the bottom right of the template, below the image.
6. **Scroll to the left margin on Slide 4** to access the movable yellow dots and additional directions. (This is only available in Google Slides format.)
7. **Mark the temperature research locations** on your Main Map using the yellow dots found in the left margin. Working with one number at a time, place the yellow dots on top of your map to identify the locations you would like students to measure the ground surface temperatures.

   Tip: It is helpful to assign each student research team to measure a short, consecutive sequence of data points. Consider placing consecutive numbers near one another on the map to simplify the data collection process.
8. **Print copies of your Main Map for the student research teams.** Make one 11" x 17" copy for each group of three students. (This is the map with the yellow dots denoting research locations.)

   Make one additional, larger copy of the Main Map for use by the instructor during the activity. We recommend enlarging the map to fit on a 24" x 36" page. Printing the map in color will make the numbers easier to see when used at any size but is not required.
9. **Ask the student research teams to add the remainder of the information** to their printed copy of the map as they begin the activity with their group.
10. **Conduct the activity** with your class(es). Analyze and then aggregate your data for use on a Data Summary Map.
11. **Create the Data Summary Map** to compile the results of the student mapping exercise for class and/or public presentations. Begin by duplicating your completed Main Map in this template (Slide 4), and work on the new slide, which will become Slide 5. Refer to the notes in the right margin of Slide 5 (visible only in Google Slides format), and use the movable temperature dots found there to illustrate your data.

    When complete, the Data Summary Map can be used to explain the students' findings in presentations to the class, principal, school board, teachers, and/or parents. We would also love to see your results!

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SAMPLE – MAIN MAP WITH RESEARCH LOCATIONS

HOW COOL IS YOUR SCHOOLYARD?™

School's Name: **Main Street Elementary School**

City, State: Everywhere, California

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Image Source: Google Earth, 2022

SCHOOL GROUND SURFACE TEMPERATURES (ºF)

50s 60s 70s 80s 90s 100s 110s 120s 130s 140s 150+

Date and Time: May 15, 2023, 12:15 pm – 1:00 pm

Class: Ms. Stewart, 4th period

Air Temperature: 70 ° F

Team: Ayesha, Dante, Erica

Weather (circle one): Sunny Partly Cloudy Overcast

HOW COOL IS YOUR SCHOOLYARD?™

School's Name: **Main Street Elementary School**

City, State: Everywhere, California

green schoolyards america

Image Source: Google Earth, 2022

SCHOOL GROUND SURFACE TEMPERATURES (°F)

50s 60s 70s 80s 90s 100s 110s 120s 130s 140s 150+

Date and Time: May 15, 2023, 12:15 pm - 1:00 pm

Class: Ms. Stewart, 4th period

Air Temperature: 70 °F

Aggregated data from all student research teams

Weather (circle one): Sunny Partly Cloudy Overcast

HOW COOL IS YOUR SCHOOLYARD?™

School's Name: _____

City, State: _____

green schoolyards america

Image Source: _____

SCHOOL GROUND SURFACE TEMPERATURES (ºF)

Date and Time: _____ Class: _____

Air Temperature: _____

Weather (circle one): Sunny Partly Cloudy Overcast

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Directions

1. **Decide whether to use the Horizontal or Vertical Interactive Map Template.** Select the template that provides the best fit for the shape of your school grounds and the map or aerial photo you will use. Download a copy of the template you select in Google Slides format.
2. **Review the examples** on Slides 2 and 3 to better understand the two maps you can produce with this template.
3. **Use the blank template on Slide 4 to begin customizing** your "Main Map" with your school's name and location.
4. **Add a school ground base map**, aerial photograph, or an accurate diagram of the grounds by clicking on the grey box in the center of the template on Slide 4. The image size that works best for the vertical template is: 10" x 11.25" or 2000 x 2250 pixels. Resize and/or crop the image after you add it, if needed.
5. **Add the image credit/source** at the bottom right of the template, below the image.
6. **Scroll to the left margin on Slide 4** to access the movable yellow dots and additional directions. (This is only available in Google Slides format.)
7. **Mark the temperature research locations** on your Main Map using the yellow dots found in the left margin. Working with one number at a time, place the yellow dots on top of your map to identify the locations you would like students to measure the ground surface temperatures.

   Tip: It is helpful to assign each student research team to measure a short, consecutive sequence of data points. Consider placing consecutive numbers near one another on the map to simplify the data collection process.
8. **Print copies of your Main Map for the student research teams.** Make one 11" x 17" copy for each group of three students. (This is the map with the yellow dots denoting research locations.)

   Make one additional, larger copy of the Main Map for use by the instructor during the activity. We recommend enlarging the map to fit on a 24" x 36" page. Printing the map in color will make the numbers easier to see when used at any size but is not required.
9. **Ask the student research teams to add the remainder of the information** to their printed copy of the map as they begin the activity with their group.
10. **Conduct the activity** with your class(es). Analyze and then aggregate your data for use on a Data Summary Map.
11. **Create the Data Summary Map** to compile the results of the student mapping exercise for class and/or public presentations. Begin by duplicating your completed Main Map in this template (Slide 4), and work on the new slide, which will become Slide 5. Refer to the notes in the right margin of Slide 5 (visible only in Google Slides format), and use the movable temperature dots found there to illustrate your data.

    When complete, the Data Summary Map can be used to explain the students' findings in presentations to the class, principal, school board, teachers, and/or parents. We would also love to see your results!

THIS IS A REFERENCE COPY OF THE ONLINE TEMPLATE. PLEASE USE THE ONLINE VERSION.

National Schoolyard Forest System℠

green schoolyards america

HOW COOL IS YOUR SCHOOLYARD?™

green schoolyards america

School's Name: Main Street Elementary School

City, State: Everywhere, California

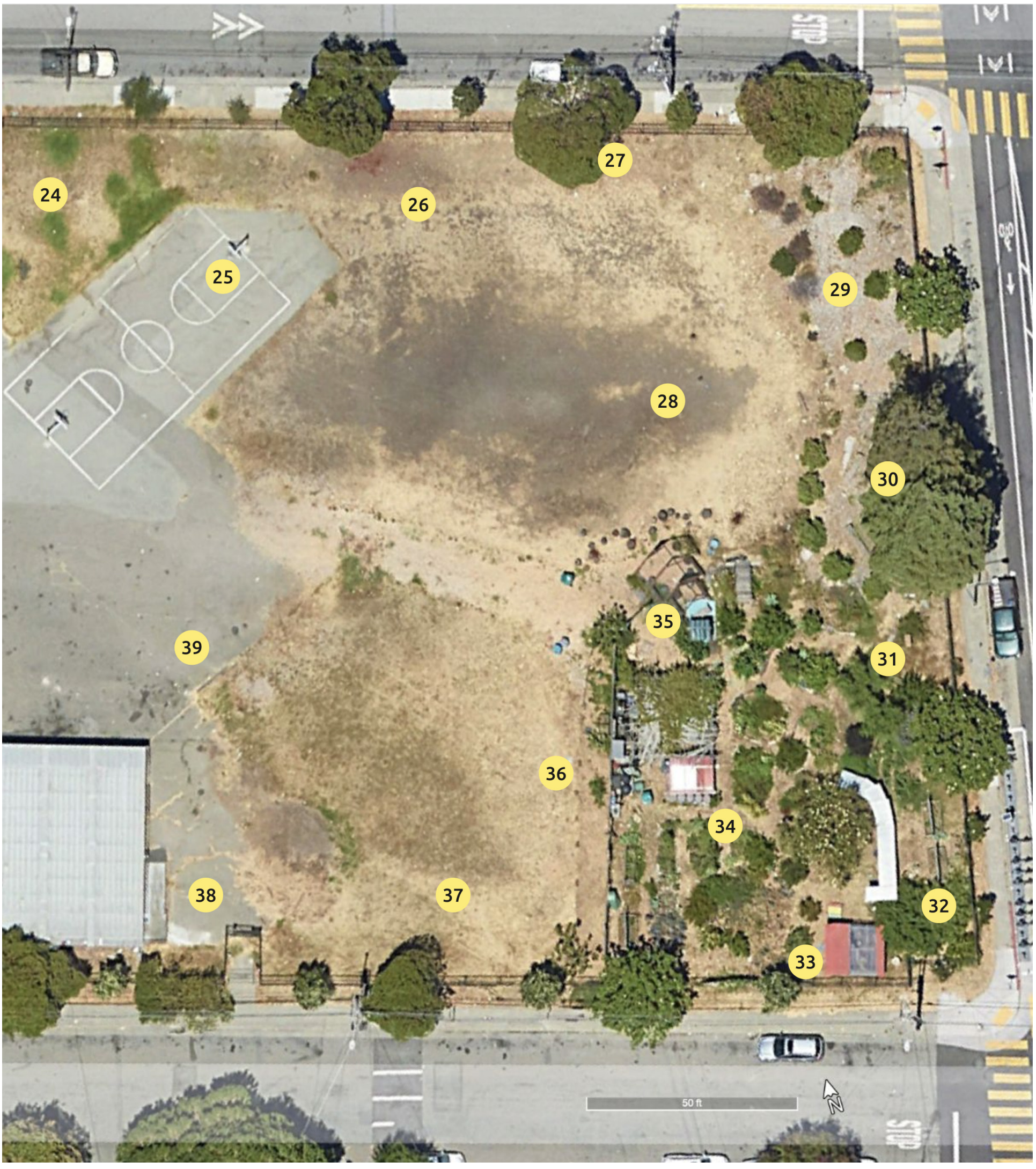


Image Source: Google Earth, 2022

SCHOOL GROUND SURFACE TEMPERATURES (ºF)

50s 60s 70s 80s 90s 100s 110s 120s 130s 140s 150+

Air Temperature: 70 ºF

Weather Conditions (circle one): Sunny Partly Cloudy Overcast

Date: May 15, 2023

Time: 12:15 pm – 1:00 pm

Class: Ms. Stewart, 4th period

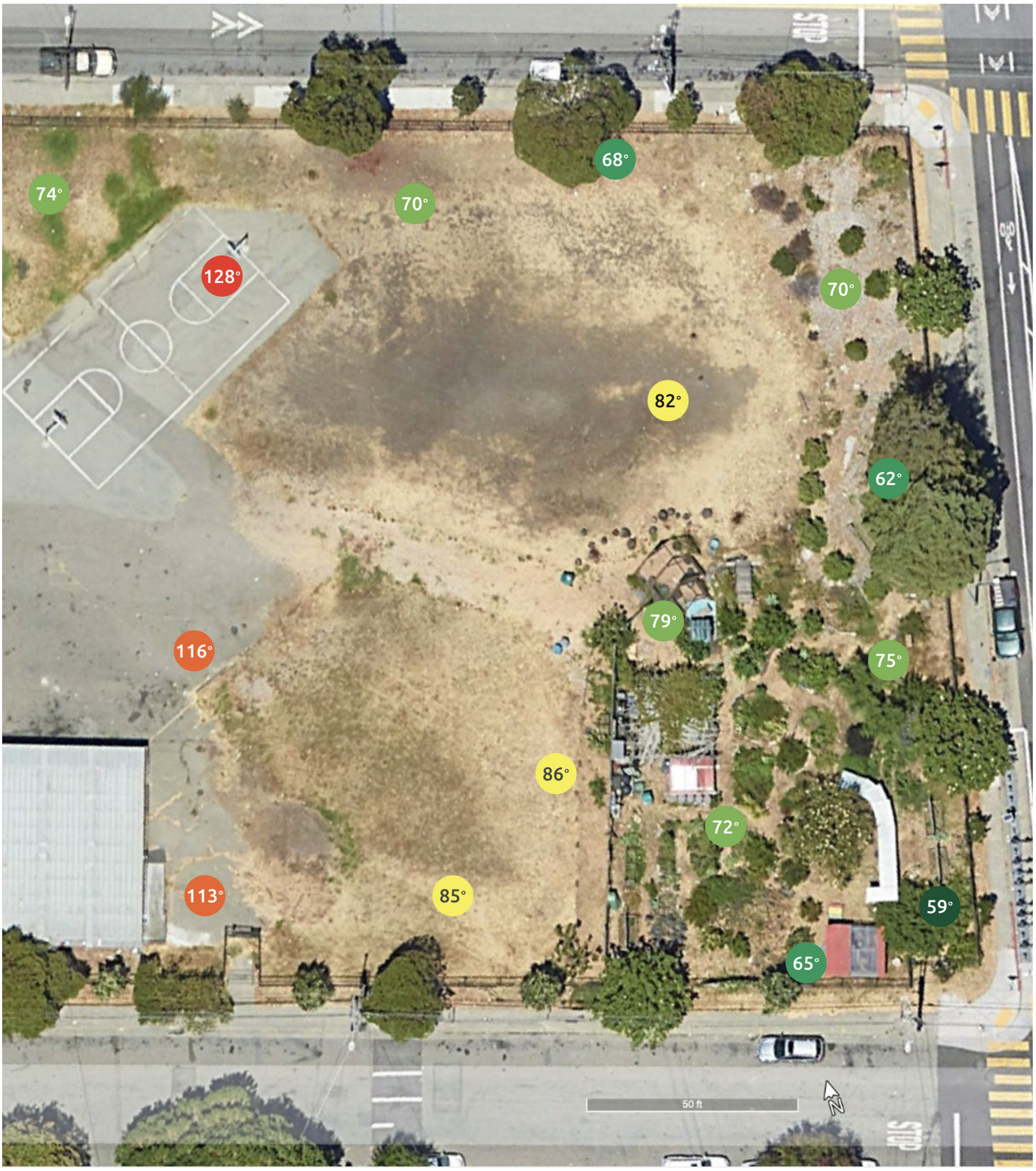
Team: Ayesha, Dante, Erica

HOW COOL IS YOUR SCHOOLYARD?™

green schoolyards america

School's Name: Main Street Elementary School

City, State: Everywhere, California



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Aggregated data from all student research teams

HOW COOL IS YOUR SCHOOLYARD?™

green schoolyards america

School's Name: _____

City, State: _____

SCHOOL GROUND SURFACE TEMPERATURES (ºF)

Air Temperature: _____ ºF

Weather Conditions (circle one): Sunny Partly Cloudy Overcast

Image Source: _____

Date: _____

Time: _____

Class: _____

_____

_____