

Preparing for a Hotter Philadelphia

ACTIVITY TYPE: Hands-on exploration

AUDIENCE: All ages

TIME FRAME: 5-10 minutes

SUMMARY:

The Ready Row Home kit is a model urban streetscape that invites learners to explore ways to prepare for living in a hotter Philadelphia. Guests will learn that climate change means hotter temperatures in Philadelphia and how green infrastructure – like trees and gardens – can help reduce temperatures on their block.

MATERIALS:

1. Model Ready Row Home
2. Heat lamp and stand
3. Extension cord
4. Infrared (IR) thermometer
5. Black tiles for street and roof
6. Tree parts; 2 plastic bases and 2 round green sponges
7. Small container of water (for moistening sponges)
8. Liquid crystal “people”

SET UP:

1. Set up lamp stand so that the base is underneath the Ready Row Home (to avoid tipping). Attach lamp so that it is shining down on the roof and street of model. **Note: The heat lamp’s light is fairly directed, so it doesn’t heat the entire model evenly. You can talk about the limitations of the model, or if visitors are interested, point the heat lamp temporarily at another area to see what happens.**
2. Place tiles on roof and street.
3. Set up one tree on sidewalk using tree base and one dampened sponge. **Note: Check dampness of sponges frequently during the activity and refresh as needed.**

4. Place liquid crystal “people” on sidewalk – one beneath the tree and one directly under the heat lamp.
5. Turn on heat lamp ~10 minutes before starting the activity to allow materials to reach maximum temp. **Note: Roof tiles may become very hot. Do not let guests touch roof tiles.**

PROCEDURE:

1. Engage guests in conversation by asking how they think climate change is impacting Philadelphia.
 - a. Many guests will be familiar that climate change means hotter temperatures.
 - b. Here’s a standard script: *Climate change means it’s going to be getting hotter in Philadelphia. Currently, Philadelphia experiences around 26 days over 90°F on average. With climate change, scientists project an average of as many as 47 days over 90°F by the 2020s. That’s three more weeks of being sweaty and uncomfortable, not to mention more serious problems like asthma attacks and heat stroke. This is especially a problem for us here in the city. You might have noticed on weather reports that the city is usually already several degrees warmer than areas around it. Let’s see if we can figure out why.*
2. Introduce the Ready Row Home as a model of a typical Philadelphia block. Explain that you’re using the heat lamp to simulate the conditions of a summer heat wave.
3. Ask guests about where they think the warmest and coolest spots on the block might be.
4. Give guests IR thermometer(s) and instruct them on how to use it. **Note: Warn guests that the laser can damage eyesight and to only point it at the Ready Row Home.**
 - a. To operate the thermometer: Aim the thermometer at a location on the Ready Row Home and press the trigger
5. Ask your guests where they measured the hottest and coolest temperatures
 - a. The coolest temperatures should be found underneath the tree. Ask your guests, “Why?” Here’s a standard script: *What makes the tree so much cooler? (Touch top of tree—what do you feel?) Trees and other plants have water in them. They use heat energy to evaporate this water in a process called evapotranspiration; a fancy name for tree sweat. This “tree sweat” cools them down, AND the air around them. Kind of like the way sweat helps our bodies cool down.*
 - b. Darker colored materials should also register relatively higher temperatures. Ask your guests, “Why?” Here’s a standard script: *Do you notice temperature differences between different colored materials? Dark colors absorb heat from the sun. Light colors, reflect it. The materials and colors we choose to build with impact how hot our city can get.*
6. Point out the liquid crystal “people” and ask your guests, “What places made them too hot? Where might they stay coolest on a hot summer’s day?”

- a. **Note: These figures are made of a heat-sensitive material that will change temperature from black to green when they reach ~90 degrees F. The figure beneath the tree should remain unchanged, but the figure exposed directly beneath the heat lamp should have changed color to green. If it has not, try lowering the heat lamp closer to the sidewalk. Do this incrementally, lowering it about ~1 inch at a time, then wait 10 minutes before lowering it further.**
 - b. **Note: There might be confusion about the color change of the “people.” This is not related to the body temperature of an actual person. The “people” just indicate when their surroundings get uncomfortably (possibly harmfully!) hot.**
 - c. Here’s a standard script: *These little “people” are made of a special material that changes color between 85 and 95 degrees F—around the temperatures of a hot and uncomfortable heat wave. Think about the last time there was a really hot summer day, and what it felt like. If they start to change color, they’re getting too hot!*
7. Ask your guests, “What are some ways we could change this neighborhood to help it stay as cool as possible?”
 - a. Offer an additional tree. Suggest taking away a dark roof tile to reveal a “white roof.” Replace roof tile with damp sponge to create a green roof, etc.
 8. To close, ask your guests, “What are some ways you could make this happen in your neighborhood?”
 - a. This is an excellent opportunity to engage parents/adults while younger guests place with the model row home. Provide information on programs/resources related to the activity.

TAKE IT FURTHER:

Many Philadelphia residents will be interested in understanding how they can help implement these solutions along their own block. Recommend that guests check out the Office of Sustainability’s Greenworks Program (show handout) – this is the City of Philadelphia’s official climate adaptation plan. It provides information on green infrastructure solutions available to Philadelphia residents (many of which are free!).

ADAPTATIONS:

1. For younger guests, simplify the process to communicate the following take home messages:
 - a. Climate change is making Philadelphia hotter, making summer heat waves are becoming both longer and hotter.
 - b. Tree cover helps cool city blocks

2. The IR gun and liquid crystal “people” pretty much illustrate the same thing—you could use either or both depending on the audience. Small children might get more out of the visual color change than the thermometer reading; adults might not need the crystal people and want to talk about the temperatures.

WHAT'S THE SCIENCE?

- Evapotranspiration
 - Trees & other plants have high amounts of water in them. Water has a very high specific heat, meaning it takes a lot of energy to warm it up – energy that would otherwise be absorbed by other city surfaces, like roads and sidewalks, and raise the ambient air temperature
- Albedo
 - Albedo is the reflectivity of a surface. Light colored surfaces have a high albedo – they reflect most of the sun’s energy that hits them back up into the atmosphere. Dark colored surfaces have a low albedo – they absorb most of the sun’s radiation that hits them.
 - One solution to help keep city row homes cool is to paint their roofs white, which will help reflect then sun’s incoming radiation back up into the atmosphere, preventing the house from absorbing that energy and warming up