



Changing Climate, Changing Cities: Virtual Field Trip From Phoenix to Shenzhen

TEACHER'S GUIDE

Grades: 3-8

Subjects: Science and Geography

Purpose: This guide contains a set of discussion questions and answers for any grade level, which can be used during and after the virtual field trip. It also contains links to additional resources ranging from lessons, activities, videos, demonstrations, experiments, and multimedia presentations.

Essential Question: How can nature-based solutions be used by communities and cities to mitigate the impacts of climate change equitably and justly?

Supporting Questions:

- How does climate change impact our world?
- What is climate resilience?
- How can we become more resilient in the face of climate change?
- What is the role of nature in increasing climate resilience?

Description:

It's so hot in Phoenix, Arizona, some residents have baked cookies in their cars. By the end of August, the desert city had recorded 50 days this year of temperatures exceeding 110 degrees, scorching the previous record of 33 days in 2011.

Remember when climate change was some distant threat that we had years or decades to prepare for? Well, not any longer. It's here now. And it's just warming up—particularly if we don't do more to curb it.

Phoenix isn't the only city experiencing the tangible effects of a changing climate. Urban centers around the world are feeling the heat. Shenzhen, China, for example, is facing historic flooding that is linked to climate change. But it's not alone. Flooding in China's cities has doubled in just the past decade or so. Worldwide, still more cities are vulnerable to stronger hurricanes or to the effects of drought and other natural forces—all coming at us more frequently and with more fury. Climate change is happening, and it's happening all around us.

Get your students a front-row, ground-level seat to the challenges cities face as they confront this force of nature, the solutions experts are promoting to mitigate it, and the hands-on role your students can play today as the next generation of environmental stewards.

Materials

Video supporting this lesson plan:

- *Changing Climate, Changing Cities: A Virtual Field Trip from Phoenix to Shenzhen*
 - Vimeo: <https://vimeo.com/465872949>
 - YouTube: <https://youtu.be/yqPaTHmdVVE>

Materials for Teacher:

- Computer with Internet connection, LCD projector, screen

Materials for students:

- If remote, students can use the discussion questions [Google Doc handout](#)

Standards:

Next Generation Science Standards:

Disciplinary Core Ideas:

- LS1.C Organization for Matter and Energy Flow in Organisms
- LS2.A Interdependent Relationships in Ecosystems
- LS2.C Ecosystem Dynamics, Functioning, and Resilience
- LS4.C Adaptation
- LS4.D Biodiversity and Humans
- ESS2.A Earth Materials and Systems
- ESS2.C The Role of Water in Earth's Surface Processes
- ESS2.D Weather and Climate
- ESS2.E Biogeology
- ESS3.A Natural Resources
- ESS3.B Natural Hazards
- ESS3.C Human Impacts on Earth Systems

Crosscutting Concepts:

- Patterns
- Cause and Effect
- Stability and Change
- Influence of Engineering, Technology, and Science on Society and the Natural World

Science and Engineering Practices:

- Asking Questions and Defining Problems
- Developing and Using Models
- Planning and Carrying Out Investigations
- Constructing Explanations and Designing Solutions
- Engaging in Argument from Evidence

Common Core Standards:

6th-8th Grade Science and Technical Subjects

- CCSS.ELA-Literacy.RST.6-8.3 Follow precisely a multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks.
- CCSS.ELA-Literacy.RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.
- CCSS.ELA-Literacy.RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.
- CCSS.ELA-Literacy.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g. in a flowchart, diagram, model, graph, or table).

Vocabulary:

- **Adaptation:** a change or process of change that allows an organism or species to become better suited to its environment
- **Carbon sequestration:** A process of removing carbon dioxide from the atmosphere
- **Carbon storage:** Carbon dioxide stored within trees, plants, water, and other spaces
- **Climate:** The weather conditions in an area over a long period of time
- **Filtration:** passing a substance, e.g., liquid, through a device or material (e.g., soil) to remove unwanted material
- **Green infrastructure:** Human-made infrastructure that incorporates nature
- **Impervious:** Not allowing substances, e.g., fluids, to pass through
- **Mitigation:** an action that reduces the severity or harm of an impact
- **Nature-based solutions:** a broad term that refers to solutions that rely on nature
- **Natural climate solutions:** actions that are nature-based and increase carbon storage or avoid greenhouse gas emissions to tackle climate change
- **Pollution:** Unwanted substances, e.g., some chemicals, that impact water quality
- **Precipitation:** Water in the form of rain, snow, sleet, or hail that falls to the ground
- **Resilience:** the capacity to recover quickly from difficulties
- **Run-off:** Water that drains into streams and rivers following rainfall
- **Stormwater:** Water that results from heavy rain or snow fall and is not absorbed into pervious surfaces such as soil or sand, but flows over impervious surfaces such as streets, sidewalks, and rooftops
- **Urban forest:** all the plants, big and small, within a city

Discussion Questions: You can use or adapt these questions for a follow-up discussion with your students after viewing the virtual field trip or you pause as you go along.

1. What is the difference between climate and weather?

Answer: Weather refers to what happens to the conditions around you in the short term (the next day or week). Climate is what you expect the conditions to be like in the longer term.

2. What are some of the impacts of climate change?

Answer: Extreme weather, natural disasters, chronic droughts, and poor air quality.

3. How do plants benefit cities?

Answer: They can clean the air (making it easier for us to breathe) and they can capture and store carbon.

4. Why are some areas in Phoenix hotter than others?

Answer: Looking at side-by-side examples of two neighborhoods, you can see that the first neighborhood has lots of plants and trees, but the 2nd neighborhood has almost no trees, which probably makes it hotter.

5. Why is it important to plant the right trees?

Answer: Trees that are “adapted” to warm climate or used to desert conditions should be the ones planted in those environments, so they are more likely to survive.

6. In what ways can stormwater pollute our drinking water?

Answer: In cities around the world, paved surfaces can make even a simple storm much worse because the rainwater can’t soak into the ground. Stormwater carries with it almost anything that’s on the ground. That means trash, definitely pollutants (like oil from cars, gasoline, pesticides and fertilizers...), and this dirty water can be funneled into rivers and oceans, harming wildlife and ruining our drinking water.

7. How does green stormwater infrastructure work? Why is it so powerful?

Answer: It provides a natural setting that allows stormwater to soak into the ground, vs. flowing from paved city streets/sidewalks, picking up dirt and pollutants, and emptying into rivers and lake. Instead of water flowing over city streets and sidewalks, picking up pollutants along the way, and dumping all of that into our waterways, we can use green infrastructure to intercept and clean this dirty water before it reaches our waterways.

8. What are some ways that individual people can help?

Answer: We all can do our part to help mitigate and adapt to the effects of climate change. And if we all did just ONE small thing to change it, it could make a BIG difference! We can help plant trees in communities that need them most, keep our streets free of pollution, and look for organizations to volunteer with. See what you can do in your own backyard, and inspire others to join the cause!

Nature Lab Related Resources: The following lesson plans and videos can be used to supplement the virtual field trip.



Urban Trees

Grade Levels: 6-8

Tree planting can reduce summertime temperatures, thereby reducing air-conditioning bills and trapping some of the greenhouse gases responsible for global warming. In this lesson, students learn how trees renew our air supply by absorbing carbon dioxide and producing oxygen, and how they clean our air by filtering out dust and greenhouse gases. Students also learn to identify tree species and the species that threaten them, and develop a plan for protecting and promoting trees in their own community.

<https://www.nature.org/en-us/about-us/who-we-are/how-we-work/youth-engagement/nature-lab/middle-school-lesson-plans/>

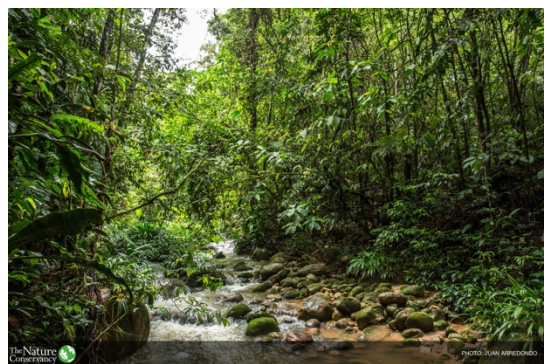


Wild Biomes: America's Rainforests and Deserts

Grade Levels: 3-8

Two wildly different ecosystems, both dependent on the same precious resource: Water. On this virtual field trip, we'll travel to the lush, rain-soaked splendor of the Olympic Peninsula and explore the urban watershed of Seattle. Next, we'll head to Arizona's dry, desert landscape and take a tour down the Verde River that nourishes this parched land.

<https://www.nature.org/en-us/about-us/who-we-are/how-we-work/youth-engagement/nature-lab/virtual-field-trips/>



How Water Works

Grade Levels: 3-8

By filtering rainwater and slowing the movement of water to rivers, lakes and oceans, your garden works as a mini-watershed. In this lesson, students calculate the permeable surface area of their garden and periodically measure rainfall amounts, acting as junior hydrologists.

<https://www.nature.org/en-us/about-us/who-we-are/how-we-work/youth-engagement/nature-lab/elementary-lesson-plans/>

Other Related Resources

Classroom Resources (All Grades)

- Social Justice and Climate Change: Sinking Cities (PBS)
<https://pbslearningmedia.org/resource/scities18-sci-climategap/social-justice-and-climate-change/>
- Weather vs. Climate (Generation Genius)
https://www.generationgenius.com/videolessons/weather-vs-climate-video-for-kids/?gclid=Cj0KCQjw8fr7BRDSARIsAK0Qqr7RsPBTv4vRa7rQxqVtSthbCFbVBKpXZLcoLrHxCSUg5hzts3iWDLYaAqPREALw_wcB
- A Vanishing Island (Global Oneness Project)
<https://sharemylesson.com/teaching-resource/vanishing-island-global-oneness-project-274395>
- Field Guide for Conservation in Cities (TNC)
<https://www.nature.org/en-us/what-we-do/our-priorities/build-healthy-cities/cities-stories/field-guide-for-conservation-in-cities/>
- Urban Green Jobs in Atlanta (TNC)
<https://www.nature.org/en-us/about-us/where-we-work/united-states/georgia/stories-in-georgia/urban-green-jobs-atlanta-south-river/>
- Addressing Heat and Air Quality in Phoenix: Equitably building cool, healthy and climate-resilient cities (TNC)
<https://www.nature.org/en-us/about-us/where-we-work/united-states/arizona/stories-in-arizona/city-heat-air-quality/> Google

Groups Advocating for Climate Justice

- [Sunrise Movement](#) is a movement to stop climate change and create millions of good jobs in the process.
- [SustainUS](#) is a youth-led organization advancing justice and sustainability by empowering young people to engage in advocacy at the domestic and international levels.
- [Uplift](#) connects, trains, and supports young people to act for climate justice on the Colorado Plateau.
- [U.S. Youth Climate Strike](#) is building a powerful grassroots movement to combat the climate crisis at its core.
- [Youth Climate Leaders](#) is a global youth leadership network catalyzing climate careers that position young people to lead actions and solutions to the climate crisis.

Activities and Experiments

- Students explore the relationship between weather and climate by graphing weather temperature data and comparing with climate averages.
 - <https://scied.ucar.edu/activity/weather-and-climate-data-exploration>

This virtual field trip and teacher guide was made possible with generous support from

