Water Cycle Lesson: Transpiration

Water Cycle Unit, Lesson 2 of 4

Created By	Grades	Subjects	Duration
Mallory Swafford	6th, 7th, 8th	Science	≅ 110 minutes

Lesson Overview

Essential Questions	• How can transpiration help cool cities? • How can climate change impact transpiration? • How can transpiration improve the quality of life for people most impacted by climate change in urban areas?
Learning Outcomes	Students will be able to: • Explain transpiration. • Explain the impacts of climate change on transpiration. • Explain how transpiration can help cool cities and improve the quality of life for people who live in them.
Summary	In this lesson, students learn about transpiration and how transpiration plays a role in cooling cities that experience extreme heat due to climate change. **Inquire:** Students explore the idea of transpiration. **Investigate:** Students learn about transpiration through a hands-on experiment and how it applies to urban heat islands. **Inspire:** Students create a proposal to improve tree equity in their neighborhoods.

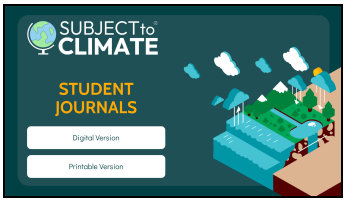
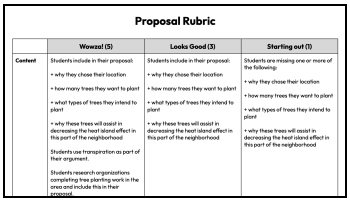
Instructions

Inquire
≅ 10 minutes
	• Students work up a sweat either by running in place or jumping. Another option is for students to think about a time they were sweaty.
	• Teacher asks the following questions and students think-pair-share:
	  ○ When you are sweaty, how does it feel to sit under a wide tree?
	  ○ When you are sweaty, how does it feel to sit in the middle of a sunny parking lot?
	  ○ Why do our bodies sweat?
	• Using the Teacher Slideshow, students read the definitions of the terms *condensation*, *precipitation*, *transpiration*, and *evaporation* then explain them in their own words.

Investigate **≅ 55 minutes**	• Students explore the idea of transpiration through this hands-on experiment. Students can complete experiments in lab groups and record their data in their student journals, or the whole class can watch the demonstration and record the data on the Teacher Slideshow. • As a class, students discuss the link between transpiration and the water cycle using the following prompts to guide the discussion: ○ What did you learn about transpiration from the experiment?

	○ How do you think transpiration is connected to the water cycle? ○ Based on the experiment, how do you think climate change can impact transpiration? ○ Do you think transpiration can cool the air around trees? ○ What effect might more trees have on a city? • Using the Teacher Slideshow, students or teachers read aloud two facts about transpiration. • Students read this article linking heat islands and transpiration in cities and think-pair-share the big takeaway from the article. After watching the video, students can define an urban heat island, identify one cause and one impact. • Students watch this video and share what environmental influences affect transpiration. Example answers from the video include light intensity, temperature, humidity, and wind speed. • As a class, students summarize key ideas or facts they learned about transpiration. Alternatively, students can list three things they learned and one question they have about transpiration. This can be used as an exit ticket or formative assessment.
Inspire ≅ **45 minutes**	• Students think-pair-share how they think climate change affects transpiration, then watch chapter four (4:11-5:36) of this video explaining the impacts of climate change on transpiration. • Using the Printable Student Journal or the Digital Student Journal, students create a proposal to convince people or organizations in power how and why they should incorporate more trees in a community. • Students review the goal and five steps for creating their proposal. • Students use the Tree Equity Score website to select and research a neighborhood to focus on for their proposal. Students take note of the temperature, canopy cover, and demographics. • Students brainstorm and investigate their proposal and create an outline. In their outlines, students include why they chose their location, how many trees they want to plant, what types of trees they intend to plant, why these trees will assist in cooling heat islands, and how transpiration is connected to heat islands. • Students draft their proposals using sketches, diagrams, and/or digital images. Students use Google Street View to help them visualize the area. • Students review their proposal using the Proposal Rubric to self-evaluate and then find a partner to peer-evaluate.

Accompanying Materials

Teacher Slideshow	Student Journals	Teacher Documents
		

Teaching Tips

Suggestions	• The Investigate and Inspire sections can be completed on separate days or class periods. Both sections can also be extended. • Students share diverse perspectives and ideas in journal prompts encouraging action. • Students can share their proposals in a class presentation or with school administration or city officials at the discretion of the teacher. Optionally, the class may vote on a proposal they think is most likely to be received well and send that proposal as a whole group effort. • This lesson touches on the concept of redlining. This could be discussed further in a social studies class using Redlining and Tree Equity: Social Justice Lesson or Redlining and Environmental Racism.

Prerequisites	• This is lesson 2 of 4 in our 6th-8th grade Water Cycle Unit.
	• Materials required for the experiment include the following:
	  ○ Three small, thin-leafed plants
	  ○ Three small, broad-leafed plants
	  ○ Small watering can
	  ○ Scale
	  ○ Six plastic bags large enough to fit completely around each plant pot
	  ○ Masking tape
	• Previous student knowledge of the water cycle and climate change will be beneficial for this unit.
	• Students should have some understanding of the terms *condensation*, *precipitation*, and *evaporation.*
	• Teachers should preview the experiment, article, and videos prior to teaching the lesson.
	• Teachers should familiarize themselves with the Tree Equity Score resource prior to teaching the lesson. Students might also benefit from definitions of certain terms used in the resource including *temperature*, *canopy cover*, and *demographics*.

Differentiation	• Students can complete the demonstration in lab groups. Teachers can create groups mixed-ability groups to aid in understanding. • Students can watch this video on transpiration for additional learning or support. • Journal prompts can be used for a whole group discussion if desired. • Students can research organizations already doing this work and write a proposal that includes school support or city support for this organization. • The article can be printed out and read independently, in small groups, or as a class. Additionally, students can annotate, highlight, or make notes of key ideas in the printed article. • The Inspire section may be completed in groups or individually at the discretion of the teacher. • Students can further explore and research urban heat islands or redlining and be encouraged to make connections within their community or region.

Learning Standards

Primary Standards
Next Generation Science Standards (NGSS) PS, LS, ESS, ETS
MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
Supporting Standards
Common Core English Language Arts Standards (CCSS.ELA)
CCSS.ELA-LITERACY.W.6.1 Write arguments to support claims with clear reasons and relevant evidence.
CCSS.ELA-LITERACY.W.7.1 Write arguments to support claims with clear reasons and relevant evidence.
CCSS.ELA-LITERACY.W.8.1 Write arguments to support claims with clear reasons and relevant evidence.
CCSS.ELA-LITERACY.W.6.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
CCSS.ELA-LITERACY.W.7.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
CCSS.ELA-LITERACY.W.8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.