Hill

Earth & Space Science | Lesson Guide

4th Grade

Photo Description

This picture shows a large house with a red tile roof sitting on a hill covered with green trees. In the distance, you can see a city skyline through hazy air. The thick forest of trees stretches between the house and the city buildings far away.

Scientific Phenomena

The Anchoring Phenomenon this image represents is air pollution and atmospheric haze affecting visibility. The hazy appearance of the distant city skyline occurs because tiny particles (particulates) and gases in the air scatter and absorb light as it travels from the city to our eyes. This happens when pollutants from cars, factories, and other sources mix with water vapor and natural particles in the atmosphere, creating a visible layer that reduces how clearly we can see distant objects.

Core Science Concepts

1. Air Quality and Pollution: The atmosphere contains a mixture of gases, water vapor, and tiny particles that can affect how clearly we see distant objects and impact human health.

2. Light Scattering: When light travels through air containing particles, it gets scattered in different directions, making distant objects appear hazy or less clear.

3. Urban vs. Natural Environments: Cities produce more air pollution than forested areas, which is why the vegetation in the foreground appears clearer than the urban skyline in the distance.

4. Environmental Impact: Human activities in cities create pollution that can travel through the air and affect areas far from where it was produced.

Pedagogical Tip:

Use the "See-Think-Wonder" thinking routine with this image. Have students first observe what they see, then think about why the city looks hazy, and finally wonder about questions they have. This builds scientific inquiry skills.

UDL Suggestions:

Provide multiple ways for students to engage with this concept by offering binoculars for outdoor observations, air quality apps to check local conditions, and drawing activities to compare clear vs. hazy visibility.

Zoom In / Zoom Out

1. Zoom In: At the microscopic level, air pollution consists of tiny particles smaller than the width of a human hair, including dust, pollen, soot from burning, and droplets of chemicals that float in the air we breathe.

2. Zoom Out: This local air quality connects to the global atmosphere system, where air currents can carry pollution hundreds of miles away, affecting weather patterns, climate, and air quality in distant locations around the world.

Discussion Questions

1. What do you think is causing the city in the distance to look hazy compared to the trees in the front? (Bloom's: Analyze | DOK: 2)

2. How might the air quality in this picture affect the plants, animals, and people living in both areas? (Bloom's: Evaluate | DOK: 3)

3. What solutions could help reduce the haze we see over the city? (Bloom's: Create | DOK: 3)

4. If you were standing in the city looking back toward this house, what do you think you would see and why? (Bloom's: Apply | DOK: 2)

Potential Student Misconceptions

1. Misconception: "The hazy air is just fog or clouds."
   Clarification: While fog and clouds are made of water droplets, the haze in this image is primarily caused by air pollution mixed with some water vapor.

2. Misconception: "Air pollution only affects the area right around where it's made."
   Clarification: Air pollution can travel many miles through wind currents, affecting air quality far from its original source.

3. Misconception: "You can't see air pollution, so it's not really there."
   Clarification: Air pollution is often invisible, but when it builds up enough, it creates visible haze like we see in this image.

Cross-Curricular Ideas

1. Math Connection - Data Collection and Graphing: Have students collect air quality data from different locations in your community over several weeks using an app or local weather station information. Create bar graphs or line graphs to show how air quality changes over time and compare pollution levels between urban and rural areas. This connects to measurement, data representation, and comparing numbers.

2. ELA Connection - Persuasive Writing: Students write a persuasive letter to their city leaders explaining why reducing air pollution is important. They can use facts from the photo and research to convince readers that cleaner air benefits everyone. This builds argumentative writing skills and helps students understand how science informs real-world decisions.

3. Social Studies Connection - Community Impact: Explore how air pollution affects different communities differently. Discuss why some neighborhoods might have more pollution than others, and research what local organizations are doing to improve air quality in your area. This connects to understanding how human activity shapes communities and the importance of environmental justice.

4. Art Connection - Visual Representation: Have students create two paintings or drawings side-by-side: one showing clear visibility and one showing hazy visibility like in the photo. Students can use different techniques (watercolor wash, charcoal smudging) to show how particles affect what we see. This helps them visualize the scientific concept through creative expression.

STEM Career Connection

1. Environmental Scientist: Environmental scientists study how pollution affects air, water, and soil. They measure air quality, figure out where pollution comes from, and help communities find ways to make the environment cleaner and safer for people and animals. They might use special equipment to collect air samples or work in laboratories. Average Annual Salary: $68,000 - $75,000 USD

2. Air Quality Engineer: These engineers design and build systems that clean polluted air, like filters in factories or devices that reduce car emissions. They work to invent new technology that stops pollution from getting into our atmosphere in the first place. Average Annual Salary: $70,000 - $85,000 USD

3. Meteorologist/Atmospheric Scientist: Meteorologists study the atmosphere and weather patterns, including how pollution moves through the air. They predict how air quality will change and warn people when air pollution might be unhealthy. Some meteorologists also help governments make rules to protect our air. Average Annual Salary: $65,000 - $95,000 USD

NGSS Connections

- Performance Expectation: 5-ESS2-1 - Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
- Disciplinary Core Ideas: 5-ESS2.A - Earth's major systems interact through physical and chemical processes
- Disciplinary Core Ideas: 3-5-ETS1.A - Possible solutions to problems can be compared by how well they meet criteria
- Crosscutting Concepts: Systems and System Models - A system can be described by its components and their interactions
- Crosscutting Concepts: Cause and Effect - Events have causes that generate observable patterns

Science Vocabulary

* Air pollution: Harmful substances in the air that can make it dirty and unsafe to breathe.
* Atmosphere: The layer of gases that surrounds Earth and contains the air we breathe.
* Particulates: Tiny pieces of solid or liquid matter floating in the air.
* Visibility: How clearly and how far you can see through the air.
* Haze: A thin layer of particles in the air that makes distant objects look unclear or fuzzy.

External Resources

Children's Books:
- The Magic School Bus: In the Air by Joanna Cole
- The Air Around You by Franklyn Branley
- Pollution by Rebecca Hirsch