

Grade/ Grade Band: 7/8	Topic: Heat Islands/Human Impact	Time: 8-10 days
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Standards for Science

MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Standards for Math

KY.7.EE.3 Solve real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.

Graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line, called the slope.

Distinguish proportional relationships from other relationships.

Begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.

Brief Lesson Description:

Using the site <https://mynasadata.larc.nasa.gov/lesson-plans/creation-urban-heat-islands-story-map> the students will interact with various visualizations (i.e., images, charts, and graphs), students will explore the *urban heat island effect* using land surface temperature and vegetation data. Students will investigate the processes that create differences in surface temperatures, as well as how populations and human activities have led to the creation of urban heat islands. The students will be able to make scientific claims on the formation and rate of change of UHIs. The students will be able to graph and have visual representation of the data they are collecting during the investigative section. The students will be able to graph and plot points by the end of this unit. They will have a better understanding of slope of line and proportions. This unit is perfect for seventh and eight grade science and math. The students reasoning skills are increasing and they should be able to look and patterns and functions and compare the differences in the data they see or collect. They are at the right age to start making claims and looking for solutions, they are making strong neural connections at this age.

Performance Expectation(s):

- Students will analyze surface temperature data to use as evidence to explain the *urban heat island effect*.
- Students will explore the role of Earth’s energy balance in the creation of *urban heat islands*.
- Students will evaluate examples of human activity that have led to the creation of urban heat islands.

Specific Learning Outcomes:

- Why do different materials experience differences in surface temperature?
- What is the role of *urban heat islands* in Earth's energy balance?
- How has human activity led to the creation of *urban heat islands*?

Narrative / Background Information

Prior Student Knowledge:

- Familiarity with finding coordinates on a map
- Familiarity with line plots and bar graphs
- Basic concepts of energy transfer

Science & Engineering Practices:

Analyzing and Interpreting Data: Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. Analyze and interpret data to determine similarities and differences in findings.

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

Disciplinary Core Ideas:

ESS3.B: Natural Hazards
Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events.

ESS3.C: Human Impacts on Earth Systems
Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth’s environments can have different impacts (negative and positive) for different living things. Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

Crosscutting Concepts:

Patterns
Graphs, charts, and images can be used to identify patterns in data.

Cause and Effect
Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.

Possible Preconceptions/Misconceptions:

1. The term “global warming” means the temperature is getting warmer everywhere.
2. We just had a month that was the coldest on record. That means that the climate has started to cool again.
3. Earth’s temperature will steadily warm.
4. The “warming” scientists write about is not real.

LESSON PLAN – 5-E Model

<https://mynasadata.larc.nasa.gov/lesson-plans/creation-urban-heat-islands-story-map>

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:

The students will go to

<https://nasa.maps.arcgis.com/apps/MapSeries/index.html?appid=44b9c8738f0e47e68d9e8ae2c530ed08>

They will click on Engage

On this site the students will:

- analyze images and create a chart comparing surface types and temperatures
- analyze an image that compares and contrasts surface types and temperatures.
- will learn how to navigate the GLOBE Visualization System to view surface temperature measurements collected by students around the world.
- create inferences and predictions, and claims based on a case study that they will read and then repeat in their own area.

Their responses to prompts will be completed in Google Forms.

EXPLORE: Lesson Description – Probing or Clarifying Questions:

The students will go to

<https://nasa.maps.arcgis.com/apps/MapSeries/index.html?appid=44b9c8738f0e47e68d9e8ae2c530ed08>

They will click on Explore

On this site the students will:

- analyze images and patterns to create bar graphs
- compare relationships between vegetation and surface temperature
- compare surface temperature with human activity and population density
- graph surface temperature changes
- create inferences and predictions based on trends and changes of surface temperature

Their responses to prompts will be completed in Google Forms.

EXPLAIN: Concepts Explained and Vocabulary Defined:

The students will go to

<https://nasa.maps.arcgis.com/apps/MapSeries/index.html?appid=44b9c8738f0e47e68d9e8ae2c530ed08>

They will click on Explain

On this site the students will:

- define Urban Heat Island
- learn how Earth balances its energy
- describe how a city becomes an urban heat island and explain why this is a growing issue

Their responses to prompts will be completed in Google Forms.

Vocabulary:

Air Temperature: Describes the temperature of air close to the surface (about 2 meters above the surface).

Albedo: the fraction of sunlight that is reflected by a surface or object (such as vegetation or a cloud)

Conduction: transfers heat from cooler air that is in contact with a hot surface

Convection: causes warm air to rise upward, moving away from the surface

Radiation: a form of energy released as waves or particles from many different sources like light bulbs, radioactive materials, fires, and chemical reactions. X-rays, visible light, infrared, microwave, and radio waves are all examples of radiation.

Rural: An area away from cities and towns, typically with farms or natural land cover.

Skin Temperature: Describes the temperature of the top few centimeters of a surface.

Urban: A land surface that contains cities or towns, with more buildings and population than a rural area.

Urban Heat Island: An urban area or city that is warmer than its surrounding rural areas due to human activities

ELABORATE: Applications and Extensions:

The students will go to

<https://nasa.maps.arcgis.com/apps/MapSeries/index.html?appid=44b9c8738f0e47e68d9e8ae2c530ed08>

They will click on Elaborate

On this site the students will:

- Compare and contrast population of urban and rural areas
- create claims on the futures of urban heat islands

Their responses to prompts will be completed in Google Forms.

There is no connection to their state in this section and there needs to be a real world connection for my students.

A Tale of Two Cities in the Bluegrass State- This is a document from Teachers Pay Teachers, where the students will look at three local cities, investigate, and define one of the cities as an Urban Heat Island. I changed the cities in the document to make it more real world for my students.

EVALUATE:

Formative Monitoring :

- Bell Ringers
- Interactive Word Wall (Hexagonal Thinking)
- Google Forms for each activity

<https://docs.google.com/forms/d/1bEyfTkWldY5MDqYCdtcyt2GTBphesxHai1kMXvKmY3A/edit>

Is a survey I created to find out how comfortable the students are with the content (math and science) once we finish the lesson.

Summative Assessment:

The students will go to

<https://nasa.maps.arcgis.com/apps/MapSeries/index.html?appid=44b9c8738f0e47e68d9e8ae2c530ed08>

A Case Study: Peachtree Road Race in Atlanta, Georgia

Materials Required

Resources Needed Per Student:

- Student Data Sheet
- Students may also use the Interactive Files (i.e., Google Forms and the Google Sheet) for each section, in place of PDF Data Sheet

Resources Needed Per Group:

- Computer/Tablet
- Internet Access
- Link to the "*Creation of Urban Heat Island*" Story Map