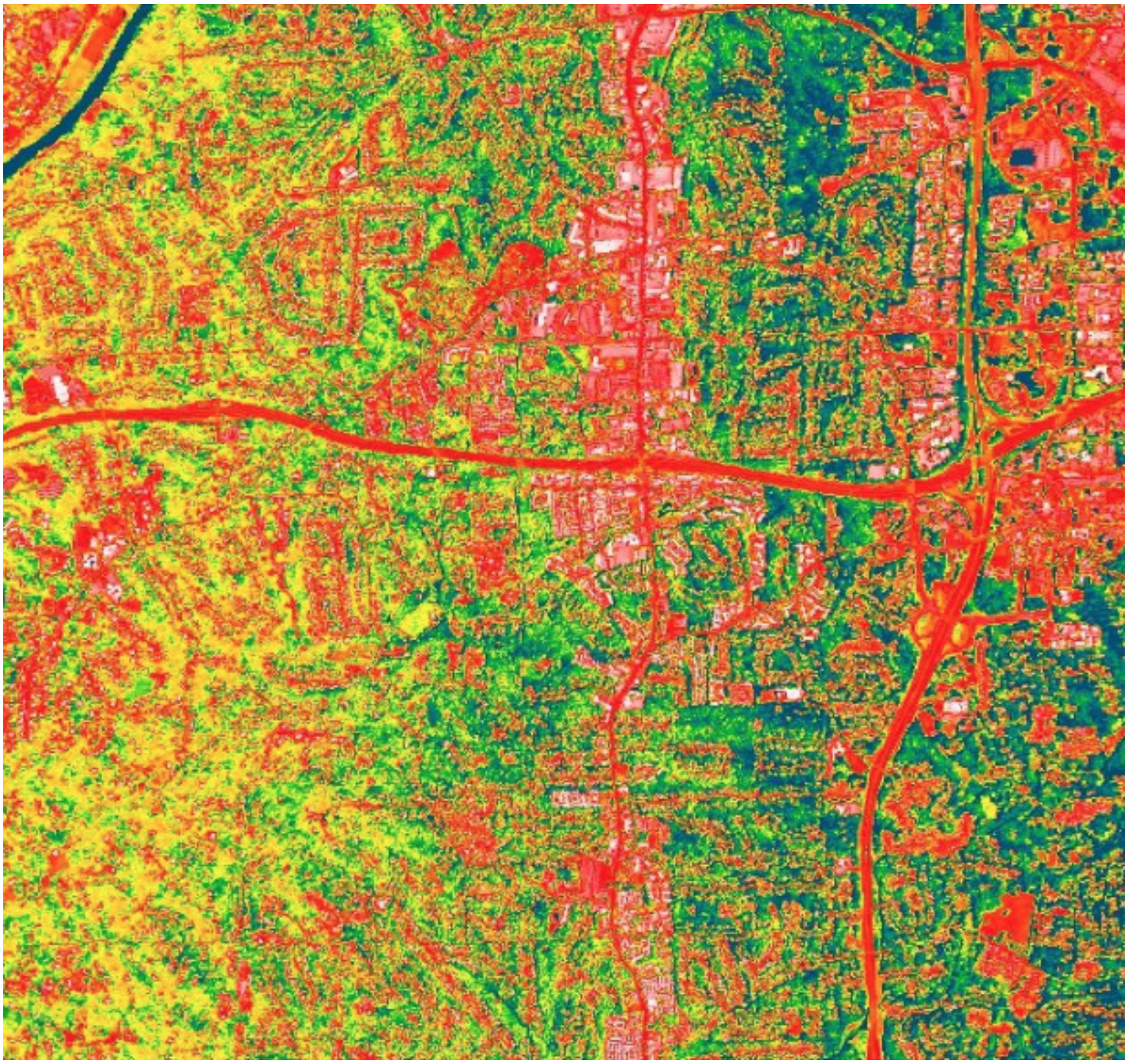
My NASA Data - Lesson Plans

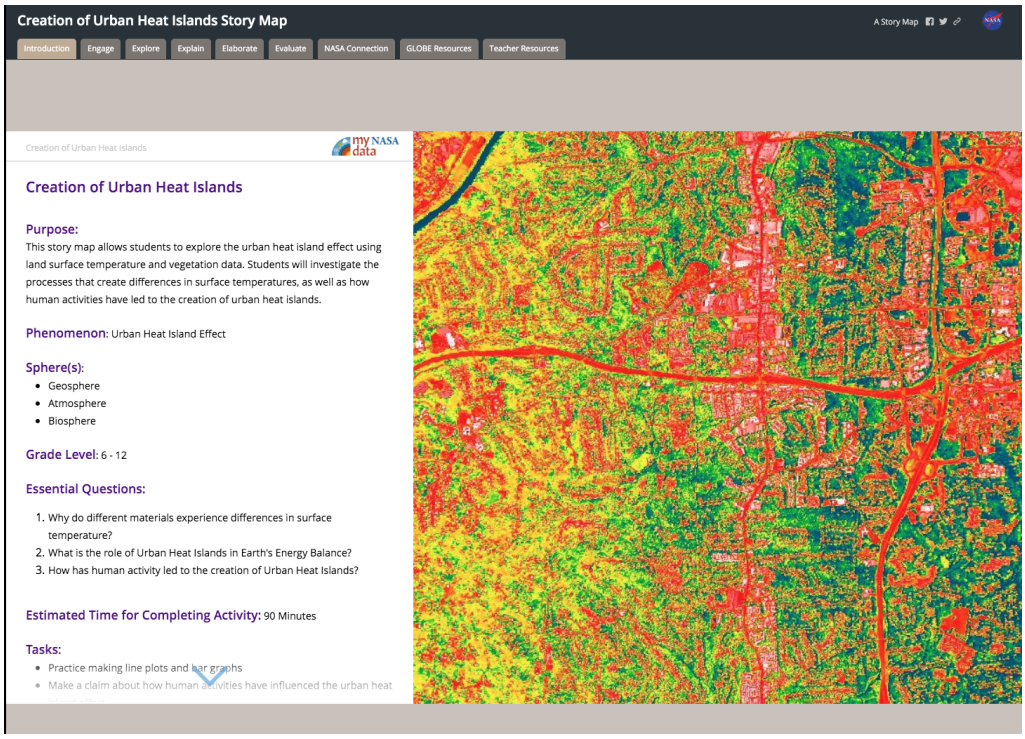
Creation of Urban Heat Islands Story Map



Overview

By interacting with various visualizations (i.e., images, charts, and graphs), students 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 human activities have

led to the creation of urban heat islands.



CLICK HERE

While this story map is intended to be used with students who have access to a computing device in a 1:1 or 1:2 setting, teachers may pull various visualizations to use in singularity or may assign parts of this story map without assigning the full resource. Please see our Google Forms and Sheet for tools that can be modified to fit your instructional needs. This Sheet, *Embedded Activities for Upload*, is a template that enables students to complete and upload activities that are featured in the *Student Sheet* (PDF) that cannot be completed in Google Forms.

(**Virtual Teachers**: Make a copy of the Google Form of your choice so that you may assign it directly from your Google Drive into your Learning Management System (e.g., Google Classroom, Canvas, Schoology, etc.). Do you need help incorporating these Google Forms into your Learning Management System? If so, read this **Guide to Using Google Forms with My NASA Data.**)

Learning Objectives

- 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.

Why Does NASA Study This Phenomenon?

An urban heat island occurs when a city experiences much warmer temperatures than in nearby rural areas. Cities are full of rocky surfaces – asphalt, brick, and concrete – which increases the amount of energy from solar radiation they absorb. Urban areas often see temperatures rise 6°C (10°F) hotter than the surrounding suburbs and rural areas. These higher temperatures can cause people to become dehydrated or suffer from heat exhaustion.

NASA analyzes surface temperature data from around the world to better understand the characteristics of cities that drive the development of *urban heat islands*.

Essential Questions

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

Cross-Curricular Connections

National Geography Standards:

- How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.

Materials Required

Resources Needed Per Student:

- Student Data Sheet - Link
    - 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 - Link

Technology Requirements

- Internet Required
- One-to-One (tablet, laptop, or CPU)
- One-to-a-Group
- Visualization Tool Required

Teacher Background Information

Heat islands form as vegetation is replaced by asphalt and concrete for roads, buildings, and other structures necessary to accommodate growing populations. These surfaces absorb—rather than reflect— the sun's heat, causing surface temperatures and near-surface air temperatures to rise near these surfaces. Displacing trees and vegetation minimizes the natural cooling effects of shading and

evaporation of water from soil and leaves (evapotranspiration).

To learn more, visit:

- The MND **Urban Heat Island Phenomena** page for background information.
- **Explain** tab found in the Story Map for more information.

Are you new to Story Maps? Review the link below for a guided tour of this story map by My NASA Data.

Prerequisites Student Knowledge

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

Student Misconception

The following misconceptions were taken from GLOBE's Climate-Change Misconceptions Blog Post.

1. Misconception: The term "global warming" means the temperature is getting warmer everywhere. "Global warming" sounds to many like the temperature should be warming everywhere. If there is "global warming" shouldn't it be getting warmer where I live? Or, if it's not getting warmer where I live, how can "global warming" be happening!

If you look at the recent temperature records from several GLOBE schools, the temperature does seem to be warming gradually in some places. But other schools show a cooling trend. It is the same way with the stations used to monitor climate change. The global average temperature change is often much less than the trends at local sites.

The term "global warming" really means that the yearly average of the temperature averaged over all the Earth's surface is rising over time scales of several years.

2. Misconception: We just had a month that was the coldest on record. That means that the climate has started to cool again. When I stop thinking like a scientist, I also briefly think – or hope – that a cold month means that "global warming" will go away. But a record cold day or month doesn't mean that the climate is getting cooler on the long term.

In a warming climate, there are still changes in both directions from day to day, month to month, and year to year. But there will be fewer record cold months. And there will be more periods of record high temperatures.

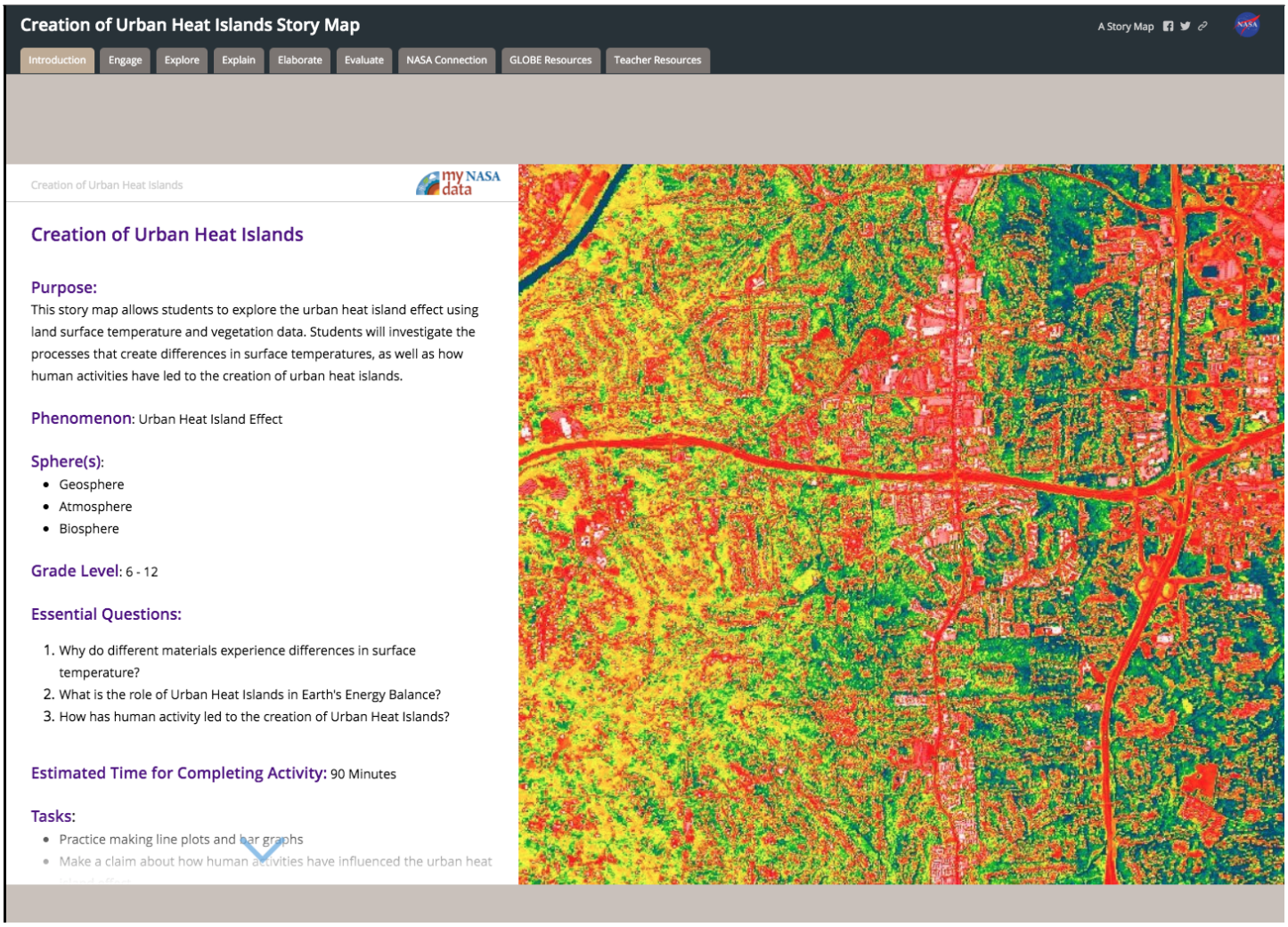
3. Misconception: Earth's temperature will steadily warm (as in "This year is warmer than last year, and next year will be warmer than this year."). The globally-averaged yearly temperature record has many dips and peaks. It is well-known that strong El Nino events, through spreading warm water across the tropical Pacific, will cause peaks in the record. Similarly, volcanic eruptions can cool the surface temperatures globally for a year or two.

4. *Misconception: The "warming" scientists write about is not real. Many thermometers are showing*

warmer temperatures because their surroundings have changed over time, and this affects the global average You can find web sites showing weather stations next to buildings, air-conditioning heat exhausts, and so on. So this is certainly true for some sites. However, climate scientists try very hard to eliminate such sites from the climate record. There are literally thousands of weather stations in the United States today, and a similar density of sites exist in other parts of the developed world. These are used for many things, such as weather forecasting, keeping track of weather at airports or along roads or railroad tracks, or for education and outreach purposes by television stations or schools. But only a small fraction of these are used to document the global change in temperature. It is important to know that the temperature at any station is not taken at face value. Each measurement is checked carefully. For example, each station is compared to nearby stations to see if their temperatures are biased or just plain wrong.

Procedure

Visit the Story Map to access the 5 E Lesson.



Teacher Answer Key

Teachers who are interested in receiving the answer key, please contact My NASA Data from your school email address at larc-mynasadata@mail.nasa.gov.

Extensions

If your students need additional practice with data analysis, consider incorporating this story map with the My NASA Data Data Literacy Cubes.

For high school students to meet performance expectation HS-LS2-7 (listed below), consider modifying the Evaluate tab activity as follows:

HS-LS2-7.	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

1. Design the experiment as described.
2. Conduct the experiment.
3. Evaluate the results.
4. Test the proposed solution on a larger scale.