Name _____ Period _____

Visualizing Data

Your Tasks (Mark these off as you go)

- ☐ Tell a data story
- ☐ Use maps to visualize locations
- ☐ Use maps to visualize patterns
- ☐ Use maps to tell stories
- ☐ Use maps to communicate emotions
- ☐ Use maps to provide innovation solutions
- ☐ Receive credit for this lab guide

☐ Tell a data story

With a partner, look through the graphs on this site: [What's Going on in this Graph?]

Scroll a bit and you will notice that the graphs are organized by topic and type,

Graphs Organized by Topic

Environment, Science and Technology

- Houston May Get 50 Inches of Rain. How Long Does it Take Your City to Get That Much?
- It's Not Your Imagination. Summers Are Getting Hotter.

Graphs Organized by Type

es Again and Again

Most?

Distribution (values and their frequency)

- Six Myths About Choosing a Major (boxplot)
- It's Not Your Imagination. Summers Are Getting Hotter. (histogram)

Paste a graph that you and your partner find interesting below.

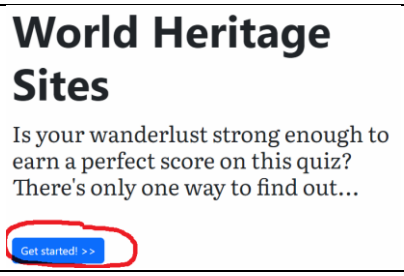
What do you notice? Share what you are noticing and what this may imply.

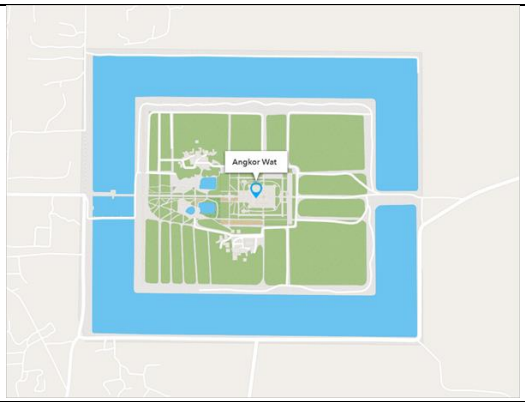
What do you wonder? Where could you find the answers to what you wonder?
What's going on in this graph? Use what you notice. What can you infer from this graph beyond what it shows directly? What's the deeper story that comes from this graph?

☐ Use maps to visualize locations

In addition to the graphs you just explored, maps are another powerful tool for visualizing data. In this section we will use maps to visualize World Heritage sites.

Follow the tutorial below to complete the section.

Have you or your partner open the Treasure Hunt: World Heritage Sites website.	 https://storymaps.arcgis.com/collections/eee4392c4b1c4927aadbcd1b478e71da?item=3
Click *Get started.*	

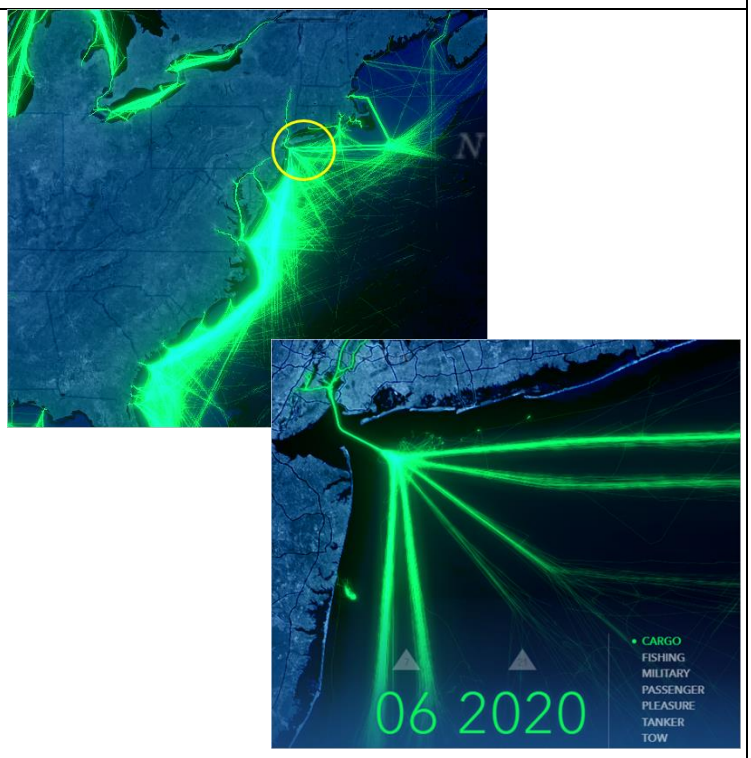
In the side pane, there is an image of a UNESCO World Heritage site. A clue is shown below the image. **Note**: UNESCO stands for United Nations Educational, Scientific and Cultural Organization. It is a United Nations agency seeking to promote peace and security through education, arts, sciences, and culture.	 Photo credit: Manfred Werner / CC BY-SA 3.0 **QUESTION** This sprawling complex of picturesque ruins was built originally as a Hindu place of worship, and eventually transformed to Buddhist. It appears on its host country's national flag. If you think you know the answer, pan and zoom to the site's location!
On the map, scroll your mouse wheel to zoom and click and drag to pan the map and locate the site. Zooming means changing the scale of a map to see more or less detail. Panning means changing the extent to see different areas on the map. When you get close enough, a pin and label appear.	
Don't click the *Next Question* button yet. Zoom in further to explore the site up close. At a certain zoom extent, the basemap shows more details of the area. You can see the grounds of Angkor Wat and the wide rectangular moat that surrounds the temple.	
In the side pane, click the *Next Question* button. Locate the other heritage sites in this game and explore them up close.	**ANSWER** Angkor Wat, Cambodia Next Question

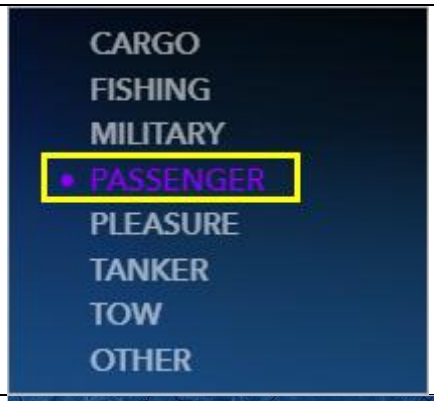
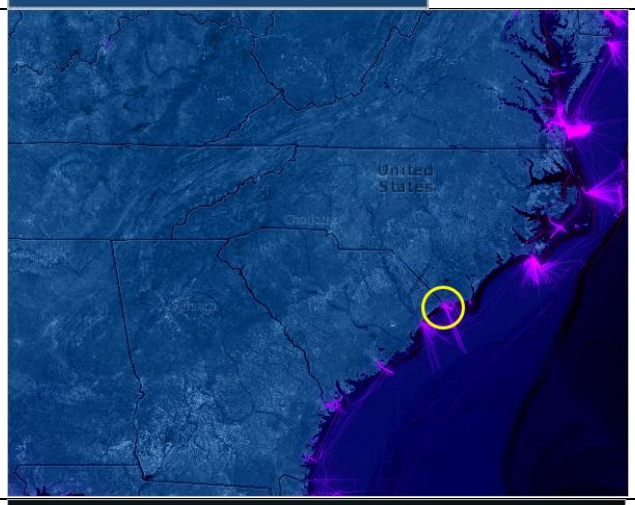
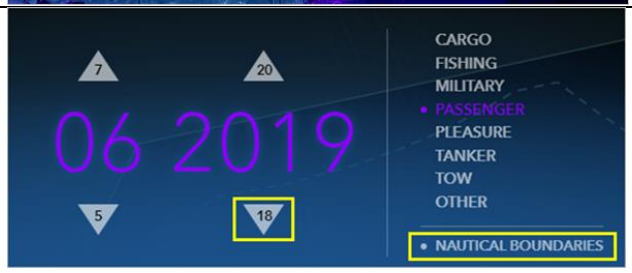
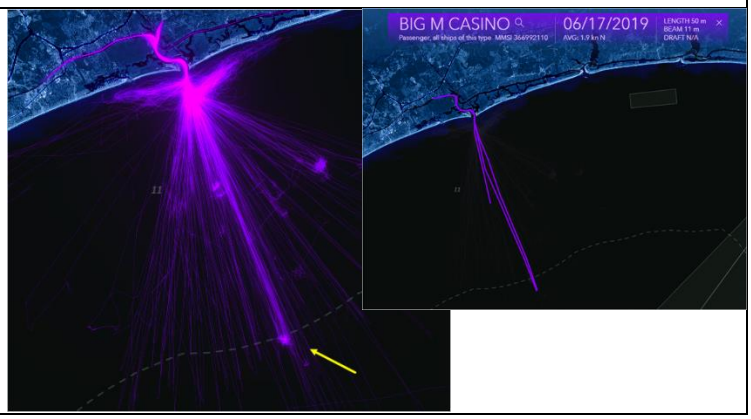
What was your final score for you and your partner?
What type of data did the map show?

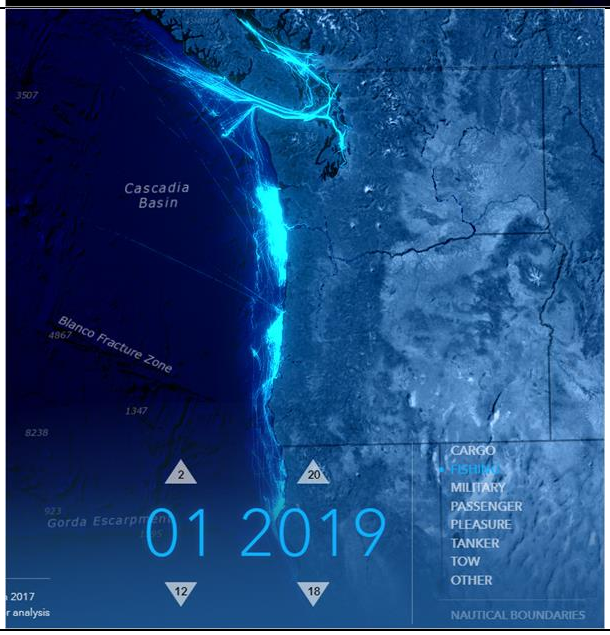
☐ Use maps to visualize patterns

Maps not only provide a picture of what is on the ground, but they can help you visualize large sets of data and reveal trends. In this section we will use maps to visualize patterns of U.S. maritime vessels.

Follow the tutorial below to complete the section.

Close the **Treasure Hunt** map and open the U.S. Vessel Traffic map. This map shows U.S. maritime activity and includes tools that allow you to explore the paths of vessels, visualize patterns, and download data. You can explore the paths of vessels and identify trends by time, vessel type, and place on data between January 2017 and June 2020. Vessel traffic data is an important resource made available by the U.S. Coast Guard, NOAA (National Oceanic and Atmospheric Administration), and BOEM (Bureau of Ocean Energy Management) through Marine Cadastre. Vessel traffic data can help avoid ocean-based slow downs and crashes.	 https://livingatlas.arcgis.com/vessel-traffic/#@=-108,40,4&time=202006&sublayer=Cargo
Zoom in to the coast of New York. It is important for cargo ships to follow sea traffic rules and control their speed and course as they come in and out of major ports. On the map, you can see what looks like lanes on the open seas. Port managers define the lanes to keep the vessels safe.	

In the list of vessel types, click *Passenger*. The map is lit up with pink lines, indicating passenger ship traffic.	
Zoom in to Long Bay off the coast of South Carolina.	
Click the down arrow to change the year to *2019* and click *Nautical Boundaries.* By turning on **Nautical Boundaries**, a line appears showing where the bounds of a country reaches beyond the land and into the ocean. There are a number of line clusters out in the open water. Why might a passenger vessel sail just beyond the nautical boundary and return?	
Click one of the lines located just beyond the nautical boundary. A bar appears at the top of the application with the vessel name. This is a gambling vessel. In states where gambling is not legal, there are vessels that ferry passengers outside the nautical boundaries where the rules no longer apply.	

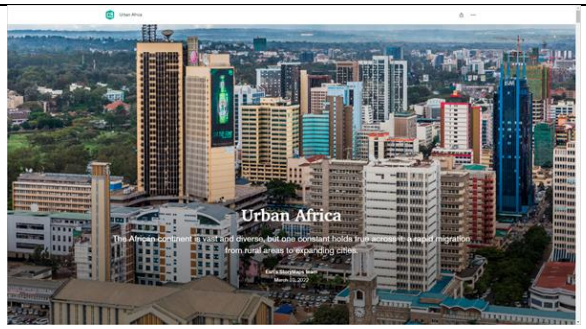
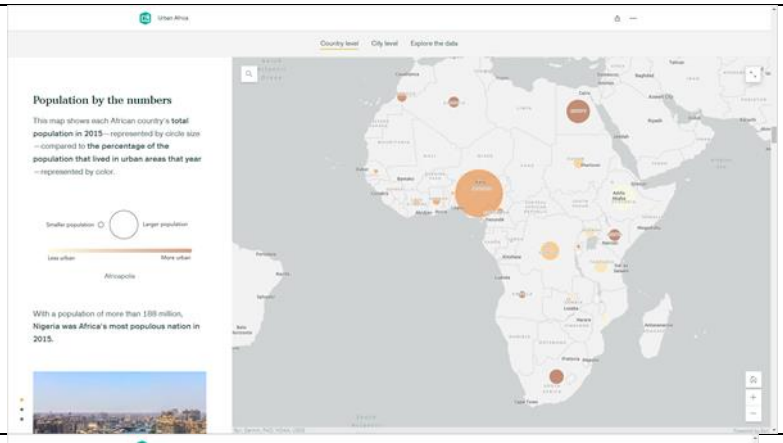
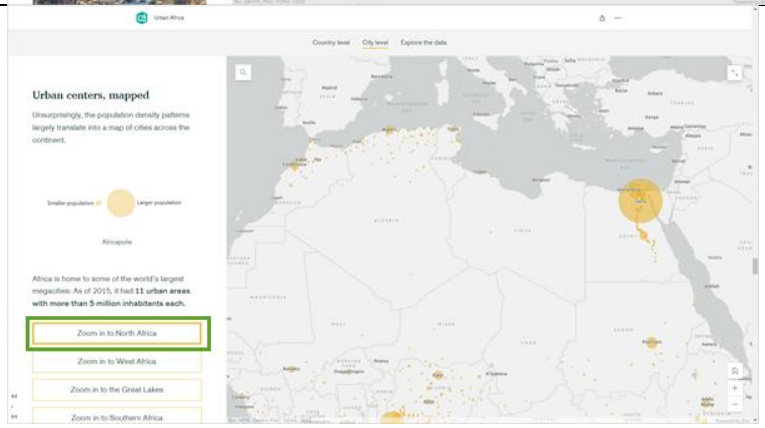
Next, you'll explore an example during the first month of the COVID-19 response. On the map, navigate to the waters off the coast of San Francisco, California. Set the date to March (**03**) **2020**. There are a number of routes forming rectangular off the coast of San Francisco. What do you think was happening?	
Click one of the routes traveling in loops. These were cruise ship vessels. When medical personnel in the United States were first responding to the spread of COVID-19 in March 2020, cruise ships, which may have had COVID-19 cases on board, were not allowed to dock. These vessels, and their passengers, traveled in loops outside their ports for several days and weeks, waiting for clearance to dock.	
Now, you'll explore how patterns in vessel traffic reflect the cycles of nature. Zoom to the Cascadia Basin off the coast of the state of Washington, known for salmon fishing. Click *Fishing* and set the date to January (**01**) **2019**. Increase the date by one month at a time and observe the changes in the vessel pattern. When are the busiest fishing months of the year?	

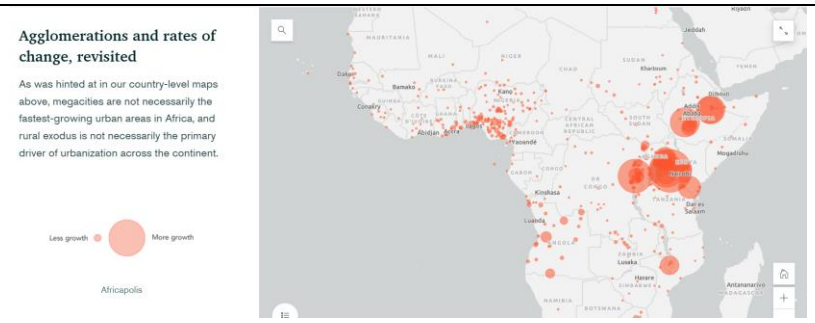
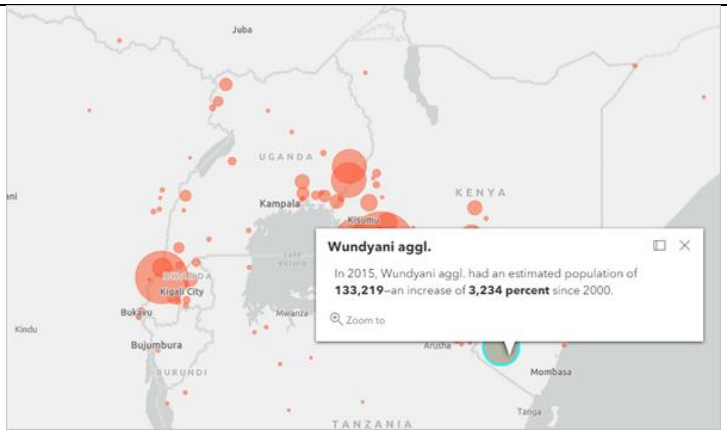
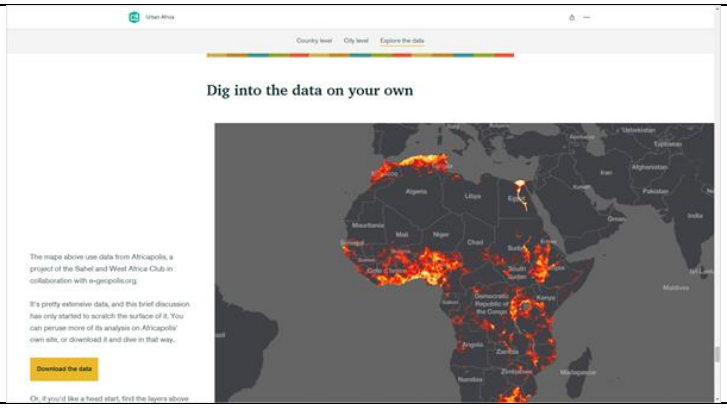
This map contains so much data that it can't all be shown at the same time. By using the built-in tools for filtering the data, it enables you to ask questions and find answers using the map. What is another question you could answer with this map?

□ Use maps to tell stories

Maps don't only provide you with information. They can engage readers and tell immersive and compelling stories. Some maps guide your explanation to tell powerful and engaging stories. When maps tell stories, they turn information into knowledge and understanding.

Follow the tutorial below to complete the section.

Close the **U.S. Vessel Traffic** application and open the Urban Africa story. Start scrolling and reading the story. As you explore, be curious and click buttons and interact with the maps to get the full experience of an ArcGIS StoryMaps story.	 https://storymaps.arcgis.com/stories/73a4b40120b44a3fb9d6935d53d49330
Scroll down to the **Population by the numbers** section. A map of the African continent is displayed. The percentage of people living in cities is growing fast in countries like Egypt and Nigeria.	
Scroll down to the **Urban centers, mapped** section. In the side panel, click the **Zoom in to North Africa** map action button (you may need to scroll down a bit). Map action buttons add an interactive component to maps in a story, allowing the reader to adjust the map view by turning the map action buttons on and off. Among these urban centers are some of the oldest human settlements on the continent. Cairo is Africa's largest city with a population of nearly 23 million.	

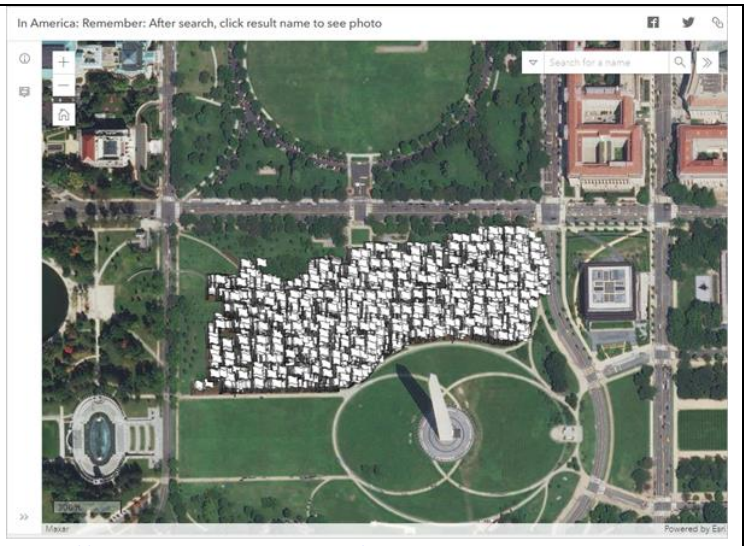
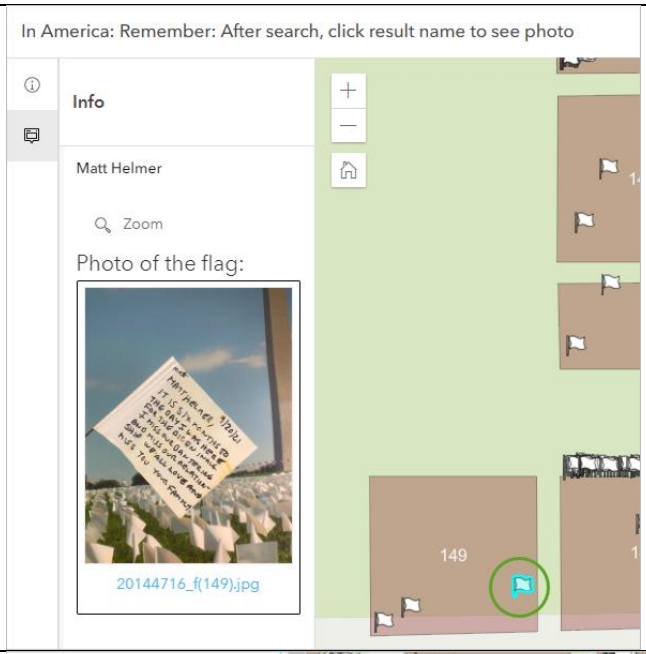
Scroll down to the section titled **Agglomerations and rates of change, revisited**. Rapid population growth and development in rural areas have also led to the emergence of thousands of small urban agglomerations, or urban centers.	
On the map, click any of the red circles. A pop-up appears with more information. These map symbols represent the percentage of growth in the population from 2000 to 2015. Clicking each circle reveals a pop-up with information about the small urban agglomeration, the estimated population, and the percentage of growth.	
Scroll to the **Dig into the data on your own** section. You can download the maps and data in this story. Including a way for viewers to access the data used in maps throughout the story provides opportunity for further learning and creativity.	

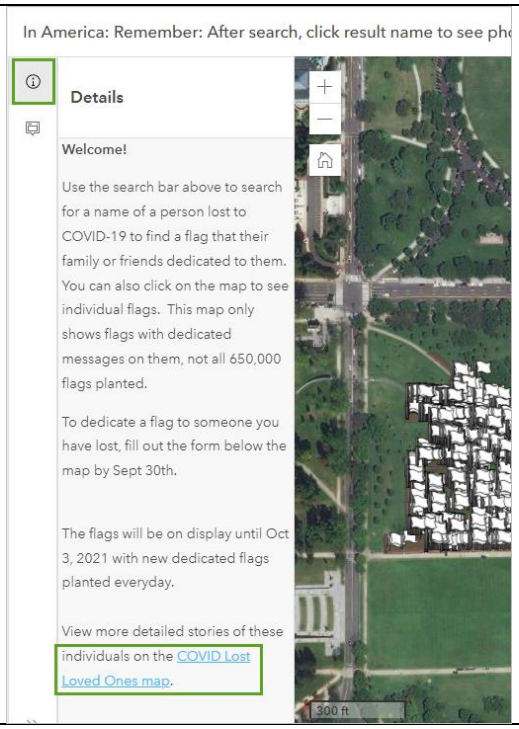
Earlier you selected a graph from the New York Times. How might you incorporate this graph into a story map to tell a more complete story? What additional information would you add?

☐ Use maps to communicate emotions

Maps don't only communicate information and knowledge. They can also make you feel and connect to emotions.

Follow the tutorial below to complete the section.

Close the **Urban Africa** story and open the In America: Remember website and scroll down to the embedded web app with a map of flags. The In America: Remember exhibit was a memorial and art installation on the National Mall in Washington, D.C., in September and October of 2021. The lawn on the National Mall was blanketed with more than 660,000 white flags, each representing a life lost to COVID-19. Visitors were invited to personalize and dedicate a flag for someone they lost, and using GIS technology, visitors who could not be there in person were able to dedicate a flag digitally. The website includes a map that serves as a memorial to those who have died in the pandemic. Each flag on this map represents a life lost to COVID-19 and many of the flags include personal dedications and messages added by someone who wished to honor a loved one they lost.	 https://www.inamericaflags.org/
In the map, zoom in and click a flag. The **Info** pane appears; it includes information about the flag you clicked. An image of the flag when it was on the lawn on the National Mall appears with a personal message, hand written from a loved one. For those who submitted a flag online, a dedicated group of volunteers transcribed the messages onto a flag and took a picture to show the message was part of the exhibit. The flags were organized by numbered sections so that a reference could be provided to locate a specific flag.	
Zoom in to section **106**, click the flags, and read the messages that appear. This section was dedicated to physicians and frontline health workers who lost their lives serving and providing medical care to others who had COVID-19.	

In the side pane of the app, click the information button to see the **Details** pane. At the bottom of the pane, click the **COVID Lost Loved Ones map** link. This map features photos and messages of remembrance for the lives lost to COVID-19. While this map can't bring these people back, it can offer a space for mourning and remembrance. It allows us understand the losses from COVID-19 not as numbers, but as individual lives. This map is an example of crowdsourcing, in which you invite anyone to contribute data and information to a survey or map. This is one of many ways you can collect data to show on a map.	

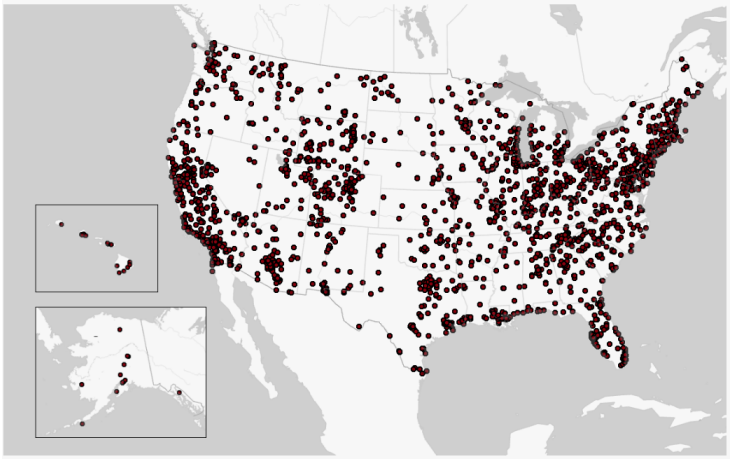
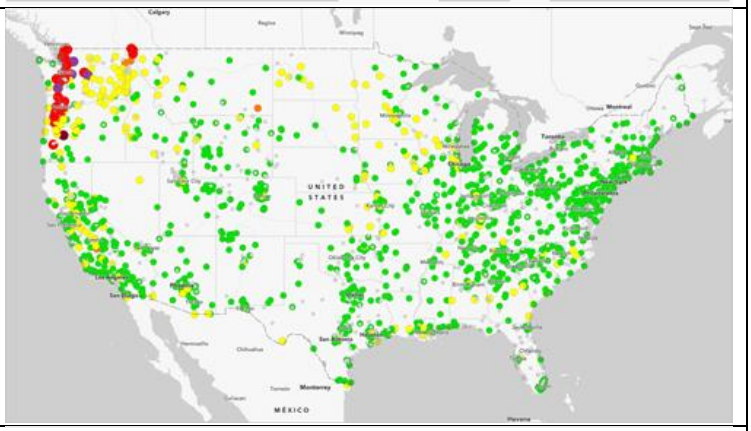
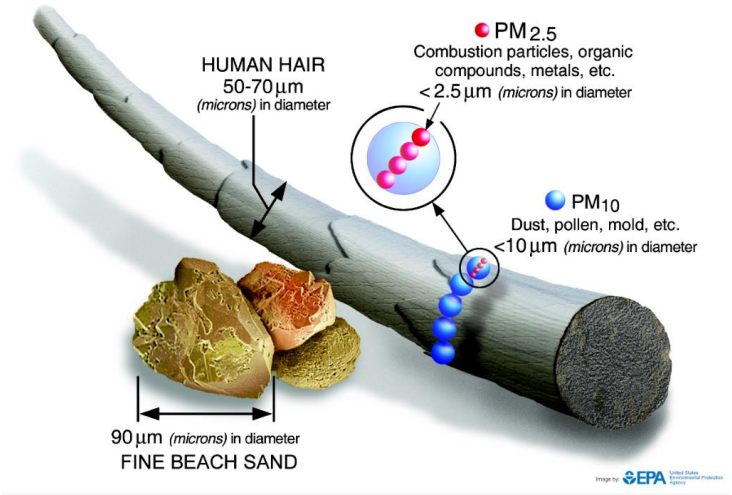
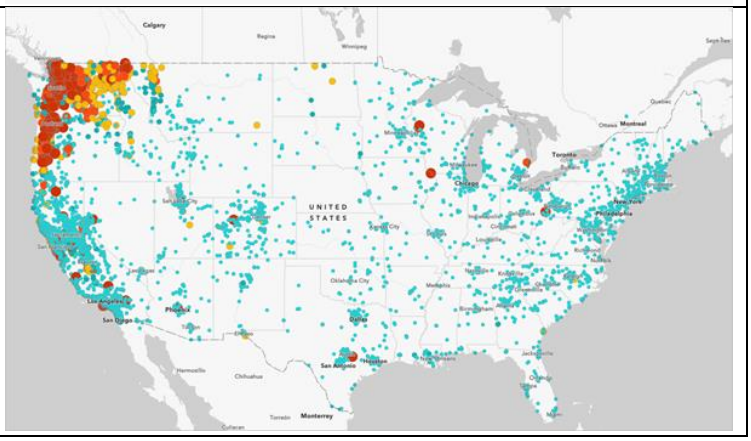
The map above used crowdsourcing as way to collect data. What is another type of map you could create that utilizes crowdsourcing?

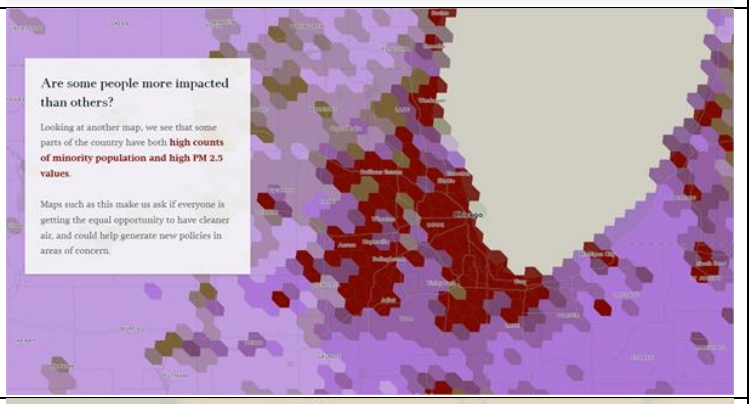
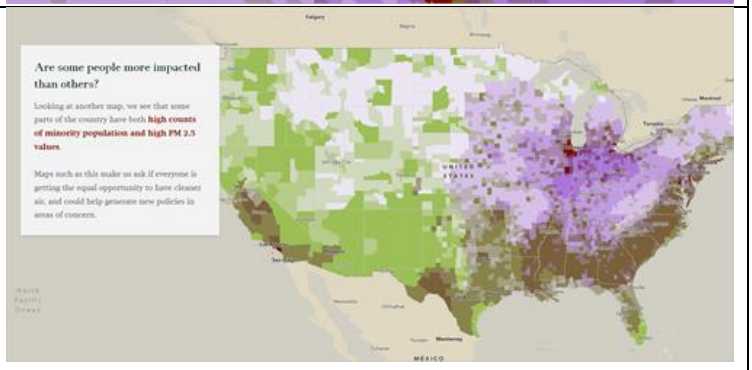
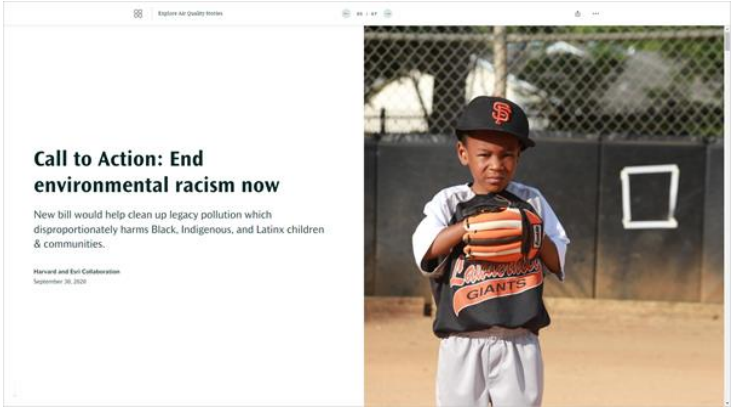
☐ Use maps to provide innovative solutions

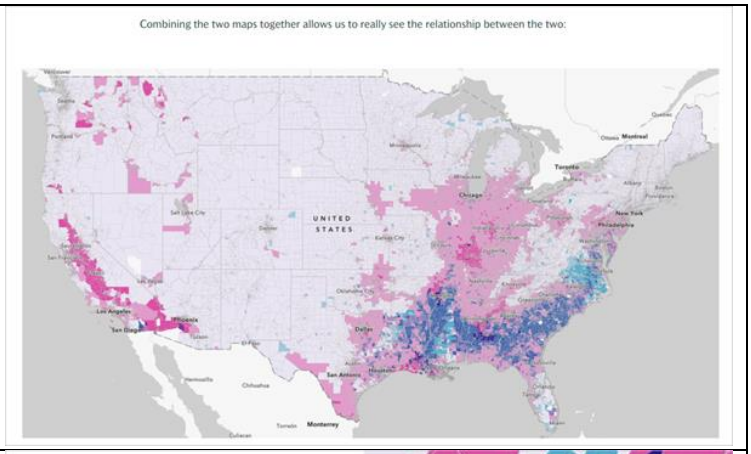
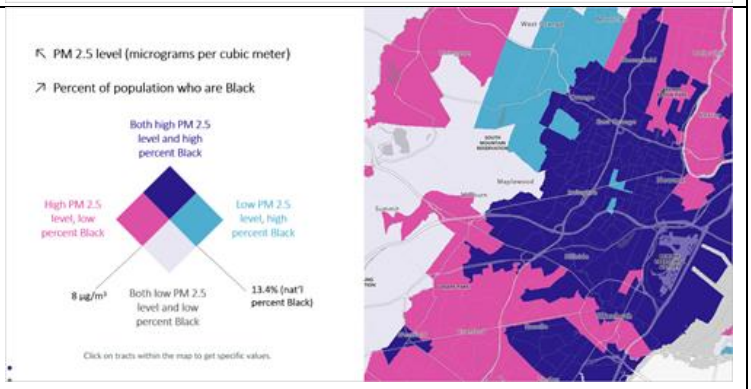
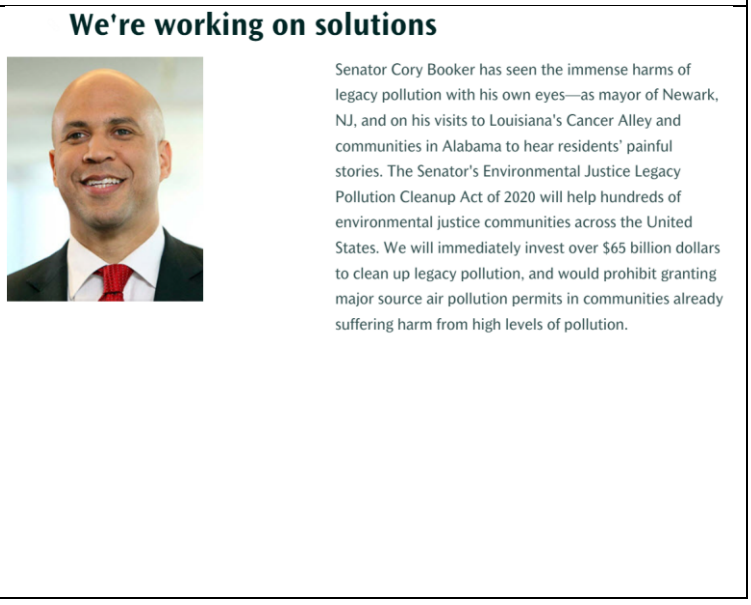
Maps don't only help identify and communicate challenges in our world—they also help inform decision making and identify solutions to address them. We can use maps to perform analysis and help improve our communities, prepare for emergencies, and plan for the future.

Follow the tutorial below to complete the section.

Close the **In America: Remember** site and open the The air we breathe story. This story explains the causes of poor air quality, shares data on air quality in maps, and illustrates the human impact of poor air quality.	 https://storymaps.arcgis.com/collections/20aeacd852de4ea8b6616a130fb61760?item=4

Scroll down to the **How is the air quality near me?** section. There are many ways to visualize air quality. One way is to view Air Quality Index (AQI) values.	
Explore the second map showing AQI values and determine what the current air quality data reading is in your area.	
Scroll to the **PM 2.5 near me** section. Particulate matter, or PM, at the size of 2.5 micrograms per cubic meter is especially concerning to human health, as it is small enough to enter deep into lungs and even the bloodstream.	
Scroll further and explore the map in the **PM 2.5 near me** section.	

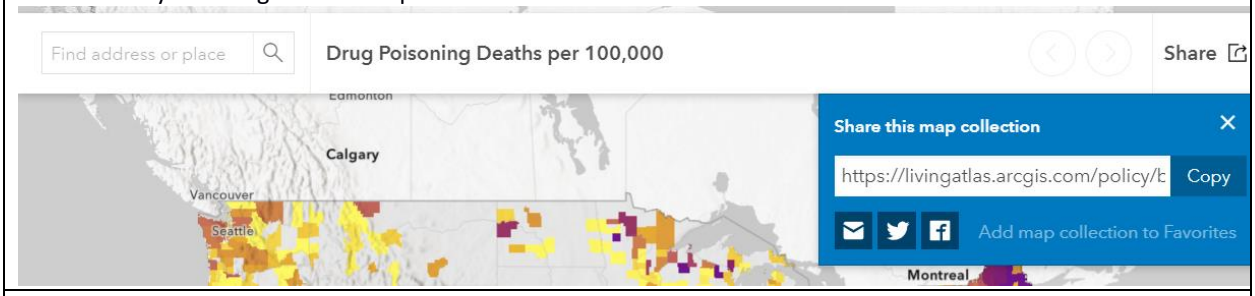
Scroll down to the **The human impact** section. Poor ambient or outdoor air pollution is a major environmental health risk all over the world, increasing the chance of people developing diseases such as stroke, heart disease, lung cancer, and asthma.	
Continue scrolling through the **Has air pollution decreased?** section. Read and explore the maps until you get to the question: **Are some people more impacted than others?** This map explores the relationship between areas with high PM 2.5 values and communities of color in the United States.	
Click the zoom out button and pan the map to see the entire country. Maps can help visualize where new policies can address and improve equity. This story is part of a collection of stories exploring air quality conditions and policies around the world.	
At the top of the story, click the next arrow to view the next story in the collection. The title of the next story is **Call to Action: End environmental racism now**. The beginning sections explain how the burden of environmental pollution is not evenly distributed throughout the United States and that communities of color, indigenous communities, and low-income communities are more likely to live and work in areas that have historically been disproportionately burdened with poor air and environmental pollution impacts. In particular, the African American population has been found to be 54 percent more likely to live in an area of heavy air pollution and under-resourced communities are 35 percent more likely.	 

Scroll to the map that combines the high levels of PM 2.5 (pink) and high percentage of Black populations (blue). By combining the maps that show where there are high levels of PM 2.5 (in pink) and a high percentage of Black population (in blue), the relationship between PM 2.5 and Black populations is more evident.	
Scroll to the **Newark, New Jersey** section and explore the case studies presented. Another way to visualize relationship in a map is to style layers using a relationship map. A relationship map displays two data values with a grid of colors, showing whether the two attributes have data values that are both high, both low, or individually high or low, with two different colors for each corner of the grid. In this example, the darkest blue color represents areas where there is both a high PM 2.5 level and high Black population. The lighter blue areas represent where there is low PM 2.5 but a high percentage of the Black population, and the pink areas represent the reverse—areas with low Black population but high PM 2.5.	
Explore the **We're working on solutions** section. Government agencies, advocacy groups, and concerned residents can all use maps to make informed decisions about air quality policy. If racial equity and social justice are important components of the policy-making process, maps can serve as a useful tool for determining where to allocate resources where they are most needed. You can continue exploring the remaining stories in the collection, which includes more maps, data, and tools for policy mapping in the United States and around the world.	

Navigate to Esri Maps for Public Policy,
https://livingatlas.arcgis.com/policy/browse/#col=null&hs=0&viz=88de138ce61b4dc8821960f19dca7bae&loc=-96.176,39.208,3

- Explore the maps.
- With a partner, propose a question to investigate. For example, what is the relationship between homeless populations and drug deaths? What is the relationship between High School Dropouts and Firearm fatalities?
- Write your question below,

Select two maps that can be used to answer the question you proposed. Paste links to your maps below. You can do this by selecting the **share** option.



How do the maps you selected serve to answer your question. Is there are relationship, a partial relationship, no relationship. Discuss your results below.

□ Receive Credit for this lab guide

Submit this portion of the lab to Pluska to receive credit for the lab guide.