ALL for Science™
Authentic Literacy and Language for Science

Baylor College of Medicine CENTER FOR EDUCATIONAL OUTREACH

Mini-Lesson (15 minutes)

Reading Data Through Graphs

OVERVIEW

Scientists come across many different types of texts when they look for information written by other scientists. In addition to words, images, and captions, scientists also have to interpret data found in graphs. Graphs can appear in scientific papers, reports, books, and on websites. Many graphs illustrate changes over time and are helpful for understanding patterns or trends in a phenomenon. Some graphs are interactive, allowing users to look for specific information.

When scientists record measurements or observations, these measurements represent only one single moment in time—a snapshot—but scientists use graphs to record multiple moments in time, which can reveal patterns over longer periods of time, such as hundreds of years. When scientists interpret graphs, they have to look at all the data points together rather than one by one. Zooming out to look at the big picture allows scientists to notice patterns in the data. Part of interpreting a graph is drawing conclusions about patterns in the graph and making predictions based on those patterns.

At this point, your learners might have added questions to their Inquiry Charts about how environmental conditions in their ecoregions have changed over time. If they have not, you might want to lead them toward asking a question that addresses change in their ecoregion over time. You might model this by saying something like, *We've been discussing rainfall over the last few days. I've been thinking about my ecoregion, and wondering if the rainfall in the Gulf Coast ecoregion is always the same or if it has changed over time.*

NOTES: You are encouraged to create the "Reading Data Through Graphs" anchor chart with your learners as you move through the lesson, using the provided anchor chart as a model. Post it for easy reference when completed, and remind learners to refer to the anchor charts during inquiry circles.

This mini-lesson is intended to teach learners to read data represented in graphs. Learners should be able to apply this strategy to any graph they encounter. (**Drawing conclusions** and **making predictions** are sub-routines embedded in this strategy.) However, we have also provided information to support you and your learners in navigating a specific online data set represented in graphs. The teacher instructions below will help your learners use the online system to generate a graph that represents specific information for a specific state or county. **We recommend that you practice using the online system to generate graphs together as a class before teaching this mini-lesson. This lesson will support learners in reading the graphs they have generated.**

Instruction for generating graphs to read:

- Open the Climate at a Glance page on the National Centers for Environmental Information website: https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/time-series

- Scroll down select your state (Texas) and a county in Texas. Direct your learners to counties located in the ecoregion they are studying. Some examples can be found on this map from Texas Highways: https://texashighways.com/wp-content/uploads/2020/03/wildflower-regions-of-texas.jpg
- You can select from several parameters (e.g., precipitation, average temperature) to graph.
- Set the start year as 1895 and the end year as 2023.
- Click "Plot" to generate a graph.

MATERIALS

Teacher needs:

- chart paper
- marker(s)
- "Reading Data through Graphs" anchor chart as a model
- online graphs to model the strategy
- precipitation graph for 1895–2023 (generated on https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/time-series)

PROCEDURE

Each *italicized statement* below contains suggested wording the teacher may choose to use for the lesson; additional teacher actions and considerations are in parentheses.

Tell what the strategy is (declarative knowledge)

1. *Today, we will learn how to read data through graphs. Graphs are particularly helpful for understanding changes over time. While scientists (and you) can observe and record the environmental conditions (e.g., temperature, rainfall) on a particular day, this is just one moment in time. Scientists use graphs to record, understand, and communicate how environmental conditions change over longer periods of time, such as hundreds of years. When interpreting a graph, scientists look at the "big picture": they examine all the data points together (instead of one by one) to look for patterns.*
2. *The information represented by a graph is called "data." Graphs can be found in books and videos, but today we will explore graphs online. The graphs we will explore today are interactive—this means that you will interact with the map or graph to find the information you need. Being able to create and read a graph is important because they help us understand changes over time.*

Tell when and why to use the strategy (conditional knowledge)

1. *I create and read graphs whenever I want to understand how something is changing over time. When I come across a graph in a text I'm reading, I read the graph to help me understand patterns related to the topic I'm reading about.*
2. *Graphs offer unique information that I can't get from the text, so it's important that I stop to read the graph and think about the unique information it contains. This information may be useful when I'm writing a scientific report.*

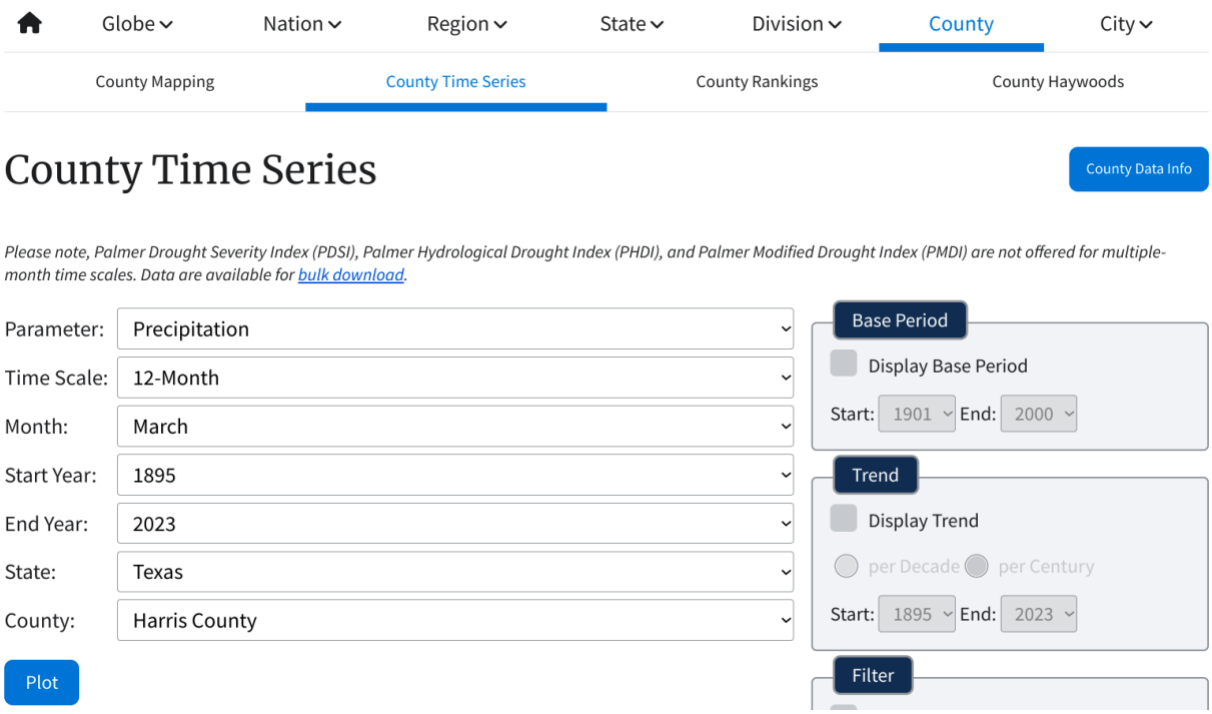
Tell how to use the strategy (procedural knowledge)

1. *First, I notice the features that tell me I am looking at a graph:*

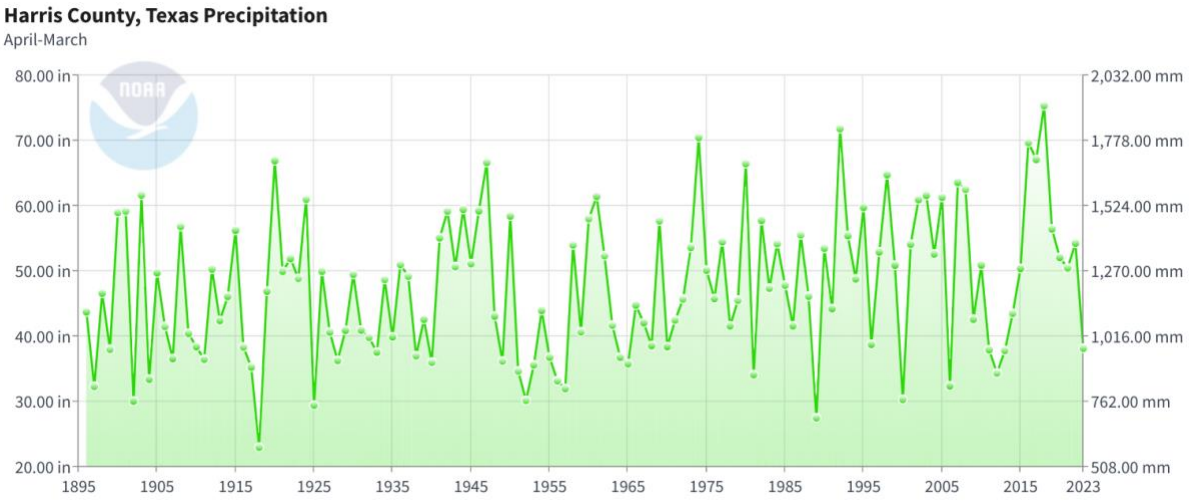
    - *A graph is a visual representation of data (e.g., temperature, precipitation). Graphs have a title that tells us what the data in the graph is about. A graph includes labels on the bottom (along the x-axis) and the side (along the y-axis).*
    - *Usually, measurements are written on the side (y-axis) and time is written on the bottom (x-axis). Each point on the graph represents a measurement, and the labels along the bottom (x-axis) tell us when that measurement was recorded.*
    - *I can look for a unit next to the measurements to help me understand what is being measured and how. For example, because time is usually on the x-axis, I can look at the bottom for units of time (sec, min, hr, day, year) to understand how time is measured.*
2. *I note the title and the labels on the x-axis and y-axis and ask myself, What information is this graph representing?*
3. *Then I look at the whole graph and all the data points. I ask myself, What is the big picture? What patterns do I notice in the data?*
4. *Then I draw a conclusion about what this pattern means. I combine what I know about the information the graph is representing AND the patterns I notice.*
5. *Finally, I make a prediction based on the pattern and the information in the graph. I ask myself, What would it look like if this pattern continues?*

Model the strategy:

1. *I am curious about the precipitation, or rainfall, in the Gulf Coast ecoregion. The Gulf Coast is a big ecoregion, but one of the counties in this region is Harris County, which includes most of the people who live in Houston, Texas.*
2. *First, I'll open the link to the Climate at a Glance page on the National Centers for Environmental Information website: https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/time-series*
3. *Then I'll adjust the settings so that they are set to my state (Texas) and the county I am interested in (Harris County). Next, I'll select the parameter I want: precipitation. Later, I might go back to explore other parameters, such as average temperature. Finally, I'll check to make sure that the start year is set to 1895 and the end year is set to 2023. I will leave the month setting in March.*

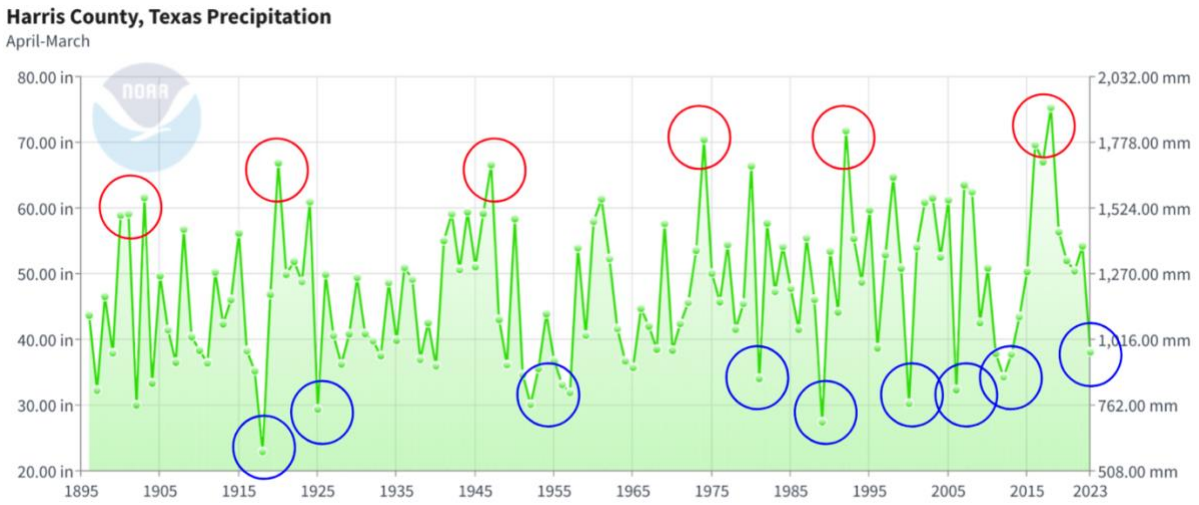


4. *Then, I will click "plot" to graph the data.*



5. *First, I read the title of the graph: "Harris County, Texas Precipitation." I know the graph represents the amount of precipitation (rainfall) in Harris County, Texas. Then, I read the labels on the bottom of the graph (x-axis). The number starts with 1895 and ends with 2023. Because I selected 1895 and 2023 as my start and end years, I know that the x-axis tells me the year each measurement was recorded. Then I look at the labels on the side (y-axis), and I notice that each number is followed by "in." I remember that "in" stands for "inches." I can conclude that the y-axis tells me the amount of precipitation in Harris County, Texas, in the month of March each year.*

6. *Then, I read the graph. When I first look at this graph, I notice a lot of ups and downs. I conclude that in March of some years, Harris County got more rainfall, and in March of some other years, it gets less rainfall. When I look at the data points one by one, there is no clear pattern. In March 2024, Harris County might get more rain than in March 2023, or it might get less. I can't make a strong prediction here; I need to look at the data differently in order to make a prediction.*
7. *To find a pattern, I have to "zoom out" and look at all the data together as a whole. If I look across this graph at all the annual rainfall measurements, I notice that the highest points on the graph—the rainiest years—are getting slightly higher. I also notice that the lowest points on the graph—the least rainy years—are getting slightly higher as well. This makes me conclude that, over 123 years, the wettest years have been wetter, and even the driest years have been less dry.*



8. *Finally, I can make a prediction. Because I have observed this pattern in the data from the last 123 years, it is reasonable to predict that it might continue. I can predict that, over the next 100 or more years in Harris County, Texas, we might expect more precipitation and wetter conditions overall. However, it is important to note that I* ***cannot*** *predict more precipitation every year. Rather, I can reasonably expect ups and downs (some dryer years and some wetter years) because this has been the case for the last 123 years.*