TOWNGREEN2025
Middle School Climate-Change Curriculum

Lesson 6

Carbon Cycles through Ecosystems

Unit Title: **Carbon Cycles through Ecosystems**	
Theme: **Ecosystems & Cycles**	Grade Level: **7**
# of sessions for the unit: **1**	Session #6: **How do scientists analyze a graph?**
Date created: **Summer 2017**	Author: **B. Allia, C. McWilliams**

CC Climate Change Curriculum

Unit Description

Focusing on systems and cycles, students use their understanding of climate-change and how carbon and thermal energy interact with Earth's land and atmosphere. Students practice skills such as argumentation and collecting and analyzing data. Students gain experience with the interactions of humans and Earth processes with ecosystem dynamics, and with developing solutions to complex climate-change issues. The lessons generally follow this order:

- Introduce unit and culminating event: climate-change's effect upon fauna
- analyze global temperature and carbon dioxide trends
- understand personal climate-change experiences, such as weather, matter and energy uses
- collect wetland and upland forest soil carbon-stores
- sample atmospheric carbon-store
- analyze land and atmospheric carbon-stores
- understand the carbon cycle, pre-human and human era
- describe personal experiences with solid forms of carbon changing into atmospheric carbon
- develop and present solutions to save a fauna from climate-change issues

Standard(s)

Based upon the 2016 MA Science & Technology/Engineering Curriculum Framework

MA LS2 Ecosystems: Interactions, Energy, and Dynamics

MA 7.MS-LS2-3 Develop a model to demonstrate how matter and energy are transferred among living and nonliving parts of an ecosystem and that both matter and energy are conserved through these processes

Unit Goals

1. Create an action plan to decrease carbon in the atmosphere, increase carbon stored by the land, and preserve natural carbon-stores in the ground
2. Build background knowledge of how carbon cycles within a local ecosystem
3. Understand relevant climate-change issues in order to make informed decisions
4. Identify authentic scientific processes, such as sampling, gathering, and analyzing land and atmospheric carbon-content data, in order to validate evidence regarding climate-change

Unit Objectives

Students will be able to

understand that:

1. Carbon cycles through the atmosphere and land
2. Human activities increases atmospheric carbon by burning fossil fuel
3. Atmospheric carbon is a "greenhouse gas"
4. Greenhouse gases increase global temperatures
5. Wetlands and uplands store different amounts of carbon above and below ground

and to:

1. Sample, collect, and analyze primary-source data
2. Collect and analyze secondary data as a means to validate causes of climate-change

Lesson Objectives

Students will understand how human interaction increases atmospheric carbon when they turn on a lightbulb

Note any potential barriers to the lesson — consider variability

Student challenges

- understanding the vocabulary used in the graphs
- math disabilities

Evaluation/Assessment

(directly linked to the goals, i.e., Formative/Ongoing Assessment or Summative/End of Lesson Assessment)

Formative Assessment

1. Students will correctly identify the purpose of the graph by describing the labels on the graph and explaining what the graph is showing. This can be done in writing or through a verbal explanation.
2. Homework graphing questions

Vocabulary

- graph
- x-axis
- y-axis
- labels
- anomaly
- mean (average)
- parameters

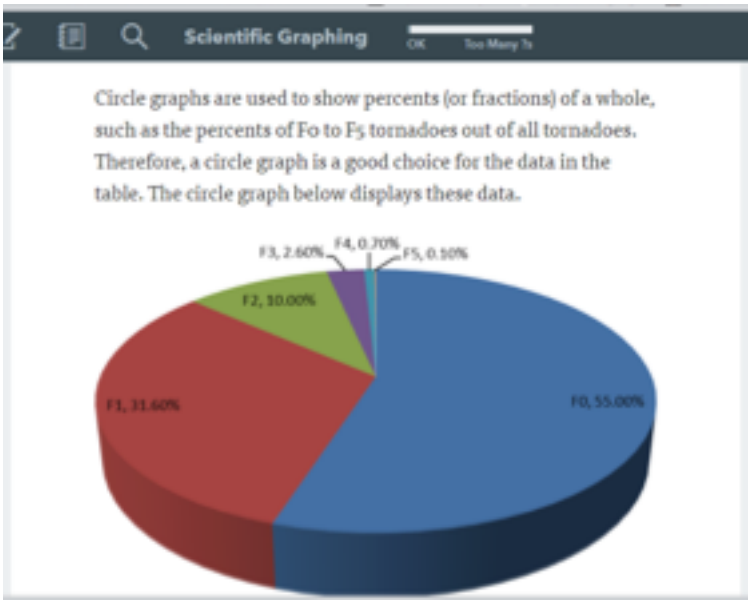
NOTE: Consider the UDL Guidelines in selecting methods and materials to ensure that you provide options for engagement, representation, and action and expression.

Methods

(e.g., Anticipatory Set, Introduce and Model New Knowledge, Provide Guided Practice, Provide Independent Practice)

1. The teacher will introduce ways that scientists can show or represent the data they have collected during scientific exploration or through other methods.
   - A. Sample graphs can be projected (or handed out if no projection device is available) for all students to see and the different axis and labels will be solicited and then explained for student understanding.
   - B. Explain that scientists need to analyze graphs to determine what the data tells them.
     1. For each of the graphs, students should identify what the X and Y parameters are, what the lines on the graph are telling you, and analyze it (what does this mean).
     2. To ensure that all students are actively thinking on their own, the teacher explains to them that they will do this activity by themselves for 5 minutes.
     3. Teacher circulates and provides encouragement and comments/suggestions on student work.
     4. For the next 5 minutes the students will share their discoveries with a neighbor or in a small group.
     5. The teacher selects the groups for quick transition and to be sure no one is left out and so that each group comes up with an explanation of the graph.
     6. The teacher allows a few minutes to have the groups share their answers with the class.
   - C. The teacher then hands out the graphs (attached below), one at a time:
     1. first, the graph related to the amount of carbon dioxide in the atmosphere.
     2. Students identify the labels, and the parameters of the X and Y axis , then and explain what the graph is showing.
     3. Students can write this on their copy of the graph or on lined paper.
     4. Each group shares their discoveries with the whole class.
   - D. The teacher then hands out graph #2 (which is a similar to graph #1, but with fewer years to show the annual variability of CO_2) and the above process is repeated.
     1. The teacher explains that scientists need to analyze graphs to determine what the data tells them.
     2. Students brainstorm why, for each year, the line goes up and down, and this process repeats itself for each of the years.
     3. This is caused by the seasons. The northern hemisphere has more land mass and therefore more trees, the amount of CO_2 goes down due to increased photosynthesis in summer, and when the northern hemisphere has winter, the amount of CO_2 goes up again due to reduced photosynthesis.
   - E. The teacher hands out graph #3 and repeats the process used for graph #1.
     1. This graph shows how the temperature has been increasing over the years when data was collected and shows a steady upward movement.
     2. Then, explain that scientists sometimes need to analyze multiple graphs together to determine what the data tells them.
     3. Students compare the results of graph 1 and 3 together, following the same steps as above.
     4. Students analyze at what is similar and what is different on the 2 graphs.
   - F. If time allows, after the students share their findings and ask where is the additional CO_2 might be coming from or why the temperature is rising as the carbon dioxide is increasing.
2. Homework preview or review suggestions
   - A. Actively learn *www.activelylearn.com* (free) "Scientific Graphing"
     1. Reading comprehension strategies
     2. Embedded videos multimedia

3. Embedded guiding questions



B. Mr. Anderson how a graph works video: *https://youtu.be/9BkbYeTC6Mo*

C. Mr. Anderson analyzing a graph video: *https://youtu.be/9NkT-oYPkOA*

D. Brain Pop "Graphs" *https://www.brainpop.com/math/dataanalysis/graphs*

1. understand different types of graphs
2. how to read graphs
3. how to analyze graphs

4. Companion guiding questions to video

1 Graphs can help you visualize data. What does this mean? Choose the best answer.

- **A** Graphs can help you better understand data by presenting it in an easy-to-read format
- **B** Graphs are always pretty to look at
- **C** Making graphs requires basic knowledge of optics and data entry
- **D** Graphs present information without using numbers, letters or words--only pictures

2 In a bar graph, how does the x axis differ from the y axis?

- **A** The x axis represents positive values, the y axis represents negative values
- **B** Numbers are placed along the x axis, while words are placed along the y axis
- **C** The x axis is very long, the y axis is very short
- **D** The x axis is a horizontal line, the y axis is a vertical line

3 What graph should you use when you're comparing parts of a whole?

- **A** A bar graph
- **B** A line graph
- **C** A circle graph
- **D** A box-and-whisker graph

4 The following graph breaks down, by percentages, what the kids in Tim's class had for lunch today. What can you learn from this graph?

A That nobody likes bologna sandwiches

B That more kids had peanut butter for lunch than any other option

C That tuna fish is the most popular lunch option

D That more kids ate ham and cheese than bologna

6 Which kind of graph would you use to show how the price of bread has changed over time?

A Bar graph

B Line graph

C Circle graph

D Box-and-whisker graph

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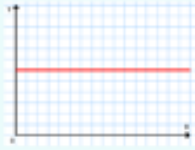
7 Tim has played baseball for five years. Each year, his batting average has increased by .010 points. If you plotted Tim's batting average on a line graph, what would it look like?

A

B

C



D

Lab Report

Carbon Cycles through Ecosystems

8 There are 15 kids in Tim's class. If you wanted to use a graph to plot how tall each one of them is, which type of graph should you use?

- **A** A circle graph
- **B** A bar graph
- **C** A line graph
- **D** A box-and-whisker graph

9 What's another name for a circle graph?

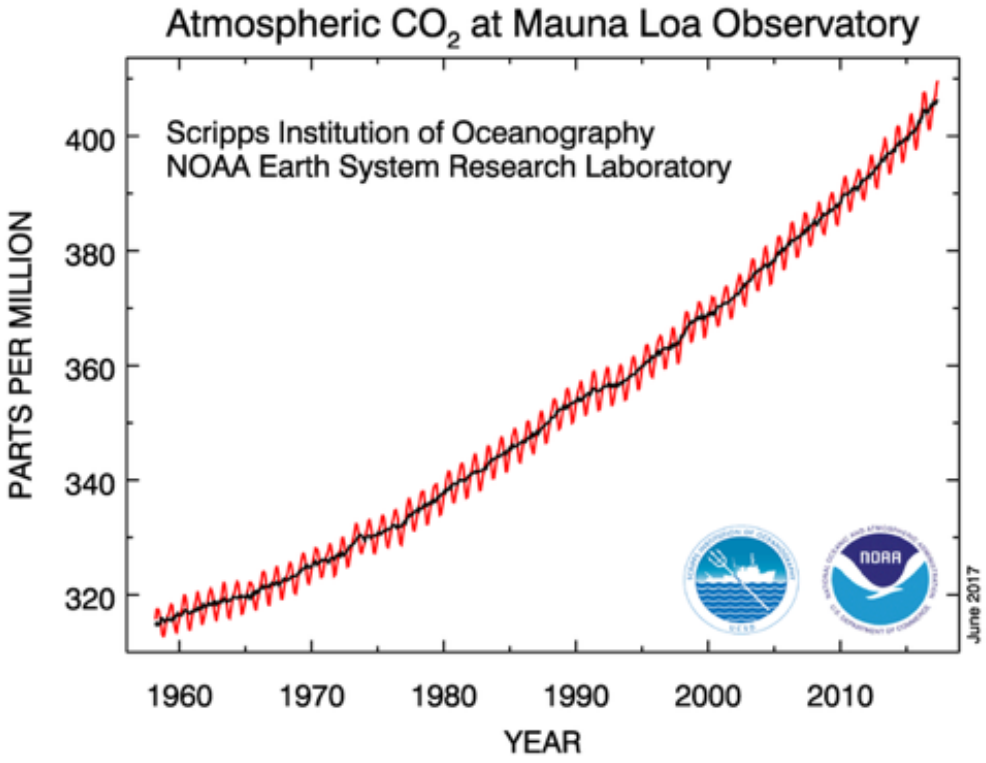
- **A** Pizza chart
- **B** Cake chart
- **C** Pie chart
- **D** Box graph

10 A bar graph shows the number of calories in five separate types of cookies. How can you tell which cookie has the highest number of calories?

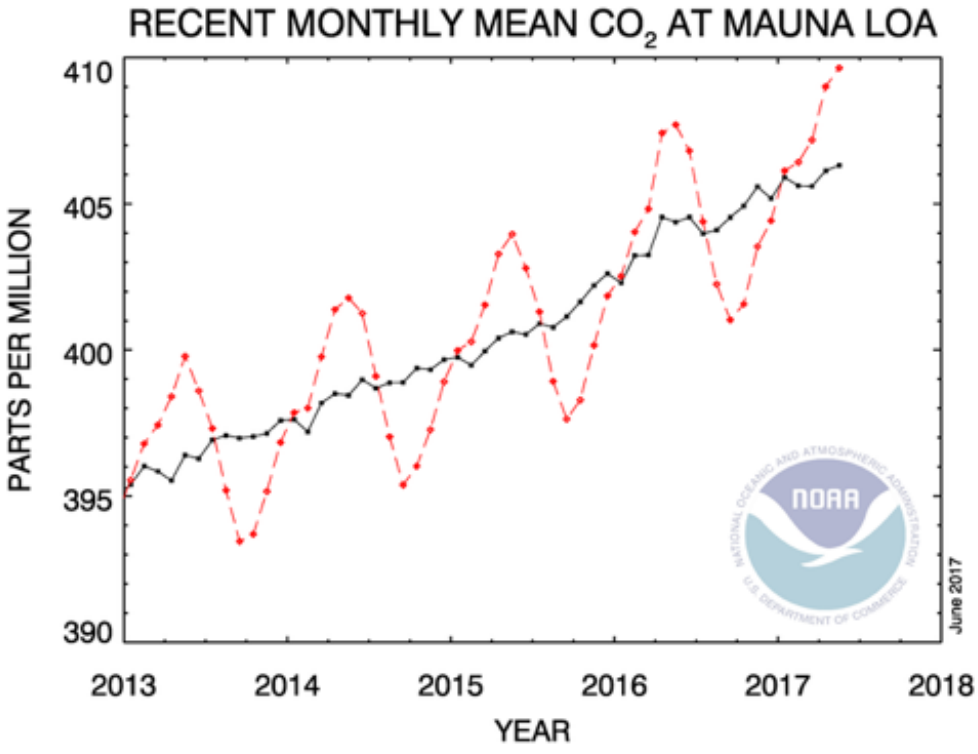
- **A** Its bar extends the furthest up the y axis
- **B** Its bar is the widest
- **C** Its bar is twice as large as all the other bars combined
- **D** Its bar is the shortest

Materials

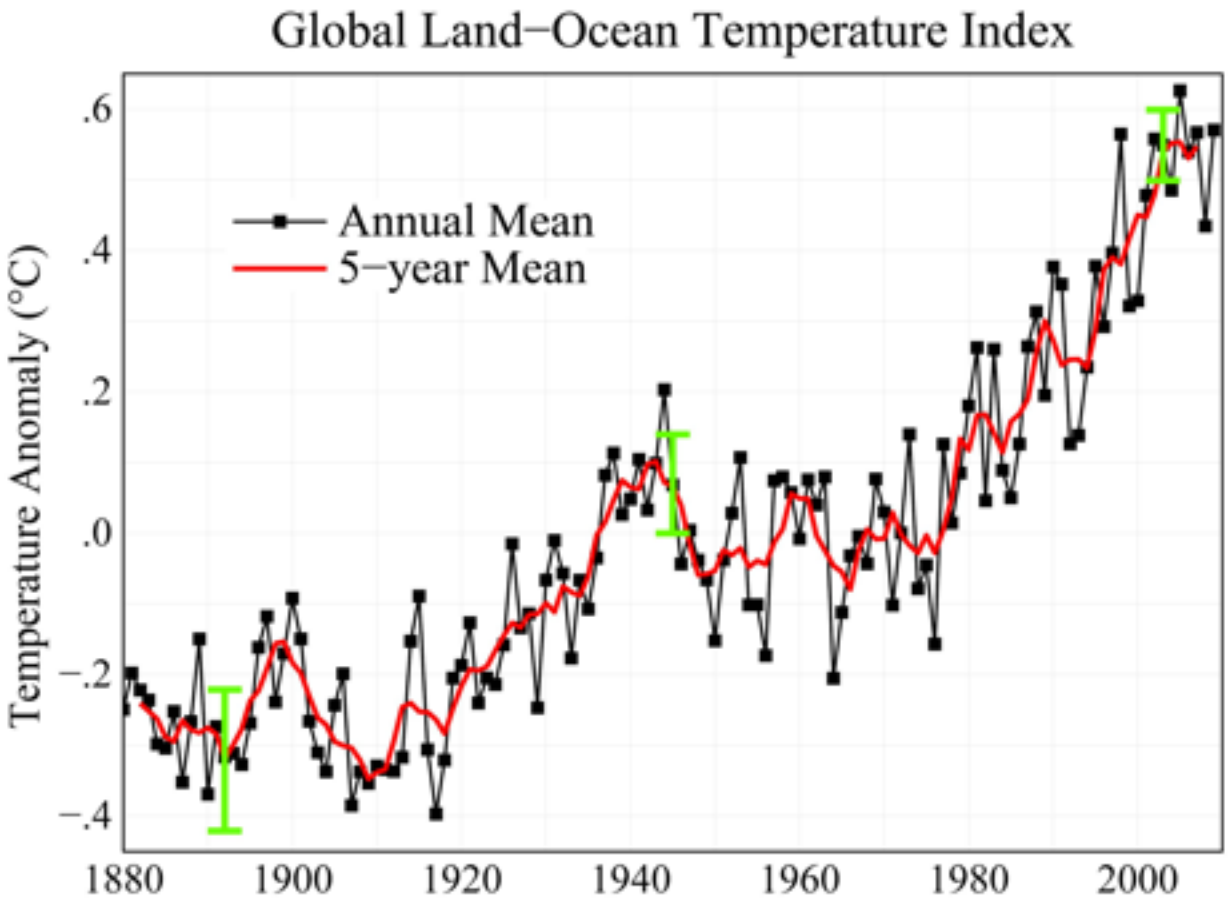
Graph 1 (from *https://www.esrl.noaa.gov/gmd/obop/mlo/*):



Graph 2 (from *https://www.esrl.noaa.gov/gmd/ccgg/trends/*):



Graph 3 (from *https://www.nasa.gov/topics/earth/features/temp-analysis-2009.html*)



Notes and Comments

Strongly suggested website *https://climate.nasa.gov/*

Combination graphs are available if students can compare multiple parameters in a single graph.