



## Lesson Overview

This lesson allows students to zoom out and see how the food system is linked to a global issue: climate change. Students will learn about how climate change occurs, analyze the connections between climate change and agriculture, and consider ways to reduce the food system's greenhouse gas emissions.



### Learning Objectives

- Explain the science of climate change.
- Analyze how the food system contributes to climate change.
- Analyze how climate change affects agriculture.
- Propose interventions to reduce the food system's contributions to climate change.



### Essential Questions

- What is the relationship between climate change and the food system?
- How can we reduce the food system's contributions to climate change?



### Materials

- Student Handouts
- Presentation Slides
- Climate Change Impacts Teacher Guide
- Large pieces of paper
- Food, Agriculture, and Climate Change Primer
- Food System Curriculum Infographic



### Resources

- Food, Agriculture, and Climate Change Primer (<http://bit.ly/1YniR6X>)
- Eat Low Carbon (<http://www.eatlowcarbon.org/>)
- Carbon Footprint Calculator (<http://coolclimate.berkeley.edu/calculator>)

## Warm-Up:

What is Climate Change?

## Main Activity

Climate Change Impacts on Agriculture

## Main Activity

Reducing Food System Contributions to Climate Change

## Wrap-Up:

Reflecting on Action

## Warm-Up: What is Climate Change?

Science [15 minutes]

Explain how the food system is linked to the global issue of climate change. Display the **Weather vs. Climate Slide**, or write the following two statements on the board:

- The temperature in New York City averaged 82 degrees Fahrenheit on July 20, 2010.<sup>1</sup>
- The temperature in New York City averaged 77 degrees Fahrenheit for the month of July between 1981 and 2010.<sup>2</sup>

Ask students to reflect on the difference between these two statements. *What is similar about the measurements? What is different?* Explain that the first statement describes weather, while the second statement describes climate. A region's climate is the temperature, precipitation, humidity, and other weather conditions over a long period, whereas weather refers to those conditions over a short period of time, usually hours or days.

Ask students: *How often does weather change? Does the climate change like weather does?* No, weather changes day to day, whereas climate generally changes slowly, over decades or centuries. To gauge students' knowledge about climate change, ask: *Is our climate changing? If so, how?* Explain that climate change

is a significant, lasting change in temperature, precipitation, humidity, or other weather conditions, and in the last century, the Earth's climate has begun to change much more rapidly.

Display the **Greenhouse Effect Slide**. Ask for volunteers to describe the process depicted on the slide. Summarize the concept that greenhouse gases (GHGs) trap heat in the atmosphere. The increased accumulation of these gases due to human activity is causing global warming: an increase in average global temperatures. GHGs from human activities and natural processes include carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O).

Students will complete a worksheet on sources of GHGs. Distribute the **Sources of Greenhouse Gases Handout**. Give the students three to five minutes to complete Part I as best they can, then reveal the answers on the **Sources of Greenhouse Gases Slide**. Tell students they will return to the worksheet later in this lesson. Ask: *What does this information tell you about agriculture's role in climate change?*



**Teacher Note:** Make it active! If time allows, ask students to draw and/or physically act out the greenhouse effect, with groups of students playing each key part (CO<sub>2</sub>, solar radiation, etc.). Play with the amount of greenhouse gases in the atmosphere: *What happens to solar radiation when there are less GHGs? What about when there are more GHGs?*

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# Main Activity: Climate Change Impacts on Agriculture

Science, Social Studies [20 minutes]

Display the **Drought Slide**. Ask: *What happened to these crops? How might climate change have been responsible?* These Texas corn crops were killed by drought—an extreme weather event that occurs more frequently because of climate change. Ask students to brainstorm other climate change-related events. Use guiding questions to emphasize the following major aspects of climate change:

- Rising sea level
- Extreme heat
- Changes in rainfall patterns
- More frequent and intense extreme weather events (e.g., droughts, hurricanes, flooding)

Students will explore how different aspects of climate change impact agriculture. Write each aspect of climate change (listed above) on a large piece of paper and post them around the room. Then display and read the **Climate Change Impacts on Agriculture Slide**, or write the following impacts on the board:

- Loss of topsoil
- Fungus invasion in corn crop
- Saltwater contamination of freshwater supply
- Increased cost to fight weeds
- Increase in a crop's water needs
- Higher food prices
- Depletion of freshwater sources for irrigation

After you read each impact aloud, students should move to the aspect of climate change they believe is responsible for that impact. Once students have made their choice, give each group of gathered students one to two minutes to discuss why they selected this aspect. Then have one volunteer from each group share with the class.

Use the **Climate Change Impacts Teacher Guide** to respond to students' explanations and facilitate discussion. For example, for the impact "Loss of topsoil" students could move to "Extreme heat" because it dries out the soil and makes it vulnerable to being blown away.



**Teacher Note:** Refer students to the Crop Production, Health, and Ecosystems Primer (<http://bit.ly/1U962gE>) for details on the importance of topsoil in agriculture.

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## Main Activity: Reducing Food System Contributions to Climate Change

Science, Social Studies [15 minutes]

Distribute the **Food System Greenhouse Gas Emissions Handout** and/or display the **Food System Greenhouse Gas Emissions Slide**. Tell students to examine the charts and ask: *Which areas of the food system are responsible for the most GHG emissions? Are these statistics surprising? Why?*

Instruct students to pair up and complete Part II of their **Sources of Greenhouse Gases Handout**, which asks them to list different sources of GHG emissions from the food system, rank them in order of importance, and propose interventions that could reduce emissions from each source. Ask students to report back from their pairs. As a class, discuss: *Which sources of GHG emissions did you prioritize for interventions? Will the proposed interventions be effective? Why or why not? What steps would be involved in making them a reality? What barriers might you need to overcome?*

## Wrap-Up: Reflecting on Action [5 minutes]

Have students write a journal entry in response to the prompt: *The food system contributes to climate change in many ways. What sources of GHG emissions from the food system should we tackle first and why? If there is time, discuss students' responses.*



Food waste in landfills releases GHGs  
Photo credit: Andrea Westmoreland. Some rights reserved.



Cattle killed by drought, Kenya  
Photo credit: Brendan Cox, Oxfam International, 2004. Some rights reserved.

## Extensions:

### Revisiting the Infographic (Social Studies, Science)

Distribute copies of the **Food System Infographic** (students may already have their own from previous lessons). Ask students to identify parts that represent climate change. Ask: *Do these accurately represent what we learned about climate change? If not, what could we add to make the infographic more accurate?* Working individually or as an entire class, have students draw their own versions, create a collage, or add images to the existing infographic. Share photos of students' work on social media and tag **#CLFlesson**.

### How Big is Your Footprint? (Science)

Students will calculate the carbon footprint of their food choices and write a report based on their findings. *How big is your footprint? What could you do to reduce your footprint? What does this activity tell you about individuals' ability to address climate change?* Here is an example of a carbon footprint calculator: <http://coolclimate.berkeley.edu/calculator>.

### Climate Change Ambassadors (Social Studies, ELA)

Students will create an educational campaign (in the form of video PSAs, class presentations, social media campaigns, posters, etc.) to educate their peers about how they can reduce their climate impact. Students' campaigns should include individual behavior changes as well as policy recommendations. Encourage students to share their campaigns on social media. They should use the hashtags **#climatechange** and **#CLFlesson** so they can be aware of related projects done by students at other schools and collaborate if possible.

### How Does Climate Change Impact Food Security? (Social Studies)

Students will take what they have learned about climate change and its impact on agriculture and conduct a research project on how it affects food security. In a paper or presentation, students should answer the question: *How will climate change impact food security in the United States and around the world?* Refer to **Lesson 14: The Hunger Gap** and the **Hunger and Food Insecurity Primer** (<http://bit.ly/1ts7Gi3>) for background reading and additional sources.



**Share Your Knowledge:** *How does the food system contribute to climate change? How can we reduce the food system's greenhouse gas emissions?* Ask students to tweet their reflections and tag **#CLFlesson**, **#foodandclimate**, and **#climatechange** to join the conversation.

1. Weather History for KJFK. Weather Underground. The Weather Company. 20 July 2010. [https://www.wunderground.com/history/airport/KNYC/2010/7/20/DailyHistory.html?req\\_city=New+York&req\\_state=NY&req\\_statename=New+York&reqdb.zip=10001&reqdb.magic=1&reqdb.wmo=99999](https://www.wunderground.com/history/airport/KNYC/2010/7/20/DailyHistory.html?req_city=New+York&req_state=NY&req_statename=New+York&reqdb.zip=10001&reqdb.magic=1&reqdb.wmo=99999)
2. National Oceanic and Atmospheric Administration, National Climatic Data Center. 1981-2010 Climate Normals.