Learning Objective: Global Climate Change

NGSS Standard: (MS-ESS3.D) Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.

Objective:
Students will be able to:

1. Explain Earth's natural greenhouse effect.
2. Identify natural and human-created sources of greenhouse gases.
3. Understand that the Earth's systems keep its temperature balanced as long as those systems are also balanced.
4. Explain why climate change is a global occurrence, not a local one.

Time Required: 75 minutes

Materials Needed:

- Teacher computer with internet access
- Projector/Smartboard
- 1 computer/laptop/iPad per student with internet access
- Global Climate Change and the Greenhouse Effect Handout (attached)

Teacher Preparation:

- Create Playlist 1, a 40 minute playlist in Legends of Learning with the following games found in the Global Climate Change objective (in order):
  - *Warm Planet Adventure*
  - *Oscar's World: Climate Change*
- Create Playlist 2, a 10 minute playlist in Legends of Learning with 5 assessment questions from the Global Climate Change learning objective

Engage (5 minutes):

1. On the projector/Smartboard show images from NASA's change website. When you show these images be sure to scroll back and forth slowly to indicate the change that took place. Plus, point out specifically what the image is showing.
2. Ask students:
   a. What are some examples of the effects of global climate change?
      i. *Mudslides, melting glaciers, flooding, drought, deforestation, and changes in plant production.*
   b. Is global climate change always considered global warming?
      i. *No, that changes of the warming of the planet cause climates to changes in a variety of different ways.*
   c. Why are the images showing large portions of land instead of smaller local events?
      i. *Climate change is an a very large scale both in terms of time and the land area.*
3. Explain to the students that today they will be learning about what causes global climate change throughout the world and what we can do stop it.

Explore (40 minutes):

1. Have your students sign in to Legends of Learning and enter your teacher code.
2. Launch Playlist 1 to your students.
3. As students complete *Warm Planet Adventure*, students should fill out the Global Climate Change and the Greenhouse Effect Handout.
4. Assist students as needed during game play, pause playlist if you need to address content or questions to entire class.
5. If students finish the first game and worksheet early they can continue on in the playlist and try the game *Oscar's World: Climate Change*. This game will help test their knowledge.

Explain (10 minutes):

1. Review the answers to the handout Global Climate Change and the Greenhouse Effect Handout by recreating the diagram on the whiteboard.
2. As you review the chart and answers, clarify any misconceptions that students may have.

Elaborate (10 minutes):

1. Global climate change is often discussed in terms of how it will affect humans. However, many other organisms will be affected as well. Let's take a look at how other species will be affected by climate change.
2. Show the following video to the class: https://www.youtube.com/watch?v=ZCKRjP_DMII
3. Ask:
    a. How many species have been identified as evolving in response to climate change?
        i. *20*
    b. How are humans helping wildlife adapt to climate change?
        i. *Refugees, climate change checkups, moving species,*
    c. Some organisms may not be able to evolve fast enough to climate change to survive. How might this affect this biodiversity on Earth and why is this so important to consider?
        i. *Total biodiversity on Earth will decrease. Lower biodiversity creates a negative feedback loop on the total biodiversity of an ecosystem*

Evaluate (10 minutes):

1. Launch Playlist 2 to your students. When they finish the assessment questions, any time left is freeplay.
2. Analyze student results to determine what concepts need to be a focus for reteaching.

Global Climate Change and the Greenhouse Effect Name / Pd: _____

Directions: After playing the first game in Legends of Learning called *Warm Planet Adventure*, use the diagram below to answer the question.

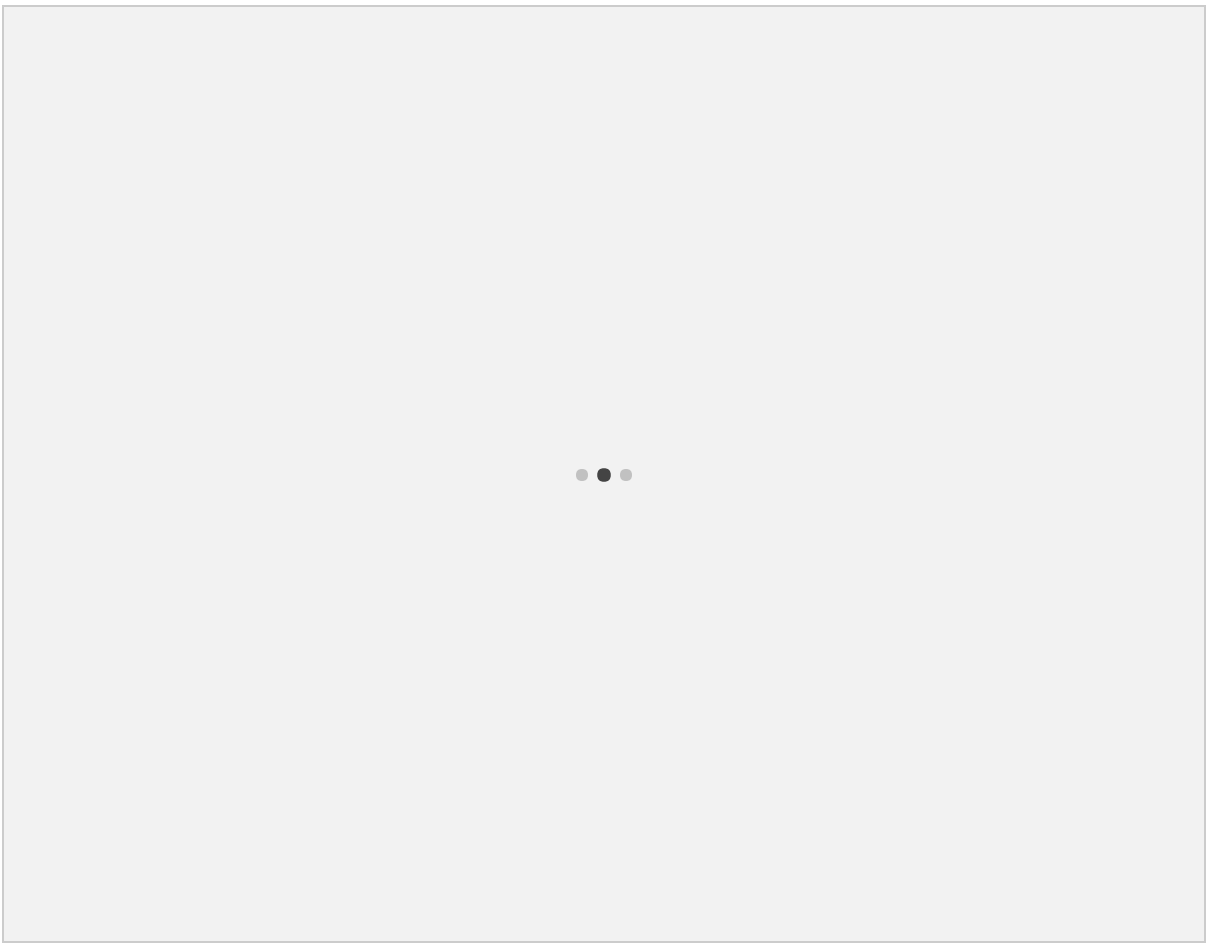

Image source.

1. The “Natural” diagram is showing how Earth’s greenhouse effect helps keep the planet at a warm enough temperature for life to occur. Does all of the energy become trapped the by greenhouse effect?

2. How are the greenhouse gasses different on the “Human Enhanced” system when compared to the “Natural” system?

3. The “Human Enhanced” system allows (*more / less*) heat to escape the atmosphere.

4. Why does the “Human Enhanced” system have a greater temperature than the “Natural” system?

5. What is the difference between weather and climate?

6. Does global climate change mean global warming?

7. Are all large scale changes in the climate caused by humans? Give two examples.

8. What are some methods of reducing global climate change?