

National Geographic Lesson: Seeing Climate Change

YOUR NAME: Kyle Tredinnick

LESSON TITLE: Seeing Climate Change

RECOMMENDED GRADES: 9-12

TIME NEEDED: One – 85 Minute Class

OBJECTIVES:

Students will examine glaciers using historical satellite imagery and remote sensing to determine the actual effects of global warming. Students will analyze satellite images to determine how glaciers are changing and design an action plan to create a solution.

MATERIALS:

Materials that will need to be gathered or prepared for this lesson.

- Computers loaded with google earth pro
- [Climate 101: Glaciers](#) (National Geographic) video for step 2 of Measuring Climate Change Activity
 - o <https://video.nationalgeographic.com/video/101-videos/climate-101-glaciers>
- [Physical Characteristics of Iceland: Land of Ice and Fire](#) (Story Map) for Iceland Overview
 - o <http://mrtredinnick.maps.arcgis.com/apps/MapJournal/index.html?appid=d838d771e28547a0acca1f69d8794060>
- [Glacial Melt Time Machine](#) for step 3 of Measuring Climate Change activity
 - o http://timemachine.cmucreatelab.org/wiki/EarthEngineTourEditor#presentation=EHDkDASxBvkK_YqfEastern%20Iceland_Brei%C3%B0amerkurj%C3%B6kull_DkDAkPgW8FER5kBWestern%20Bolivia_Chacaltaya%20Glacier_DkDA4GuIoCFubSouthern%20Alaska_Columbia%20Glacier_DkDAfcuvJrwV0ZEastern%20Greenland_Helheim%20Glacier_DkDAZfulDZInviBSouth%20Central%20Asia_Himalayan%20Glaciers_DkDAvPrHQ5OS-RAntarctica_Larsen%20Ice%20Shelf_DkDAI-HG71ZhzYAntarctica_Shirase%20Glacier_Glacial%20Melt_B

PREPARATION:

The following should be prepared in advance.

- Make sure the necessary software and programs work on computers students have access to, as well as any computer being used to demonstrate
- Practice the remote sensing activity from Measuring Climate Change activity (Part 4) to be comfortable enough with it that you can demonstrate to students.

DIRECTIONS:

1. Anticipatory Set – “Why might some people not think that climate change is that big of an issue? (Explain two reasons)”
(5 minutes individual answer time – 5 minutes discussion)
2. Iceland Overview – Using the Story Map [Physical Characteristics of Iceland: Land of Ice and Fire](#) preview the country of Iceland, highlighting geological features, wildlife, and scenic physical features. Stress the importance of Volcanization and Glaciation on shaping the land. These can be connected to the adaptations humans, plants, and

animals have had to adapt to live in the environment by looking through the Cultural Landscape and Icelandic Wildlife Bits.

(25 – 30 minutes)

3. Measuring Climate Change – Work through the worksheet on Measuring Climate Change (attached below) with students.
 - a. Step 1 - poses an establishing question for the students to consider. (2min)
 - b. Step 2 - has students watch a video overview of what glaciers are and how they are connected to climate change to acquire an understanding (6-8 min)
 - c. Step 3 – Using a Google Earth Time Machine tour created using the Earth Engine Tour Editor (<http://timemachine.cmucreatelab.org/wiki/EarthEngineTourEditor>) students will generalize observations about the earth’s glaciers by examining 7 different ice masses around the world. (10 min)
 - d. Step 4 – Students will use Google Earth Pro (Desktop download - <https://www.google.com/earth/download/>) for a remote sensing activity to mark out the glaciers progression and make actual recordings of how far glaciers are retreating (instructions on Lesson handout attached below) (15 min)
 - e. Step 5 – Students design an action plan to address issues related to global warming. (5-10 min)

MODIFICATIONS:

Suggested ways in which the lesson might be modified for specific student audiences, different abilities, etc.

Pairing – Students can be paired with partners to help reach conclusions related to materials, and to assist one another with remote sensing activity.

Resources – Make lesson resources available to students (suggested through the use of a class website) to allow them to revisit them if need be. A good additional resource with supporting information can be found here:

<https://www.nationalgeographic.com/environment/global-warming/big-thaw/>

Time – As time allows complete as much necessary to allow students to ask questions for clarification along the way. Allow students to complete sections at home that are not completed in class.

EXTENSIONS:

Possible ways to extend this lesson and enhance learning.

If students finish early suggest they do the remote sensing activity for another glacier to see if there are similar results to the example of Breiðamerkurjökull glacier in Iceland. The Columbia Glacier in Alaska offers a particularly stark view of the melting ice.

Another more thorough lesson could be examining the melt of a glacier over a number of years to measure the rate at which the glacier is melting to determine if the rate is increasing, decreasing, or staying the same.

LEARNING FRAMEWORK:

Connections between this lesson and the attitudes, skills, and knowledge areas of the Learning Framework.

- **Attitude** – Responsibility: Through connecting the ideas of climate change to an actual location with a story of its own, Iceland, students will hopefully empathize with the struggles faced from global warming. Students will hopefully realize that decisions they make can have global impacts and will lead them to make more earth-responsible decisions.
- **Skills** – Observation: Students are using geospatial technologies to make authentic observations of changes to the earth’s surface resulting from climate change. The remote sensing activity has student analyze historical imagery of change over time that can be used to record multiple types of changes that are going on around the world.
- **Knowledge** – Our Living Planet: Students will see how changes in one part of the planet can have an effect in a completely different part of the planet. The project helps drive home how areas of the world are being impacted by the decisions made by humans all around the planet, and although they may not see them now, the changes will have an impact on them as well.

VOCABULARY:

New vocabulary students might need in order to learn and complete this lesson.

- **Volcanization** – The process of change connected to volcanic activity
- **Glaciation** – Changes in the landscape as a result of the movement of glaciers
- **Remote Sensing** – Analyzing images taken by plane or satellite of the earth’s surface to obtain information

ASSESSMENT:

Suggested method of assessment for this lesson.

Seeing Climate Change Grading Rubric					
	No Evidence (0)	Attempted (1)	Basic (2)	Reaching (3)	Advanced (4)
Question Completion	Assignment missing, or none of the questions answered	Student at least attempted to answer one or more questions	At least 50% of questions answered, though some are incorrect or lack depth of thought	At least 75% of questions answered fully, and completely, but some questions are incomplete	All questions are answered correctly, showing clear depth of thought
Thought Questions	Assignment missing, or no proof of attempt to do assignment	Student attempted to respond, but failed to answer more than half of required tasks	Answers show basic understanding of concepts, though some are incorrect or incomplete	Answers show comprehension of ideas though might be lacking reasoning or evidence to support answer	Obvious mastery of ideas in answer shows that student understands concepts clearly and
Depth of Thinking	Assignment missing, or no evidence of attempt to do assignment	Some evidence that student understands, but answer is confusing or incomplete	Answer contains definition, but lacks analysis and higher order thinking	Question contains analysis, but some ideas need further explanation	Answers exhibit higher order thinking, <u>or answers questions as completely as needed</u>

Lesson Handout

Measuring Climate Change

Section:

Score: ____/10

Directions: Using Google Earth you will be measuring global warming as it happens. Following the framework of investigation, work through the process of asking a question, collecting and analyzing information, and then designing a solution.

Step 1: Ask – How can we actually see the effects of climate change over time?

1. Based on what you know, what type of effect will global warming have on glaciers around the world?
2. Which areas will have the larger impact from global warming? Which areas may not be impacted as much?

Step 2: Acquire – What are glaciers and how are they connected to climate change?

1. Watch the Video *Climate 101: Glaciers* by National Geographic (video.nationalgeographic.com/video/101-videos/climate-101-glaciers) and answer the following questions.
 - a. What are the two different types of glaciers and where do they form?
 - b. What impact do glaciers have on the landscape and why are they important?
 - c. How do glaciers act as an indicator of climate change?

Step 3: Explore – Which areas are being most impacted by global warming?

1. Use the Glacial Melt Time Machine (linked on course website) to examine glaciers around the world. Watch the time lapses for each of the following glaciers and explain the general trends the glacier has been experiencing since 1984.
 - i. Breiðamerkurjökull glacier, Iceland
 - ii. Chacaltaya Glacier, Bolivia
 - iii. Columbia Glacier, Alaska, USA
 - iv. Helheim Glacier, Greenland
 - v. Himalayan Glaciers

- vi. Larsen Ice Shelf, Antarctica
- vii. Shirase Glacier, Antarctica

Step 4: Analyze – What actual data is there that shows just how rapidly glaciers are retreating?

Process

1. Open up the desktop version of **Google Earth Pro**
2. In the **Search Bar** in the top left type in **Breidamerkurjokull** to navigate to the Breiðamerkurjökull glacier in eastern Iceland
3. Take a minute to **navigate** around the map and get a better sense of the glacier’s location as part of the Vatnajökull ice cap and the source of the Jökulsárlón glacial lagoon
4. Along the top bar click the  button to open up the **historical imagery** bar
5. Move the slider all the way to the left so that the imagery from 1984 is displayed (**Note:** Your view must be zoomed out further than 31,473 feet to be able to view imagery from before 2008)
6. Trace the location of the face of the glacier as it was in 1984 by selecting the **Add Path** tool (). Title it 1984, then, once finished tracing the face of the glacier, select ok to close the menu.
7. Move the historical imagery to show the most recent view of the Breiðamerkurjökull glacier (Should be December of 2016)
8. Repeat the process from step 6 to trace the face of the glacier again for the most recent view
9. Open the **Ruler** menu by selecting the  button in the top bar.
10. Take 10 different measurements of the distance between the 1984 line and the 2016 line and record your observations below to help calculate the average distance of retreat for the glacier. Once you have made your 10 observations record the mean.

Breiðamerkurjökull Glacier Average Retreat	
Observation 1	_____ miles
Observation 2	_____ miles
Observation 3	_____ miles
Observation 4	_____ miles
Observation 5	_____ miles
Observation 6	_____ miles
Observation 7	_____ miles
Observation 8	_____ miles

Observation 9	_____ miles
Observation 10	_____ miles
Mean:	_____ miles

Step 5: Act – What can people do about it?

1. What is something that you can do as a consumer to help address the issue?
2. What is something you can do as a citizen to help address the issue?
3. What is something you can do as a part of your role as a student (now or in the future) to address the issue?
4. Choose one of the solutions above and plan out a 4-5 step process to actually implement your solution.