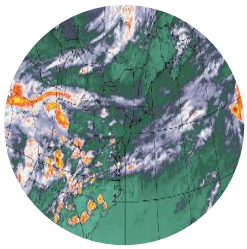

Back to the Future

Climate Variation

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Published by *K20 Center*

Grade Level	6th – 8th Grade	**Time Frame**	150 minutes
Subject	Science	**Duration**	2-3 class periods

Essential Question

How does climate variation affect different environments?

Summary

Students will explore climate variation in various environments using EOMF (Earth Observation and Modeling Facility) data, GIS (Geospatial Information Science) data, and weather and climate data. Students will use their observations and data to make predictions about future environmental change and possible effects on local populations. Students will analyze, interpret, and present their findings.

Snapshot

Engage

Students view time-lapse footage over a 30-year period to observe environmental change.

Explore

Students make observations and predictions about a specific location using time-lapse footage, climate data, and the Earth Observation and Modeling Facility (EOMF) Field Photo library website.

Explain

As a class, students informally share their findings and discuss similarities and differences among climate trends and observed environmental changes among their locations. Through discussion, they build a shared understanding of the broad impacts of climate change.

Extend

Students compare their locations with other predetermined locations and make predictions about climate and environment change based on their observations and data.

Evaluate

Students present their answers to the essential question, supporting their explanation with cited evidence from throughout the lesson. The audiovisual presentations discuss cause-effect relationships between the observed environmental changes and climate data at the locations they investigated.

Standards

Next Generation Science Standards (Grades 6, 7, 8)

MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

Oklahoma Academic Standards (6th Grade)

6.LS1.8 : Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

Attachments

- Blank Data Tables—Back to the Future.pdf
- I Think, We Think—Back to the Future - Spanish.docx
- I Think, We Think—Back to the Future - Spanish.pdf
- I Think, We Think—Back to the Future.docx
- I Think, We Think—Back to the Future.pdf
- Observation Sheet 1—Back to the Future.docx
- Observation Sheet 1—Back to the Future.pdf
- Observation Sheet 2—Back to the Future.docx
- Observation Sheet 2—Back to the Future.pdf
- Presentation Rubric—Back to the Future - Spanish.docx
- Presentation Rubric—Back to the Future - Spanish.pdf
- Presentation Rubric—Back to the Future.docx
- Presentation Rubric—Back to the Future.pdf
- Student Checklist—Back to the Future - Spanish.docx
- Student Checklist—Back to the Future - Spanish.pdf
- Student Checklist—Back to the Future.docx
- Student Checklist—Back to the Future.pdf
- Temperature & Precipitation Data—Back to the Future - Spanish.docx
- Temperature & Precipitation Data—Back to the Future - Spanish.pdf
- Temperature & Precipitation Data—Back to the Future.docx
- Temperature & Precipitation Data—Back to the Future.pdf

Materials

- Internet-connected computers or tablet (1 per group)
- Digital presentation program (such as PowerPoint, Google Slides, Prezi, iMovie, etc.)
- Observation sheets and rubric (attached)

Engage

Show students one of the premade time-lapse videos at http://world.time.com/timelapse/ or http://world.time.com/timelapse2/ (Videos showing drastic visible change will help generate student discussion and questions.)

Ask students to talk with an elbow partner to describe what they are seeing and brainstorm possible causes. Student answers can vary depending on the video chosen.

Possible Student Answers

The glacier seemed to get smaller over time. The river changed course and wandered back and forth. The size of the sea fluctuated and eventually dried up.

Ask students: How are these changes affecting the surrounding environment?

Explore

Explain to students that they will work in groups and report their observations on 1 of 5 given environments. Explain that they will be creating their own time-lapse video for the location, observing and describing the changes that are occurring over a 30 year period, researching weather and climate data for that location, looking for evidence of possible causes of the change, and reporting their findings to the class.

Give students the presentation rubric and their assigned location sheet so they know what type of information they will need to be collecting during their research. Go over your expectations for the presentation they will be doing at the end.

Teacher's Note: Student Choice

Consider letting student groups choose their own location from the five provided to strengthen their autonomy and ownership over learning.

Time Lapse

Have students go to http://world.time.com/timelapse2/ and use the search box at the top-left side of the map to find their assigned location. As of March 2019, the "Explore Your World" search box no longer works.

Walk them through the process as follows:

1. Press enter to search, and the time-lapse map should zoom into the exact location from the photograph.
2. Zoom in or out to view how the area has changed over time.
3. To save the time-lapse view, click the share button and copy the "Share Current View" link. Paste the link somewhere it can be saved.
4. Explain that they may want to use this time-lapse clip as a part of their presentation at the end of the lesson.
5. If they choose to use the video, show students how to properly cite the source of the video [e.g., *Columbia Glacier Time-lapse Video 1984-2018. (2014) Time. http://world.time.com/timelapse2/*].

Teacher's Note: Time-Lapse Animation

Students can also use a gif making program to save the actual time-lapse animation as a file they can insert into their presentation. The "Chrome Capture" extension for the Google Chrome browser can be downloaded for free and is an easy tool for saving animated screen-captures as .gif files.

Have students describe and record the changes in the environment they observe using the attached *Observation Sheet 1* handout under Step 1.

Climate Graphs

Now that students have a time-lapse video, explain that they are going to explore and look for evidence of possible causes of the changes they observed. Instructions for this section are included in *Observation Sheet 1*: Step 2.

Give each group the correct temperature, precipitation, and drought rating data sets for their assigned location. All of the data can be found in the *Temperature & Precipitation Data* handout. Note that the data sets from Telluride, Colorado, and Columbia Glacier, Alaska, use snowfall rather than precipitation.

Ask students to use the data to create graphs that illustrate the changes within the regions they are researching. Let students know that these graphs will need to be included in their final presentation. Consider having students do their graphing activity digitally using a program like Excel or Google Sheets.

Teacher's Note: Technology in Science

Scientists no longer make graphs or analyze data by hand in their work. Consider helping students transition to digital rather than paper-pencil graphing. Fluency with digital data tools will be a **more valuable skill set** for students in their future than graphing by hand. If graphing by hand cannot be avoided, a *Blank Data Table* handout is attached.

Have students record any new observations, inferences, and supporting evidence the discover using the data and graph they construct.

Field Photo Library

Students will use the Field Photo Library to add images from near their location to their presentation. The photos they will be viewing and using are a small part of the Citizen Science project described below.

Explain to students that this database is a Citizen Science Project in which individuals take photos with their phone or camera and upload them to the website. Each photo is tagged with its date, time, and GPS location. It is part of a research project to document climate change and its effects on both a global and local level. There is an app that students can use to upload their own photos to the project as well.

The following instructions are included in *Observation Sheet 1*: Step 3. Have students go to http://www.eomf.ou.edu/photos/map/

1. On the left side of the page there is a box that says "Search By." Click on the "Region" option in the list.
2. Have students enter the GPS coordinates provided for their assigned location in the *Min-Lon, Max-Lon, Min-Lat,* and *Max-Lat* boxes. The map should now display one or more orange dots near their location.
3. Zoom in and click on one of the dots. All the pictures taken at that location can be found below the map.
4. Instruct students to select one of the available photographs of the area and save the image and citation for use in their presentation [e.g., Photo file name. (2014). Earth Observation and Modeling Facility: Geo-Referenced Field Photo Library. http://www.eomf.ou.edu/photos/]

Explain

Now that students have several types of data from their observations, graphs, and photos, help them synthesize the information. Student groups should share out the information in their Environment #1 Summary with the whole class. The I Think/We Think strategy would be a good way to help them consolidate the information. Students would summarize their key findings in the "I Think" column and record details from the other groups' summaries under "We Think."

After students have shared, have them look for patterns (e.g., similarities and differences) in climate and environmental change across their locations. As a class, have students share out their conclusions about the patterns they observe. Some questions to consider include:

- How do temperature and precipitation relate to drought conditions?
- What conclusions can we draw about how (drought/temperature/precipitation) have been changing over time?
- [*If students made similar predictions about environmental change*] Why do you think your predictions are similar when your locations are so different?
- How has climate affected these environments?

After the group discussion, reaffirm the major points for students and address any of their remaining questions or alternative conceptions.

Extend

Groups will now explore a second location to compare with the one they have already investigated. Provide students with the *Observation Sheet 2* handout and have them fill it out as they explore their new location. They will use the same procedures to observe the time lapse and should also read the additional materials provided.

Teacher's Note: News Articles

Links to news articles are included on the observation sheet. You may print these for students, have students type out the URL, or provide a QR code for the URL. Note that some articles may be challenging for students and adjustments might be necessary.

After students complete their observations, they should fill out the Environment #2 Summary table on *Observation Sheet 2*. Before answering the conceptual questions, have students write a summary of the articles in 140 characters or less, including a hashtag (#) to highlight the main idea (e.g., *The Mendenhall Glacier is slowing receding. Underneath the glacier are the remnants of a 1,000-year old forest that must have existed before the glacier. #glaciersmelting #climatechange*).

After completing *Observation Sheet 2*, students should return to Step 4 in *Observation Sheet 1*. The final summary questions are to help students wrap-up their conceptual understanding and answer the essential question. It may be helpful to finish this part of the lesson with a final summary discussion.

Evaluate

Students will now complete their presentations over what they have learned during the course of the lesson. Be sure to have students address the essential question in their presentation: "How does climate variation affect different environments?" In the presentation, they should support their answer to this question with evidence they collected on their own locations and anything additional their classmates shared. Have students present to the class and turn in their presentations (including citations) for your review.

A "Student Checklist" handout is provided for groups to make sure they included all necessary details. It also includes a self-reflection for students to rate themselves and their group on their teamwork and consider ways they can improve their teamwork. A rubric is attached to help students construct their presentations and for use in grading.

Teacher's Note: Visuals

Students should include their graphs and time-lapse videos in the presentation. Depending on the program used for creating presentations, these may be embedded or linked and opened during the presentation.

Provide options for the presentation and allow students time, in school or outside of class, to complete and practice their presentation. Four suggestions are offered, but there are many other programs that may be useful.

- PowerPoint or Google Slides
- Prezi
- Adobe Spark

Optional Extension

You may have students start their own investigation or start an extended year project, taking pictures of a selected location throughout the year and uploading them to the EOMF website, becoming part of the Citizen Science Project. Students may also research water conservation strategies and outline what policies communities can implement to mitigate the effects of drought. Students can research climate, weather, and/or drought in their local area. (See additional resources below.)

Resources

- Adobe. (n.d.). Adobe Express. https://spark.adobe.com/
- AgriLife Today. (2011, July 20). *AgriLife Extension to address effect of climate change on animal agriculture.* The Texas A&M University System. http://today.agrilife.org/2011/07/20/climate-change-grant/
- Aljoe, H. (n.d.). *Prepare for Drought With Regenerative Ag Mindset*. Noble Research Institute. https://www.noble.org/drought/
- Center for Earth Observation and Modeling. (n.d.). *Welcome to the Center for Earth Observation and Modeling (CEOM)*. The University of Oklahoma. http://www.eomf.ou.edu/photos/map/
- Center for Spatial Information Science and Systems. Global Agricultural Drought Monitoring and Forecasting System. George Mason University. http://gis.csiss.gmu.edu/GADMFS/
- Coffey, C. *The "New Normal" – or Was it?.* Noble Research Institute. http://www.noble.org/ag/pasture/new-normal/
- Greenhouse Gas Working Group. (2010). *Agriculture's role in greenhouse gas emissions & capture*. Greenhouse Gas Working Group Rep. ASA, CSSA, and SSSA, Madison, WI.
- *Historical Weather*. Weather Underground. http://www.wunderground.com/history/
- K20 Center. (n.d.). I Think / We Think. Strategies. https://learn.k20center.ou.edu/strategy/141
- Kluger, J. (n.d.). TIME and Space. TIME Timelapse. https://world.time.com/timelapse/
- Locke, J. (n.d.). *2012: Drought Recovery or Drought Persistence?.* Noble Research Institute. http://www.noble.org/ag/soils/drought-recovery-persistence/
- *Maps & Data*. NOAA. http://www.climate.gov/maps-data
- NIDIS. (n.d.). *NIDIS Launches Improved and Expanded State Pages on Drought.gov*. NOAA. http://www.drought.gov/drought/
- NOAA. *Data Tools: Find a Station*. National Centers for Environmental Information. https://www.ncdc.noaa.gov/cdo-web/datatools/findstation
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- Presley, D. (Aug. 2012). *Efficient Crop Water Use in Kansas*. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. http://www.ksre.ksu.edu/bookstore/pubs/MF3066.pdf
- Prezi Inc. (n.d.). *Prezi*. Prezi. prezi.com
- Swaffar, S. (n.d.). *What is the Water Cycle?*. Noble Research Institute. http://www.noble.org/ag/research/hydrologic/
- TIME. (n.d.). *EARTH'S MOST STUNNING TRANSFORMATIONS*. TIME Timelapse. http://world.time.com/timelapse2/
- USDA. (2014, August 1). *Climate Solutions*. U.S. Department of Agriculture. http://www.usda.gov/wps/portal/usda/usdahome?navid=climate-change