



Preserving the Battlefield: Climate Change Lesson

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Overview

This lesson discusses the importance of preserving the resources of the battlefield and entire park. It introduces the science behind anthropogenic climate change from greenhouse gas emissions and discusses the challenges associated with preserving MONO's resources in the face of this change.

Learning Objectives

- Discuss MONO's resources and the importance of working to preserve them
- Understand generally what anthropogenic climate change is and its cause
- Identify challenges in preserving MONO's resources in the face of climate change

Materials Needed

- Graph of CO₂ concentration and temperature over time for each group (see below)
- Summary sheet of climate change impacts in the Northeastern US

General Outline

1. Opening Discussion

Youth will discuss MONO's purpose for being designated a national park and the many important resources the park contains related to this purpose.

2. Climate Change Exploration – Greenhouse Effect Activity

Youth will be divided into groups and analyze data related to CO₂ concentrations over time. Youth will then be led on a discussion related to the large-scale impacts of climate change.

3. Discussion of Climate Change Impacts to MONO's Resources

Youth will explore the impacts of climate change on MONO and in groups identify how these impacts present challenges in preserving and managing park resources.

Background

Anthropogenic climate change refers to the wide array of occurrences that result primarily from the combustion of fossil fuels since the Industrial Revolution by humans. The process of burning fossil fuels entails the release of carbon dioxide (CO₂), among other gases, into the atmosphere.



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CO₂ is a greenhouse gas, which means it effectively traps heat from the sun into earth's atmosphere via a phenomenon called the greenhouse effect. As a result, the earth has on average been getting increasingly warmer, around 2 degrees Fahrenheit since the 1880s. This warming has caused many impacts globally, and in the United States. See the "Materials" section at the end to read impacts in the Northeastern US, which are especially relevant to MONO.

These impacts of climate change in the region where MONO resides pose threats to preserving the park's resources. Increased erosion from greater precipitation volumes can degrade historic structures, important landscape components, and biotic communities. Additionally, increasing temperatures make the park vulnerable to invasive pests.

Procedure

1. Opening Discussion

- a. To begin, ask the entire group: "Why do you think national parks are established?"
 - i. Field all responses. Then explain to youth: "the Park Service establishes parks to preserve the many valuable natural and cultural resources within those park lands for the benefit of society and future generations."
- b. Follow up with the question: "what do you think the purpose of establishing MONO was?"
 - i. Field all responses, then read MONO's purpose statement:

"The purpose of Monocacy National Battlefield is to preserve the breastworks, earthworks, walls, and other defenses and shelters used by the Confederate and Union armies on July 9, 1864, as well as the buildings, roads, and outlines of the battlefield; to commemorate the Battle of Monocacy; and to provide opportunities for visitors to understand and appreciate the significance of the Battle of Monocacy within the full context of the Civil War and US history."

- c. After, ask: "Now that you all have heard the purpose of MONO, what resources, of any kind, do you think reside in the park that are important to preserve?"
 - i. Field all responses.
- d. Next, inform youth:



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“MONO and all national parks have features within them that are essential to preserve in order to fulfill the purpose of the parks. These features can be anything: buildings and wildlife in parks, processes that occur in parks, experiences people have while at parks, or sounds and smells associated with parks. These features of parks are referred to as **Fundamental Resources and Values** and are necessary to preserve. Parks also similarly have **Other Important Resources and Values**, which are those features in parks not necessarily related to the purpose of the park but are still important to preserve and manage.”

- e. Inform youth of MONO’s FRVs and OIRVs (read to youth):

FRVs:

- The Battlefield Landscape is one FRV. This consists of components of the landscape as they were during the Battle of Monocacy. For example, the numerous historic farmsteads, B&O railroad, historic Georgetown Pike, Monocacy River, and farmlands comprise battlefield landscape resources.
- Historic Structures: In total, MONO has 52 historic structures, many of which existed during the battle, which are important resources to preserve.
- Archaeological Resources: MONO is home to 21 archaeological sites which can provide insight into how people in the park area lived in the past.
- Museum Collections: MONO houses many artifacts relating to the Civil War and the Battle of Monocacy which allow educational opportunities.
- Views and Vistas: The park has wooded areas, farmlands, and meadows which allow visitors to experience the landscape in its historical context as it was during the Civil War.
- Commemorative Atmosphere: MONO’s monuments and memorials induce a commemorative atmosphere conducive to memorializing the Battle of Monocacy.

OIRVs

- Natural Communities: MONO’s over 1600 acres house a diversity of wildlife in a rapidly urbanizing area.



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- Appropriate Recreational Opportunities: MONO represents a greenspace in a rapidly urbanizing area. It offers activities such as running/jogging, hiking, bird watching, fishing, and photography.
- f. Conclude first section by informing youth: “Many challenges exist in preserving these resources, as we’ll soon see.”

2. Greenhouse Effect Activity and Discussion on Climate Change’s Impacts

- a. Divide youth into groups, each with 3-5 individuals, and distribute the graph.
- b. Explain to youth the activity: “Each group will analyze the supplied graph, which depicts the concentration of the gas carbon dioxide in the atmosphere and the average global temperature over time from the year 1880.”
 - i. Inform youth: “During your analysis, write down anything you believe is important or notable about the graph. To guide you all, focus on addressing the following questions:
 1. What is the current concentration of CO₂ like relative to the concentration in 1880? What do you think caused this change?
 2. How does temperature relate to the concentration of CO₂?”
- c. After each group has finished discussing, have each group share the insights they generated in their analysis.
- d. After all groups share, ask youth: “Does anyone know why the relationship between CO₂ concentration and temperature is positive? (i.e. why one tends to increase as the other does)”
 - i. Field all responses.
- e. Explain to youth about the greenhouse effect and its relevance to climate change:

“CO₂ is a greenhouse gas. Greenhouse gases are those that trap heat (infrared radiation) from the sun in earth’s atmosphere. Many greenhouse gases exist naturally in earth’s atmosphere including water vapor (H₂O), carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and fluorinated gases. Without naturally existing greenhouse gases, earth’s average temperature would be around 0 degrees Fahrenheit! In other words, natural greenhouse gases are essential in regulating earth’s climate. However, human actions like burning fossil fuels and cutting forests can add more greenhouse gases to the atmosphere, intensifying the greenhouse



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effect, which scientists agree is the primary cause of global climate change (IPCC).”

- f. Explain to youth: “This climate change, caused by the intensifying of the greenhouse effect, has many unique effects on the environment around the world, including the Northeastern United States, where MONO is located.”
 - i. Ask youth: “Does anyone know any of these impacts, especially in this region?”
 - 1. Field all responses.
- g. Inform youth: “I am giving each of your groups a sheet containing some information on these impacts in the region for your reference”.
 - i. Distribute a sheet to each group.

3. Discussion of Climate Change Impacts to MONO’s Resources

- a. Keep youth in their groups, again 3-5 individuals in each.
- b. Inform youth: “These impacts that climate change has in this region, summarized by the sheet you all have, ultimately pose many difficulties in our mission to preserve the park’s resources.”
- c. Next, inform youth: “In your groups, you will now work together and identify ways in which climate change poses challenges in preserving MONO’s resources.”
 - i. Tell youth: “Discuss together and write down ways how climate change makes resource preservation difficult in the park.”
- d. After each group has finished, tell each group: “please share the ideas your group generated.”
 - i. Field all groups’ responses.
- e. Inform youth of the ways in which climate change makes preserving park resources challenging currently and in the future:
 - i. “Increased erosion due to increased runoff from greater precipitation amounts in shorter bursts poses huge challenges to many park resources:
 - 1. Eroded bridges around the park require invasive construction to be repaired, harming the battlefield landscape.
 - 2. Bush and Gambrell creeks are becoming more channelized due to eroded riverbanks, harming the stream components of the landscape.



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3. Increased runoff from intense storm events erodes sediments near historic structures, impacting their structural integrity. This can also uncover and expose archaeological resources, degrading their integrity.
4. Channelization of streams in such an urban environment degrades the biotic integrity of streams, depleting recreational activities such as fishing, birding, and hiking in the park.
 - ii. Increased temperatures can alter the distributions of species' populations, changing the composition of the biotic community in the park, while also making it more vulnerable to invasive species."
- f. Conclude; explain to youth: "continuing to study climate change and its impacts on park resources is instrumental to ensuring preservation of MONO into the future."



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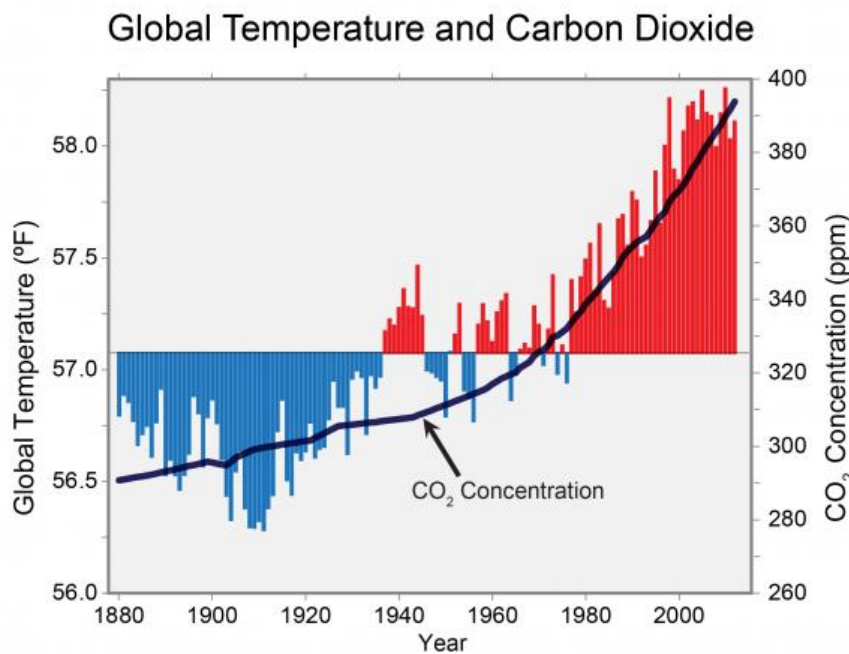


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Materials

Fact sheet:

1. From 1895 – 2011, temperatures have risen by almost 2 degrees Fahrenheit. By 2080, they are projected to rise by 4.5 – 10 degrees Fahrenheit.
2. From 1958 – 2012, the volume of rainfall in heavy precipitation events has increased by more than 70%. Increases in precipitation are projected to increase further in the future.
3. Annual precipitation in MONO is projected to increase by 11.7% - 16.8%.
4. The intensity, duration, and frequency of heat wave events is projected to increase.
5. Ranges of certain plants and animals are moving northward as species seek cooler temperatures.



Source: Highlights of Climate Change Impacts in the United States: The Third National Climate Assessment, Figure 2.2