

Earth and Space Science:

Unit 4

Human Impact - Climate Change: Introduction

Purpose: The Why, What, and How of This

Essential Question: What will happen to the Earth if we do nothing about climate change?

Unit Storyline Synopsis: This unit begins by examining different sources of information and evaluating their credibility. Scholars identify bias and learn how misinformation about climate change circulates. They examine the factors that affect climate change, such as natural greenhouse gases and man-made carbon emissions from burning fossil fuels. Scholars create and expand on their own climate model and then focus on answering the Essential Question by examining the impact of climate change on different aspects of our planet. Having answered the essential question, more questions should pop up as scholars look at the real-world applications of climate change knowledge.

Why This Unit? While the majority of scientists have come to a consensus about climate change, it remains a political controversy. The media discusses opinions on climate change, often overlooking the science behind it. In order to combat the effects of rampant science denial around climate change, we must fully educate our scholars about the processes that cause climate change, the impacts of climate change, and the solutions to climate change. This unit explores all these topics through the lens of the Essential Question: “What will happen to Earth if we do nothing about climate change?” By examining climate change through the lens of inaction, it allows us to push our scholars to think about cause and effect and consider solutions to a real-world problem.

Scholars extend their thinking about climate change to a new context and prepare to fully participate in a discussion of the politics of climate change. Through the lens of climate change, scholars examine how scientific knowledge is shared with the public and is acted on by the government. By studying the economic and political facets of climate change, scholars understand why there is confusion and science

denial around climate change. By the end of the unit, they are able to combat oppositional arguments using scientific evidence accumulated throughout the unit.

What Is the Bottom Line?

Big Idea: Human activity is a major factor in Earth's global warming.

- Human activity has significantly altered the biosphere by releasing greenhouse gases from burning fossil fuels, acting as a major factor in the current rise in Earth's mean surface temperature. As human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

Big Idea: Changes to Earth's environment has different impacts for different living things.

- Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But changes to Earth's environments can have different impacts (negative and positive) for different living things.

Big Idea: Natural hazards cannot be eliminated but humans can take steps to reduce their impact.

- Energy that humans use is derived from natural resources, and their use can impact the environment in many ways. Some resources are renewable and others are not. But individuals and communities are doing things to help protect Earth's resources and environments.

How do Next Generation Science Standards practices and crosscutting concepts support mastery of the Big Ideas? Science and Engineering Practices highlighted in this unit:

- **Engaging in Argument from Evidence**
 - Obtain information and use it to distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation.
 - Apply scientific principles to generate solutions and construct and/or support an argument with evidence, data, and/or a model.
 - Ask questions and use data to evaluate claims about cause and effect.

Crosscutting Concepts highlighted in this unit:

- **Systems and System Models**
 - A system can be described in terms of its components and their interactions.
- **Connections to Engineering, Technology, and Applications of Science**
 - All human activity draws on natural resources and has both short- and long-term consequences, positive as well as negative, for the health of people and the natural environment.

Safety

Plan carefully for safety in all lessons. The top safety risks in this unit include:

- In Lesson 5, scholars will use long-handled lighters and candles. Ensure that scholars are aware of how to work with these materials safely to avoid accidentally burning themselves, as well as what to do should they burn themselves. Ensure that scholars wear proper personal protective equipment (PPE) as indicated in this lesson.
- In Lesson 7, scholars will use hot water. Ensure that scholars are aware of how to work with hot materials safely to avoid accidentally burning themselves, as well as what to do should they burn themselves. Ensure that scholars wear proper PPE as indicated in this lesson.
- In Lesson 7, scholars will use antacid tablets. Review all safety information and the Safety Data Sheet for **ALKA-SELTZER** to ensure proper safety precautions are taken before conducting this lesson. Ensure that scholars wear proper PPE as indicated in this lesson.
- In Lesson 7, scholars will use bromothymol blue, a pH indicator solution. Review all safety information and the Safety Data Sheet for **bromothymol blue** and ensure that proper precautions are taken before conducting this lesson. Ensure that scholars wear proper PPE as indicated in this lesson.

Important Note: These lesson plans highlight some of the safety risks you should be aware of while teaching these lessons. These safety suggestions are not meant to take the place of a formal science safety training. Please be sure to follow all safety rules from your district, as well as all local, state, and federal science safety guidelines.

Unit Storyline

Engage: Whereas the majority of scientists agree that climate change is occurring because of humans, many Americans do not believe climate change is happening. Many also aren't willing to agree that it is mostly due to human activities. Our country is in a state of debate over what actions, if any, should be taken to combat climate change. In this unit, scholars are asked to consider what would happen if we did nothing. In this Engage lesson, they begin a unit-long journey to find out the truth about climate change through exploration and research.

- **Lesson 1: How Do We Know What To Believe?** Scholars question how information on climate change is portrayed to the public, the implications of inaction, and possible solutions to the problem. By examining the public's relationship with science, particularly those who do not have a background in science, and the methods of propagandizing science, scholars are able to better assess the reliability and bias of a source.

Explore: Through modeling and graphing, scholars discover the factors that influence and intensify climate change. They learn that greenhouse gases contribute to climate change, and increased human emission of carbon dioxide is the main culprit in the shift of climate we are seeing today. As scholars learn the process by which climate change is occurring, more questions form about what would happen if we keep doing nothing about it.

- **Lesson 2: What Do Greenhouse Gases Do to the Environment?** This investigation allows scholars to model the greenhouse effect to understand how our atmosphere influences Earth's climate.

- **Lesson 3: What Is Natural Climate Variation?** Scholars create mathematical models of both natural and biased global temperature change. They apply this analysis to our real-world global temperature data to see that the variation of the graph is not caused by nature but is the result of human impact.
- **Lesson 4: Where Does Carbon Come From?** Through this whole class role-play exercise, scholars explore how carbon interacts with Earth's systems. They act as a carbon atom to better understand where we find carbon, how it gets released into the atmosphere, and how humans have impacted the carbon cycle in recent history.
- **Lesson 5: Model Man-Made Climate Change.** Scholars become reinvested in the Essential Question when they model human-added carbon versus natural carbon during the investigation. Based on the knowledge they have gathered so far, they should be able to predict several possible outcomes of humans' disruption of the carbon cycle.

Explain: Scholars learn the impact of climate change is incredibly varied. To further complicate the situation, some impacts intensify or change the probability of other events from happening. Scholars are able to describe the impacts, how it connects to climate change, and what secondary impacts it may have. They use these critical effects to construct an argument to the Essential Question.

- **Lesson 6: What Will Happen to Weather?** Scholars examine what a warmer ocean may mean for the development of hurricanes. By understanding the basics of hurricane formation, scholars learn that we can anticipate the impact of rising global climates on these extreme weather events.
- **Lesson 7: What Will Happen to Oceans?** Scholars use a NASA website to examine changes in the landscape that occur as ice melts, glaciers recede, and ocean levels rise. Scholars perform an experiment to see the impact of CO₂ on water as a proxy for our oceans. Though the problem of ocean acidification may feel far away to us, the effect that an acidic ocean would have on underwater life would impact the way we and other societies across the world eat, how our coastlines look, and how certain countries attract visitors.
- **Lesson 8: What Will Happen to Human Lives?** To give scholars a broader sense of the global impacts of climate change, they examine six regions across the world to describe the many ways Earth will change and the impact on humans if we do nothing to stop climate change.

Elaborate: Now that scholars have all the facts about climate change, they are pushed to think about possible solutions to the problem of climate change.

- **Lesson 9: Green Energy.** Scholars examine different ways of fulfilling the energy needs of our society by studying different forms of energy to determine the benefits and drawbacks of each energy source and evaluate whether it is a realistic energy solution.
- **Lesson 10: Lifestyle Changes.** Scholars research the electricity consumption of different appliances they use frequently. They determine the amount of carbon they contribute to emissions just based on these appliances and consider what they can do to reduce their carbon footprint.

Evaluate: Scholars demonstrate their understanding of climate change by using information they have gathered throughout the unit to respond to the information around them, whether it is accurate or not. They practice responding to climate change deniers using social media, which for many people is their primary news source.

- **Lesson 11: Responding to Skeptics.** Scholars practice making concise arguments by writing tweets. Through this investigation, scholars feel empowered to jump into the climate change

debate using the facts they have learned in class and argumentation skills they have built over the course of the year.

Extra Resources

- [Printable Exit Tickets](#)
- [Printable Lab Notebook](#)