Unit 10: Global Climate Change

Content Area: **Science**
Course(s):
Time Period: **Marking Period 4**
Length: **2 weeks**
Status: **Published**

Summary

In this unit students will explore the impact of air pollution on global climate and temperature. The unit will address the specific impact of climate change on different biomes and regions of the world. Major topics in this unit include sea level rise, coral bleaching and ecosystem impact from rising temperatures. Particular attention will be paid to the causes of this phenomenon and options for mitigating this issue on a global scale.

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MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
LA.RI.11-12.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
MA.S-IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
MA.S-IC.B.6	Evaluate reports based on data.
9.4.12.IML.5	Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).
9.4.12.IML.6	Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5).
9.4.12.IML.8	Evaluate media sources for point of view, bias, and motivations (e.g., NJSLSA.R6, 7.1.AL.IPRET.6).
8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
8.2.12.ED.4	Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
LA.SL.11-12.1.A	Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well reasoned exchange of ideas.
LA.SL.11-12.1.B	Collaborate with peers to promote civil, democratic discussions and decision-making, set clear goals and assessments (e.g., student developed rubrics), and establish individual roles as needed.
LA.SL.11-12.1.C	Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or

	challenge ideas and conclusions; and promote divergent and creative perspectives. Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets. Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.
HS-LS4	Biological Evolution: Unity and Diversity
HS-LS4-4	Construct an explanation based on evidence for how natural selection leads to adaptation of populations. Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations.
HS-LS4-6	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
LS4.D	Biodiversity and Humans Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus, sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent. The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's reradiation into space.
HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution. Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These

	phenomena cause a cycle of ice ages and other gradual climate changes.
	The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.
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	Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate.
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HS-ESS3	Earth and Human Activity
HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and climate change have influenced human activity.
	Resource availability has guided the development of human society.
	Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations.
HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.
	Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.
HS-ESS3-5	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
	Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).
	Assessment is limited to one example of a climate change and its associated impacts.
	Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.
HS-ESS3-6	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity (i.e., climate change).
	Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.
	Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere.
ESS3.D	Global Climate Change

Essential Questions and Enduring Understandings

Essential Questions:

How has the development of human civilization impacted our long term ability to survive as a species on Planet Earth?

How are individual choices and actions related to changing climatic conditions?

In what ways are aquatic and marine ecosystems negatively impacted by changing atmospheric conditions?

Who bears responsibility for the problem of global climate change?

Enduring Understandings:

The planet is warming due to human activity, which will impact climate worldwide and threaten the long term survival of humans on Earth.

Global climate change will impact biodiversity and ecosystems all over the world, including major impacts on marine and aquatic habitats.

Objectives

Students will know key terms: greenhouse gas, greenhouse effect, infrared radiation, coral bleaching, thermal expansion

Students will know the process by which air pollutants can impact the surface temperature of the planet.

Students will know the chemical composition and the major sources of greenhouse gases.

Students will know that sea level rise and its 2 causes: polar ice melting and thermal expansion

Students will know the impact that rising temperatures can have on human populations

Students will know how greenhouse gases cause changes in the atmosphere, and how these changes impact the Earth's temperature.

Students will know the impacts that increasing global temperatures will have on different biomes and ecosystems around the world.

Students will be skilled at interpreting and analyzing climate data such as annual temperature and atmospheric carbon dioxide levels.

Students will be skilled at synthesizing mitigation methods and government policies/laws to help combat climate change.

Learning Plan

Complete homework assignments consisting of 3-5 textbook questions, web based assignments or using outside resources.

Independently navigate a PPT on the greenhouse effect, greenhouse gases and their major sources, answering essential questions and linking to internet resources.

Complete a Case Study on the Effects of Global Warming using news articles: Sea level rise, effects on coral reefs, polar bears, polar ice caps, penguins

Evaluate the effects of climate change on multiple biomes and ecosystems: Jigsaw acitivty related to droughts and wildfires

Video: An Inconvenient Truth with class discussion

Coral bleaching and Ocean Acidification Power Point Presentation

2-day stations activity: Forest impacts and Sea level rise

Class brianstorm: how can climate change can influence the spread of diseases?

Independent research assignment: impacts of climate change on agriculture and fresh water

Assessment

Formative Assessments:

- Worksheets
- Do Nows
- Exit Tickets
- Class Discussions

Quiz:

- Greenhouse gas types, sources and the process of climate change

Bench Marks:

SGO, Midterm and Final Exam

Alternative:

- Independent research assignment: impacts of climate change on agriculture and fresh water
- Jigsaw activity and questions: Impact of cliamte change on droughts and wildfires
- Worksheet: Sea level rise: thermal expansion vs melting ice caps
- Review Sheet and Study Guide

Summative:

Unit Tests:

- Air Pollution: Major Categories, Ozone Depletion, Acid Rain, Smog and Urban Air Quality Issues

Materials

Raven & Berg Evnironment Textbooks (ISBN: 978-1-119-39341-2)

Guided note packets (teacher developed)

Technology (student & teacher laptops, SmartBoard)

PowerPoints

Worksheets/notes

Youtube/Netflix

An Inconvenient Truth DVD

Suggested Strategies for Modification

https://docs.google.com/spreadsheets/d/1P8BzKodtBsbWi4rQ0tunGWhZkCOg52IvbNO7yy-TFJI/edit?usp=sharing