Unit 6 Global Climate Change

Content Area: **Science**
Course(s): **Environmental Science CP**
Time Period: **March**
Length: **0**
Status: **Published**

Transfer Skills

Enduring Understandings

- Today's decisions define our future environment
- Thinning of the ozone layer increases the amount of ultraviolet light that reaches Earth's surface.

Essential Questions

- What are the causes and consequences of a warming earth?
- What factors determine earth's climate?
- What are the effects of climate change?
- How can we respond to climate change?
- What evidence shows that global climate change is happening?

Content

Vocab:

Greenhouse effect, greenhouse gas, thermohaline circulation, El Nino, topography, global climate change, global warming, proxy indicator, climate model, fossil fuel, coral bleaching, carbon footprint, carbon tax, carbon offset, carbon sequestration, Kyoto protocol

Skills

- **Performance Expectations:**

- **HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.**

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  [Clarification Statement: 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.] [Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.]

- **HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.**

  [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [Assessment Boundary: Assessment is limited to provided data.]

- **HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.**

  [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]

- **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.**
  [Clarification Statement: 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 Boundary: Assessment is limited to one example of a climate change and its associated impacts.]

- **HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.**
  [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]

- **HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities**

on natural systems.
[Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]

- **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.**

  [Clarification Statement: 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.] [Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.]

- **Science Engineering Practices (SEP)**
  - Use mathematical and/or computational representations of phenomena or design solutions to support explanations.
  - Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments
  - Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations.
- **Cross cutting Concepts (CC):**
  - The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs.
  - Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Resources

Text References:

- Interpreting Graphs- Real Data p.493, **HS-LS2-1. HS-LS2-2.**
- Interpreting Graphs- Ice Cores p.509, **HS-LS2-1. HS-LS2-2.**
- Human Response to Climate Change p. 502-507 **HS-ESS3-1, HS-ESS3-4.**
- Effects of Climate Change p. 497-501 **HS-ESS3-1, HS-ESS3-4**
- Evidence of Global Climate Change p. 491-496 **HS-ESS3-1, HS-ESS3-4**
- Determining Earth's Climate p. 484-490 **HS-ESS3-1, HS-ESS3-4, HS-ESS3-5.**
- Analyze evidence of climate p. 509 **HS-LS2-1. HS-LS2-2.**
- Evaluate effects of weather on humans p.500 **HS-ESS3-1, HS-ESS3-4**
- Design and evaluate human ecological footprints p.513 **HS-ESS3-1, HS-ESS3-4, HS-ESS3-5.**

Video References:

1. Global Warming 101
    1. http://video.nationalgeographic.com/video/101-videos/global-warming-101
2. Bill Nye Climate Reality Project
    1. http://climaterealityproject.org/video/climate-101-bill-nye

Lab Activity:

1. http://www.epa.gov/climatestudents/documents/mapping-emissions.pdf **HS-LS2-1. HS-LS2-2. HS-ESS3-5, HS-ESS3-1**
    1. In this activity students will learn about greenhouse gases, identify the sources and use environmental data to analyze greenhouse gas emissions in Wall Township.
2. https://osep.northwestern.edu/climate-change-activities **HS-ESS3-5, HS-ESS3-1,**
    1. Multiple activities listed using proxy indicators to understand past climates to predict future climate patterns.

Standards

SCI.HS	Human Sustainability
SCI.HS	Interdependent Relationships in Ecosystems
SCI.HS	Weather and Climate
SCI.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.
SCI.HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
SCI.HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
SCI.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.
SCI.HS-LS2-1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
SCI.HS-LS2-6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
SCI.HS-LS2	Ecosystems: Interactions, Energy, and Dynamics
SCI.HS-LS2-2	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
SCI.MS-ESS2	Earth's Systems