

The Atmosphere & Climate

Suggested Pacing: Approximately 5-7 Blocks

Topics at a Glance:

- What makes up the Atmosphere?
- The Greenhouse effect
- Pollutants in the atmosphere
- Climate change
 - Climate is how the atmosphere behaves over long periods of time

Stage 1 – Desired Results

Performance Expectations: (PE) (Established Goals / Content Standards)

- Construct an explanation based on evidence for how the availability of natural resources in the atmosphere, occurrence of climatological hazards, or other changes in climate have affected human activity. (HS-ESS3-1)
- 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's systems. (HS-ESS3-5)
- Use a computational representation to illustrate the relationships among Earth systems (specifically the atmosphere) and how those relationships are being modified due to human activity. (HS-ESS3-6)

Enduring Understandings (1-3 max)

Students will understand that:

- The global climate is changing largely due to human influence, particularly emissions of carbon dioxide, methane and other greenhouse gasses but also land use patterns such as deforestation and loss of perennial grasslands.
- Climate change is already influencing global weather patterns, drought and flooding, heat waves and the suitability of agricultural land for traditionally grown crops.

Essential Questions (1-2 EQ per EU)

1. What is the atmosphere & how do humans rely on it?
2. What are people doing that is contributing to climate change, and to what extent is climate change natural?
3. What solutions and or improvements can humans make to stop the negative impacts we place on our climate and move toward sustainability?

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Bolded SEP's are a suggested focus for this unit.</p> <ul style="list-style-type: none"> ● Ask questions and define problems ● Develop and use models ● Plan and carry out investigations ● Analyze and interpret data ● Use mathematics and computational thinking ● Construct explanations and design solutions 	<p>ESS3.A: Natural Resources</p> <ul style="list-style-type: none"> ● Resource availability has guided the development of human society. (HS-ESS3-1) <p>ESS2.D: Weather and Climate</p> <ul style="list-style-type: none"> ● 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. (HS-ESS3-6) 	<p>Bolded CC's are a suggested focus for this unit.</p> <ul style="list-style-type: none"> ● Patterns ● Cause & Effect: Mechanism & Explanation ● Scale, Proportion, & Quantity ● Systems & System Models ● Energy & Matter: Flow, Cycle,

<ul style="list-style-type: none"> Engaging in argument from evidence Obtaining, evaluating and communicating information 	<p>ESS3.D: Global Climate Change</p> <ul style="list-style-type: none"> 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-ESS3-5) Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. (HS-ESS3-6) 	<p>Conservation</p> <ul style="list-style-type: none"> Structure & Function Stability & Change
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Stage 2 – Model Assessments

<p>Summative Performance Task(s)</p> <p>Suggested Tasks:</p> <p>-Talking to a Climate Skeptic - Dialogue OR -Engaging in Climate science Debates (Although skepticism is essential to the scientific process, misinformation and twisted information is often perpetuated without a merit or basis that needs to be overtly addressed)</p> <ol style="list-style-type: none"> Students will choose a climate change myth to investigate. Students will make an attempt to understand the standpoint of the false claim either for the sake of creating a written dialogue or to defend it in a debate. Students will also review the scientific basis for dispelling the false claim, twisted claim or out of context claim to understand the full picture. Students will reference a more detailed rubric for more specific scoring criteria. 	<p>Formative Assessments:</p> <ul style="list-style-type: none"> Student worksheets Checkpoint questions and submissions. Formative quizzes Teacher conferences and check-in's Student self-assessment & reflection
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Stage 3 – Learning Plan / Road Map (Design to make as student-centered as possible)

<p>Suggested Resources for Planning:</p> <p>Nasa Atmosphere Resources https://climate.nasa.gov/resources/graphics_and_multimedia/?page=0&per_page=25&order=pub_date+desc&search=&condition_1=1%3Ais_in_resource_list&category=47 Global Warming & Climate Change Myths https://skepticalscience.com/argument.php Bozeman Science - The Atmosphere https://www.youtube.com/watch?v=6LkmD6B2ncs&list=PLIIVwaZQkS2qK4Z6xBVDRak8an1-kqsgm&index=4&spfreload=10 Bozeman Science - ESS3D - Global Climate Change https://www.youtube.com/watch?v=Ou1WFBYwN4o</p>

SciShow - Climate Change <https://www.youtube.com/watch?v=M2Jxs7IR8ZI>

Overview of Greenhouse Gases

<https://www3.epa.gov/climatechange/ghgemissions/gases/ch4.html> Scientific American

How Bad of a Greenhouse Gas Is Methane? The global warming potential of the gaseous fossil fuel may be consistently underestimated

<http://www.scientificamerican.com/article/how-bad-of-a-greenhouse-gas-is-methane/>

Film: How the Earth Changed History

Withgott, J., Wiggins, G. P., Lisowski, M., Scotchmoor, J., Thanukos, A., & Pearson Education, Inc. (2011). Pearson environmental science: Your world, your turn. Boston, Mass: Pearson.

Learning Activities:

Climate

- Use measurements of sun angles, earth tilt, distances from the earth to the sun and other data to explore seasonal, decadal and geological patterns of variation in climate.
- Reconstruct climate records from ice core and sediment data using isotopic analysis, gas chromatography and analysis of microfossils.
- Compare the greenhouse effect caused by the Earth's greenhouse gas layer to the greenhouse effect of other planets like Venus and Mercury and to that of a glass greenhouse used to grow plants. ● Analyze carbon dioxide and other greenhouse gas levels to explore the effect of industrialization and human population growth on the atmosphere.
- Contrast natural and human generated sources of methane and suggest ways to reduce human generation of this greenhouse gas.
- Use the concept of positive feedback to explore how different regions of the planet may contribute to and be affected by global warming.
- Explain why many scientists believe that the Earth's climate will get warmer.
- Draw and explain the short and long term carbon cycles. Be able to relate these cycles to photosynthesis, respiration, burning, and fossil fuels.