

## The Ecological Impacts of Climate Change

**Context:** Climate change is arguably the most pressing ecological threat of our time. To better understand the impacts of climate change, scientists employ various tools and technologies to monitor changes in species distribution and ecosystem functioning, which enables researchers to make resource management and policy decisions that may lessen the impacts of these changes. In this unit, students investigate the question: **What are the ecological impacts of climate change?** Students use online citizen science databases, Geographic Information System (GIS), and field and wet lab activities to investigate the ecological impacts of climate change and understand the tools and practices scientists used to study climate change.

**Project:** Students' lab, field, and background research culminates in an infographic poster session that fosters authentic scientific discourse between student peers and experts within the community.

**Approach:** Students use hands-on labs, projects, and activities that connect them to authentic scientific practices that relate to the study of climate change. Students develop background knowledge by exploring public controversies around climate change, and engage in discipline-specific discussions about the evidence supporting this theory. Students design in-class experiments to study the possible impacts of climate change on plants, and construct infographic posters to share their findings with peers and experts in their community. In addition to their project-based research, students collect information on local species abundance and distribution and upload their data to an online citizen science database, and use GIS mapping, climate models, and global species case studies to predict the long-term impacts of climate change on species around the globe.

**Literacy Design Collaborative (LDC) Template Task:** Students will engage in extended reading and writing in science as they write a position paper on the cause of climate change.

**LDC Task:** Does human activity contribute to global warming? After reading background information on climate change, write a position paper that addresses the question and support your position with evidence from the texts. Be sure to acknowledge competing views. Give examples from past or current events or issues to illustrate and clarify your position. **(Argumentation/Analysis)**

**Expert Involvement:** At the beginning of the unit, experts and students get to know each other through a forum discussion in which the students and experts ask and answer questions about each other. Experts provide feedback to students on their Fast Plant study design, their species case studies, and their infographic. Experts also participate in Skype discussions about causes and impacts of climate change, and review the final infographic presentations.

**Digital Tools:** online greenhouse gas simulation; Milankovitch cycle online simulation; GIS tool; national databases; data logger.

Primary Standards: Next Generation Science Standards- Performance Expectations
<ul style="list-style-type: none"> <li>• 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.</li> </ul>
<ul style="list-style-type: none"> <li>• HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.</li> </ul>
<ul style="list-style-type: none"> <li>• HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.</li> </ul>
<ul style="list-style-type: none"> <li>• HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity</li> </ul>
<ul style="list-style-type: none"> <li>• HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.</li> </ul>

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| <ul style="list-style-type: none"><li>• HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.</li></ul>   |
| <ul style="list-style-type: none"><li>• 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.</li></ul> |
| <ul style="list-style-type: none"><li>• 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.</li></ul>   |

**Primary Standards: CC Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects**

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| <ul style="list-style-type: none"><li>• WHST 9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.</li></ul> |
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**Primary Standards: CC Reading Standards for Literacy in Science and Technical Subjects**

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| <ul style="list-style-type: none"><li>• RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.</li></ul> |
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