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Climate Change within a Biome

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Vol. 1

Climate Change within a Biome

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Abstract: In this lesson, students will investigate impacts of climate change on the native plants and animals, as well as the fisheries, agriculture, and forestry, within a biome of their choosing, and then develop and refine a solution for one of the impacts resulting from the climate change.

Lesson Description:

Grade Level: Grade 9-12
Estimated Time for Completing Activity: Three class periods (40 – 50 minute each)
Learning Outcomes: <ul style="list-style-type: none">To demonstrate understanding of climate change impacts on a specific biome and propose, evaluate (pros and cons) and refine a technological solution that mitigates one of the human-induced impacts.
South Dakota Standards of Learning:
Standards (Acronym definitions are at the end of this paper) <ul style="list-style-type: none">Next Generation Science Standards (NGSS: HS-LS2-1, HS-LS2-6, HS-LS2-7, HS-ESS2-4, HS-ESS3-1, HS-ESS3-3, HS-ESS3-4, HS-ESS3-5; https://www.nextgenscience.org/)South Dakota Standards of Learning: HS-ESS2-3, HS-ESS3-1, HS-ESS3-4, HS-ESS3-5, HS-LS2-2, HS-LS2-6, HS-LS2-7, HS-LS4-4, HS-LS4-5 https://doe.sd.gov/contentstandards/documents/sdSciStd.pdfOceti Sakowin Essential Understandings and Standards https://indianeducation.sd.gov/documents/OcetiSakowinEUS.pdfESSENTIAL UNDERSTANDING 1: Grade 9-12, Indicator 1 and 3; definitions on the last page)
Prerequisite: A general understanding of: the biotic and abiotic factors that impact ecosystems, the importance of the ranges of tolerance of organisms, and the stages of primary and secondary succession that occur in ecosystems will be needed for this lesson.
Materials: <ul style="list-style-type: none">Computer accessChromebook/laptop for research

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- Poster board/PowerPoint
- Markers/colored pencils/paint
- glue
- printer for pictures/titles/written document

Vocabulary:

- Biomes
- Temperate forest
- Weather
- Latitude
- Climate
- Tundra
- Boreal forest
- Woodland
- Grassland
- Desert
- Tropical savannah
- Tropical seasonal forest
- Tropical rainforest

Lesson Links:

- <https://climate.nasa.gov/interactives/climate-time-machine>
- <https://www.youtube.com/watch?v=sTvqlijvTg>
- https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-ecosystems_.html#Overview
- www.blueplanetbiomes.org/world_biomes.htm

Background:

Climate is changing globally, as evidenced by changing temperature and precipitation patterns. The data is recorded and reported by top researchers in the world. Utilizing this data, scientists, policymakers, and others affected by the climate changes, can better determine the options for dealing with the impacts the changing climate has on native plants and animals, as well as industries such as fisheries, agriculture, and forestry. Understanding the specific impacts climate change is having within a specific biome will lead to greater understanding of how each climate change impact can influence other biotic and abiotic parts of the ecosystem.

Procedure:

- ENGAGE: Research climate change and the effects on biomes using “Climate Time Machine” by NASA (see above link)
- Pick a specific biome that you would like to research.
- EXPLORE online resources (teacher-approved) for additional research of the selected biome. Research should include the specific effects of climate change on the biotic and abiotic factors present in the biome.
- EXPLAIN the characteristics of the biome, the impacts associated with climate change.
- Use the scientific method to propose (form a hypothesis), evaluate, and refine a possible solution to solve one of the problems resulting from the climate change.
- ELABORATE by creating a poster/google slide presentation, that includes a minimum of 3 graphs/charts/visuals, to communicate the characteristics of the biome; evidence of the impacts

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of climate change on the plants, animals, fisheries, agriculture, and forestry; and a proposed technological solution to solve the problem the biome with evidence supported change and viable proposed solution.

Conclusion:

- Students will present the project to class with a 2-3 minute summary of the problem and their proposed, refined solution. Completed project will be assessed using attached checklist, which can be adapted to a rubric.

Extensions: This project can be easily be converted to a longer-term project by having students ask more specific questions related to the selected biome, to a travel brochure, or other teacher-approved project. This project can also be upgraded to include the social and economic impacts caused by the climate change occurring in the selected biome.

Teacher Notes: Students will need to research references that are specific to their selected biome, as well as the general climate change information.

Assessment:

Changing Climate Within a Biome: Assessment Questions

1. What are the characteristics of your biome? Be sure to include plants and animals typically found in your biome.
2. What is the evidence/observation that indicates possible climate change may be occurring in your biome. (Be specific about temperature, precipitation, etc.)
3. What is the evidence of climate change's effect on the native plant species? How are the types and numbers of native plants being affected?
4. How is the geographical distribution of native plants being impacted?
5. What is the evidence of climate change's effect on the native animal species?
6. How are the types and numbers of native animals affected? (5pts)
7. How is the geographical distribution of native animals being impacted (5pts)
8. What is the evidence for climate change's impact on local agriculture/fisheries /industries?
9. What is the biological impact on specific crops?
10. What is the economic impact or potential impact?
11. What is a specific problem in your biome caused by a change in climate?

12. What technological solution do you propose should be done to solve this problem?
13. Graphs/Charts/Visuals (minimum of 3)

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Standards

National Standards: Next Generation Science Standards (NGSS: HS-LS2-1, HS-LS2-6, HS-LS2-7, HS-ESS2-4, HS-ESS3-1, HS-ESS3-3, HS-ESS3-4, HS-ESS3-5; www.nextgenscience.org; definitions on the last page)

- HS-LS2-1: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- HS-LS2-6. Evaluate 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.
- HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- 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.
- 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.
- HS-ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
- HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- 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.

South Dakota Standards of Learning: HS-ESS2-3, HS-ESS3-1, HS-ESS3-4, HS-ESS3-5, HS-LS2-2, HS-LS2-6, HS-LS2-7, HS-LS4-4, HS-LS4-5 (Available at <https://doe.sd.gov/contentstandards/documents/sdSciStnd.pdf>)

- HS-ESS2-3 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
- 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.
- HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- 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.
- HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about IE affecting biodiversity and populations in ecosystems of different scales.
- HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms under stable conditions; however, moderate to extreme fluctuations in conditions may result in new ecosystems.

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- HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
- HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in:
 - increases in the number of individuals of some species
 - the emergence of new species over time
 - the extinction of other species

Oceti Sakowin Essential Understandings and Standards

<https://indianeducation.sd.gov/documents/OcetiSakowinEUS.pdf>

ESSENTIAL UNDERSTANDING 1: The original land base and natural resources of the Oceti Sakowin were under communal stewardship prior to immigrant settlement. The Oceti Sakowin tribes have a distinct and unique interrelationship with the environment that contributes to South Dakota.

- Indicator #1: Analyze the land base and natural resources of the nine reservations in South Dakota
Standard: Students are able to identify the physical geographical changes to explain the causes that impacted the land base and boundaries.
- Indicator #3: Evaluate the strategies in which the tribal governments and other leaders are taking action to improve the lands and natural gifts.
Standard: Students are able to identify and explain how a tribal government manages the ecosystem and its natural gifts.

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