

Data Interpretation: Carbon balance in an Arctic Warming Manipulation

Overview

Data collected from experimental manipulations of ecological processes can help us understand the natural world, and perhaps even help scientists predict how complex systems may change. At CiPEHR, (Carbon in Permafrost Heating Experimental Research) located near Denali National Park, scientists have collected and analyzed seven years of data to learn how increases in soil temperatures influence the carbon balance in Arctic ecosystems.

Objectives

In this lesson, students will gain an understanding of how scientists set up experiments to manipulate ecological processes and how they collect and analyze data. Students will be challenged to analyze and interpret data sets that are presented in graphical form.

Lesson Preparation

Steps Needed to Complete Lesson

1. Students will read background information using blog posts written by PolarTrec teachers that explain the science and process of the experiment at CiPEHR.
2. Students can work in pairs to study and interpret the data provided in graphical format.

Details

-  Lesson
-  Arctic
-  Less than a week
-  Download and Share
-  High school and Up

Materials

[Download Lesson Worksheet PDF](#)

Standards

Content Standards, Grades 9-12

Content Standard A: Science As Inquiry

- a. Abilities necessary to do scientific inquiry
- b. Understandings about scientific inquiry

Content Standard C: Life Science

3. Five sets of graphs will be provided to help students answer the following questions about the warming manipulation experiment:
 - What is the relationship of snow depth to soil temperature?
 - How does snow depth influence permafrost thaw?
 - What is the plant response to soil warming in the tundra?
 - How does soil warming affect carbon dioxide uptake and release?
 - How does warming affect the tundra CO₂ balance?
4. Once graphical analysis is complete, students can share their conclusions with the class.
5. A reflection posted at the end of the lesson can be used to assess student knowledge.
6. An answer key is provided to guide student knowledge.

Content Learned Prior to Start of Lesson

- Students should have a background in the carbon cycle as well as an understanding of how greenhouse gases trap infrared energy, warming the earth's atmosphere.
- Students should have an understanding that increases in greenhouse gas emissions by human activity is increasing global atmospheric temperature.
- A vocabulary list and concept list are provided in the attached lesson.
- The blog posts written by PolarTREC teachers provide a good background for many of the listed concepts and vocabulary.

Extension: N/A

Resources

National Sea Ice and Data Center <https://nsidc.org/>
 Center for Ecosystem Science at Northern Arizona University
<http://ecoss.nau.edu/>

- a. Matter, energy, and organization in living systems
- b. Behavior of organisms

Content Standard D: Earth and Space Science

- a. Energy in the earth system
- b. Geochemical cycles

NGSS Standards

ESS3.D: Global Climate Change

- 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: Scientific Knowledge is Based on Empirical Evidence

HS-ESS2-4, HS-ESS3-5: Science arguments are strengthened by multiple lines of evidence supporting a single explanation.

HS-ESS3-5: Analyzing and Interpreting Data

- Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.
- Analyze data using computational models in order to make valid and reliable scientific claims.

Assessment

Students will answer questions about the data and once all questions are complete, write a two-part reflection about what they found most interesting and how the data might help scientists understand how future warming will impact the global carbon cycle.

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