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Engaging Contexts Data Integration  
Methods of STEM: Summer 2019

In my ecology unit, interactions in ecosystems and the cycling of matter and energy are core concepts for students to understand, and can be highlighted through case studies and real-world scenarios. For example, the loss of amphibians in NJ, or the removal of wolves from Yellowstone provide scenarios and opportunity for students to study environmental problems and analyze population data. Standards MS-LS2-1 and MS-LS2-4 provides rich opportunity to incorporate real world, authentic data into ecology as students must “recognize patterns in data” to study changes to ecosystems and their impact on resources and populations.

**MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.**  
[Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]

**MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.** [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

Recently, polar bear starvation has been a topic of media controversy due to the depletion of arctic sea ice. Therefore, the NASA website, “Global Climate Change, Vital Signs of the Planet” has been chosen as a data resource for my classroom for students to recognize patterns in data that impact arctic ecosystems: <https://climate.nasa.gov/vital-signs/arctic-sea-ice/> Each year, students create food webs and study energy flow in my classroom by creating a food web for an ecosystem of choice. However, the NASA data provides opportunity for students to collect authentic data on climate change, and use this data to make predictions about the collapse of arctic food webs.

### **Arctic Meltdown Lesson Description**

#### **Goals and Objectives:**

The objective of this lesson is for students to analyze the interactions and energy flow that exists within an arctic ecosystem, and how changes to the abiotic components of the ecosystem can impact resource availability, thus disrupting feeding relationships and populations within ecosystems. In this lesson, students will establish a food web for an arctic ecosystem, recognizing the role of the polar bear as the apex predator in the food web. Students will then review NASA climate change data and will analyze trends in the data in order to study the loss

of arctic sea ice, rising sea levels, global temperatures and carbon dioxide emissions. Students will then be asked to make connections between this data and how the loss of arctic sea ice can impact resource availability and disruption of energy flow within arctic food webs. Students will analyze the impacts of a reduction in polar bear population on the arctic food web.

**Data Collection and Analysis:**

As part of the data analysis, students will be asked to review NASA climate change data graphs and to complete the analysis chart below in order to analyze arctic trends. Students will then connect this data to the arctic environment and how this may impact arctic ecosystems and food webs.

NASA Graph	Insert Graph Image	What trends do you notice in this graph?	Facts
Carbon Dioxide <a href="https://climate.nasa.gov/vital-signs/carbon-dioxide/">https://climate.nasa.gov/vital-signs/carbon-dioxide/</a>			
Global Temperature <a href="https://climate.nasa.gov/vital-signs/global-temperature/">https://climate.nasa.gov/vital-signs/global-temperature/</a>			
Arctic Sea Ice <a href="https://climate.nasa.gov/vital-signs/arctic-sea-ice/">https://climate.nasa.gov/vital-signs/arctic-sea-ice/</a>			
Ice Sheets <a href="https://climate.nasa.gov/vital-signs/ice-sheets/">https://climate.nasa.gov/vital-signs/ice-sheets/</a>			
Sea Level <a href="https://climate.nasa.gov/vital-signs/sea-level/">https://climate.nasa.gov/vital-signs/sea-level/</a>			

**Data Connection:**

1. What might the connection be between carbon dioxide emissions and arctic sea ice?
2. How can the loss of arctic sea ice impact populations of animals within the ecosystem? Choose a specific species (Walrus, Polar Bear, etc.) to support your answer.
3. How could the loss of an apex predator, such as a polar bear impact the energy flow within the arctic ecosystem?
4. What can humans do to reverse this trend?

**Lesson Enhancement:**

Through the integration of this data, students will be able to analyze real-world data compiled by a reputable and distinguished source such as NASA, and will be able to bridge the gap between Earth science and Life Science concepts to understand that an impact on abiotic factors has detrimental effects on the biotic factors of an ecosystem. Too often, students compartmentalize science concepts in middle school as they are taught Earth Science in grade 6, and Life Science in grade 7 in my school district. This type of activity brings Earth science concepts back to life as students have to incorporate geography and knowledge about climate and its impacts on living systems.

The incorporation of this data also enhances the STEM alignment. This type of digital data integration supports the use of technology in the classroom, as students will use chromebooks to visit the NASA website and work with a variety of interactive graphs. In order to complete the data activity chart, students can use Google docs to capture screenshots of graphs and insert this data into their template. Additionally, chromebooks can be used with provided links to research population data of a variety of arctic species including polar bears, walruses, seals, krill and phytoplankton. Mathematics concepts are further enhanced as students analyze and interpret trends in data presented on the graphs. Concepts of statistics and probability are incorporated into the mathematics analysis as well as students must use data in a two-way table as evidence to support an explanation for the loss of arctic ice and its connection to the cycling of matter and energy in arctic organisms. In further alignment with the NGSS, this activity allows students to address science and engineering concepts as they must analyze and interpret data and understand cause and effect relationships set forth in cross-cutting concepts.

I believe that data integration is imperative in the science classroom. In science, we ask students to make claims, present evidence and then justify their reasoning. Students must learn how to navigate resources in order to learn reliable and valid sources of information, and then how to extract and use this data to back their claim. Real world, authentic data can lead to more engaging curriculum development and education, as students can explore and design solutions to real-world problems, whether it be saving endangered species, cleaning the world's oceans (pacific garbage patch) or making daily changes to limit the volume of greenhouse gases emitted into the atmosphere.

**Resources:**

1. Next Generation of Science Standards: <https://www.nextgenscience.org/>
2. Appendix L - Connections to the Common Core State Standards for Mathematics:  
[https://www.nextgenscience.org/sites/default/files/Appendix-L\\_CCSS%20Math%20Connections%2006\\_03\\_13.pdf](https://www.nextgenscience.org/sites/default/files/Appendix-L_CCSS%20Math%20Connections%2006_03_13.pdf)