



Declining Sea Ice and the Arctic Ecosystem

Connect your classroom to the 2019-2020 [MOSAiC expedition](#), one of the largest Arctic scientific research expeditions ever attempted, with a new curriculum developed by the education and outreach team at the University of Colorado Boulder.

About this Course

Why would hundreds of scientists from around the world intentionally freeze a ship in Arctic sea ice for an entire year, braving subzero temperatures and months of polar darkness? This may sound like a fictional adventure movie plot, but from September 2019 through October 2020, the MOSAiC (Multidisciplinary drifting Observatory for the Study of Arctic Climate) Arctic research expedition did just this. The goal of the MOSAiC expedition aims to better



understand all parts of the changing Arctic climate system - studying the hydrosphere, atmosphere, cryosphere, and yes...the biosphere! Rising global temperatures and declining sea ice has likely impacted the Arctic ecosystem in ways that are not currently well understood. This curriculum challenges students to trace the flow of carbon, from algae to polar bears, to predict how the Arctic food web may change in response to the rapid decline of sea ice.

Bring the unprecedented science and adventure of the MOSAiC expedition into your classrooms with a new curriculum developed by the education and outreach team at the University of Colorado Boulder. In this course, you'll hear from MOSAiC scientists and the curriculum developers as they lead you through "*Carbon Detectives: Tracing the flow of carbon to predict changes in the Arctic ecosystem*", a curriculum tied to NGSS Life Science standards in which students explore how a declining sea ice might impact Arctic organisms large (*polar bears*) and small (*ice algae*). Engage with 360 virtual expeditions, authentic datasets, ArcGIS Storymaps and more in this 1-day online teacher workshop. *Photo Credit: Esther Horvath/AWI*



Course Goal

The goal of this course is to introduce educators to NGSS Earth's Systems standards in the context of the MOSAiC-related curriculum, "*Carbon Detectives: Tracing the flow of carbon to predict changes in the Arctic ecosystem*". At the end of the course, participants will be able to effectively facilitate each lesson, connecting concepts and standards back to the unit driving question, "How might a decline in sea ice affect Arctic organisms large and small?"

Your Instructors

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Course Format

This interactive workshop will be conducted virtually via Zoom. Facilitators will lead participants through each lesson of the curriculum following the approach below:

- 1) Utilize the main Zoom meeting room for lesson instructions
- 2) Participants engage with lesson resources either individually or in small groups via Zoom breakout rooms
- 3) Everyone returns to the main Zoom room to wrap-up and reflect on the lesson

Suggested Readings

There are no required readings for this course. However, we recommend reviewing the unit summary and curriculum resources prior to the start of the course.

Learn more about MOSAiC in [this video](#).



Course Content

Tuesday, August 3rd from 10:00 am - 2:00 pm MT

Activity/Resource	How will you be engaging with the activity/resource?
<i>Welcome and Introductions</i>	Who are you and why are you excited about the Arctic?
<i>Model-Based Inquiry and 3D Learning in Today's Classrooms</i>	- NGSS and 3D Learning Model-Based Inquiry pedagogy
<i>Course Overview</i>	Discuss the flow and content of the curriculum
<i>Lesson 1: Arctic Food Web</i>	- Arctic amplification and the decline in sea ice - Introduce anchoring phenomenon and the unit driving question
<i>Lesson 2: All About That Base</i>	Model the flow of energy through the Arctic food chain by playing "Energy Pipeline", a game modified after an activity published in Project Wild.
<i>Lesson 3: Air for Lunch</i>	- Review photosynthesis inputs and outputs - Use bromothymol blue to model the exchange of carbon dioxide between the ocean and atmosphere - Analyze and interpret changes in the amount of sunlight absorbed by the Arctic - Increased sunlight absorption (due to decline in sea ice) lead to an increase in ice algae
<i>Model Revision Assignment</i>	Revise your initial descriptive model representing the unit driving question



Tuesday, August 3rd from 10:00 am - 2:00 pm MT

Resource/Activity	Workshop Engagement: What will you be doing?
<i>Lesson 4: You Are What You Eat</i>	• Introduction to biomolecules • Conduct the “emulsion lab” to test and extract lipids from food ◦ Different foods have different types of lipids • Arctic algae produce different types of fatty acids
<i>Lesson 5: Arctic Life Cycles</i>	• Engage in a jigsaw activity where participants use an ArcGIS Storymap document and share the life cycles of various Arctic organisms
<i>Lesson 6: Case Study: Tracing carbon through the Arctic ecosystem</i>	• Analyze and interpret data showing difference between ice algae vs. pelagic algae-derived carbon in Arctic organisms
<i>Final Assessment(s)</i>	• Construct a final descriptive model and explanation for the unit driving question (<i>Must be submitted to the course instructors</i>)
<i>Additional MOSAiC-related Resources</i>	• Explore the mosaic.colorado.edu/education web page for MOSAiC education resources
<i>Feedback Survey and Closing Remarks</i>	• Complete an online feedback survey about the course

Final Assignments (required):

As part of the course, participants are required to complete a final assignment outside of online course hours. Participants will reflect on their learning from the course to construct a final descriptive model and explanation for the unit driving question, “How might a decline in sea ice impact Arctic organisms large and small?” See instructions below. Upon completion, please scan and submit your final assignment documents to jonathan.griffith@colorado.edu. *Note: These are the same summative assessments your students would complete at the conclusion of the unit.*