



Earth Science Everywhere

Exploring Wildlife Biology and Conservation

A Lesson for Middle School STEM

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Table of Contents

Introduction	1
Next Generation Science Standards	2
Lesson Instructions.....	4
Warm-Up: What’s going on with this picture?	4
NASA Earth Observatory Reading Exercise	4
Google Earth Exploration.....	4
Career Exploration	4
Wrap-Up: Wordwall Game	4
What’s Going on in this Picture? Slide/Printable	5
Printable Quiz.....	6

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Introduction: This lesson seeks to engage students in an examination of how a changing climate effects the migratory behavior of arctic caribou herds. This content provides opportunities for students to meet NGSS performance expectation **MS-LS2-4**, see next page for details. This lesson is best suited for a STEM enrichment class or as an enrichment activity included as part of a larger science curriculum. It was written with a middle school audience in mind but could be adapted for high school students.

This lesson refers to electromagnetic spectrum and remote sensing topics. It is recommended that the “Exploring the Electromagnetic Spectrum” lesson is completed first.

Keywords: Habitat, Ecology, Satellite Imagery, Global Climate Patterns, Changing Climate

Background Information: Caribou herds in northern Alaska and Canada migrate hundreds of miles each spring, moving toward the continent’s northern coast, where they birth their young. The timing of the migration—when the caribou depart their wintering ranges and when they arrive at their calving grounds is not well understood. Scientist are studying their movements and certain factors that may be important for the timing of those movements. The Landsat 9 image on the front of the Earth Observation Day poster shows the Arctic coastal plain in Alaska and part of the Arctic National Wildlife Refuge, important calving grounds for the Porcupine caribou herd. Satellite imagery helps scientists to better understand the vast ranges that the caribou herds cover (as shown in the image on the back of the poster) as well as the habitat factors that effect when and where the caribou move.

Time Frame: 45 minutes

Materials: In order to complete the activities in this Lesson, the following materials/resources are essential:

- Internet access
- One computer per pair of students (one-to-one is preferred)
- Google Earth
- Smartboard or other projection system

Next Generation Science Standards addressed:

Performance Expectation	Disciplinary Core Ideas	Crosscutting Concepts
<p>MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <p>Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.</p>	<p>Stability and Change</p> <p>Small changes in one part of a system might cause large changes in another part.</p>
<p>Evidence Statements</p> <p>1. Supported claims</p> <p>a. Students make a claim to be supported about a given explanation or model for a phenomenon. In their claim, students include the idea that changes to physical or biological components of an ecosystem can affect the populations living there.</p> <p>2. Identifying scientific evidence</p> <p>a. Students identify and describe* the given evidence (e.g., evidence from data, scientific literature) needed for supporting the claim, including evidence about:</p> <p>i. Changes in the physical or biological components of an ecosystem, including the magnitude of the changes (e.g., data about rainfall, fires, predator removal, species introduction).</p> <p>ii. Changes in the populations of an ecosystem, including the magnitude of the changes (e.g., changes in population size, types of species present, and relative prevalence of a species within the ecosystem).</p> <p>iii. Evidence of causal and correlational relationships between changes in the components of an ecosystem with the changes in populations.</p> <p>b. Students use multiple valid and reliable sources of evidence.</p> <p>3. Evaluating and critiquing the evidence</p> <p>a. Students evaluate the given evidence, identifying the necessary and sufficient evidence for supporting the claim.</p> <p>b. Students identify alternative interpretations of the evidence and describe why the evidence supports the student’s claim.</p>		

4. Reasoning and synthesis

a. Students use reasoning to connect the appropriate evidence to the claim and construct an oral or written argument about the causal relationship between physical and biological components of ecosystem and changes in organism populations, based on patterns in the evidence. In the argument, students describe a chain of reasoning that includes:

- i. Specific changes in the physical or biological components of an ecosystem cause changes that can affect the survival and reproductive likelihood of organisms within that ecosystem (e.g., scarcity of food or the elimination of a predator will alter the survival and reproductive probability of some organisms).
- ii. Factors that affect the survival and reproduction of organisms can cause changes in the populations of those organisms.
- iii. Patterns in the evidence suggest that many different types of changes (e.g., changes in multiple types of physical and biological components) are correlated with changes in organism populations.
- iv. Several consistent correlational patterns, along with the understanding of specific causal relationships between changes in the components of an ecosystem and changes in the survival and reproduction of organisms, suggest that many changes in physical or biological components of ecosystems can cause changes in populations of organisms.
- v. Some small changes in physical or biological components of an ecosystem are associated with large changes in a population, suggesting that small changes in one component of an ecosystem can cause large changes in another component.

Warm-Up: 10 minutes

Display page 5 on a screen for the entire class and pose the question of, “What’s going on in this picture?” Have students turn to their neighbor and give them a few minutes to discuss their ideas. Then have the students discuss their ideas as a class.

Notable features in the image:


- Rivers: Non-linear, meandering feature on the image. What direction is the water flowing? *Towards the ocean.*
- Sea Ice: This Landsat 9 satellite image was acquired on July 1, 2022 and features the arctic coast of Alaska. Even this late in the year, there is still sea ice present. This varies each year, depending on the spring temperatures.
- Treeless landscape
- Ponds: Why are some dark and some blue? Do the blue ones match the color of the sea ice? *The ones that appear blue, still have ice on their surface and are reflecting some of the visible light. The ponds that are dark do not have any surface ice; the water is absorbing more visible light and reflecting less, which is making it appear darker.*

Reading Activity: 10- 15 minutes

Direct the students to the NASA Earth Observatory website and have them read the “[Caribou on the Move](#)” article and view any videos associated with the article.

Google Earth Exploration: 10 -15 minutes

Have the students enter “Prudhoe Bay, Alaska” into the search bar of Google Earth and zoom to the location. What do they notice? Prudhoe Bay is the largest oil field in North America. Discuss ideas about what effect this could have on the Porcupine Caribou herd that migrates to the Arctic coastal plain every spring. While it can be a source of human disturbance and habitat alteration, it can also provide a refuge from predators. The human activity deters less social animals such as wolves and bears.

Next, have the students zoom out to see this location as it relates to where they live. Have them use the measure or ruler tool  to find out how far away is it from their home. How far away is it from the closest city of Fairbanks, Alaska. What are the neighboring countries?

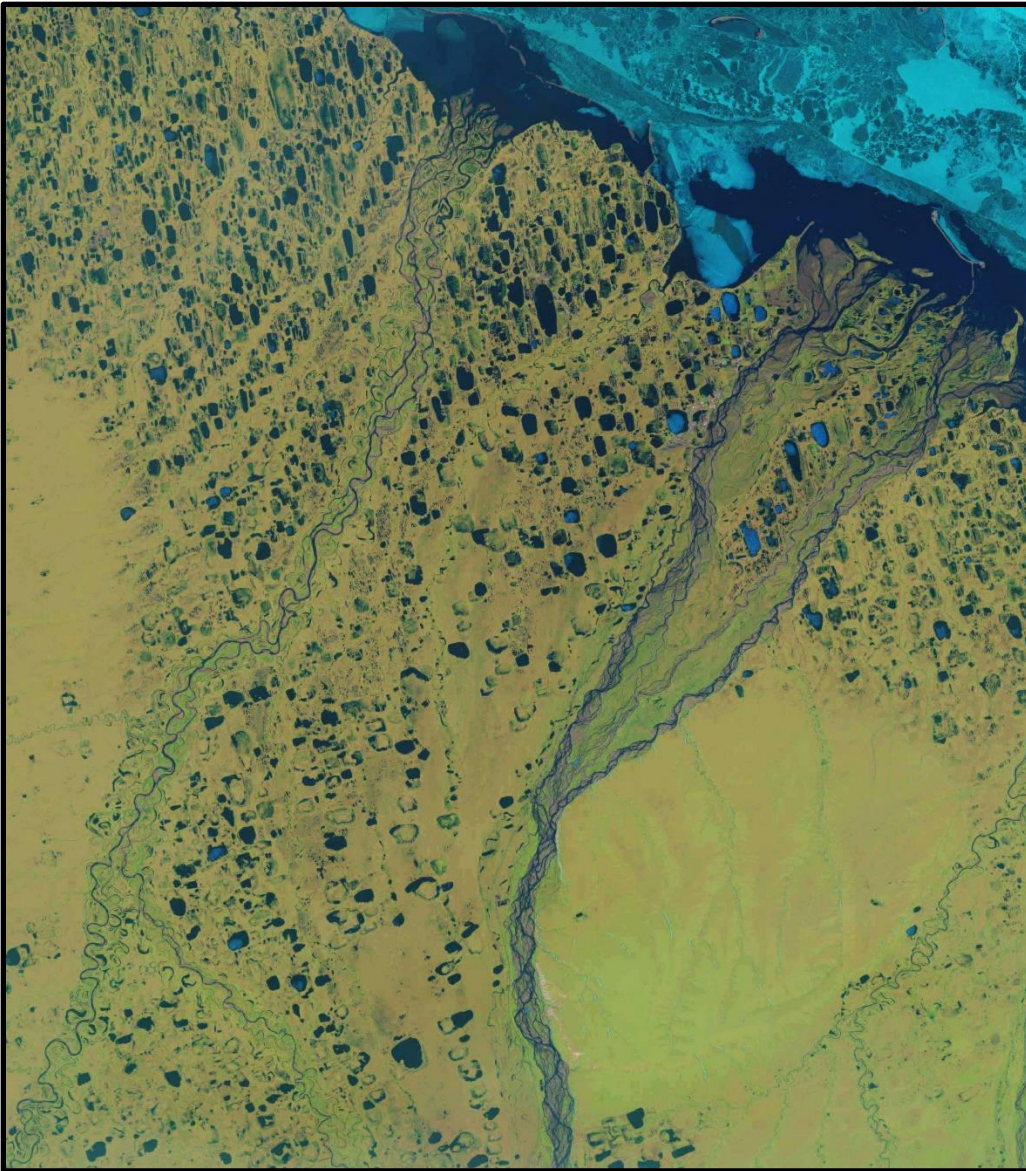
Career Exploration: 5 minutes

Have the students navigate to the below website to explore wildlife biology careers within the U.S. Department of Interior. This page gives details about job qualifications and if they scroll towards the bottom of the page, they can explore more specific jobs within that category.

<https://careers.doi.gov/occupational-series/wildlife-biology>

If there is additional time or if you want to make this a longer activity in the future, begin at this link, <https://careers.doi.gov/>. Students can click on “Find Your Path” then “Get Started” to search careers based on their personal interests.

Wrap-up: 5 minutes: Have the students play the [online game](#) to test their comprehension of the main topics of the lesson. The printable quiz is also provided on page 6.



What's going on in this picture?

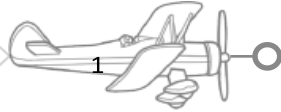
What do you notice?

What do you wonder?

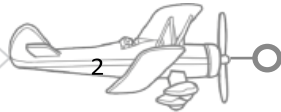


Draw a path from each airplane to its answer - don't crash into other clouds along the way

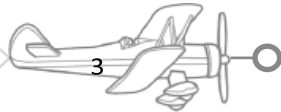
Which type of caribou migrate?



Why do caribou migrate?



What most determines when migration begins?



What time of year do caribou migrate?

