Extreme Ecosystems: A Biodiversity Lesson

4th - 8th grade unit

Transfer Goals:

Students will be able to independently use their learning to:

- *Research key concepts and assemble a brief presentation.*
- *Cultivate confidence in communicating ideas with peers in a group setting.*
- *Understand how humans play a role in the arctic ecosystem and influence species' success.*

Essential Questions:

How does the interdependence of species in the Arctic ecosystem influence biodiversity, and what role do humans play in its preservation or disruption?"

Standards:

MS-LS2-1, -2, -3, -4, -5; MS-ESS3-3, MS-LS4-5

Materials:

For Activity 1:

- Device with Internet access
- Poster paper
- Colored pencils/pencil crayons, markers, or crayons
- Pencils and erasers

For Activity 2:

- Index cards
- Pencils and erasers
- Notes/facts from species report (to be prepared in Activity 1)
- Mini white boards (preferred) or scrap paper as a substitute

Objectives:

Students will know:

- The IUCN system for classifying species according to their endangered status.
- What the different levels of the IUCN red list mean and how the IUCN categorizes species.

Students will be skilled at:

- Performing a brief research project and effectively communicating scientific concepts to a small group.

Students will understand that:

- The arctic ecosystem is highly interconnected and fragile. If one piece goes missing, the ecosystem becomes unbalanced.
- Human activity may be the cause of species loss; yet humans also have the power to be catalysts for conservation and positive change.

Duration: 2-3 hours for all activities

Description:

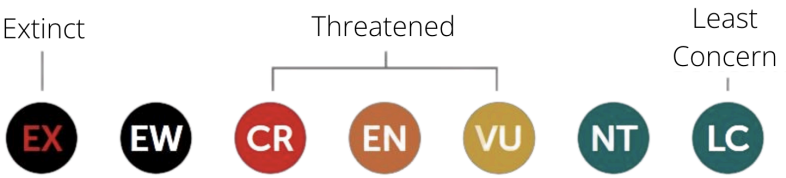
Background Information: Arctic species have developed special adaptations to survive in their harsh environment. The arctic food web is made up of fewer species and is more fragile than those in other regions of the world. A smaller food web makes it more sensitive to disruptions—the decline or extinction of a single species will impact the ecosystem as a whole, because each species depends on another for survival. The interconnectedness of these species supports the biodiversity of this region.

Non-living elements of the Arctic environment, such as sea ice, are also necessary and provide important shelter points for sea ice algae - the foundation of this ecosystem. At the top of the food chain, the polar bear requires sea ice as a platform to hunt its primary food source, ice seals, which—along with the walrus—uses the sea ice for its birthing grounds. The arctic fox trails closely behind polar bears to scavenge the remains of seals, and gulls fly in to compete for what might be left in this dynamic food web. Without sea ice, none of these species would survive.

Objective: Students will identify and categorize plants and animals in the Arctic with an emphasis on which animals are endangered, threatened, or a species of special concern. Students will participate in individual species studies, presentations, and an interactive class trivia game. They will gain a deeper understanding of the biodiversity in the Arctic and their own role in helping to protect the Arctic's unique inhabitants. Included topics of study are the indigenous peoples of the Arctic who rely heavily on various species in their ecosystem for food, clothing, and building materials.

Vocabulary:

The International Union for Conservation of Nature (IUCN) Red List of Species is broken down into the following categories:



Extinct (EX): no reasonable doubt that the last individual has died.

Extinct in the Wild (EW): known only to survive in captivity, cultivation or well outside its natural range.

Critically Endangered (CR): facing extremely high risk of extinction in the wild.

Endangered (EN): facing a very high risk of extinction in the wild.

Vulnerable (VU): facing a high risk of extinction in the wild. *Polar bears are classified as a vulnerable species by the IUCN. Their status was last evaluated in 2015.*

Near Threatened (NT): close to qualifying, or likely to qualify for a threatened category in the near future.

Least Concern (LC): population is stable enough that it is unlikely to face extinction in the near future.

Species of Special Concern: a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats (Government of Canada 2002).

Biodiversity: The degree of variation of life forms within a given ecosystem, biome, or an entire planet. Biodiversity is a measure of the health of ecosystems and is in part a function of climate. For example, tropical regions are typically rich whereas polar regions support fewer species.

Ecosystem: A biological environment consisting of all the organisms living in a particular area along with all nonliving components of the environment, such as air, soil, water and sunlight.

Adaptation: A physical attribute an organism has that helps it survive in its habitat.

Food Web: Depicts feeding connections (what eats what) in an ecological community.

Sea Ice: Formed from sea water that freezes. Sea ice supports the species within the Arctic ecosystem.

Lesson Plan:

Preparation:
Print the Arctic Species Table, and using the arctic species provided, have students pick a species randomly. Make sure all categories are represented to ensure that students understand the concept of interconnectedness in the arctic ecosystem.

Engage & Explain:
As a class, define and discuss the terms: Extinct, Threatened, and Near Threatened. Add the definitions to a class poster (as students conduct their presentations, list their animal of study in the appropriate category). This video can be shown in class to help reinforce the idea of the IUCN red list, what it means to be an endangered species and what factors lead to species fates. https://www.youtube.com/watch?v=6tjDCZrGnxc

Explore:
ACTIVITY 1: SPECIES REPORT

1. Have each student draw the name of a species from a hat. After researching their species, have them create a short PowerPoint or poster board presentation (30 - 40 minutes).
   (Note: This activity may be completed in teams of 2-4)

2. Students' presentations should include the following content:
   - Common and scientific name / other names (such as those in Indigenous Languages)
   - Category (land / marine mammal, bird, fish, invertebrate, plant)
   - Picture of the species
   - Physical adaptations that allow it to survive in the Arctic
   - Habitat (specific geographical location)

- Diet
- Place and role in the ecosystem / arctic food chain (What does it eat? Who eats it? Etc.)
- What category does the species fall under according to the IUCN. Students should visit www.iucnredlist.org to research where their species falls on the endangered spectrum.
    - If the species is of 'least concern', why so? If not, why so?
- Fun facts

3. Students can then present their presentations to each other in sharing circles (2-3 groups per sharing circle, approx. 5 minute presentations each).

4. Have each group add their studied species to the class poster created at the beginning of the activity.

ACTIVITY 2: WHAT ARCTIC SPECIES AM I?

Using the information collected in the Species Report (Activity 1), students will create a trivia card for an interactive game at the end of the activity and class presentations.

1. Distribute index cards to students.
2. On an index card, have each student or group write five facts about the arctic species they research. Note: Clues should go in order from most to least difficult, with the last fact allowing the audience to easily guess the species. Collect the index cards from the students / groups when they are complete.
3. Ask students to form new groups of 4-5 students. Distribute either a piece of paper or a small whiteboard to each team.
4. Choose a trivia card from the deck and read one fact at a time, allowing teams to confer and share their guess after reaching a consensus. Have students write down their guess on their piece of paper or mini white board ready to display before you reveal the answer.

Example: I am a marine mammal.

1. I live in the Arctic.
2. I live on the land and the frozen sea.
3. I am at the top of the arctic food chain.
5. My favorite meal is the ringed seal.

Answer: I am a polar bear.

Elaborate:

Discuss how the arctic ecosystem might be affected if one species was removed from it and what might happen if a new species was introduced.

Some extension questions may include:

- What are current threats to the species (natural and human-caused)?
- Which scientists study the species? What are the findings of their research? How are the findings impacting the arctic ecosystem and species management?
- Discuss examples of your community/regional ecosystem. Which species is threatened/endangered/of special concern in your community? Who/what is affecting this species?

How can you help? What are others doing to help?

Evaluate:
Possible methods of evaluation for this module include:

- Peer assessments of group presentations.
- Having students submit their presentations when complete at the end of the work period.
- Any one of the questions addressed in the 'Elaborate' section may be done informally as a class discussion, or as a separate reflection activity (100-300 words) to be submitted after the activity.

Additional Resources:

"What is an Endangered Species?" WWF Wildlife Classroom: https://www.youtube.com/watch?v=6tjDCZrGnxc

Appendix 1: Arctic Species Table

Mammals	**Other Animals**
Land	**Birds**
Caribou	Ivory Gull
Snowshoe Hare	Arctic Tern
Arctic Fox	Snowy Owl
Moose	Arctic Goose
Marine	Ptarmigan
Polar Bear	**Fish**
Bowhead Whale	Greenland Shark
Bearded Seal	Arctic Cod
Ringed Seal	Whitefish
Harp Seal	**Invertebrates**
Humpback Whale	Krill
Narwhal	Copepod
Beluga	Mollusk
Walrus	Nose-bot Fly
	Warble Fly
	Mosquito