Return of the wolves: Isle Royale National Park

"Lessons from the Wilderness"

Lesson 1

This lesson is designed to be used after students have viewed Part 1 of the video and completed the student video viewing guide for Part 1 as well. Download Video Pt. 1

NGSS Connection: MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

Key Disciplinary Ideas:

- Food webs demonstrate that matter and energy are transferred between components of an ecosystem.
- Organisms and their habitat make up a system in which the parts depend on each other.
- The integrity of an ecosystem's biodiversity is often used as a measure of its health.

Key Practices and Concepts:

- Develop and use a model to describe a phenomenon.
- Matter and energy flow through systems.

Time: Approximately two 50 minute class periods.

Materials:

- Poster paper or whiteboards and markers for each small group
- Copies of System Models Vocabulary (optional, Appendix A)
- Copies of ecosystem information cards for each group (Appendix B)

Engage	In small groups, using a large whiteboard or poster paper, ask students to create a model of their school as an ecosystem. Ask them to consider these questions: • What are the living parts? • What are the nonliving parts? • Where does the energy come from for the living parts? • Where does the waste material go? • What are the boundaries of the system? • What are some inputs to the system? • What are the outputs of the system? • How is energy flowing through the system? • How does matter flow through the system? • Which parts of the system provide habitats for the living things?

	(If your students are unfamiliar with developing system models, you may provide Lesson 1 Appendix A below as a guidance document. This Bozeman Science video on modeling is a great explainer for teachers as well.) Ask student groups to share their models. Pose some probing questions, such as: • What living parts of the system are students dependent on? • What nonliving parts of the system are living things dependent on? • What would happen if we removed one part of the system, for example, the cafeteria?
Explore	In the same small groups, students use the information on the ecosystem cards (Appendix B below) to create a model of the ecosystem of Isle Royale on a white board or poster paper. They should include a boundary, inputs and outputs, flow of energy, flow of matter, labeled components and interactions. They may add organisms if they are sure they are part of the Isle Royale ecosystem (from information gleaned in the video or on the cards.) Consider implementing "Three Stay, One Stray" as a strategy to improve the collaborative models before sharing them in the next step.
Explain	Students share their Isle Royale ecosystem models in a gallery walk. *In a gallery walk, student groups hang models or posters around the room to form a "gallery" of posters. Students silently walk through the room to view the posters and reflect on each poster. Students may have questions to consider or take note of their thoughts as they view the different posters. Students also may add comments or questions to the posters using post-it notes. A gallery walk is a quick way for students to move and view all created posters, before having a discussion on the posters.* The teacher then conducts a classroom consensus discussion using the following questions as guidelines: • What do you notice that's similar about the models? • What do you notice that's different? • What patterns do you notice? • How is energy flowing through the system? • How is matter flowing through the system? • Which biotic and abiotic components are important habitats for other species? • What would happen to the system if you took out:

	○ Moose ○ Squirrels ○ Beaver ○ Mushrooms (decomposers) • What did you choose as the boundary for your ecosystem? • How does being an island affect the inputs and outputs of the ecosystem? • Why is biodiversity important for a healthy ecosystem?
Elaborate	In small groups, students develop a prediction about what would happen if the aspens and balsam firs were removed from the ecosystem. How would a decrease in tree species populations affect the flow of matter and/or energy in the system? How would losing trees affect the animals that need them for habitat? Groups share their predictions in a whole class discussion, using a whiteboard, poster paper, or slide show if desired. Teacher guiding questions for the discussion include: • How are trees important for habitats? • How are trees important for food sources? • How do trees provide structure for the ecosystem? • What is the effect on the ecosystem if many of the trees are overgrazed by an abundance of moose?
Evaluate	Students complete an exit ticket with questions like these: 1. Describe three examples of how energy and/or matter are transferred into, within, or out of the Isle Royale ecosystem. 2. Explain the value of trees in the Isle Royale ecosystem. 3. Generate two scientific questions you still have about the Isle Royale ecosystem.

Appendix A

<u>Systems Models Vocabulary</u>

System: A group of related parts that make up a whole and can carry out functions that individual parts cannot do alone. Can be parts of other systems.
System Model: A representation of a system and its interactions, including inputs, processes, outputs, and flow of energy, matter, or information.

A good system model identifies:

System Boundaries: Define what is in the system and what is not. Boundaries are	Parts or Components: All the things in the model that are needed to explain the process.

decided by the person creating the model.	
Inputs: Parts that enter the system from outside the boundaries.	Outputs: Parts that leave the system boundaries.
Flow of Energy and Matter: Show how energy, matter, or information moves through the system.	Relationships: Show how parts work together to change inputs into outputs. (For example, as one input increases, another output decreases…)

Appendix B
Isle Royale Ecosystem Information Cards

Moose	Wolves
	
Moose eat aquatic pond plants and grasses in summer and aspen and balsam fir in winter. Moose are prey for wolves.	Wolves eat mostly moose, and sometimes beavers and snowshoe hares. They are the apex predator on the island.

Beaver

Beavers build dams by cutting down trees. The dams form ponds which are habitat for many aquatic plants, insects, minnows, and amphibians. Beavers eat maple and aspen bark, as well as some aquatic plants. Beavers are eaten by wolves.

Balsam Fir

Balsam Fir is an important winter food source for moose. The seeds and buds are food for squirrels. The Balsam Fir provides thermal shelter from cold winds in the winter for moose, hare, squirrels and birds.

Soil

Soil provides habitat for insects, worms, and microbes, as well as nutrients like nitrogen for plants.

Water

Water is necessary for both plants and animals to assist in cellular processes and for plants to make sugars through photosynthesis. It provides habitat for fish, aquatic plants, amphibians, insects, and plankton.

Sunlight  Sunlight provides energy for plants to build sugars through photosynthesis.	Air  Air provides oxygen for plants and animals to break down sugars through respiration, and carbon dioxide for plants to build sugars through photosynthesis.
Quaking Aspen  Aspens are food for beaver and moose and provide shelter for squirrels, birds, and other animals.	White Throated Sparrow  White Throated Sparrows live in the undergrowth of conifer (pine and fir) forests. They eat a variety of tree seeds, nuts, and insects.

Red Squirrel	White Mushroom
 Zoom Image Credit: National Park Service	
Red Squirrels nest in pine and fir trees. They eat insects, seeds, bark, nuts, fruits, mushrooms and pine seeds or cones. Forgotten seeds and cones that they bury for winter storage often grow into new young trees. Red Squirrels are eaten by Red Foxes and martens.	Mushrooms are decomposers, breaking down decaying plants and animals as a food source, and returning nutrients to the soil.