**Title: Web of Life**

Adapted from 4-H Earth Connections, by permission of the University of Maine Extension Services

**Theme:** All parts of an ecosystem are connected and interdependent.

**Objectives:**

- Students will understand that living (biotic) and non-living (abiotic) components of ecosystems are connected.
- Students will be familiar with predator-prey relationships.
- Students will understand how human impacts can disrupt an ecosystem.
- Students will brainstorm ways to protect and restore ecosystems.

**Supports NGS Standards:**

5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

If teachers choose to include a focus on matter and make comparisons to how energy flows through an ecosystem, this activity can also support 5-LS2-1: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

**Crosscutting Concepts:**

***Energy & Matter:*** Tracking energy and matter flows into, out of, and within systems helps one understand their system's behavior.

***Systems & System Models:*** A system is an organized group of related objects or components. Models can be used for understanding and predicting the behavior of systems.

**Duration:** 30-45 minutes

**Age Range:** 2nd – 6th Grade

**Rural Ready: Yes**
**Homeschool Friendly: Yes, with modifications**
**Location: Indoors or Outdoors**

**Materials:**

- Ball of yarn, twine, or rope
- Photographs/drawings of ecosystem components:
    - sun (optional: soil, water, air)
    - producers

- prey
- predators
- decomposers

**Background:**

This activity helps students understand how components within an ecosystem are interconnected and dependent upon one another. It works well to reinforce concepts of food webs, but extends to include abiotic factors as well. Once the web of life is constructed, it provides a great tool to illustrate the ripple effects of disturbances in an ecosystem. Oil spills are one such impact, but there are many other human impacts that can be included.

**Preparation:**

Prepare laminated photographs of components in a local ecosystem, with a lanyard if desired so students can wear the cards. If you are unfamiliar with components of a local ecosystem, connect with a local scientist or expert for help or refer to ID guides and natural history books. Be sure to include a wide variety of living organisms (predators, prey, plants, and decomposers) and non-living factors (sun, soil, water, air).

*Educator Tip: Ideally, these organisms represent your local ecosystem. This makes the lesson much more place-based and relevant to students and allows them to draw on their existing knowledge. However, if you need some direction here are some examples from the temperate forest and nearshore ecosystems of Southcentral Alaska:*

*Abiotic factors: sun, rocks, soil, air, freshwater, saltwater, ice*
*Plants/producers: spruce trees, alder, blueberry, beach rye grass, kelp, phytoplankton*
*Consumers – prey: snowshoe hares, spruce grouse, voles, squirrels, mussels, clams, snails, copepods*
*Consumers – predators: coyotes, owls, herring, otters, salmon, seals, sea stars, pigeon guillemots, orcas, humpback whales*
*Decomposers – fungus, bacteria, isopods, marine worms, terrestrial worms*

**Introduction:**

Ask students to discuss the human members of their community. Who are they? What role do they play in the community? How does their work help others in the community? After you have compiled a thorough list, examine the interdependence among them. Discuss what might happen if people couldn't fill their roles (i.e. grocers shutting their stores = harder to acquire food).

**Procedure:**

Explain that students are going to investigate how parts of natural communities and ecosystems depend upon each other and how the sun's energy gets passed through the ecosystem.

Pass out a photo/drawing card to each student and tell them they are now this organism or abiotic (non-living) factor.

*Homeschool tip: With individual or small groups of learners, provide them with all of the cards and have them place the cards on a piece of poster board or cardboard and use markers or yarn and glue to connect the various aspects of the ecosystem.*

Have students stand in a circle, and to ensure that students understand their role and place in the food web, go through a few rounds of identifying the various groups represented. Say,

*If you can make food from sunlight, take two steps forward. You're the plants, or producers!*

*If you are an animal that eats plants and/or animals, take two steps forward. You're consumers!*

*If you help break down dead plants and animals, take two steps forward. You're decomposers!*

Do several rounds, having the students step back into the circle after each turn. Have students help each other figure out if anyone should have stepped forward who didn't.

Ask the students, "Who of you is the source of all energy on earth?" This will be the sun student. Hand this student the ball of yarn and have them hold onto the end. Then ask students if they are an organism that depends upon the sun. It is likely many students will say they depend upon the sun. Choose one who needs the sun directly for energy through photosynthesis (i.e. a plant, or marine algae or phytoplankton). Unwind the yarn to this student and have them explain how their organism is connected to the sun. Then ask who is connected to this organism and continue to pass the yarn as their interdependence and relationships emerge.

*Teacher Tip: While the most simple relationship is food (moose depend on willow because they eat willow), students might also consider relationships such as shelter (birds depend on willow because they build nests there) and pollination or seed dispersal (willow depends on insects because they pollinate the willow). If you want to focus solely on the way energy from the sun gets passed in a food web or how matter flows through an ecosystem, you'll need to limit the connections to those related to food. But you might consider doing two or three rounds, one that focuses only on transfer of energy or matter and another that includes other types of interdependence. For upper elementary and middle school students, make sure to differentiate between*

*the energy (originally from the sun) that gets transferred between organisms and the matter (from soil, water, air, etc.) that gets transferred between organisms. To demonstrate this, you might consider creating a model with the yarn where something like water or oxygen is in the middle of the circle. Students will need more guidance to figure out how the water or oxygen flow through the ecosystem.*

Continue until the whole circle is connected by yarn. *Teacher Tip: Depending on the organisms and abiotic factors you've chosen, you may need to cut the yarn after one food chain is constructed with 3-6 students and start another food chain at the sun. Keep going until every student is holding at least one piece of yarn.*

Once the whole circle is connected, warn the students to hold tightly onto their yarn and have them carefully pull up any slack and raise the web above their heads to look through it. Bring the web back down. Pluck on the yarn to note how strongly connected everyone is in the ecosystem. Then introduce threats to the web. Begin with something the students are familiar with, such as litter. Pick 1-3 parts of the ecosystem to be affected and have them carefully drop the yarn to the floor. Anyone who feels slack in their yarn should also drop their yarn. Continue the process until everyone is disconnected.

Then, ask students what could be done to reconnect and restore the ecosystem. Probe them to suggest things like picking up litter and reminding people not to litter with signs, posters, public service announcements, etc. Have the initial parts of the ecosystem that were lost carefully pick up their piece of the yarn, and the students connected to them pick up their yarn until the ecosystem is complete again. Alternately, if the yarn is a tangled mess, begin your web again from one of your healthy organisms.

If you would like, introduce the more complicated concept of an oil spill disrupting an ecosystem. Again, have students drop the yarn as they are affected and watch the effects ripple through the ecosystem until everything is disconnected. Brainstorm ways that an ecosystem can be restored after an oil spill and/or how oil spills can be prevented; use these ideas to reconnect parts of the ecosystem.

**Wrap-up:**

Discuss how components in an ecosystem are interconnected and even that ecosystems are connected to each other. Brainstorm how ecosystems around the school are connected to ocean ecosystems. Compile a list of ways students can have positive effects on the ecosystems around the school and community. Challenge students to take action, and put one of the ideas into action as a class (i.e. picking up litter around the playground, which will benefit that ecosystem and prevent the trash from ending up in the ocean!)

**Assessment:**

In their science notebooks or on a piece of paper, ask students to create a visual model of how ***energy*** flows in a different ecosystem. Ecosystems are very complicated, so let students know that it is okay to simplify their example ecosystem and include 4-5 species of organisms as well as 2-3 abiotic factors. Students who successfully meet the performance expectation will clearly show energy flowing from the sun to producers to consumers, as well as decomposers at various points along the food web. If you've covered it during the activity, you could also ask students to create a visual model of how ***matter*** flows in a different ecosystem. Students will demonstrate understanding by illustrating matter flowing from soil to producers and then on to consumers (as well as decomposers at various points, and from decomposers back into soil) and/or matter flowing from water sources directly to producers, consumers, and decomposers and back to water sources.