

Predators Are Tops

INTRODUCTION

The survival of biological communities is based upon the complex interactions among their members. The more members there are in a community, and the more complex their relationships, the more stable that community will be. On the other hand, simple systems or systems with few members and/or interactions collapse more easily. Ecologists study the networks of relationships among organisms in living systems.

Understanding that the activities of each member in a community or system affect all the other members is important. The axiom of physics, "For every action there is an equal and opposite reaction," also applies to biology. Also, as in physics, if there are a larger number of objects in a system then the reaction is distributed into a larger number of *smaller* effects. In a classic example, arctic foxes reproduce rapidly when there are a large number of arctic hares. When too many foxes eat most of the hares, fox populations diminish just as rapidly. However, if one species of a jaguar's prey is rare it can switch to another prey item in its tropical ecosystem because of the diversity and stability of that community.

Another important concept is that ecological relationships are more like pyramids than "food chains." Not only can there be diversity in the *types* of community members, the *quantity* of community members is higher toward the base of the pyramid. At the base are inorganic components that are essentially unchanging, at least from the living organism's point of view. The next level up consists of the producers. These are green plants that convert carbon dioxide and the sun's energy into molecules useful as energy supplies for themselves and other organisms. They also return oxygen to the atmosphere. Decomposers help break down waste materials and the bodies of consumers into building blocks useful to the producers themselves. The first level of consumers eats the green plants and in their turn become prey to consumers higher on the pyramid. At each higher trophic level in the system, there are fewer individuals, and the "top predator" is usually rarest of all. This species may be what is known as a keystone species: the one by whose abundance or scarcity the health of the community may be judged.

This activity is designed to be a noisy and fun experience in which students exercise their motor skills while they also discover that consequences arise from every action. They should have the opportunity to realize that sometimes change is inevitable, but that making careful choices can allow systems to change and adapt in order to survive.

OBJECTIVES:

- 1) Establish the concept of a food pyramid, with non-living components at the base, **Producers**, **Consumers** and **Decomposers** building the trophic levels leading to a **predator** at the apex of the pyramid.
- 2) Discover the interdependence of each community member on every other.
- 3) Develop motor skills.

MATERIALS:

- 1) Pictures depicting examples of non-living components, plants, **Decomposers**, **prey** and **predators** in a community. These can be downloaded from the Printable Files page of the Jaguar SSP[®] website.
- 2) Black and white "situation cards" with pictures and descriptions of situations that might cause the removal of a species or component in the pyramid. These are found

in Printable Files, too. They are printed four to a page, so you will need to cut them apart. Laminating them makes them more durable, but it is not necessary.

- 3) Twenty-one one-gallon food cans. These are not supplied with the module, but might be easily acquired from your school cafeteria. Be sure to clean them thoroughly and remove all sharp edges before use in this activity.

ACTIVITY:

- 1) Attach each picture to a can to represent the pyramid's building blocks. (As an optional extension activity, provide black-and-white versions of the pictures to students. Instruct them to color the pictures and use the best ones as the pyramid building blocks.)

Guide the participants through identification and description of each building block as it relates to this activity:

SUN: The primary source of energy to living organisms on earth.

SOIL: The source of physical and chemical building blocks for plants, and a habitat to many

Decomposers.

WATER: An essential component for life, as a transport medium of incoming supplies or outgoing waste; and as a basic building block for all living cells.

WEATHER: An agent of change in the physical **environment**, and one way that water may be supplied to a living community.

SPACE: The immediate area and/or **geography** in which organisms live. In this case, the picture is a **map** of the range of the jaguar before about 1900.

GRASS: The dominant form of (many-celled) plant life in **grasslands** and marshes. Using sunlight and non-living resources, it is a **Producer** in the living community.

TREE: The dominant form of (many-celled) plant life in **forests** or swamps. Using sunlight and non-living resources, it is a **Producer** in the living community.

CACTUS: A representative form of many-celled plant life found in deserts. Using sunlight and non-living resources, it is a **Producer** in the living community.

FUNGUS: A member of a many-celled taxonomic kingdom that usually physically invades the body of other organisms (living or dead) and incorporates their stored energy and resources for its own use. A fungus is considered a **Decomposer** in a living community.

EARTHWORM: An **animal** that restructures and enriches soil through its own biological activity and movement. An earthworm is considered a **Decomposer** in this living community.

MILLIPEDE: An **animal** that consumes and breaks down decaying plant and **animal** material on the soil's surface. A millipede is considered a **Decomposer** in a living community.

BACTERIA: Members of a single-celled taxonomic kingdom found nearly everywhere on earth. Bacteria are important in the **Decomposers** of dead plants and **animals**.

TURTLE: An aquatic or marine reptile whose bony shell is a primary means of defense against **predators**. It is a **Consumer** in a living community. Jaguars have a strong ability to swim and possess the power in teeth and jaws to penetrate turtle shells.

ARMADILLO: A small, insect-eating **mammal** that is often **prey** to jaguars. It is a **Consumer** in a living community.

CAPYBARA: An aquatic rodent found in and near rivers, lakes and **wetlands** in Central and much of South America. It is the largest rodent, and a favored **prey** of jaguars. It is a **Consumer** in a living community.

VULTURE: A bird that scavenges the remains of dead **animals**, including uneaten portions of jaguar **prey**. It is a **Consumer** in a living community.

INSECTS: Probably the dominant form of **animal** life on earth. They may be primary **Consumers** of plants, scavengers or **predators**. It is a **Consumer** in a living community.

JAGUAR: The top **predator** in our pyramid's ecological community. It is the largest cat in the Americas. While it features prominently in the cultures of people in its range, the jaguar also faces threats to its survival from humans. It is a **Consumer** in a living community.

- 2) Assist students in building the pyramid itself, using the following table as a template. Soil and trees are repeated twice at their respective levels solely for the purpose of balancing out the number of building blocks in the pyramid.

JAGUAR						Consumer-predator
VULTURE	INSECTS					Consumer-scavenger
TURTLE	ARMADILLO	CAPYBARA				Consumer-prey
FUNGUS	EARTHWORM	MILLIPEDE	BACTERIA			Decomposer
GRASS	TREE	CACTUS	TREE	GRASS		Producer
SUN	SOIL	WATER	WEATHER	SPACE	WATER	Non-living

- 3) Demonstrate the interdependence of all components of the pyramid by helping the students carefully remove one building block at a time. Shuffle the Situation Cards and have a student draw one. After the teacher reads the situation described on the card (e.g. "A flash flood forced armadillos to move to higher ground.") ask the student to remove the block with the animal pictured on the card. Have another student pull a card and repeat the process. How many blocks can be removed before the pyramid collapses? Do the students make the connection that the top **predator** can be a **keystone species** because it is often the first one to disappear when the community suffers?
- 4) As an additional activity, reinforcing knowledge gained building the pyramid, cover the written label on each picture and use them as cues for a spelling bee. Or learn the translations of the words in English and Spanish.