

Tropical Rainforest Food Web Game

Teacher Background

This is an interactive, role-playing game, using the plants and animals of the Amazon rainforest. In this Game there are no winners or losers. Instead, preparing for and "playing" the game helps students become more familiar with the names, biology and natural history of the plants and animals of the Amazon rainforest. Details of plants and animals are provided because children are intrigued by specific facts. But most importantly, by simulating a rainforest *food web*, students will learn the ways in which the plants and animals are associated with one another in diverse and interdependent relationships.

The Amazon rainforest provides a dramatic and engaging context for the simulation, since it is an example of one of Earth's richest and most diverse systems, and because, like rainforest everywhere, it is vulnerable to disruption. However the ecological principles demonstrated in this game are true for *all* ecosystems, including habitats existing on the school playground or in a student's backyard. Many other natural systems around the world are threatened, including several in North America. This includes rainforest in Hawaii, old growth forests of the Pacific Northwest, portions of still-forested Puerto Rico outside the national and state parks, and the only tropical ecosystem in the continental U.S., the tropical hardwood forests of the Florida Keys.

Key Concepts

Everything is connected to everything else by the flow of energy and the cycling of matter.

- All energy comes from the sun.
- Plants capture some of this energy (by photosynthesis) and make food.
- Plant-eating animals obtain this energy from plants and meat-eating animals, in turn, take energy from them.
- Death and decay recycles matter and energy to help begin the process anew.
- All living things need a "home"--a place that provides shelter, food, air, and water.
- Living things need one another to survive. the connections are different and comprise the "Web of Life." Some relationships involve eating or being eaten, but many other "cooperative" relationships exist--e.g. providing a place to grow, helping pollinate flowers or scatter seeds.
- Damaging the strands in the Web can have unforeseen and far-reaching consequences.

Objectives

- Students will research key facts about selected rainforest plants and animals
- Students will simulate typical food webs found in tropical rainforests
- Students will demonstrate and explain disruptions in the food web caused by the loss of intermediate species.

Materials

- 6-10 ft length of colored yarn (yellow, red, green, brown) for each player (length depends on the size of the area used; color should relate to role and/or link, i.e., green = plant)
- poster paper or reused materials suitable for organism name tags (I.D.'s)
- a sun-hat for the student chosen to be the sun
- markers or crayons
- safety pins
- a papered area for the wall chart

Before Beginning the Game

If not already created in earlier Activities, we suggest making a large wall chart or display of a tropical rainforest, showing the plants and animals in the locations where they would typically be found. Smaller animals (e.g. ants, bromeliad frog, etc.) could be portrayed in magnified "boxes" on the bottom of the chart. This chart or display should be located in the classroom where students can see and refer to it during the game. Teachers may be able to secure other large posters, but it may be more valuable to have students construct their own "skeleton" rainforest with trees of varying heights, and then either draw in or tape on the various animals and plants in their appropriate locations as actually used in the game. (Have students refer to their Rainforest Logs and Activities already done.)

Forest construction can occur in steps. For example, the class could be divided into different community units, each working on one layer of the rainforest. If you have time, considerable effort could go into the construction, with cylindrical trunks or branches sticking out into the room and with vines snaking across the ceiling to give a three-dimensional effect. This is a place for creativity and realism--e.g. rope lianas attached to the canopy trees, perhaps enlivened with real orchids and bromeliads from a greenhouse.

Engage

Using the wall chart/model, review what students have learned and seen in the videos about Amazonian plants and animals. Introduce the set of plants and animals in the game and allow students to select their organism.

Students should then research their organism in the school library or online. Since students know the identities of the other plants and animals in the Game, encourage them to also pay attention to information about these as they do their research.

Students will construct their "Organism I.D." and create as accurate a picture of their plant or animal as possible. (Illustrations of some plants and animals, which can be photocopied, cut out and used for name tags and/or the wall chart can be found on the Live from the Rainforest website--<http://passporttoknowledge.com/rainforest>. Have them tape a drawing or picture of their organism in the correct location on the chart.

With a large class, there is the issue of time and class dynamics. Some students may become impatient as their classmates slowly make connection. However, if the pre-game steps have proceeded as suggested, students should already be well informed about the Amazon rainforest, its occupants, and their relationships to other inhabitants. Tell them they'll be putting their knowledge to work, simulating the real world in action. (Younger students may not thrill to the "eat-and/or-be eaten" drama, but it might be very engaging for middle-schoolers.) With this occur more efficiently than it would with little or no pre-game preparations.

As Practice for and prelude to physically constructing the Food Web, students could join hands in a series of specific connections such as:

Sun -- Brazil nut tree -- Agouti -- Bush dog

Sun -- Parkia leaf decomposing in a bromeliad "pool" -- Bromeliad frog -- tadpole -- Dragonfly nymph -- Capuchin monkey

Sun -- Fig tree -- Toucan -- Emerald boa

Explore

Playing the Food Web Game

1. Choose a large unobstructed "play" area in the classroom or on school grounds.
2. Each student has his/her "Organism I.D." prominently displayed. The "Sun" (yellow hat!) is in the middle of the game area. "Plants" stand around and near the sun; students portraying animals position themselves in an outer circle around the plants.
3. The first student actor in the game should be a "plant." Students, in turn, identify themselves, referring to key facts on their I.D., and form a "Food Web" link with another student.

(Special note: Teachers should feel free to try different approaches in the logistics of forming the food web, but Dr. Sandford, the original developers and field testers of the Game recommend that the web be constructed in 3 rounds, and that in each round, each student is asked to make *one* link with another organism.)

Round 1 "What I need" Each student links up with something it need in order to survive.

Round 2 "What needs Me" Each student links to some other plant or animal that needs it in order to survive, whether a predator-prey or mutualistic relationship.

Round 3 Other possible connections

- A. In round 1, a "plant", would form a link (yellow yarn) with the Sun, since all plants need sunlight to live and grow. Then in round 2, the "plant" should also extend a link (green yarn) to an animal that is likely to eat the plant the student represents. The animal might eat any part of the plant such as the leaves, roots, flowers, branches, fruits and seeds, or the nectar and pollen produced by the flowers. Some plant-eaters eat different parts of the plant at different times in their life cycle. Butterflies drink nectar as adults, but munch leaves as immature caterpillars.
- B. Students portraying a plant-eating animal (or "herbivore") could either link with a plant that it might likely eat, or an animal that might likely eat it (or its young, eggs, etc.). Meat-eating animals (carnivores) should link to the prey animal eaten with a red string.
- C. Some animals may feed on a variety of things (e.g. plants, other animals, dead or decaying plant or animal matter as a scavenger, etc.), or may feed on only very specific animals or plants (a specialist feeder), or may feed on only very specific animals or plants (a specialist feeder), or on animals and plants that tend to be found only in certain locations in the rainforest (e.g. on the forest floor, in the canopy, etc.). Students will likely be familiar enough with many of the plants and animals to form appropriate links, but some less well known organisms may cause problems at first. If the student has difficulty making a link, or makes an obviously incorrect link, prompt other students to provide relevant information gathered during their research, or present hints.

Some animals feed at different levels in the food chain (e.g. some monkeys eat mainly plants, but will eat insects or small animals given the opportunity). As they are mainly plant-eaters it would be best to use a green string. *If the student recognizes that some animals have diverse feeding habits and that relationships in nature are not always simple or predictable, this should be encouraged and emphasized*

by the teacher. It could also be incorporated into the game if desired (e.g. with a link consisting of two intertwined strings--one red, one green).

Animals that are top carnivores in food chains (e.g. harpy eagles), which could eat an animal (e.g. red-faced spider monkey) which has eaten another animal (e.g. baby antbird) also form links with a red string, although it would be appropriate to explain that these animals are feeding at the top levels in the food chain.

4. Not all associations between living things in the rainforest are "eat-or-be-eaten" relationships. For example, the tank bromeliad lives as an epiphyte on the trunks and branches of trees, it does not derive nourishment directly from the trees as a parasite would, but it does depend on trees as a support base and as a location where it can grow and successfully reproduce. Likewise, a bromeliad frog does not eat the tank bromeliad. It eats insects living in or on the bromeliad, and its tadpoles develop in the pool of water in the bromeliad's tank. Thus, the bromeliad is necessary for the survival of both the adult frog and its offspring. Associations such as those represented by the tree-bromeliad, and the bromeliad frog, should be linked using a brown thread to indicate that not all associations are predator prey or feeding relationships. [Both the tank bromeliad and the orchid are epiphytes. Thus, they will show two types of linkages: (i) directly to the sun (yellow yarn), and (ii) to the trees on which they grow (brown yarn)]
5. After each student has identified him/her self, and made a link with someone else (rounds 1 and 2) they should have the opportunity, in the third and final round, to make as many other connections as they can think of, and thus convert the series of food chains into a more complicated and realistic food web.
6. Constructing such a food web can be time-consuming, since a large number of linkages are often possible--an important lesson in itself. For example, the 3-toed sloth will form mainly one plant link (green) as it is largely a specialist feeder and eats mainly Cecropia leaves. Other animals such as the capuchin monkey are opportunistic or generalist feeders likely to eat a wide variety of different flowers or fruits, as well as insects, small animals, etc. (and thus be linked to many other organisms with yarn of different colors.) And because the fig tree supports a large number of different plants and animals, the student representing the fig tree will be left holding many strings.

The important thing here is not to form *all possible* links, but rather to realize that in most instances *many* connections are possible, and that the plants and animals of the Amazon rainforest are *interrelated and interdependent*. They need one another to survive.

Expand/Adapt/Connect

Discuss what would happen if outside forces (e.g., natural disruptions such as a tree fall or human development such as clearing for farming) interfere with the web by damaging or breaking connections. Using the "What if...?"

Additional Notes for Teacher

While associations are given for each organism in the game, these are not all completely specific. For example, it's started here that the red-faced spider monkey eats fruits, tree buds and other foods on occasion. The kinds of tree eaten and the other possible foods are not specifically identified. In such circumstances the students can assume that the monkey utilizes many different kinds of buds and fruits and other food items that would exist in the upper forest canopy where it's usually found.

It should be emphasized that a game such as this can only *roughly* approximate the actual complexity of interrelationships existing in the Amazon. Many of the relationships that exist are to date unknown and unstudied, and still to be discovered--yet one more reason for protecting and preserving the rainforest in order to someday reveal the secrets it holds.

This activity was developed by Professor Floyd Sanford, Biology Department, Coe College, and was adapted with permission, by PASSPORT TO KNOWLEDGE.