Food Chains Are Not a Necklace!

Second Grade Science Lesson

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E & E IPM Standard(s): 4.3.4 C, 4.5.4 A, 4.6.4 A

Introduction:

An ecosystem has many important participants, each of which must be kept in balance. The first part of a food chain consists of the producers. These are living things that take minerals and gases from the environment and use them to support life. Green plants are producers.

The next link of the chain is the consumers, which need the producers to be their food. The consumers' hierarchy begins with herbivores who eat plants and moves on to carnivores who eat the herbivores. There are also omnivores who eat both plants and animals.

The final part of the food chain are the decomposers which are living things that feed off dead plants and animals and reduce their remains to minerals and gases again. Biological magnification is the tendency of pollutants to become concentrated in successive trophic levels. Often, this is to the detriment of the organisms in which these materials concentrate, since the pollutants are often toxic.

Biomagnification occurs when organisms at the bottom of the food chain concentrate the material above its concentration in the surrounding soil or water. Producers take in inorganic nutrients from their surroundings. Since a lack of these nutrients can limit the growth of the producer, producers will go to great lengths to obtain the nutrients. They will spend considerable energy to pump them into their bodies. They will even take up more than they need immediately and store it, since they can't be "sure" of when the nutrient will be available again (of course, plants don't think about such things, but, as it turns out, those plants, which, for whatever reason, tended to concentrate inorganic nutrients have done better over the years). The problem comes up when a pollutant, such as DDT or mercury, is present in the environment. Chemically, these pollutants resemble essential inorganic nutrients and are brought into the producer's body and stored "by mistake". This is the first step in biomagnification; the pollutant is at a higher concentration inside the producer than it is in the environment.

The second stage of biomagnification occurs when the producer is eaten. Remember from our discussion of a pyramid of biomass that relatively little energy is available from one trophic level to the next. This means that a consumer (of any level) has to consume a lot of biomass from the lower trophic level. If that biomass contains the pollutant, the pollutant will be taken up in large quantities by the consumer. Pollutants that biomagnify have another characteristic. Not only are they taken up by the producers, but they are absorbed and stored in the bodies of the consumers. This often occurs with pollutants soluble in fat such as DDT or PCB's. These materials are digested from the producer and move into the fat of the consumer. If the consumer is caught and eaten, its fat is digested and the pollutant moves to the fat of the new consumer. In this way, the pollutant builds up in the fatty tissues of the consumers. Water-soluble pollutants usually cannot biomagnify in this way because they would dissolve in the bodily fluids of the consumer.

Since every organism loses water to the environment, as the water is lost the pollutant would leave as well. Alas, fat simply does not leave the body.

The "best" example of biomagnification comes from DDT. This long-lived pesticide (insecticide) has improved human health in many countries by killing insects such as mosquitoes that spread disease. On the other hand, DDT is effective in part because it does not break down in the environment. It is picked up by organisms in the environment and incorporated into fat. Even here, it does no real damage in many organisms (including humans). In others, however, DDT is deadly or may have more insidious, long-term effects. In birds, for instance, DDT interferes with the deposition of calcium in the shells of the bird's eggs. The eggs laid are very soft and easily broken; birds so afflicted are rarely able to raise young and this causes a decline in their numbers. This was so apparent in the early 1960's that it led the scientist Rachel Carson to postulate a "silent spring" without the sound of bird calls. Her book "Silent Spring" led to the banning of DDT, the search for pesticides that would not biomagnify, and the birth of the "modern" environmental movement in the 1960's. Birds such as the bald eagle have made comebacks in response to the banning of DDT in the US. Ironically, many of the pesticides which replaced DDT are more dangerous to humans, and, without DDT, disease (primarily in the tropics) claims more human lives.

Information obtained from:
http://www.marietta.edu/~biol/102/ecosytem.html#Biologicalmagnification6

Learning Objectives:
Students will discover how food chains interact among many different plants and animals through an activity. They'll learn the terms: producers, consumers, and decomposers.
Through a game, students will learn how pesticides affect a food chain.
Students will be able to draw and label a food web containing a producer, a consumer, and a decomposer.

Materials:
Day 1:
Name cards of plants, animals, and the sun
Yarn
Day 2:
Plastic baggies, enough for all grasshoppers
Popcorn (some plain and some cheese coated or stained with food coloring)
Paper and crayons
Magazines (optional)

Timeline:
Two class periods

Procedure for Day 1:
Write the words "Food Chain" on the board. Draw three lines radiating out from the two words. At the end of each line, write the words "producers", "consumers", and "decomposers". Explain what each of these groups consist of and write an example after each (consumer – chipmunk). Ask students for several more examples for each group.

On another section of the board, write “pesticides”. Have a discussion of what this word means and give examples of products students might find in their homes.
Give each child a card labeled with the name of the sun, a plant, or an animal and stand at random in a small area. Give the sun the ball of yarn. Remind the children that the sun is earth’s energy source and ask what the sun helps to grow. Have the sun hold on to the end of the yarn and toss the ball to a plant. Inquire whether students understand why plants are the first step of the food chain.
Ask students who should get the yarn ball next. Plant tosses the ball to a plant eater, such as a caterpillar. Plant should retain grip on the yarn ball when it tosses it.
The consumer or plant eater looks around for something that might eat it and, holding onto the yarn, tosses it to that animal. Play continues in this way until the yarn ball reaches the top of the food chain.
Give the ball back to the sun and play the game again with different plants and animals receiving the yarn ball. Some of the first players may join in again to show how interactive a food chain can become. For instance, some animals eat both plants and animals.
Have one link in the chain drop their hold on the yarn because it died from pesticides. Discuss what happens to the chain that followed the now dead animal. Also discuss what happens to the dead animal (decomposers).
Sing the song, “I Know an Old Lady Who Swallowed a Fly” with a new twist. Have students make up a true food chain to sing with the tune. This could be done in small groups or as a whole class.

Procedure for Day 2:
Students will review concepts learned the day before. Then, they’ll play a game about food chains. In a large circle sprinkle regular and colored popcorn. Give out name cards to each child plus a baggie to
each grasshopper. (Example: 1 or 2 hawks, 3 or 4 chipmunks, 8-14 grasshoppers)
Explain that there will be time limits when the different groups “feed”. Give the grasshoppers 15 seconds to pick up as much popcorn as possible and put it in their “stomachs”(baggie). Next, the chipmunks will hunt the grasshoppers for 15 seconds. If the chipmunk catches (tags) a grasshopper, the grasshopper must give up its “stomach” and sit down outside the circle. They have been eaten. For the final 15 seconds, the hawks hunt the chipmunks and take their “stomachs”.
After time is up, anyone left standing will display their “stomachs”.
The teacher will explain that the colored corn was sprayed with a pesticide. Look at all the “stomachs”. If a grasshopper’s “stomach” contains more than 10 pieces of colored corn, the grasshopper is considered dead from pesticide poisoning. If it has less than 10 pieces of colored corn, it’s still alive but very sick. If the chipmunk’s “stomach” catch has more than 20 pieces of colored corn, consider it dead. If it has less than 20, again, consider it alive but ill. The hawk, although not necessarily dying at this time, may also show evidence of pesticide poisoning through very thin egg shells that can’t survive nesting time. This leads to a decrease in the hawk population and loss of an important predator to control smaller animal and insect populations.

Analysis:

Using magazine pictures or crayons to draw, students will compose an example of a food chain and label each section as producer, composer, and decomposer and use arrows to show the cycle.

Discussion:
Can you tell what a food chain is and why it's important to everyone?
Do you know the different parts of a food chain?
What can happen to a food chain when pesticides are introduced to it?
Can you give an example of a food chain with three parts? Four parts?

Web Sites:
www.planetpals.com/foodchain.html (information and graphic chart)
www.iit.edu/~smile/bi9002.html (activities)
www.nwf.org/kids/games.html# (games: Thank a Tree, Toxic Gobble, Everglades Photo Shoot)
www.oswego.org/staff/cchamber/resources/foodchain.cfm (source of web sites about food chains for all grade levels)
www.uen.org/curriculum/html/corelessonplans.html (go to Science, TRB 3:1, activities 3,4,7)