BIOMAGNIFICATION GAME (ADAPTED FROM PROJECT WILD)

MODEL ENERGY AS IT MOVES THROUGH TROPHIC LEVELS IN THE FOOD CHAIN; OBSERVE BIOMAGNIFICATION OF PESTICIDES

Fifth Grade Next Generation Science Standards Met:

LS1.C Energy flows in organisms

- 5-LS1-1
- MP.2

LS2.A Interdependent relationships in ecosystems

- 5-LS2-1

LS2.B Cycles of Matter and Energy Transfer in Ecosystems

- 5-LS2-1
- MP.2
- MP.4

ESS3.C Human Impacts on Earth Systems

- 5-ESS3-1

5-PS3 Engery

- 5-PS3-1

LS1.C Organization for Matter and Energy Flow in Organisms

- 5-PS3-1

Pre-Trip Information

Fabulous Food Chains Video

NewsELA Article on Food Chain Disruption (5th Grade level)

Materials:

- Multicolored puff balls
- Pinnies/jerseys
- 3 colors of plastic bags

Objectives:

- Give examples of ways pesticides enter the food chain
- Understand how energy moves through a food chain
- Describe possible consequences of pesticides in food chains

Introduction:

Pesticides are chemicals (often man-made) used to control organisms that have been identified as "pests" in certain conditions. Common pesticides include herbicides (used to control unwanted plants), insecticides (used to control nuisance insects), and rodenticides (used to control rodents like mice and voles). These toxic chemicals can end up far from where they were originally applied, and can become concentrated in unexpected places- from food and water supplies to wildlife and people.

Activity:

- Discuss the idea of food chains with the students
- Divide the group into 3 groups; in a class of 30 there would be 3 hawks, 7 shrews, and 20 grasshoppers
- Give each group the appropriate materials:
    - Hawks receive a red pinnie and red baggie
    - Shrews receive a blue pinnie and blue baggie
    - Grasshoppers receive a green baggie
- Spread the "food" (multicolored puff balls) over a large playing area
- Grasshoppers will enter the playing field first and begin "feeding" (collecting puff balls in their baggies)
- After 30-60 seconds, allow the shrews to begin "hunting" the grasshoppers; when a shrew catches a grasshopper the grasshopper must give its food to the shrew and move to the sidelines
- After 30-60 seconds allow the hawks to begin "hunting" the shrews; when a hawk catches a shrew the shrew must give its food to the hawk and move to the sidelines
- After 30-60 seconds call time and have all students line up side-by-side in front of you
- Ask all grasshoppers to step forward
- Tell grasshoppers that if they were eaten or have no 'food' in their bag have them step back
- Ask the remaining grasshoppers to count their food; have them report how much food they have in total
- Record this information, then repeat with the shrews and hawks
- Once you have only the "living" grasshoppers, shrews, and hawks remaining, explain that there is something called a pesticide in the environment. It was sprayed on the crop the grasshoppers were eating to prevent the grasshoppers from destroying the crop
- Decide what you would like to use as the pesticide for this round (color or size of puff ball) and tell students that any grasshoppers that have the pesticide in their food supply are now dead. Have them report how many of the pesticide they have, and if they died have them step back
- Next have the shrews report how many of the pesticide they have in their food supply. Tell them if more than half of their food supply is pesticide they are dead and have them step back
- Finally have the hawks report how many of the pesticide they have in their food supply. The one with the most pesticide can no longer produce viable offspring, the others are not yet visibly affected at this time

Have students switch roles and repeat game 2-3 times, recording information from each round. You may change the 'pesticide' each round, or keep it the same.

Talk with the students about what they experienced in the activity. Ask for their observations about how the food chain works and how energy (in this case represented by puff balls) moves through different levels. Pesticides accumulate in the food chain through a process called **biomagnification**.

- Which animals had the highest amount of pesticide in their food? (The hawks)
- Did these animals have a choice of what kind of food to pick up off the ground? (No, they got whatever the shrews ate, and the shrews got whatever the grasshoppers ate)
- Did what the grasshoppers ate/avoided change between rounds? What could this represent in real life? (Probably, students will typically learn to avoid the things that have already been identified as pesticides; this could represent adaptation in real life)

Take the documentation sheet back to class.

Post activity: (to be done in class after trip)

- Graph the results from each round and compare the levels of pesticides found in each type of animal
- Have students to research the types of chemicals that we use as pesticides, and the effect they have on organisms (DDT, TBT, and PCBs are well documented)

BIOMAGNIFICATION GAME

Record the total # of food tokens collected and the # of pesticides collected for each surviving student below.

	Round 1	**Round 2**	**Round 3**	**Round 4**	**Round 5**
# of starting grasshoppers					
# of starting rodents					
# of starting hawks					

# of grasshoppers left					
# of rodents left					
# of hawks left					
# of grasshoppers affected by pesticides					
# of rodents affected by pesticides					
# of hawks affected by pesticides					

Post activity: (to be done in class after trip)

- Graph the results from each round and compare the levels of pesticides found in each type of animal
- Have students to research on the types of chemicals that we use as pesticides, and the effect they have on organisms (DDT, TBT, and PCBs are well documented)