

The Bartering System

Wyoming Science

Objectives:

- Students will learn how plants and insects trade services, and to become familiar with the concept of an energy exchange.

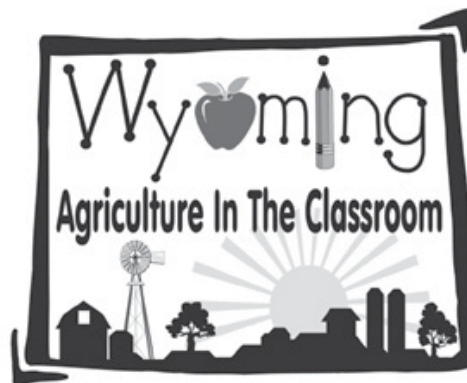
Activity Procedure:

Creating flowers requires a large input of energy (i.e., hard work!) on the part of plants. This energy is expended for a reason. In nature, living things survive by maintaining or acquiring as much energy as possible, while expending as little as possible. For plants, this means generating as many leaves and getting as much sunlight as possible while attracting pollinators to the flowers for pollination services.

Some plants take a completely different pollination path: Instead of developing flowers for attracting pollinators, they produce long catkins, which scatter pollen when the wind blows. This process, called wind pollination, is used by many plants such as grasses and oak trees. Still other plants are pollinated by splashing water that carries pollen away. These methods are less efficient, because pollen is scattered widely and may or may not reach its target. However, less energy is expended than to produce the flower. It's a trade-off. Like with most activities, the more energy and effort put into something, the better chance it will be a success.

Activity:

1. Photocopy the Energy Credit pieces and have students cut them out.
2. Divide the class into two groups, with 25% pretending to be pollinators and 75% pretending to be plants. Distribute 10 energy credits to each child who is a plant. Each student playing a plant should choose to be either a showy, animal-pollinated plant (such as a sunflower or petunia) or a "non-showy," wind-pollinated plant (such as grass or trees). Each student playing a pollinator should choose to be a bat, bee, fly, moth, beetle, butterfly, hummingbird or other pollinator.
3. The game will proceed by stages: Insects will make one pass around the room to barter pollination services for energy, which will make up one "rotation." After each rotation, the plants will use sunlight to produce 10 new energy credits, which the leader provides. (Explain that



Standards

Science

Life Systems:

1.2, 1.4, 1.5, 1.6

Materials

- Energy Credit Pieces
- Paper
- String
- Markers or colors to create signs
- Small paper bags (brown lunch bags work well) to collect pollen
- Masking tape to use as pollen grains



Estimated Time

45 Minutes

Grades 5-6

notes:

plants transform energy from the sun into food through a process called photosynthesis.)

4. The game consists of two or three rotations or more if you wish, until the group understands the concept of energy exchange.

Wind-Pollinated Plants:

- Space apart the wind-pollinated plants. Either you or an assigned student can play the wind and carry (or “blow”) pollen around the plants.
- Remember: The wind doesn’t know which plants need which pollen—it is only a matter of chance that some of the many pollen grains produced hit their targets.
- You can simulate the mass production of wind-disseminated pollen by using small balls of tape that stick onto gardeners’ clothes, or you can use confetti. The confetti will better convey the concept of mass production. The gardeners will be able to see that most of the pollen ends up on the floor or on other plants, while only a few grains end up on the other wind-pollinated plants. This is why wind-pollinated plants produce so much pollen.
- Many wind-pollinated plants trigger people’s allergies because of the huge amounts of pollen they produce.

Animal-Pollinated Plants:

- Space the animal-pollinated plants evenly around the room for the most part, although you might want to consider creating one or two “clusters” of animal-pollinated plants so that their pollinators can work more efficiently. (Insect pollinators often are more attracted to groups of plants.)
- Have them stick pollen grains (balls of sticky tape) to their shirts and arms, so that insect pollinators can come by and collect them.
- They also will need a bag (a brown paper bag will do) to use for the pollen grains they receive. After collecting pollen from one flower, an insect will drop it off at another flower.
- The recipient should place the pollen in his or her pollen bag, so that it is not collected again inadvertently. Their goals are to send their pollen away and to gather new pollen. They will use this pollen to fertilize their eggs and produce seeds, which is the overall goal of all plants—to reproduce.

Animal Pollinators:

- The animals’ goal in this game is to collect pollen and nectar (represented by energy credits) for a meal. There should be only a few animal pollinators, mostly insects. This is most representative of nature, which has many

more low-energy organisms (plants) than higher-energy organisms (animals). As you go up the food chain, the organisms become more complex and use more energy, and there are fewer of them.

- The pollinators should travel around the plants, gathering pollen from some in exchange for an energy credit and dropping it into the pollen bags of others in exchange for another energy credit. The energy credit is the price plants pay, and the reward pollinators receive, for being pollinated or for pollinating.
- The pollinators will begin the game with one energy credit each, and will need to use the plants to obtain the additional energy credits they need to survive.
- The animals can “barter” with the plants to get nectar to eat in exchange for transferring pollen to other flowers, or they can be animal raiders that decimate a plant’s leaves (such as a grasshopper).
- The animal raiders do not pollinate. They just take an energy credit from each plant on demand.
- Each of the pollinators gets an energy credit from a plant for each flower they pollinate (the one that it cost the plant to produce the flower) and for each leaf they eat, which takes away from the plant’s energy reserve.
- The pollinators’ use their energy in moving about the room—one energy credit for one rotation around the room—and must have five energy credits left at the end to produce eggs. The plants must have pollen in their bags to produce seed.

Managing the Game:

1. Begin the activity by assigning roles to the children. Ask the students to create signs to hang around their necks identifying their roles, and to draw pictures of the organisms they are portraying.
2. About 75% of the students will be plants that remain stationary in designated spots around the room. The other 25% can be animal pollinators, with only one or two being plant-eaters such as grasshoppers. (You may need to set limits on the amount of plant material a grasshopper can eat, to maintain a balanced ecosystem within your group.)
3. Allow the pollinators to circle the room one time in exchange for one energy credit, which they must give back to you. During their rotation they must barter with some of the plants for energy credits. Most do this by providing pollinating services, while one or two may feed on plants to obtain their energy.

notes:

4. After each rotation, pause to discuss what is happening with your group.
 - Who has gained energy?
 - Who has lost energy?
 - What would happen in nature if this occurred?
5. Some plants may accumulate pollen and produce seeds, while others may not. Likewise, some insects will have enough energy credits remaining at the end of two or three cycles to produce eggs for the next generation of insects, while others may not.
 - What are the advantages of being a plant?
 - What are the advantages of being a pollinator?
6. The rules are flexible and can be adjusted to fit your group's needs. You may need to use more plants and fewer animals to balance the available energy, or you may add some varying climatic conditions, such as drought versus adequate rain.
7. It is important that your group experiment with and understand some of the complexities of energy exchanges between plants and animals, and to think about how delicate a balance it is.



Materials Adapted from Junior Master Gardener Teacher/Leader Guide

