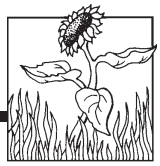

Carrying Capacity

Objective: Students will learn about the limits of natural resources.

Summary: Students will participate in a simulation of land use on a farm, exploring how various organisms meet their basic needs.

Time: 1½ hours

Student Grouping: Entire class

Materials: Water, plant and insect cards (see preparation for numbers needed), one old sock, three 1' pieces of cord, a 3'-long strip of cloth labeled "SNAKE," 20 paper cowbells labeled "COW," 30 envelopes, safety pins to attach snake and cowbells, large playing area.

Background Information: A piece of land can support only a certain amount of life. If too many organisms try to live in a limited space, they will deplete the area of food and water sources, thus causing some of the animals to die. This holds true for any limited space. An excessive number of organisms may live for a some time, but eventually the plants will not be able to grow fast enough and the water cannot be replenished quickly enough to allow healthful living conditions. If a balance of animals and plants exists, the area can produce indefinitely. That means the total numbers cannot increase; any animals that are born replace others that have died or left,or must move elsewhere themselves. This is referred to as the "carrying capacity" of the land, how many organisms the land can "carry" and provide for adequately over an extended period of time.

Marin Ag. Facts: A farmer is limited in how many animals his or her land can provide for adequately. Depending on the quality of the feed that grows there, a given area can support only so many animals. Ranches in different areas can support varying numbers of animals per acre. Dairy ranches on the coast vary from .1 to 1 cow per acre. For sheep, those numbers run from .5 to 5 sheep per acre. Carrying capacities are very evident in wild areas as well. On land where domestic animals graze, there is less feed for deer, elk or other grazing animals. Because different animals utilize different plants for food, there is often overlap in animal land use. For instance, deer eat some shrubs, nuts and trees that cows do not utilize as heavily The cow therefore impacts the food supply but does not completely displace the deer.

Preparation:

1. Read through this activity carefully. It is involved; but, once you have the hang of it, it is not difficult. The students will collect cards that symbolize some of their basic needs. They will go through three rounds of card-collecting then return to the classroom to do a bit of math and see if they survived.
2. For food and water cards you can buy packages of colored 3" x 5" cards or make them with construction paper. These numbers work for a class of 30: 120 water (blue), 120 plant (green) and 20 insect (black). Once these are made, cut 20 water and 20 plant cards into quarters.
3. Collect the strip of cloth and cowbells with pins, cord and old socks (you can have students bring them in during the preceding week). Choose one long sock to cut into strips up to the cuff (see illustration). This one will represent the fox's bushy tail.
4. Put the names of the players on the envelopes. You will assign students their roles by distributing these. As students collect cards, they will put them into their envelopes. For a class of 30 you will have 1 snake (gets the long cloth with word "SNAKE" pinned to their back), 1 fox (gets the shredded sock for a bushy tail stuck in their waistband), 2 birds (must flap their wings when collecting food), 2 mice (get a piece of cord for a tail, stuck in waistband), 3 ranchers and 15 cows (get paper cowbells with "COW" on them).

Procedure:

1. Ask students how many of them could live on one farm. What do they think would happen if there were too many cows on one farm?

2. Go outside or into a gymnasium. Have students hold hands and make a large circle. Drop hands and take three giant steps backward. Everyone must remember the spot they are starting from. This represents their home (house, barn, nest, den, burrow). The center of the circle represents the farm they all live on.
3. Being careful to mix up cards so the farmer is spaced away from fox, mice and birds, assign students roles by giving each of them an envelope which says "cow" or "rancher" or "mouse," etc. on it. Give them their tails or other identification. Have each student place the envelope on the ground at their home. They do not take it with them when they forage.
4. Scatter the cards all through the farm area. Make sure the colors are mixed. Tell students these cards represent food they need for survival, but do not tell them what the colors represent.
5. Explain to the students that when you say "start," they are to go in search of the things they need for survival. Be clear about their not running into each other. Cows must amble slowly, as cows do. They can pick up two cards but then must return to their envelope and put the cards in it before they resume their foraging. All other critters can pick up only one card and must put it in their envelope back at home (they have much smaller mouths). The humans can walk, the birds must flap their wings and can move quickly, the snake must keep its arms to its sides and walk, the fox can run and jump, as can the mice. When you call "stop," players must drop any cards not in their envelopes and return to their homes.
6. Repeat the "start" and stop" sequence three times (rounds) or until all the cards are picked up. In rounds two and three the fox and snake have special roles. They can capture (tag) and eat the mice and birds. They must look out for humans, though; humans can decide to kill (tag) them. Anyone caught and eaten or killed is out of the game.
7. Have students return to the classroom with their envelopes. In the classroom have them count up how many cards of each color they collected.
8. To survive,

   A cow needs at least 6 water and 6 plant cards.

   A rancher needs at least 1.5 (1 big card and 1 little card) water and 1.5 plant cards.

   A mouse needs at least .75 water and .75 plant cards and 1 insect.

   A bird needs at least .75 water and .75 plant cards and 1 insect.

   A fox needs at least .75 water and .75 plant cards or must capture one animal.

   A snake needs at least .75 water and .75 plant cards or must capture one animal.

Questions for Discussion:

- Who survived? Who did not?
- What were you lacking? How does that happen in real life?
- Did you have extras of anything? Do animals use more of these things than they need sometimes to survive? How does this affect the other farm residents?
- What would happen if the rancher bought 10 more cows?
- What would happen if the farmer butchered and ate some cows?

Extensions:

- Try increasing the numbers of different animals and see how this affects the outcome.
- What would happen if some of the water cards were polluted?

Idea from Project WILD