



Energy Pyramids

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Activity Name: Energy Pyramids

Ages: 9-13 (also works for older students as well)

Activity Level: Low (low level gymnastic activity)

Length of time: 20 to 30 min

Number of Participants: 10-12

Concept: This activity is designed to bring one of the simplest, yet most frequently ignored facts of life - everything is connected to everything else. Pyramid models are one of the best ways to demonstrate the flow of the sun's energy through complex food webs or whole ecosystems.

Materials Required: Index cards with plant/animal names with string to hang around neck; food pyramid diagram

Introduction: Groupings can allow 2 three tiered pyramids or 2 four tiered pyramids. Any extra people can act as team organizers or spotters. Need to choose a site with soft ground or can be done on a hard surface with mats.

Methods: The group is divided up into two teams using the formula above. The leader shows the participants a diagram of a food pyramid depicting various trophic levels (energy transfer levels) between organisms. The diagram is explained generally as: green plants would be on the bottom as trophic level one because their energy level has been transferred once from the sun to the plants.. the herbivores (plant eaters) are trophic level two because their energy level has been twice - from sun to plants to herbivores. Carnivores are trophic level three because their energy has been transferred three times - from sun to plants to herbivore to carnivore. High level carnivores (those that eat other carnivores) are at trophic level four because their energy has been transferred four times. It should be emphasized that this is a very simple model and that some chains are very long.

The challenge is for each team to organize themselves into these levels while applying the 10 % rule to each level. It is obvious that this rule could not be applied specifically so the trick is to let each person at any one level know that they are representing a certain energy value related to the level below them. The chart below helps with that.

Each team is presented with a set of large index cards with animals or plants showing a particular energy flow illustrated on each. The object is for each team to build and label their energy pyramid first. Correct labeling counts as much as speed. For safety, suggest

that the biggest people be in trophic level one and smallest in trophic level three or four. Some examples could include:

| Trophic level | Organism | Organism |
|---------------|-------------------|----------------------|
| 1 | Plankton (1000) | Plants (10,000) |
| 2 | Blue Mussel (100) | Slug (1,000) |
| 3 | Sea Star (10) | Garter Snake (100) |
| 4 | | Red Tailed Hawk (10) |

The index cards are hung around the neck of one of the players at each level. Have the teams facing face to face so they can see each other's progress. The first team to have all their members in position and labelled correctly is the winner of that round. Have other sets of cards to do more pyramids if time permits. In a subsequent round the leader asks what would happen if one of the trophic levels were to be removed such as from pollution, over harvesting or even disease. The resulting changes in the structure would be points of discussion after the activity is complete.

Tips for Teachers:

- This activity is fun for the participants and to prevent injuries ensure that the participants know the correct positioning of their knees and hands on the people below them. The most stable placement is to have the knees resting on the small of the back of the person below with hands on or just above the shoulder blades. Make sure that when the pyramids collapse that each level rolls to the outside or each level steps down in order.

Background facts and information:

On average only 10% of the plant material consumed by animals results in new growth. When humans act as herbivores and eat leaves (lettuce, kale), or flowers (broccoli), or grains (corn, wheat), about one quarter of this food passes through the digestive system undigested (fiber), and most of the rest is "burned" in respiration to maintain normal body function (body temperature, muscle movement, etc.). At most, only 10% goes to growth (i.e. weight gain or tissue replacement). The same holds true for other organisms and 10 % is a good average estimate of the overall efficiency of energy transfer in feeding relationships among organisms - known as the 10% rule. In practice it means that a herbivore consuming 100 units of plant material would transform them to 10 units of new body mass and a carnivore consuming these 10 units of herbivore would transform

them into one unit of carnivore body mass. Hence the use of a classic pyramid shape to represent this relationship in nature.

Literature Cited:

Adapted from **Rediscovery by Thom Henley 1996.**

Developing Ecological Consciousness - Path to a Sustainable World by Christopher Uhl 2004