

Biology
Feed Relationships Activity

Name: _____

Date: _____ Hour: _____

This lab was created by Mr. Buckley from Edward Knox High School. Credit is given for this original activity to Mr. Buckley.

The mouse eats the red clover plant, and then an owl snatches the mouse. This series of events is called a food chain. A food chain can be described as a means of transferring energy from one organism to another. For most organisms, the only source of energy available to begin the chain is the sun. Therefore, the food chains we will study will start with the sun. Only autotrophs such as green plants and algae can convert sunlight into food. The mouse that consumes the grass seeds gets its energy from the sun through the plant. The owl in turn receives the sun's energy from eating the mouse. The food chain could be diagrammed as:

sun ----> red clover ----> mouse ----> owl

Each animal and plant can be thought of as a link in a chain. The sun is not usually included in the food chain diagram because it is assumed that we know the sun is in every food chain. An example of a three-link food chain is: grass - mouse - owl.

Notice that the arrow always points in the direction of the movement of energy.

There are millions of simple food chains that include a plant, a plant eater and a meat eater, that is, a producer, a herbivore (primary consumer) and a carnivore (secondary or higher level consumer). Here are a few more examples of a three link food chain:

water lilies ----> moose ----> wolf

grass ----> rabbit ----> fox

Four-linked food chains are also common. In a four-link food chain there are two omnivores and/or carnivores. The larger or better adapted animal kills and eats the previous organism in the link. Some examples of a four link food chain are:

leaf ----> caterpillar ----> shrew ----> badger

cattails ----> muskrat ----> weasels ----> Great Horned Owl

1. What is the ultimate source of energy for most organisms and how is this energy captured so it is useful in a food chain?

2. What is a food chain? _____

3. Give an example of a four step food chain not listed in the examples above and label its levels of consumers and the producer organism.

4. What always starts off a food chain? _____ What ends it? _____

5. What is a carnivore? _____

6. What is an herbivore? _____

Food Webs

Food chains only show one possible source of food for the animal. A better way of seeing what an animal eats is to construct a food web. A food web describes all the feeding relationships of one animal or plant to the other members of the community. Most plants and animals are members of many different food chains. The animal eats a variety of different foods, but it is being preyed on by a number of predators. A field will have many food chains. These might include:

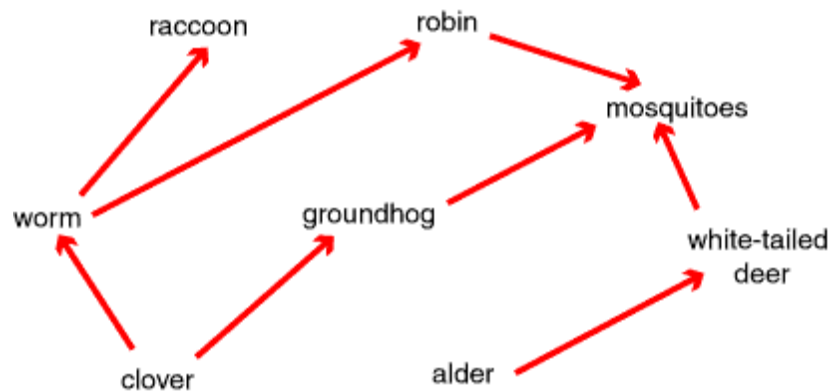
clover ---> worm ----> robin ---> mosquitoes

clover ---> worm ----> raccoon

clover ---> groundhog ---> mosquitoes

alder ----> white-tailed deer ---> mosquitoes

The food web diagram allows us to trace quickly these different food chains and to see how each chain is related to all the other food chains. The above four food chains can be drawn as a single food web. The resulting food web shows at a glance how the plants and animals are interrelated.

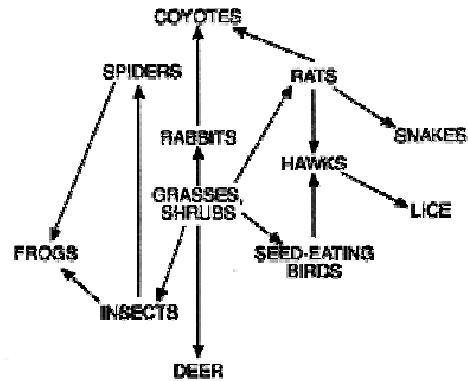


7. What is a food web? _____

8. Why is a food web a better description of feeding relationships in a community than a food chain?

9-12. Use the diagram of the food web at the right to complete the following:

With the sun in the center create a functional food web combining at least 4 separate food chains. Identify the trophic feeding levels of each organism in the chains you create. Place your answer in to this question at the end of this lab.



Feeding Pyramids

The food pyramid illustrates the loss of food energy along the food chain. Energy is required in order for an animal or plant to carry out its life processes. Since animals cannot capture and use the sun's energy directly, they must eat plants. The plants along with oxygen and water provide the animal with its energy needs.

If we examine the food pyramid, we see that each feeding level is smaller than the feeding level directly below it. There must be more plants (producers) than plant eaters (herbivores) and more plant eaters than meat eaters (carnivores). The amount of energy available to the next higher level is only a fraction of the energy of the previous level. On average the energy available to the next trophic level is only 10% of the energy which was in the previous feeding (trophic level). This is called the rule of 10's. In animals much of the 90% of the energy which is wasted in metabolism is released as heat and metabolic wastes. Only a small part of the sun's energy is ever used by the plants in the production of food. Of the energy containing material stored in the leaf, some are used by the plant for its life processes. Not all of the material eaten by the herbivore can be used. Some of the plant material cannot be digested and this material passes out of the animal's body as solid waste. This waste material becomes the first link in a decomposer food chain.

Biomass is the weight of all living things within an environment or habitat. In a large meadow, for example, you might have one fox with a biomass of five kilograms, 60 rabbits with a combined mass of 120 kilograms, 4000 mice and voles with a combined mass of 50 kilograms and plants, trees and shrubs with a mass of 8000 kilograms. Even this large number of rabbits, mice and voles might be insufficient to support a fox. The red fox, very likely, considers the meadow to be only part of its habitat. The fox visits many other areas, such as ponds and woodlots each night while it is hunting.

Notice that there are far more mice, voles and rabbits than foxes, both in number and combined biomass. Also there are far more plants than herbivores. This is because at each level-producer, herbivore and carnivore - most of the energy is consumed in the life processes. Very little energy - only that stored in

the bodies of the animals or plants - is available to the next level consumer. This means that the number of consumers and their total biomass must be far smaller than the level below. One useful way of showing this is with a food pyramid.

13. What is the rule of 10's?

14. Why are there more herbivores than carnivores?

15. Why are there no more than four or five links in a food chain?

17. Rewrite this feeding pyramid as a food chain.

18. What is biomass? _____

19. What is the feeding (trophic) level of this pyramid containing the most biomass?

20. Why does the tertiary consumer feeding level containing the grizzly bears contain less total energy and biomass than the chipmunk feeding level (secondary consumers)?

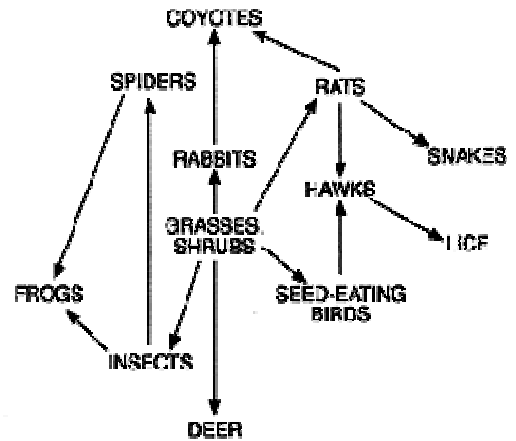
21. Which feeding level represents the primary consumers?

22. Which feeding level represents the producer organisms in this feeding pyramid?



23. Imagine a massive population crash occurs in the rabbits in this food web. List two populations which would be influenced by this in the food web AND completely explain why the crash in the rabbit population would have this effect.

24. Select one other species besides rabbits in this food web AND explain how the removal of this species would influence another species population in this food web.



Use this space to complete 9-12: