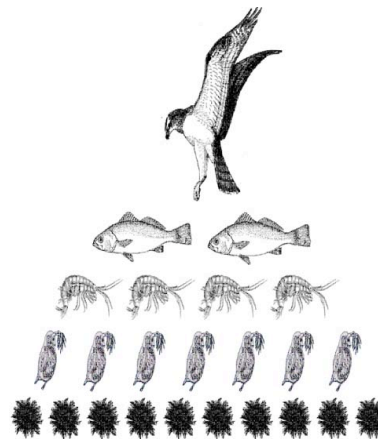
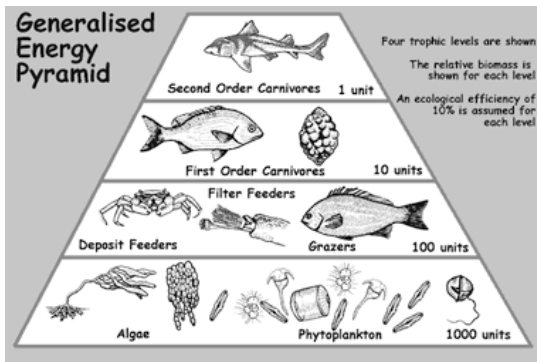
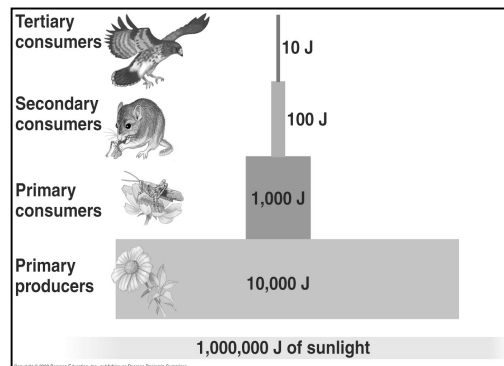
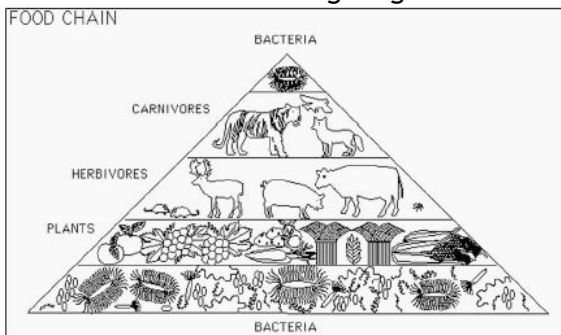


APES Food for thought... Trophic levels

Plants make food during photosynthesis; they are called primary producers or autotrophs. Animals eat the food. They are known as consumers or heterotrophs.

1. What does the suffix “troph” mean?
2. What do you think a trophic level is?
3. How about food chains, food webs? Compare and contrast those terms you learned in biology.
4. Quickly sketch a food chain using organisms that might be found on our school grounds.
 - a. What do you have to do to turn it into a food web? Do so.
5. Look at the following diagrams called Energy Pyramids.



- a. What do they all have in common?
- b. How are they different from one another?
6. Why are there are more organisms at the base and less organisms as you travel up the pyramid?
 - a. Any idea what an energy pyramid shows?
7. Two of the pyramids have numbers. Do you see a pattern in the numbers?
 - a. What might the numbers mean?

Read the following description from Earth Force
<http://www.earthforce.org/content/article/detail/1284>

Energy pyramids, otherwise known as *trophic level diagrams*, are used to represent the flow of energy through an ecosystem. An organism's *trophic level* indicates the organism's position in the sequence of energy transfers.

There are two apparent trends represented in an energy pyramid. First, there are enormous numbers and masses of individual animals or plants at the bottom and the numbers decrease as you reach the top. Secondly, the sizes and energy needs of the individual organisms generally increase as you reach higher levels.

The bottom, or base, of an energy pyramid is a position always held by the producers and represents (by far) the largest percentage of biomass for the food web. The need for such a large biomass of producers is to support the energy needs for all the organisms at higher trophic levels.

In the illustration above, the osprey is positioned at the highest trophic level. Therefore, for the energy transformations represented by the pyramid, the osprey is the organism with the greatest energy needs and relies on all of the transactions from producers to consumers to have enough energy left over to fill its own energy needs.

It should be acknowledged that ecosystems are very complex and any food chain, food web or energy pyramid simply illustrates the general idea. It would be practically impossible to illustrate all the possible ways that animals interact and all the possible ways that energy moves throughout an ecosystem.

Next, now that you've thought about food chains, energy pyramids and so on, let's do some **problem solving**. As you do these, think about the benefits and drawbacks of eating at lower trophic levels. First, for some background, read about soybeans from the...



<http://www.iasoybeans.com/index.html>

Small Bean, Big Dreams

"Small bean, big dreams" is a fitting motto for the versatile soybean plant. Known as the "Cadillac" of protein sources, soybeans nourish the people and animals of the world. Soybeans also help us reduce reliance on petroleum through hundreds of renewable product innovations that enhance our everyday lives. All this from a bean so small that it takes around 150,000 soybeans to fill one bushel. Good things do come in small packages!

Soybeans have a rich history from their creation in China 5,000 years ago. In our country, they started from humble beginnings, serving as ballast for Chinese ships coming to America. Making their U.S. agricultural debut in 1829 for soy sauce, inventors like George Washington Carver and Henry Ford embraced soybeans for plastics, printing inks and a range of industrial uses.

Dreams Become Reality Between 1945 and 1985 the annual soybean harvest increased eleven-fold. Today, America grows around three billion bushels of soybeans and accounts for more than one-third of the world's soybean crop. It represents a \$16 billion crop that strengthens our country's balance of trade while providing a domino effect of job growth and prosperity.

The dreams of our early architects of innovation are reality today. For example, soybeans can be grown in space. Their compact nutrition and flavor variety is key to our astronauts. This small bean continues to dream and achieve - enabling soy to change our world.

At 55 grams of protein per day, one acre of soybeans can meet a person's dietary protein needs for 8,400 days

Okay now for the problem... Its 2017. You're the owner of a soybean farm. You also raise guinea hens for food and insect control. The hens will eat grasshoppers and other insect pests, including ticks. This is good. Biological control of your pests will save you money on chemical pesticides. The hens also act as watchdogs squawking a lot when intruders approach. You allow the hens to free range during the day in your fields and but at night, you provide roosts for them to keep them safe.



Use the following for your calculations. Show all work with units!

- You can live on 1 hen/day for a year
- 1 hen eats 25 **gh**/day (25 **gh**/day)
- 1000 **gh** have a mass of 1 kg
- 1 **gh** requires about 30g soy/yr
- 1 human requires about 600 **gh**/day
- Dry soybeans have provide about 3.3 cal/g

1. Calculate the number of **gh** a hen needs to eat per year.
2. How many **gh** are needed for a year's supply of hens for you, the farmer?
3. What is the total mass in kg, of the **gh** needed to feed all the hens for one year?
4. How many kg of soybeans are needed to feed all the **gh** for one year?
5. Sources tell us that Native American Indians ate **gh**. So you can too! These early Americans could collect about 90 kg of **gh** per hour, when they were abundant. How many people could the **gh** feed, compared to the one person that the hen fed? (Perhaps you could dip the **gh** in chocolate.)

6. You need to consume 3000 calories/day. If you ate only soybeans how many grams of soybeans would you have to eat per day for calories alone?

7. Cows produce about 19 kg protein/acre/year and soy produces 200 kg of protein/acre/year.
 - a. Which is more efficient to eat? Why?
 - b. Have you ever eaten a soy burger (veggie burger)? Why or why not?

8. In theory, the earth could support many more people if we ate at a lower trophic level.
 - a. List 2 benefits of doing this.

 - b. List 2 drawbacks of eating lower on the food chain.

 - c. What are some benefits of being a vegetarian?

 - d. What are some drawbacks?

9. And then there are fish to eat! Large predatory fish usually are found at the 3rd or 4th trophic level of an energy pyramid. What does this mean in terms of energy loss?

10. Large predatory animals can also be problematic to eat because of bioaccumulation and biomagnification of toxins such as lead or mercury in their habitats. What do those two big words mean and why should this be considered when discussing food chains and trophic levels?

11. Do you think about the food you eat? Why or why not?