Name _____

Eating at a Lower Trophic Level

BACKGROUND INFORMATION

A **tropic level** is made up of all the organisms whose energy source is the same number of steps from the Sun. Therefore, a producer is considered to be part of the first trophic level, a primary consumer is in the second trophic level, and so on.

THE PROBLEM

A soybean farmer decides to raise hens. The benefit the farmer receives is two-fold: Not only are the hens a source of food for the farmer, but they also eat insect pests such as grasshoppers that can destroy the soybean crop. During the day, the farmer allows the hens to roam freely; at night, the farmer stows the hens safely away in roosts.

ASSUMPTIONS

- The farmer lives on 1 hen per day
- 1 hen eats 25 grasshoppers per day
- 1,000 grasshoppers have a mass of 1 kg
- 1 grasshopper requires 30 g of soybeans per year
- 1 human requires 600 grasshoppers per day
- Dry soybeans have about 3.3 calories per gram

CALCULATIONS — NO WORK SHOWN, NO CREDIT (DESPITE CORRECT ANSWERS)

1. How many grasshoppers does a hen need to eat in a year in order to live?

2. How many grasshoppers are needed for a year's supply of hens for the farmer?

3. What is the total mass, in kilograms, of the grasshoppers needed to feed all the hens for one year?

4. How many kilograms of soybeans are needed to feed all the grasshoppers for one year?

5. A person can collect 90 kg (200 lbs.) of grasshoppers per hour, when they are abundant. Suppose the farmer chose to eat grasshoppers instead of hens. How many people could the grasshoppers feed, compared to the ONE person that a hen fed?

6. The farmer needs to consume 3,000 calories per day. If he ate only soybeans instead of hens or grasshoppers, how many people would his soybean crop feed (use your answer to #4 to determine how big the crop was)?

7. In summary, how many people can be supported by eating at each of the following trophic levels:

   Trophic level 1 = Producer (Soybeans) support _____ people

   Trophic level 2 = Primary Consumer (Grasshoppers) support _____ people

   Trophic level 3 = Secondary Consumer (Guinea Hens) support _____ people

8. Draw a biomass pyramid using the data you have developed up to this point. Do this by placing one farmer at the top of the pyramid, and then list the amount of food in each trophic level (hint: there should be four tropic levels total — including the farmer).

Based on the analysis you performed, it would seem as though one could make an argument for eating at lower trophic levels.

9. What would be two "pros" of eating at a lower trophic level?

10. What would be two "cons" of eating at a lower trophic level?

11. On average, cows produce 19 kilograms of protein/acre/year and soy produces 200kg of protein/acre/year. Relate this information to the fact that people in less-developed countries usually eat at lower trophic levels than those in developed countries.

12. Why do you think that omnivores (animals that can eat meat or plant materials) are typically more stable in their populations?

13. List five foods you have eaten in the past few days and identify the trophic level it comes from:

    a. _____ trophic level: _____

    b. _____ trophic level: _____

    c. _____ trophic level: _____

    d. _____ trophic level: _____

    e. _____ trophic level: _____