

CB 12 Trophic Scavenger Hunt

Where does food energy come from? What happens to energy as it is utilized by organisms? In a simple food chain, corn, a photosynthetic plant, would be called a producer because it receives its energy from the sun. A mouse would occupy a second level, as a primary consumer or herbivore. What could you call the level of a snake, which eats the mouse? Or an owl which feeds on the snake? The snake and owl are called secondary consumers or carnivores.

How much of the solar energy captured by a plant is actually available to a herbivore? If the herbivore is eaten by a snake, how much of the original energy is available for use by the snake? Food levels represent the amount of energy available for the ecosystem. These are usually referred to as trophic levels. You can estimate the total energy in a given trophic level by the number of organisms that occupy that level.

In this activity, you will participate in a scavenger hunt to find the producers and consumers in your ecosystem. You will observe how the producers and consumers interact, and then document everything you observe. What do you expect will happen to the energy available at each level in a food chain?

Materials

- watch with a second hand
- 10 m² sample area outside classroom; an area that is as natural as possible
- field guides to identify names of organisms
- colored construction paper and graph paper
- scissors and tape
- Casio fx2 Graphing Calculator
- Casio QV2800 Digital Camera

Procedure

1. Prepare in your *Log* a data table with the following format:

Number of Individuals Found in a School Sample Area

Trophic Level in Sample Area	Group Counts (number of individuals)	Class Averages (numbers of individuals)
Producer		
Herbivore		
Carnivore		
Scavenger		

2. Write a hypothesis that expresses what you expect to observe about this ecosystem on the basis of different organisms that you find.

3. Form teams of four. Two members are responsible for producers, one for herbivores, and one for carnivores.
4. Prepare for a fifteen-minute scavenger hunt. Your teacher will tell you which area to explore. Follow your teacher's instructions for safety precautions.
5. Describe in your *Log* what you believe you will find in your area.
6. Make sure your entire team understands the rules for the scavenger hunt:
 - All teams will make their observations in the same 10 m² area.
 - Teams have 15 minutes for observations and counting.
 - Each member of the team will try to count as many individual organisms from the assigned trophic level as possible within the sample area. Duplicate observations do not count.
 - Do not make assumptions about the trophic level of an organism. For example, if you find an insect on the leaf of a plant, you can't just assume that the insect is a herbivore. Use your teacher as a resource.
 - For the sake of simplicity, you can count each blade of grass or each tendril of ivy as a single organism. If there are repeated patterns of a plant, such as blades of grass, which cannot be counted in just 15 minutes, count only one section of the area and use it to estimate the count for the entire area.
7. Collect digital and written data as appropriate for your trophic level for 15 minutes. Identify the organisms and make a note of their locations within the area. Ask your teacher for the identity or level of any organisms you can't identify.
8. When you return to the classroom, one person in class will make a table like the one you used in your *Log* on the chalkboard. Record your group's data in this table. Use the calculator to find the class average for each trophic level.
9. Using different colors of construction paper, cut a rectangle representing the number of organisms in each level of your group (not class). Let each organism be represented by a paper area of 1 square mm or 1 square cm. (You could also use a square on a page of graph paper.) Label each trophic level.
10. Construct a trophic level pyramid. Tape together your rectangles with producers at the bottom, herbivores on top of producers, etc. Your diagram should resemble an isosceles triangle.
11. Share your pyramid with other groups and note any differences.

Interpretations

1. Roughly by what fraction does the number of organisms decrease as you move up from one trophic level to the next?
2. Which trophic levels are missing from your food pyramid?
3. List some other names for secondary and tertiary consumers.
4. How would you explain the ratio of producers to consumers that you found?

Applications

1. On which level of the food pyramid would you find a vulture?
2. On which level would you place humans?
3. Decomposers are an important group of organisms, and they have a trophic level all their own. Where on the food pyramid would you find them? Explain.

Casio FX2.0 Calculator Procedures for CB 12

Class Average for each Trophic Level

To calculate the class average for each trophic level, press the gray [MENU] button and choose RUN-MAT using the cursor to highlight and pressing [EXE] or simply by pressing [1]. It may be helpful to organize the class data into a table, listing each trophic level observed by the students across the chalkboard. Under each trophic level list the different amounts observed by each group for a particular trophic level. It is possible that some groups will not have amounts for some of the trophic levels, and it is also possible that some trophic levels will only be present for a single group's listings. Once all the amounts have been put on the board under the appropriate level have the students add the numbers in each list. It might be helpful to have a student write the totals under each list. Once the list has been totaled, then the total will need to be divided by the number of groups contributing to the list. This can be done in two separate steps, adding, then dividing, or it can be entered into the calculator in one step. To enter it in one step, parentheses will be needed. Press the left [(] parenthesis, then each amount in the list followed by the [+], except the last amount, and follow it with the right [)] parenthesis. Then press the divide button [\div] then enter the number of groups contributing to the list. Finally press [EXE] to obtain the average. Do this same procedure for each trophic level.

Percentage of Level

Each of the four trophic levels utilizes a certain percentage of the energy available for the ecosystem. To determine what percentage each trophic level utilizes, you will first need to find the total amount plants and animals you found in your area. Add together all the totals you found for each trophic level. To find the percentage level for a specific trophic level, divide the amount of individuals for that trophic level by the total amount of all trophic levels. For instance, suppose you found 2 scavengers, 12 carnivores, 21 herbivores, and 60 producers in your "scavenger hunt." The grand total of items found would be $1+2+7+85=95$. To determine the percentage of scavengers, from the RUN-MAT menu you would enter [1], [\div], [9], [5], [x], [1], [0], [0], to get approximately 1%. Below are the percentage levels for this example:

scavenger—1%
carnivore—2%
herbivore—7%
producer—89%

Percentage of Decrease

The FX2.0 can be used to find the percentage by which the number of organisms decrease as you move up from one level to the next. From the RUN-MAT menu, subtract the smaller amount in the higher level from the larger amount in the lower level. Then divide that result by the larger number. To write this amount as a percentage, simply multiply the division answer by 100. This number is the percent decrease that occurs from the lower level to the next higher level. For

example the percent decrease from producer to herbivore would be found by subtracting 89 and 7 and then dividing by 89. This can be done with the FX2.0 using parenthesis, [(], [8], [9], [-], [7], [)], [+], [8], [9], [x], [1], [0], [0], for an answer of approximately 92%. See screen below.

(89-7)/89*100
92.13483146

MAT

Making a Trophic Pyramid

The FX2.0 will not make a pyramid graph, but you can still use it to draw a histogram of the data. Using the percentages found above, scavenger 1%, carnivore 2%, herbivore 7%, and producer 89%, we will construct a histogram of the four levels. Since producer is the lowest level, we will use "1" to represent that level, "2" to represent herbivore, "3" to represent carnivore, and "4" to represent scavenger.

- ☞ From the STAT menu, enter 1, 2, 3, 4, into List 1. Enter 89, 7, 2, 1 into List 2 so that the percentages correspond to the levels. (Recall, if there are already entries in the lists, you can clear them by highlighting any entry and pressing [F4] followed by [EXE] or you can choose two lists that do not have any entries in them.) See below.

	List 1	List 2	List 3	List 4
1	1	89		
2	2	7		
3	3	2		
4	4	1		
5				1

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- ☞ Once you have entered all the data, press [F1] for GRPH, then [5] for Set.
- ☞ Choose StatGraph1 by pressing [F1] when StatGraph is highlighted.
- ☞ Cursor down to GraphType and press [F6] for more options, then [F1] for Hist.
- ☞ Cursor down to XList. Press [F1] for List and [1] for List 1, then [EXE].
- ☞ Cursor down to Frequency. Press [F2] for List and [2] for List 2, then [EXE].
- ☞ Press [EXE]. This will return you to the main STAT screen.
- ☞ Press [F1] for GRPH, then [1] for S-Gph1.
- ☞ Be sure that both Start and pitch are followed by "1." If they are not, cursor to the position and type in a [1] followed by [EXE].
- ☞ Press [EXE] to draw. See below.

