

# Building an Energy Pyramid

*Activity adapted from TN Gateway Institute-S2/ Jennifer Dye, Gallatin High School*

OVERVIEW: Students will gain an understanding of how energy flows through an ecosystem

GRADE LEVEL: 9 – 12

TIME: 1 to 2 class periods (55 minutes)

SETTING: Classroom

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OBJECTIVES: Students will construct an energy pyramid to show the flow of energy through the Cedar Glade ecosystem; Students will calculate how much energy is transferred from one trophic level to the next trophic level

LEARNING STANDARDS: CLE 3210.2.1; 3210.3.1; 3255.3.8; 3255.3.9; 3255.4.1; 3260.2.1

QUESTION: Can an energy pyramid be constructed to show the flow of energy through the cedar glade ecosystem? How much energy is transferred from one trophic level to the next trophic level?

|            |                                   |                    |
|------------|-----------------------------------|--------------------|
| MATERIALS: | Energy Pyramid template           | One 1000 mL beaker |
|            | Cedar Glade Species List          | 3 clear cups       |
|            | Energy Pyramid Student Data Sheet | One 1-mL pipette   |
|            | Calculator                        | Pen or pencil      |

BACKGROUND: An energy pyramid illustrates how energy flows through an ecosystem. By showing the trophic (feeding) levels of the ecosystem, students can easily visualize how energy is transferred from producers to consumers. Students should be aware that only about 10% of energy is transferred to the next (**Rule of 10s**). Students should be made aware that more energy is available at the lower end of the pyramid.

PROCEDURE:

## Student Instructions Part I:

1. (*On the left of the template*): Label each level of the energy pyramid with the appropriate term: *producer, primary consumer, secondary consumer, tertiary consumer*.
2. (*On the right of the template*): Label each level of the energy pyramid with the appropriate term: *trophic level 1, trophic level 2, trophic level 3, trophic level 4*
3. From the Cedar Glade Species List, select organisms to represent each level of the pyramid. Write the name of the organism in the appropriate level.

Student Instructions Part II:

4. Observe the experimental data in **Table 1**.
5. Write the names of the organisms that you selected in Part I in the appropriate place on the table.
6. Calculate the percent of energy that is transferred from the first trophic level to the second trophic level. Divide energy from trophic level one and multiply by 100. This amount is the percent of energy transferred. Remember to add a percent sign.
7. Calculate the percent of energy transferred from trophic level 2 to trophic level 3.
8. Calculate the percent of energy transferred from trophic level 3 to trophic level 4.

Demonstration Part III:

9. Pour 1000mL of tap water into the 1000 mL beaker. Add 1 or 2 drops of food coloring to the water and swirl. The water in this beaker represents the energy found in the first trophic level (producers).
10. Line up the 3 clear cups. Look at your calculations in **Table 1**: how much energy was transferred from trophic level one to level two? \_\_\_\_%. Pour that percentage from the 1000 mL. (EX: 10% of 1000 is 100 ML) into the first cup.
11. How much energy was transferred from the second trophic level to the third level? \_\_\_\_%. Pour that percentage from cup one into cup two.
12. Repeat for the fourth trophic level/cup three.

**TEACHER KEY**

| <b>Trophic Level</b> | <b>Organism</b>     | <b>Energy Kcal/m<sup>2</sup>/year</b> | <b>Percent Energy Transferred</b> |
|----------------------|---------------------|---------------------------------------|-----------------------------------|
| Trophic Level 1      | Producers           | 200                                   | -----                             |
| Trophic Level 2      | Primary Consumers   | 19.6                                  | 9.8%                              |
| Trophic Level 3      | Secondary Consumers | 2.0                                   | 10.2 %                            |
| Trophic Level 4      | Tertiary Consumers  | 0.19                                  | 9.5%                              |

Name \_\_\_\_\_ Period \_\_\_\_\_ Date \_\_\_\_\_

## Energy Pyramid Data Sheet

**Table 1: Available Energy in Trophic Levels of the Cedar Glade**

| Trophic Level   | Organism            | Energy Kcal/m <sup>2</sup> /year | Percent Energy Transferred |
|-----------------|---------------------|----------------------------------|----------------------------|
| Trophic Level 1 | Producers           | 200                              |                            |
| Trophic Level 2 | Primary Consumers   | 19.6                             |                            |
| Trophic Level 3 | Secondary Consumers | 2.0                              |                            |
| Trophic Level 4 | Tertiary Consumers  | 0.19                             |                            |

### Questions and Analysis:

1. The beaker + 1000 mL represents which part of a food chain \_\_\_\_\_, \_\_\_\_\_.
2. a) The 1<sup>st</sup> cup represented the \_\_\_\_ trophic level, or, the \_\_\_\_ consumer.  
 b) The 2<sup>nd</sup> cup represented the \_\_\_\_ trophic level, or, the \_\_\_\_ consumer.  
 c) The 3<sup>rd</sup> cup represented the \_\_\_\_ trophic level, or, the \_\_\_\_ consumer.
3. Could the ecosystem represented in **Table 1** support another level above level four?
4. On **Table 1**, does the calculated amount of energy transferred fit our Rule of 10%?  
 Explain:
5. The beaker and cups that you arranged in Part III represented a food chain.  
 a) The beaker + 1000 mL represented which level? \_\_\_\_\_  
 b) How much of the original energy was left in the 3<sup>rd</sup> cup (tertiary consumer)? \_\_\_\_\_%
6. Where on the food chain should humans eat in order to gain the most energy? (In other words, where is the “best deal” in terms of energy?)

# Energy Pyramid Template

