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**THIS PAGE IS FOR REFERENCE *(Activity begins on the next page)***

## Wetlands Food Web Story

On a bright spring day the sun shines on the forest floor and warms the water in the nearby swamp. The warm weather and the moist soil cause plants to sprout. In the forest, the **Oak Trees** unfold their new leaves, and within a matter of days the leaves begin to produce glucose from photosynthesis. **Mushrooms** pop up on a decaying oak tree branch on the forest floor, and **Beetles** feast on the mushrooms.

Soon the spring warmth triggers the hatching of **Woolybear Caterpillars,** which crawl onto the tender oak leaves and begin feeding. In the oak tree is the nest of the **Warbler**. The warbler's eggs have just hatched and the parent birds are kept busy collecting woolybear caterpillars for the baby birds. Underneath the Oak tree, **Spicebushes** spread their leaves to the sun. The spicebush provides a meal for the **Swallowtail Caterpillars** and a **Deer** which has come down to the marsh to eat. The deer brushes against a bush and a **Tick** drops onto the deer and begins sucking blood. The deer also attracts **Mosquitoes**, which bite the deer and make it shake its head. The mosquitoes fly off, and several get stuck in the web of a **Spider**.

A bright green **Beetle** walks along the water's edge and finds a swallowtail caterpillar which has fallen off of the spicebush. While the beetle enjoys its meal, it doesn't see the **Bullfrog** in the water at the edge of the marsh. A quick jump and the bullfrog swallows the beetle.

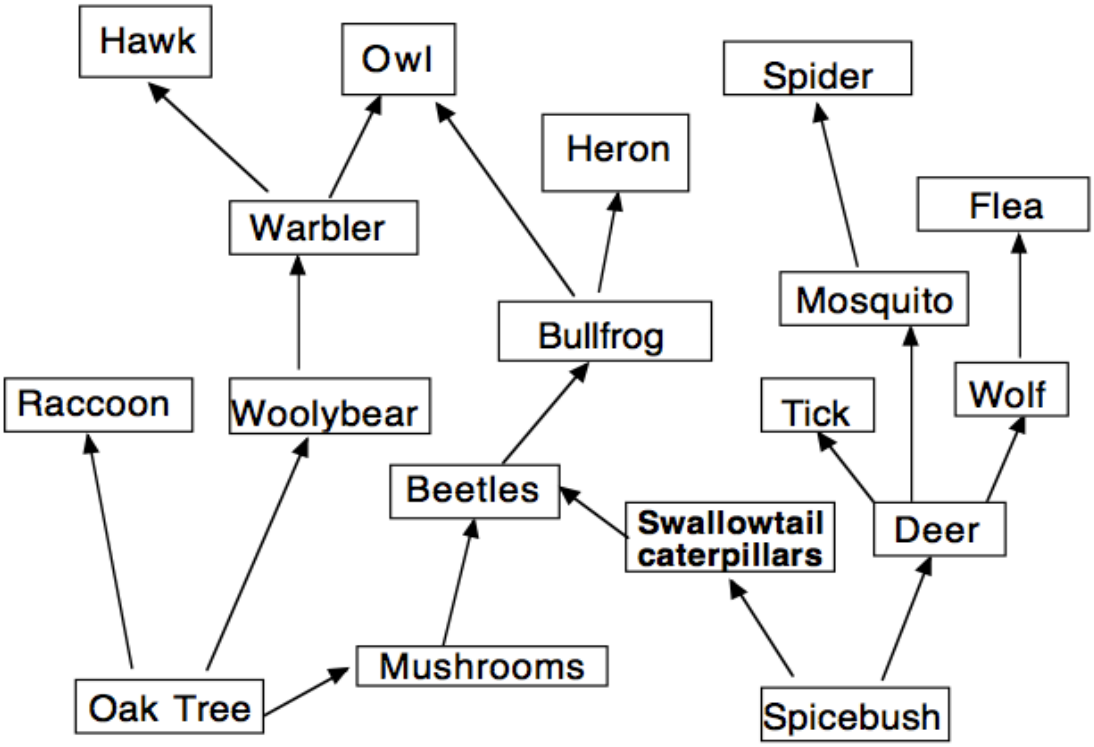
Back under the oak tree, a lazy **Raccoon** searches the ground for acorns that have fallen from the oak tree. Three **Wolves** enter the clearing in the forest where the deer is feeding and catch the deer. There are **Fleas** on the wolves; one of the wolves stops to scratch behind its ears. An **Owl** and a **Hawk** wait in the branches of the tree to catch a warbler for their meal. At the water's edge, a **Heron** stabs its beak into the water and catches a bullfrog. As the sun sets, the remaining bullfrogs begin a chorus of croaks, which stops suddenly as an owl swoops down out of the night sky and carries off a bullfrog in its talons.

**Food Webs & Energy Pyramids**

*Formative Content Assignment worth 10 points*

Below is a **food web diagram** of a wetland area of Northern California. Follow the instructions below. Use the **Wetland Story** handout for reference.

**Background info:** Plants produce energy from the Sun (producers). Herbivores are animals that eat only plants (primary consumers). Carnivores are animals that eat only other animals (consumers). Omnivores are animals that eat both plants and animals.




**Part 1: Food Web Analysis: WRITE SMALL! (10 points)**

1. Which organisms are producers?

2. Which organisms are primary consumers?

3. Which organisms are secondary (2nd level) consumers?

4. Which organisms are tertiary (3rd level) consumers?

5. Which organisms are top-level consumers?

6. Which organism is a decomposer?

7. What do the arrows represent in the diagram? Why are they pointing in that direction?

8. A disease wipes out the deer population. Predict what would happen to the spicebrush population and to the wolf population. Provide reasons for your prediction.

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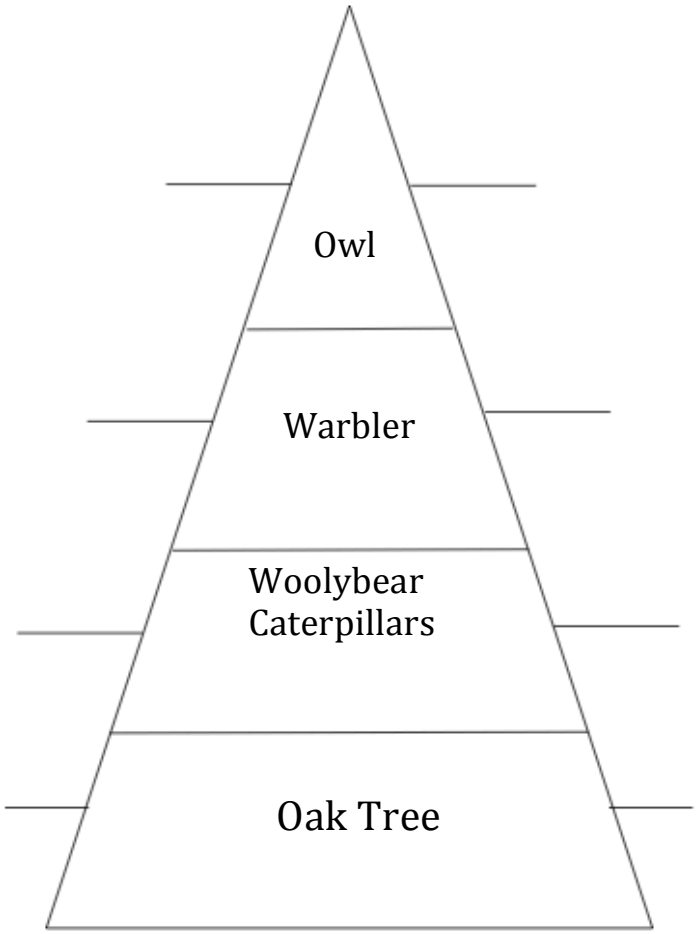
## Part 2: Energy Pyramids (10 points)

On the right is a food chain drawn as an energy pyramid. The Owl eats the Warbler, the Warbler eats the Woolybear Catepillar, etc.




1. (On the left of the pyramid): Label each level of the energy pyramid with the appropriate term: producer, primary consumer, secondary consumer, tertiary consumer.

2. (On the right of the pyramid): Label each level of the energy pyramid with the appropriate term: trophic level 1, trophic level 2, trophic level 3, trophic level 4. (Trophic level 1 corresponds with the producers.)

3. Observe the experimental data in Table 1 below.

4.. Write the names of the organisms from the energy pyramid into the appropriate place on Table 1.

5. Calculate the percent efficiency of the energy transformation from Trophic Level 1 to Trophic Level 2.
*How to do this:* Divided the Trophic Level 1 to Trophic Level 2. For example: $\frac{200}{19.6}$ = 10.2 %

6. Record your data in the data table.
7. Calculate the percent of energy transferred from trophic level 2 to trophic level 3. Record your data.
8. Calculate the percent of energy transferred from trophic level 3 to trophic level 4. Record you data.
9. Ask your teacher to check your work.

**Table 1. Available Energy in Trophic Levels of the Wetland Ecosystem**

| Trophic Level | Organism | Energy Kcal/$m^2$/year | Energy Efficiency |
|---|---|---|---|
| Trophic Level 1 | | 200 | ---------- |
| Trophic Level 2 | | 19.6 | |
| Trophic Level 3 | | 2.0 | |
| Trophic Level 4 | | 0.19 | |

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***PART 3: WATER STATION LAB***

1. Pour 1000mL of tap water into the 1000 mL beaker (use the tap water at the sink). The water in this beaker represents the *energy found in the Trophic Level 1 (producers).*

2. 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 beaker (Hint: 10% of 1000mL is 100 mL) into the first cup.

3. How much energy was transferred from the second trophic level to the third trophic level? _____%. Pour that percentage from cup one into cup two. (Hint: 10% of 100 mL is 10 mL)

4. How much energy was transferred from the third trophic to the fourth trophic level? _____%. Pour that percentage from cup two into cup three. (Hint: 10% of 10 mL is 1 mL)

## Analysis Questions: WRITE SMALL!

1. The beaker + 1000 mL of water represents which part of a food chain?

2. a) The 1st cup represented Trophic Level ____ or the _____consumer.

   b) The 2nd cup represented Trophic Level ____ or the _____consumer.

   c) The 3rd cup represented the Trophic Level _____, or the _____consumer.

3. What percent of the original energy (1000 mL) was left in the 3rd cup (1 mL)? (*Hint: 1/1000 x 100*) _____%

4. Could the wetland ecosystem represented in **Table 1** support another level above level 4? Why or why not?

5. Based on the last column in Table 1 (energy efficiency), about how much energy gets transferred from one trophic level to the next? Answer in a percentage.

6. If only 10% of energy is transferred, what happens to the other 90%?

7. 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?*)

8. Infer: Why does the energy efficiency lessen as you move up the food pyramid? In other words, why is more energy lost with larger consumers?

9. Infer: Why are the largest animals on Earth are also the fewest?

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