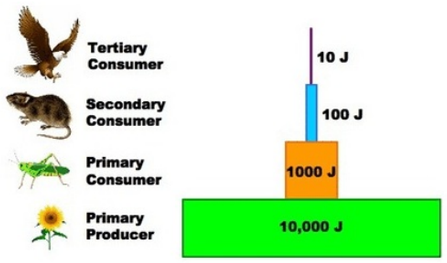
SCIENCE 1206 UNIT 4: SUSTAINABILITY OF ECOSYSTEMS
Worksheet #5: Energy Flow In An Ecosystem Part 2

The transfer of energy from one trophic level to the next is never 100% efficient since each organism must utilize some of the energy to support its own existence.

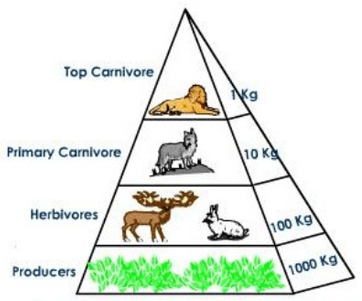
The primary producers use light energy to manufacture food which is utilized by all other trophic levels for all life activities such as growth, maintenance, and reproduction, and in many cases, locomotion. The ecosystems entire energy budget is determined by the photosynthetic activity of the primary producers.

Although the actual quantity of energy that is transferred from one trophic level to the next varies with the time of the season and from one ecosystem to another, biologists have generalized what is called the 10% rule. This generalization suggests that 90% of the energy taken in at any trophic level is lost during the life of the organisms to carry on its own life processes and is lost as heat. Only 10% of the energy is therefore able to be transferred from one trophic level to the next

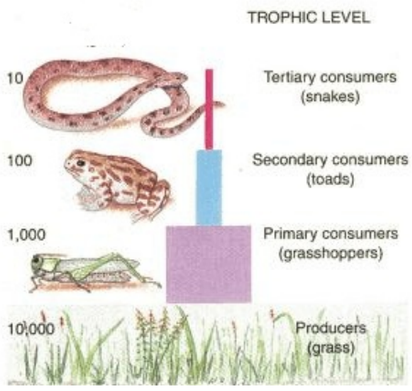
Pyramid of Energy: The idea that each higher trophic level has less energy available.



Pyramid of Biomass: The dry mass (after water has been removed) of the dry tissue in the plants or animals is measured



Pyramid of Numbers : used to show the number of organisms at each trophic level in an ecosystem.



Stability means that there is an ecological balance between the various organisms that make up the food web, and because of this balance the ecosystem is self-sustaining over long periods of time. To be stable there must be a balance between food production, food consumption, and decomposition of dead organisms and/or their wastes.

This means that a stable ecosystem must have a source of energy (usually sunlight for photosynthesis), producers to capture the sunlight and make food, and a means to recycle the materials. The greater the biodiversity in the ecosystem the more stable it will be

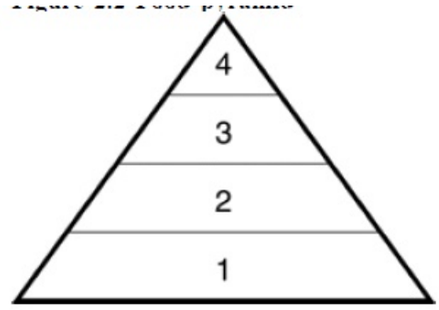
Biologists have also recognized that some species in the ecosystem function as a keystone species. A **keystone** species is one considered so important to the stability of the ecosystem, that if there was a decline in that species, the community would not be able to maintain its stability and may even collapse.

The snowshoe hare in Newfoundland.

PART A: MULTIPLE CHOICE

1. In the figure below, at which trophic level would tertiary consumers be found?

(A) 1
(B) 2
(C) 3
(D) 4

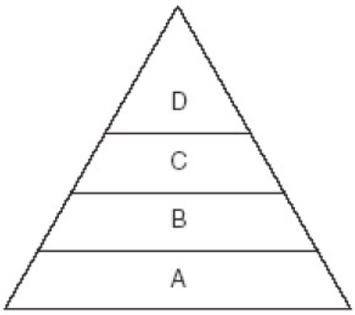


2. What does a pyramid of biomass represent?

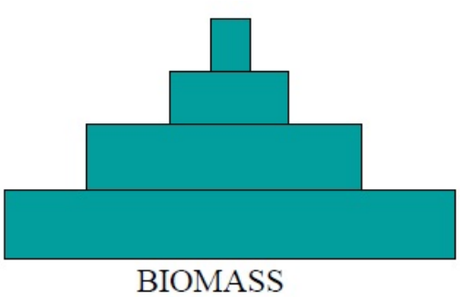
(A) the energy available at each trophic level
(B) the number of organisms at each trophic level
(C) the number of food chains at each trophic level
(D) the total mass of living things at each trophic level

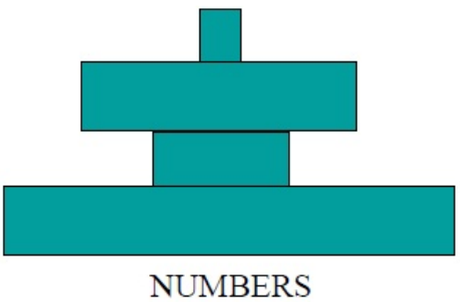
3. The diagram below represents a pyramid of biomass. Which organisms would most likely be found at level B?

(A) Eagle
(B) Robin
(C) Shrub
(D) Worm



4. Both diagrams below represent energy flow in the same ecosystem. Which food chain is most likely responsible for the shape of these diagrams?


BIOMASS


NUMBERS

(A) Algae → capelin →cod → seal
(B) Birch tree →caterpillar → robin →hawk
(C) Grass → cow → tick → sparrow
(D) Lichen → caribou →wolf → bacteria

5. In a pyramid of energy which would you find at the bottom level?

(A) First order consumer
(B) A herbivore
(C) Producers
(D) Decomposers

6. In a tide pool, 15 species of invertebrates were reduced to eight after one species was removed. The species removed was likely a(n)

(A) community facilitator.
(B) keystone species.
(C) herbivore.
(D) resource partitioner.

PART B: WRITTEN RESPONSE

1. What is a pyramid of energy? Explain/draw what a typical pyramid of energy looks like and describe why it has this shape.

Pyramid Directions

1. Shade the first (bottom) level of each pyramid green.
2. Shade the second level of each pyramid yellow.
3. Shade the third level of each pyramid blue.
4. Shade the fourth (top) level of each pyramid red.
5. Label each level of the first pyramid side with the following terms as you move up the pyramid: producer, primary consumer, secondary consumer, tertiary consumer.
6. Label each level of the second pyramid side with the following terms as you move up the pyramid: plants, herbivores, carnivores, top carnivores.
7. Label each level of the third pyramid side with the following terms as your move up the pyramid: autotroph, 1st order heterotroph, 2nd order heterotroph, 3rd order heterotroph.
8. Draw a picture of what might belong in each level:
   1st: flowers, trees, grass, algae
   2nd: caterpillars, cows, grasshoppers, beetles
   3rd: humans, birds, frogs
   4th: lions, dogs, snakes
   9. Fold your pyramid on the lines radiating from the center and tape it together.
   10. Answer the following questions using your pyramid:

   a. What are three terms used to describe organisms such as trees?

   b. What are two terms used to describe organisms such as cows?

   c. What are two terms used to describe organisms such as humans?

   d. What are two terms sued to describe organisms such as lions?

   e. What do the organisms in each trophic level eat?

   f. Do organisms always stay in the same level? Explain your answer.

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