Modeling Ecosystems Virtual Lab

Directions

1. Open the Virtual Lab titled "Model Ecosystems".
2. In this exercise, you will examine several model ecosystems and their characteristic plant and animal species. To begin, read the information in the "Field Guide" to learn more about the organization of five selected ecosystems. Read through all of the information in the "Question" (left side of page) and fill in the blanks on your answer sheet.
3. You are now ready to begin the activity. Start by selecting the ecosystem type that you would like to model from the pull down menu at the top of the screen. First read the field guide's information about that particular ecosystem.
4. Click and drag the various organisms to their correct locations within the different trophic levels of the pyramid. Once you have moved all of the organisms click the "Check" button and fix any incorrect choices if necessary.
5. List each of the organisms (by name) at each trophic level under the "Organisms:" area on Table 1.
6. Clicking on the "Pyramid of Numbers" will show the number of organisms at each trophic level within this type of ecosystem. Fill in this information from the pyramid on Table I below under the "Numbers:" area.
7. Clicking on the "Pyramid of Energy" will reveal how much energy is available at each trophic level. Fill in this information from the pyramid on Table 1 below under the "Energy:" area.
8. You must take one last step in the investigation of this ecosystem. It is important to determine the amount of energy that is transferred from one trophic level to the next. This is called the "Energy Conversion Efficiency" (E.C.E.), and this ratio is determined by taking the energy value from the trophic level you are calculating the E.C.E. for and dividing it by the energy value of the level below it. Please do these calculations as directed below and input the data in Table I below.
9. When you are completely finished analyzing the ecosystem, you can click the "Reset" button and select another type of ecosystem from the pull down menu. Follow the directions above to investigate this ecosystem and the three that remain.
10. Answer Lab Questions 1-7 below.

Table 1

To complete the Table below, students should complete the following 4 steps.

1. List the organisms present in each ecosystem (i.e. hawks, snakes, etc.) under "Organisms:"
2. List the total number of organisms present at each trophic level in each Ecosystem under "Number:"
3. List the total energy at each trophic level in each ecosystem under "Energy:"

Table 2

Calculate and list the Energy Conversion Efficiency.

The E.C.E. can be calculated by taking the energy value from the trophic level and dividing it by the energy value of the level below it.

$$\text{Example: E.C.E.} = \frac{\text{Energy of } 1^{st} \text{ Order Heterotrophs}}{\text{Energy of Producers}}$$

**Round all E.C.E. values to the 3rd (thousandths) decimal place*. ex. 0.104

Name: _____ Date: _____
Environmental Science Hour : _____

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Background Information: How does energy flow through an ecosystem?

Found on left hand side of webpage

An _____ consists of a community of living organisms _____ with each other and the _____. The source of energy that fuels most ecosystems is the _____. Plants use the Sun's energy to produce food in a process called _____.

Organisms that use energy from the Sun or energy stored in _____ compounds to produce their own nutrients are called autotrophs. They are also called _____ because most other organisms depend on autotrophs for _____ and _____. Heterotrophic organisms that can't make their own food may obtain nutrients by eating other _____. A heterotroph that feeds only on plants is called an _____. Herbivores are also called _____order heterotrophs. _____ that feed on other herbivores are _____ order heterotrophs. Carnivores that feed on other carnivores are _____ order heterotrophs. A _____is a simple model of how _____and _____ move through an _____.

Each level of production and consumption in a food chain is a _____ level. The autotrophs form the _____trophic level, the herbivores the _____ level, followed by second and third order heterotrophs.

In a pyramid of energy, the energy moves in only one direction and _____ at each succeeding trophic level. The total energy transfer from one trophic level to the next is only about _____ %. This is called the energy conversion transfer. The food consumers ingest is used to metabolize and build body tissues; some food is given off as _____. Energy lost at each trophic level enters the environment as heat.

A pyramid of _____ is the weight of living _____ at each trophic level. Biomass is calculated by finding the average weight of each species at that trophic level and multiplying the weight by the estimated _____ of organisms in each population. In _____ ecosystems, biomass decreases as the trophic level increases. In aquatic ecosystems, the biomass pyramid is inverted as phytoplankton and algae are more edible than land plants, have a shorter _____ span and are more rapidly _____.

Table 1

Ecosystem Type	Producers	1st Order Heterotrophs	2nd Order Heterotrophs	3rd Order Heterotrophs
Deciduous Forest	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____
Hot Desert	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____
Grassland	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____
Antarctic Ocean Shore	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____
Freshwater Lake	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____	Organisms: Energy: _____ Number: _____

Table 2 – Energy Conversion Efficiency

	1st Order Heterotroph		2nd Order Heterotroph		3rd Order Heterotroph	
Ecosystem Type	**Decimal**	**%**	**Decimal**	**%**	**Decimal**	**%**
Deciduous Forest	623/6011 = 0.104	10.4 %				
Hot Desert						
Grassland						
Antarctic Ocean Shore						
Freshwater Lake						

Analysis & Conclusion Questions:

1. Suggest reasons why the information represented in the pyramid of numbers of one of the ecosystems you studied may have not truly represented that ecosystem?

2. According to your data, what is the ratio of 3rd order consumers to producers? Explain your answer.

3. Compare and contrast two of the ecosystems you studied. How is the energy conversion efficiency similar or different? (Look at your percentages in Table 2.)

4. Does the population size increase or decrease at higher trophic levels in a pyramid of numbers for an ecosystem of a tree, insects (herbivores), and birds feeding on insects? Explain your answer.

5. What might happen to an ecological pyramid of numbers in a forest ecosystem if most of the deer were killed due to hunting by people and disease?

6. What could happen to an ecosystem if the decomposers disappeared?

7. Could there be a food chain without herbivores and carnivores? Explain.