

Lab: Modeling Ecosystems Virtual Lab

BIOLOGY: Interactions in Ecosystems

Directions

1. Open the Virtual Lab titled "Model Ecosystems".
http://www.mhhe.com/biosci/genbio/virtual_labs/BL_02/BL_02.html
2. Please make sure you have read through all of the information in the "Question" and "Field Guide" areas.
3. 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.
4. 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.
5. 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.
6. List each of the organisms (by name) at each trophic level under the "Organisms Present:" area on Table 1.
7. 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 1 below under the "Numbers:" area.
8. 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.
9. 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 1 below.
10. 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.
11. Answer Lab Questions 1-17 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 Present:"
2. List the total number of organisms present at each trophic level in each Ecosystem under "Numbers:"
3. List the total energy at each trophic level in each ecosystem under "Energy:"
4. Calculate and list the E.C.E. The E.C.E. can be calculated 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.

Example: First Order Heterotrophs / Producers = ECE for First Order Heterotrophs

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

Background Information:

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 _____.

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Table 1

Ecosystem Type	Producers	First Order Heterotrophs	Second Order Heterotrophs	Third 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 (ECE)

Ecosystem Type	First Order Heterotroph		Second Order Heterotroph		Third Order Heterotroph	
	Decimal	%	Decimal	%	Decimal	%
Deciduous Forest	623/6011 = 0.104 0.104 x 100 = 10.4	10.4				
Hot Desert						
Grassland						
Antarctic Ocean Shore						
Freshwater lake						

Lab Questions:

1. The ultimate source of energy for most ecosystems is:
 - a. Carbon
 - b. Oxygen
 - c. Sunlight
 - d. Water

2. Organisms that directly use energy from the sun to make their own food are called:
 - a. Autotrophs
 - b. Heterotrophs
 - c. Carnivores
 - d. Decomposers

3. Which of the following illustrates the correct ordering of trophic levels?
 - a. Decomposers→carnivores→autotrophs→herbivores
 - b. Herbivores→autotrophs→carnivores→decomposers
 - c. Autotrophs→herbivores→carnivores→decomposers
 - d. None of the above

4. Within an ecosystem:
 - a. Energy flows in one direction only and nutrients are recycled
 - b. Energy is recycled and nutrients flow in one direction only
 - c. Energy and nutrients flow in one direction only

- d. Energy and nutrients are both recycled
5. The efficiency of energy transfer from a lower trophic level to the next highest level is roughly:
 - a. 1%
 - b. 5%
 - c. 10%
 - d. 50%
 - e. 80%
 6. In aquatic ecosystems, biomass is least at which trophic level?
 - a. Autotrophs
 - b. Herbivores
 - c. Carnivores
 7. You are in an area where there are squid, seals and penguins. You are most likely in which ecosystem?
 - a. Deciduous forest
 - b. Hot Desert
 - c. Antarctic Ocean Shore
 - d. Grassland
 8. You find yourself in an area where there are snakes, hawks and coyotes. Based upon these animal populations, you are most likely in which ecosystem?
 - a. Deciduous forest
 - b. Hot Desert
 - c. Grassland
 - d. You cannot tell from this information
 9. You are in an area where the ground is littered with what appear to be dry, dead leaves. You are most likely in which ecosystem?
 - a. Deciduous forest
 - b. Hot Desert
 - c. Grassland
 - d. You cannot tell from this information
 10. This zone has the greatest concentration of plankton in a freshwater lake ecosystem:
 - a. Profundal
 - b. Littoral
 - c. Limnetic

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?

