



**Science Unit: *Ecosystem Models***

**Lesson 2: *Food Webs and Making Miniature Ecosystems***

School year: 2006/2007

Developed for: Nootka Elementary School, Vancouver School District

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Grade level: Presented to grades 6-7; Appropriate for grades 4-7 with appropriate modifications.

Duration of lesson: 1 hour and 15 minutes

Notes: This lesson can be **conducted independently or as the first part of a 3 lesson series** held over a minimum of 6 weeks (Ecosystem Models, Lessons 2, 3, and 4) where students develop and test a hypothesis involving changes to the environment using the model ecosystem they make during the lesson below.  
Complete reflections during the week following the lesson. Use the worksheet that accompanies this lesson plan.  
Make periodic detailed observation of terrariums before next lesson.

**Objectives**

1. Learn what is an ecosystem
2. Demonstrate and discuss a simple food web
3. Identify different trophic levels in a simple food web
4. Make a miniature ecosystem

**Background Information**

In this lesson students learn what is a food chain and a food web which form an integral part of any ecosystem and readily demonstrates how organisms are dependent on one another (a key definition of ecosystem). In the first part of the lesson we use a physical activity using multi colored yarn to demonstrate how a food chain and food web work. We then take that concept and apply it to a miniature ecosystem that the students make. The lesson is followed up on a later day by reflecting upon the activity and making periodic observations and measurements on their ecosystem using the measurement and observation skills developed in SRP\_Ecosystem Models\_Lesson 1\_Measurement of Biotic and Abiotic Objects\_2007 R. The miniature ecosystem that students make is used in later lessons as a model of an ecosystem on which to conduct experiments related to changes in the environment (see SRP\_Ecosystem Models\_Lessons 3, 4 and 5).

1. The **environment** is everything around us. Environments can be natural or human made e.g., a forest or a city. Environments can have different sizes depending on the scale you are focussing upon e.g., the environment inside a bottle or the environment around a river or the environment on planet Jupiter. Teachers should make students aware that when they hear or see the term “The environment” in the media, it usually refers to nature, but environments may be urban, human made and natural. Some examples of environments you can demonstrate to students are; the classroom, the school yard, their home/house, a stream, pond, beach or lake, a garden or forest, a town or farm, a lunchbox.
2. An **ecosystem** is the interaction of living things with their environment. The most important element of an ecosystem is that everything in it is reliant upon everything else, nothing can exist alone. An



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ecosystem is made up of biotic (living) and abiotic (non-living) things – see below. For example, the classroom is an ecosystem. It is made of desks, floor, lights, pencils and paper (all abiotic things). It also contains living (biotic) things such as students, a teacher and maybe a pet or ants etc. All of these things depend on one another – there can be no class without a teacher, the teacher cannot function if there are no students. The students and teacher need light and pencils and desks to function and so on. In a natural ecosystem plants and animals need air (O<sub>2</sub> and CO<sub>2</sub>), water, food, shelter, different temperatures, etc.

3. A **food chain** is a series of organisms that rely on one another for food, either to eat or be eaten or to produce food that can be eaten. In its simplest form a food chain involves a smaller organism being eaten by a bigger one which in turn is being eaten by an even bigger one. Food chains form an integral part of every ecosystem – it is an example of how every organism depends on other organisms (biotic factors) and non-living things (abiotic factors).
4. A **food web** is a series of interconnecting food chains, thus creating a web of interdependent organisms. Food webs make possible the transfer of energy from plants through herbivores to carnivores and omnivores, and ultimately to the detritivores and decomposers (see below for vocabulary definitions) that enrich the soil with organic waste. Just as a food web can transfer materials essential to the life of organisms, it is also a devastatingly efficient conduit for the transfer of poisons.
5. **Trophic** means nutrients or food, thus a **trophic level** is a level within a food chain.

For more detailed descriptions and further information visit the following websites...

<http://www.answers.com/topic/food-web>

[alaska.fws.gov/fire/role/unit1/background.cfm](http://alaska.fws.gov/fire/role/unit1/background.cfm)

[mmhs.guhsd.net/library/biomes.html](http://mmhs.guhsd.net/library/biomes.html) this site has many examples of food webs and web making activities from different types of environments and countries eg, desert, Antarctic, Africa, forest, etc.

### Vocabulary:

<u>Word</u>	Description
Organisms	living things
Nutrients	food/energy essential to keep living things alive
Producers	Producers are self-feeders because they are not dependent on other organisms as a source of energy. They produce nutrition from the sun through the process of photosynthesis which provides nutrition for itself and food for other parts of the food chain.
Herbivores	plant eater e.g., sheep, rabbits, mice
Carnivores	meat eater e.g., coyote, red fox
Top predators	top of food chain, little else eats these guys e.g., eagle, lynx
Decomposer	eats everything when dead; breaks it into nutrients e.g., maggots and vultures
Trophic level	different levels of food chain

### Materials for Yarn Demonstration

- 3 or 4 skeins of different coloured yarns
- Pictures of animals from an ecosystem e.g., Canadian boreal forest. Ensure you have only one or two pictures of top predators and increasing numbers of pictures of organisms from other trophic levels as you move down the food chain.



### Materials for Building Terrarium (class set)

- Multiple, clear 2 liter pop bottles with the tops cut off (keep tops) – if you plan to continue to use these terrariums for experiments in future lessons, ensure you end up with a total of 12 bottles.
- Duct tape
- Water plants from aquarium supply store
- 3 snails per terrarium
- Mud or soil from a local creek (it contains a lot of microscopic life which will be observable later)
- De-chlorinated water (let tap water sit in a bucket for 24 hours before adding it to the terrariums)

### Introduction

1. Review what an ecosystem is. What are the biotic and abiotic parts? How are they reliant on each other?
2. Discuss food webs. What are the various trophic levels?
3. Emphasize that everything in the ecosystem is interconnected and relies on each other. Functioning ecosystems are in balance.
4. Changes can occur to make ecosystems out of balance (changes to the abiotic or biotic factors e.g., loss of sun or plants). Spend a little time explaining this.
5. Discuss how the terrariums are mini ecosystems. Outline the elements of the terrarium ecosystem: water plant-producer; top predator-snail, decomposers in the soil.

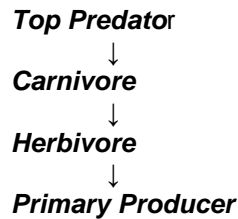
### Learning Activity - Food Web Game (balls of yarn):

- Have students form a circle
  - Hand out pictures of animal and plants in the food web you have already discussed e.g., Canadian boreal forest.
  - Each student will wear a picture of one member of the food web around their neck so it's clearly showing to the other students.
  - Make sure that the top predators are not all standing next to each other in the circle.
1. Hand out a ball of yarn/string to the first top predator, who needs to first hook the end of the string to the hook on his/her own animal
  2. Ask the student to then throw the yarn to the food item he/she would choose to eat
  3. The prey (person with that prey item) catching the ball of yarn then needs to hook the string on his/her animal and proceeds with throwing the yarn to his/her prey item of choice
  4. This step is repeated until it reaches the lowest trophic level
  5. At this point the teacher can hand a new ball of yarn to another top predator and repeat step 3-6... A top predator can start this more than once as each top predator may choose more than one prey item. It is also possible to use a different color of yarn to represent toxic algae and when one animal gets too many, then they have to step out of the food web and the consequences of their absence can be appreciated. Even more elaborate would be to have the lost animal to return as the food they eat, in order to demonstrate how they prey abundance increases in the absence of the predator... but only so long as their is enough food to eat. The absence of one animal may mean that higher predators starve and those lower preys are eventually overgrazed.
  6. At the end (once the teachers feels enough links have been made) the students should appreciate the web they created and how many connections they've made between the different items in the food web - this can be reinforced by encouraging one or two students to tug slightly on the string... and see what happens



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7. After the game is completed the students should take their animals and hang them on a board (either with pins on a cork board or with tape on a black board) in the appropriate categories that the teacher has already labeled:



### **Building a miniature/model ecosystem**

If everything is already set-up you can build these in a very short time.

Get students to identify which things are what parts of the ecosystem

Have an extension activity planned because some groups will finish this activity really fast.

- Students put in about 500 ml of soil in bottom of pop bottle
- Carefully place aquatic plant in soil
- Pour de-chlorinated water into bottle. It should come to where the bottle curves in (2 cm below the cut)
- Place 2 or 3 snails in the bottle. Try to make them stick to the side of the bottle.
- Put top back on the bottle and seal well with duct tape.
- Let sit for a few days to allow everything to settle

### Summary

Review how ecosystems work. Remind students that their terrarium is a miniature ecosystem, complete with food chains and trophic levels. Remind them not to disturb as everything is in balance.

## **APPENDIX A**

### **Extension activity**

Assembling food webs from different ecosystems (students work in pairs)

- Students will be given a blank page and a series of pictures of different organisms and are asked to assemble these into a food web and identify the different trophic levels
- The reflection/question sheet that goes with this activity will include getting them to make predictions about how the ecosystem will be affected if certain elements of the food web are changed (eg, you remove the top predator or you remove the decomposers). Can they think of any examples of how this may happen (eg, forestry, fishing industry, chemical spills, etc)
- Students will have the option of assembling a food web from one or more ecosystems depending on time available and speed of work eg, pond, forest, desert, arctic

## Ecosystems

*An ecosystem is made up of all of the biotic parts of the environment—all the living things in the environment. But living things need abiotic (non-living) things to survive*

A. Vocabulary- Define the following terms

Nutrients \_\_\_\_\_

Producers \_\_\_\_\_

Herbivores \_\_\_\_\_

Carnivores \_\_\_\_\_

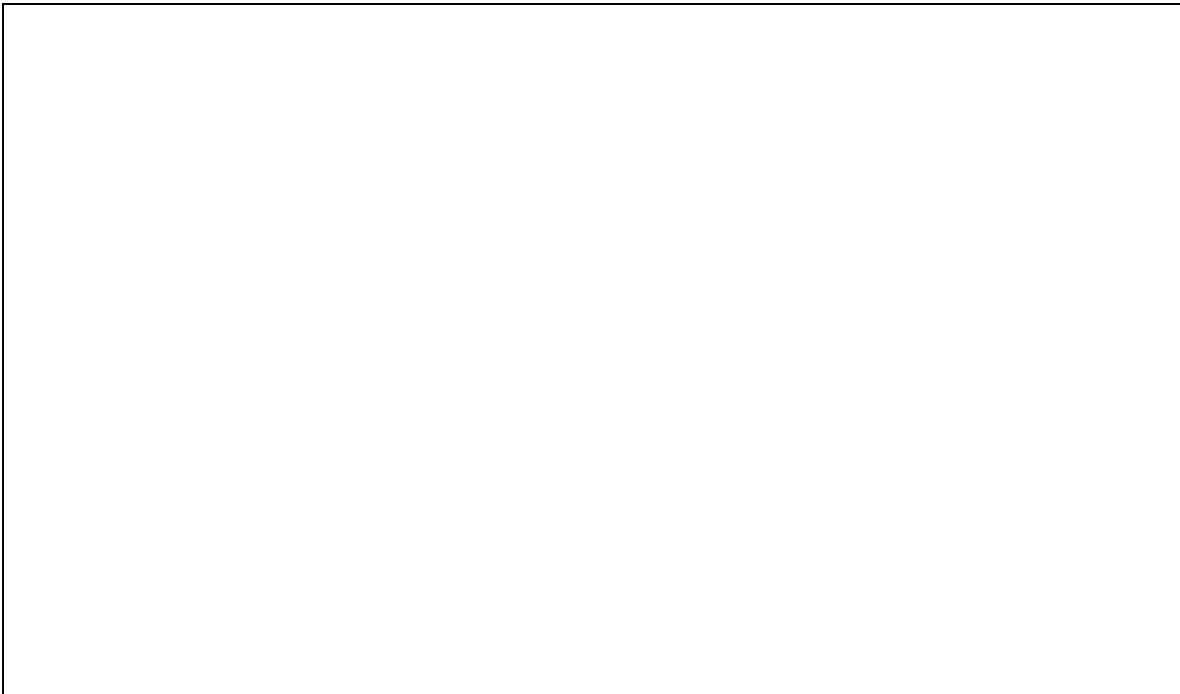
Top predator \_\_\_\_\_

Decomposers \_\_\_\_\_

Trophic Level \_\_\_\_\_

Organisms \_\_\_\_\_

B. Draw and label a diagram of the real life ecosystem that the 'yarn' represented. Mention the biotic parts and abiotic things that are needed for survival of organisms.





D. Your Terrarium

1. Describe how you made your terrarium. Give *accurate* instructions so that someone could make a terrarium that is exactly the same-*repeatable*.

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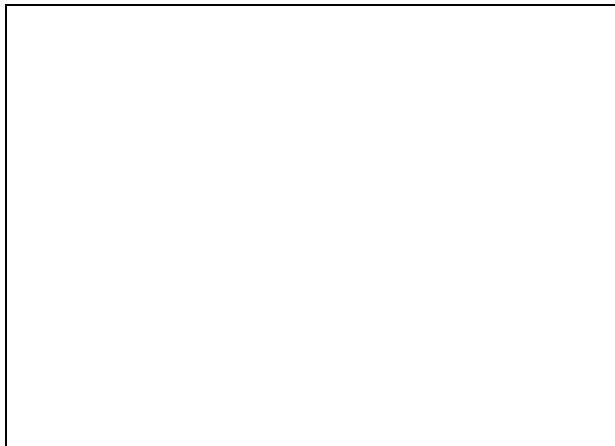
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2. Draw and label a diagram of your terrarium. Identify the biotic and the abiotic elements in your ecosystem.



3. What are different trophic levels in your ecosystem?

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