Science Unit: ***Ecosystem Models***

Lesson 3: ***Modeling Changes to Ecosystems Part 1***

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 20 minutes
Notes:	This lesson is the second part of a 3 lesson series and requires that students have access to terrariums such as those built in the lesson plan for Lesson 2, *Food Webs and Making Miniature Ecosystems* in the Ecosystem Models unit. A minimum of 6 weeks is required to complete this series of lessons. It is **essential** that terrariums used in this lesson be allowed to settle **for at least 3 weeks** from the time they were built. In this lesson students make detailed observations on their terrariums, set up hypotheses and begin an experiment. The following lesson examines the results of the experiment and students learn to communicate their results on scientific posters. Students need to make periodic detailed observation of terrariums using measurement skills (see Ecosystem Models, Lesson 1, *Measuring Biotic and Abiotic Objects*) before next lesson in this series.

Objectives

1. Learn what is a hypothesis
2. Make a hypothesis about changes to a miniature ecosystem
3. Make and record detailed, scientific observations
4. Understand the importance of keeping accurate records
5. Conduct an experiment to test the hypothesis
6. Record changes to an ecosystem over time

Background Information

It **essential** that terrariums used in this lesson be allowed to settle **for at least 3 weeks** from the time they were built. In this lesson students make detailed observations on their terrariums, set up hypotheses and begin an experiment to test them. In the week or two following the lesson students will record changes they see in their miniature, model ecosystem.

In this lesson students will by applying the scientific method, described below.

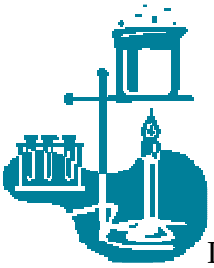
1. ***Model***. A model is a miniature example of an object or system that we make so it can be manipulated to predict what might happen in a true example of this object or system. For example, our terrariums are a model of a pond ecosystem.
2. The ***scientific method*** is the way scientists get from asking a question to finding an answer. First you need to ask a question, then…

Ask a question – be specific. What will happen to my miniature ecosystem if I add salt to it?

Make a guess and write is down – be specific and give many details e.g., the plants will grow more slowly, the water will be cloudy, the snails will die. This is your **Hypothesis**.

Take a look. Record all the details of what you see in the terrariums before you change anything. These are your **Observations**. How tall are the plants? How many snails are there? What colour is the soil?

Write it down. This is your **Data**. Take a picture; make a drawing, use words and numbers to describe what you see. If you don't write it down, how will you remember what you saw?



Do an **Experiment** to help answer your questions and see if your hypothesis was correct. Change something, add something, and remove something.

Write down the changes you see. This is more of your **Data**. Take a picture; make a drawing, use words and numbers to describe what you see. If you don't write it down, how will you remember what you saw?

Make it a picture. Compare your data from before and after you did the experiment. You can use pictures, words and **Graphs**.

Decide what it means. **Conclusions**.

For more explanations of the scientific methods for kids, visit the following websites…
http://www.biology4kids.com/files/studies_scimethod.html
http://www.nceas.ucsb.edu/nceas-web/kids/experiments/scimethod/scimethod.html
http://homeschooling.gomilpitas.com/explore/sci.htm
http://homeschooling.about.com/cs/sciexperiments/ht/cientificmethod.htm

Vocabulary

Word	Description
model	A miniature copy of a something that we can alter to predict what might happen if we altered the real object or system
microcosm	A miniature ecosystem contained in a small place
terrarium	A miniature ecosystem in a bottle
hypothesis	A guess or prediction
experiment	A test that helps you to answer a question or discover something unknown
control	Part of the experiment you do not change so you can compare the changes caused by your experiment
variable	Something that is able to be changed or altered. In our experiment a variable might be what we add to the terrariums e.g., this can be changed or altered to be salt, acid, temperature, etc. Hence our variable is what we add to the terrarium because it can be varied.
Turbidity	How clear or cloudy water looks. The water is turbid when it no longer looks clear.
pH	Is a measure of how acidic or alkaline a substance is
viable	Capable of living
Algae	Is not a plant but often looks green, algae is a microscopic organism that makes its own food from sunlight (ie, it is a producer) and is usually found in water.

Materials

Terrarium (about 12) that have settled for at least 3 weeks
1 tsp of Salt
1 tsp of vinegar
1 tsp of sugar
Aluminium Foil – enough to cover a terrarium
Bucket & ice – if you plan to change the temperature of some terrariums to cold

Introduction

1. Students start with an informal observation of the terrarium
    a. On their own 2 minutes
    b. With partners
    c. With whole group
    d. Write collective observations on the overhead.

2. Using the same format as 1 above: have students describe the food web in the terrarium - collect ideas and draw one on the overhead. Talk about how it is a microcosm of all ecosystems. In addition to the food web, mention the other aspects of the ecosystem such as shelter, dark hidey holes, variety of places (especially important for mobile animals), gases from mud and plants, light and temp.

Activity: Change a Variable –

1. Briefly discuss here that ecosystems are often subject to change such as weather, climate, pollution, development, etc. (Come back to this in detail after the field trip)
2. Discuss the idea of introducing a change-one change or **variable**. (If students have had some experience in experimental method, then consider introducing 2 variables e.g. a combination of light and temperature which would show them interactive effects – this fits with the Grade 7 IRP)
3. Students come up with some ideas for treatment. (e.g. light, temperature, salt, pH, pollution) Guide and elicit this discussion Possibilities:
    - Change the Light-cover the terrarium with tin foil,
    - Change the temperature-put it in a cooler place, possibly an ice bath,
    - Add a teaspoon of salt,
    - Add a teaspoon of vinegar
    - Add a teaspoon of sugar
4. Beforehand, write treatment possibilities on chart paper (or on an overhead), then after the discussion, produce them for different groups around the room (It will depend on how many terraria are viable).
5. Discuss the idea of a **control**: pick one or two terraria that are left alone; no variables are introduced. Before they do this we need to introduce the concept of a control. I.e., ask the students how they will know if the changes they see in the terraria are because they changed the light or temperature etc. There are two ways they can monitor this
    a. Keep written records of measurements and
    b. Have a control in their experiment (a similar terrarium that has not had light or temp changed).
6. Students make **hypotheses** as to what would happen when they introduce their variable. They can write this in their duo tangs, then share. Hypotheses should be detailed and specific e.g., what will happen to the plants (they will die, grow more slowly etc), snails, water, soil, decomposers, air, balance of the ecosystem (if not in balance, why?)

7. Display prompt questions to elicit detailed, specific hypotheses.
        i. What do you think will happen to the…

- Plants
- Water
- Worms
- Snails
- Decomposers
- Soil

ii. Be specific. For example…
- Will the plants live or die?
- Will the pant grow faster or slower than the control?
- Will the snails live or die?
- Will the snails grow faster or slower than in the control?
- Will there be more, less, or the same number of snails?
- Will there be more or less algae in the bottle?
- Will the animals be moving or not?
- If the animals are moving will they be slower or faster than in the control.

Discuss the need for detailed, scientific observations. Give them a record keeping sheet.
See the accompanying worksheet SRP_Ecosystem models_Lesson 3_Modeling changes to ecosystems record sheet_2007 R

8. Look at water: temperature, turbidity, and pH; Is there algae? In what area?
   plants: number of stems, colour of leave, percent of brown leaves, Number of branches per stem, droopy or erect, number of plants attached to soil
   animals- snails: number of snails, are they moving, where in the terrarium are the snails;
   Worms: How many types of worms are there? Where are the worms? Number of each type of worm? (See attached document for a worksheet for students).-
9. Make change to terraria (add sugar, salt etc.) One variable only per terraria. Remember to leave one or two terraria intact as controls.
10. Schedule monitoring routine e.g., every Monday and Thursday. Perhaps different groups are responsible for different measurements or if we do many different treatments e.g., light, temp, salt, each group records all measurements for their own experiment

Summary

Review and reinforce the concepts introduced: Scientific Method: Change a variable; make a hypothesis; do detailed explicit observations. Emphasize the importance of written, drawn or graphed data collection. Also discuss the function of a control. Emphasize that this is the Scientific Method, practiced by scientists around the world. As well, review the concept and scientific use of models: the terrarium as a model of a pond ecosystem.

Extension Activity

Observation Activity:
- Bring in a bunch of plants or branches or leaves and have students observe the differences between them E.g. Length, thickness, texture, colour, number of forks in the branch, etc.
- Tally results on overhead (or blackboard) find the correct answers and discuss why some of the answers differed.

Recording sheet – Observations

Water			
Date Time	Water: temperature	Turbidity: clarity, colour	pH

Plants							
Date Time	Number of stems	Colour of leaves	Percent of brown leaves	Number of branches per stem	Droopy or erect	Number plants attached to soil	Is there algae? If yes what is the area?

Animals							
Snails				Worms			
Date Time	Number of snails	Are the snails moving?	Where are the snails? (on plants, bottle, or soil)	How many types of worms? (Colour/ size)	Where are the worms?	Are the worms moving?	Number of each type of worm?