Science Unit: ***Ecosystem Models***

Lesson 4: ***Modeling Changes to Ecosystems Part 2***

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 plan forms part 2 of a series of 3 lessons that can be completed over a minimum of 6 weeks. The preceding lesson plans are Ecosystem Models, Lesson 2, *Food Webs and Making Miniature Ecosystems* and Ecosystem Models, Lesson 3, *Modeling Changes to Ecosystems Part 1*. Extra time is required outside of this lesson to complete the posters. We held a miniature scientific conference once the posters were complete. We found that students work at very different rates through this lesson, but most do not come close to finishing the poster during the lesson time.

Objectives

1. Importance of good record keeping and realistic drawings in science
2. Practice making detailed observations and comparisons
3. Observe the connections and consequences within an ecosystem
4. Develop an understanding of the value of experiments
5. Practice communicating scientific results through posters

Background Information

1. **Posters**. Scientists use many different forms to communicate results of their work and its importance e.g., written scientific articles, newspaper articles, seminars to scientists, the public and to governments or industry, short talks at conferences and finally brochures and posters. Posters are usually displayed at scientific conferences as well as throughout industries and government offices. Posters allow interested people to quickly see the outcome and advice derived from scientific research, and if the reader is interested, to read further details as to how those conclusions were made. A scientist will often present a poster at a conference. Typically at a scientific conference, the posters outlining different research projects are displayed around a large room and one person from the research group stands next to the poster of their research. Other scientists circulate around the room reading the posters, talking to the researchers about their findings and project and asking questions (e.g., what did they find? Why did they make their conclusion? If they were going to repeat the experiment how would they do it differently to make it better? How does their research affect the way we do things now? And so on). If you have time, we suggest holding a miniature scientific conference with your students once the posters are completed – the students loved this!

2. One of the most important points of this class is that students **compare their original hypothesis WITHOUT CHANGING IT to their current results**. You will need to emphasize to the students that it does not matter if the results are different from their hypothesis – this is how scientists discover new things and it is usually more interesting and we learn more when our results are different from the hypothesis. Be very aware of this because students will try to change their original hypothesis (nobody likes to be wrong). Also ensure that students record the results they need to see if there hypotheses are correct e.g., if they made a hypothesis about how many snails survived in their terrarium, they need to count the number of snails. If they made a hypothesis about whether the water would stay clear or cloudy, they need to record whether the water was clear or cloudy. A big part of observing the changes is to write it down.

3. **Decide** before beginning the class what the students should focus on. There are many different comparisons they can make, but in the end we want them to focus on a few important ones that can be transferred to the poster.

4. ***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.

Vocabulary

Word	Description
model	A miniature copy of something that we can alter to predict what might happen if we altered the real object or system
conference	A meeting where people share information
experiment	A test that helps you to answer a question or discover something unknown
hypothesis	A guess or prediction
introduction	On a poster this is where you describe what another person needs to know if they want to understand your experiment e.g., what is an ecosystem, what is a terrarium, etc
method	In science this is a description of what you did in your experiment
results	What you found or discovered
discussion	On a poster this is where you explain your results – why did you see what saw?

Materials

- Poster size coloured card – one piece per group
- Coloured marker and writing pens
- Glue or sticky tape
- A4 sized blank paper – 6 pieces per group
- Write one of the following on the top of each piece of paper: aim and introduction (1 piece), hypotheses and method (1piece), results (2 pieces), discussion (2 pieces).
- If available, an example of a scientific poster from a conference (contact your local university or government research agency – they always have several on hand you could borrow)
- See below for an outline of the structure of a scientific poster – all scientific posters (and talks and articles) follow a very similar structure so that people always know where to look to find the information they need.
- Thinking caps!

Poster Outline

- Use the table below to organize your thinking

QUESTION or AIM What question are you asking? INTRO -what is an ecosystem -what is a terrarium - what is the food web in the terrarium - what are the biotic and abiotic factors in the terrarium HYPOTHESIS This can be one or more	METHOD - what was your model? - What was your control? - What did you change to test your hypothesis? RESULTS What happened to… - water - plants - herbivores - decomposers - mud - food web pictures graphs word descriptions	DISCUSSION Did your results match your hypothesis? Why did these changes occur to the plants, water, animals, etc? What do you think would happen if salt/acid/sugar/etc was added to a lake? What experiment could we do to test your hypothesis about the lake? Or to see if your explanation about why you saw the changes you did is correct?

Activity

Students will make scientific posters to communicate their results to other scientists, government and people in the community.

Summary of steps in the lesson (more details below)

1) Show students an example of a real scientific posters (10 min)
2) Explain that we will examine the results from our terrariums today and begin making a scientific poster about the results (they can finish the poster as homework or part of an art class perhaps) (5 min)
3) Review original hypotheses (5 – 10 min) ensure this is done BEFORE students make observations or see their terrariums
4) Make observations: compare treatment and control terrariums, compare the terrarium before and after change using previous notes and records (25 - 30 min).
5) Go over why we used a control in our experiment
6) Did the results match the hypotheses? If not, explain that using experiments to test hypotheses helps us to learn more about how things work and how they are inter-related (10 min)
7) Students to discuss and write down why their change cause the results they saw – mental analysis showing understanding of connections within an ecosystem, and the needs of living things (20 min)

Details of steps in the lesson

1) All students must read the hypothesis they wrote after the last lesson. Because each group will have multiple hypotheses from making these independently, have students choose the most common hypothesis in the group and copy it EXACTLY onto the piece of paper titled HYPOTHESIS (it does not matter if the terrarium did not change the way their hypothesis suggested).

2) Observations:

Each group should have access to a control terrarium as well as their treatment or experimental terrarium. Have each group compare and discuss with one another the differences between their terrarium and the control. Allow 5 min per group to do this. Have the students write down the differences between them (be specific: water, plants, animals, soil, etc), draw a scientific (not artistic) picture or take a photo they can compare this to the one they made before changing the terrarium in the last lesson.

Have them write down the differences they see (be specific ie, plants, water, etc). This should highlight the importance of keeping good, accurate, honest records. Each group should come up with a list of changes to their terrarium and write it on one of the RESULTS pages – they can include pictures here also.

3) At the end of this activity ask students why we had a control terrarium – why didn't they rely on their notes from last lesson? Reasons for this are two-fold 1). To see how the terrarium would have changed if there were NO changes, and 2). Maybe they can see that their pictures and record keeping from the first time were not very reliable.

4) Now, have students raise their hands if their terrarium changed in exactly the way their hypothesis said. Raise hands those who's changed partly the same way, then those that changed a completely different way. This is why we do experiments, because we don't always know exactly HOW something will change.

5) Have students discuss in their groups why the terrarium changed the way it did – give students prompts if needed e.g., how was the food web interrupted? What was the action of the acid? (Acid burns). Ask students to be specific. After 10 minutes of discussion each group should write a summary of reasons why on the piece of paper labeled DISCUSSION (use two pieces of paper if needed).

Extension Activities

You can then ask the students to think about their terrariums as models of a pond or lake. Have then write on their poster what they think would happen if they made the same change to a pond or lake? Ask them to design an experiment to test this.

Putting together the poster, practice making detailed scientific drawings; further analysis of results and changes (e.g., which variable caused the fastest, slowest, most dramatic changes, etc)

Miniature scientific conference: each group can present their results in a short talk with their poster to the other groups, or posters can be hung around the classroom with a member from each group remaining at their poster to answer questions, and the other students circulate around the room to view results and conclusions from all other groups. As a class you can then discuss things like… Which changes had the biggest impact? Which had the smallest impact? Which change is a realistic one that you might see happen in a pond or lake? Give examples.

If desired there are a bunch of other comparisons that can be made with the students results, such as compare the speed of changes in each terrarium e.g., did plants die instantaneously or slowly? Did algae grow rapidly or not at all? Did the number of snails increase or decrease? They could try graphing some of these results too.

The Terrarium-an Ecosystem-Poster Outline

- Use the table below to organize your thinking

AIM	RESULTS	DISCUSSION
INTRO -what is an ecosystem -what is a terrarium - what is the food web in the terrarium - what are the biotic and abiotic factors in the terrarium HYPOTHESIS	What happened to… - water - plants - herbivores - decomposers - mud - food web pictures graphs word descriptions	Did your results match your hypothesis? Why did these changes occur to the plants, water, animals, etc? What do you think would happen if salt/acid/sugar/etc was added to a lake? What experiment could we do to test your hypothesis?