

**Reading the River, Summer 2001**

**Ecology & Conservation – A Lesson for Grade 11  
International Baccalaureate Biology**

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# Land Development and Erosion Control

## Objectives

In this lesson, students will:

- 1.) observe and measure how surface runoff contributes to soil erosion
- 2.) construct data tables and graphs to illustrate the effects of erosion

## Program of Studies

### **Scientific Inquiry**

- ❑ Identify and refine questions that can be answered through scientific investigations combined with scientific information
- ❑ Design and conduct different kinds of scientific investigations to answer different kinds of questions.
- ❑ Communicate results of scientific investigations.

### **Conceptual Understandings**

- ❑ Investigate the structure of the Earth system (eg. Rock cycle, water cycle, weather, climate, and rivers)

### **Applications and Connections**

- ❑ Use science to evaluate the risks and benefits to society for common activities.

## Core Content

- ❑ SC-M-3.5.1 Demonstrate the ability to recognize and describe the general organization and characteristics of an ecosystem.
- ❑ SC-M-3.5.4 Recognize the fragility of ecosystems and the interrelationships and interdependence of organisms within ecosystems.
- ❑ SC-M-3.6.3 Demonstrate a basic understanding of the fact that humans exist in and dramatically influence the world's ecosystems.

## Materials

- |                           |                     |
|---------------------------|---------------------|
| 3 wood boxes (1 m x 1 m)  | Meter stick         |
| Shovel                    | Watering can        |
| Large stones              | 3 One-Liter beakers |
| 3 sections of roof gutter | Filter paper        |
| 6 gutter ends             |                     |

## **Activity Procedure**

### **Classroom**

- Discuss with students the impact of local urban environment on stream ecology as it relates to general stream ecology being studied in class. Discuss characteristics of both rural and urban streams. Compare and contrast these streams, citing reasons for any differences between them.
- Identify “erosion” as a leading cause of stream pollution and degradation. Explain how erosion affects streams based on these general stream characteristics: current, temperature, clarity, pH, adjoining land use, stream substrate, and bank conditions.

### **Fieldwork**

- Weigh the three empty wooden boxes. Record.
- Using the shovel, carefully remove a 1 meter square of sod from the ground and place in one of the three wooden boxes.
- Fill a second box with packed soil and the third with a thin layer of packed soil and large stones covering the soil.
- Weigh the three filled boxes. Record.
- Place the gutter ends on the three roof gutters.
- Place these boxes at a twenty degree angle over the roof gutters.
- Find the weight of 2 liters of water. Record.
- Using the watering can, sprinkle two liters of water over each box to simulate rainfall.
- Allow water to run into gutters.
- Once complete, pour contents of gutter through filter paper into three separate one-liter beakers.
- Weigh each beaker and record.
- Weigh each piece of filter paper and record.
- Complete data charts.

### **Classroom**

- Using collected data, construct a graph showing the erosion rates of each of the three boxes.
- Answer the following questions:
  - 1.) Which section lost the most amount of soil? Why?
  - 2.) Which section lost the least amount of soil? Why?

## **Definition/Explanation of Concept**

The water cycle on Earth is crucial to life. Water evaporates from oceans, rivers, lakes, and plants and enters the atmosphere as water vapor. As warm air rises, it begins to cool, as do the water droplets inside the air mass. Condensation occurs as water droplets begin to form. Millions of these droplets form clouds. Gravity then begins to pull these droplets back to earth in the form of precipitation. Once on the surface, runoff occurs. Water is returned over land to streams, rivers, and oceans, where the process starts again.

The worldwide economic and industrial boom of the past hundred years has produced a much higher quality of life for many people. With industrialization came urbanization, and man began to eliminate many ecosystems in favor of concrete cities. This greatly affected the stream ecosystem. Water runoff has begun to increase dramatically, because the water is no longer being held by trees and forests. Streams can become “raging rivers” that sweep precious minerals and life away from their natural habitats. Many species are unable to adapt to the many changes in the water system. Some of the stream characteristics, such as clarity, pH, temperature, width and depth, and bank conditions are forever changed by the amount and frequency of water-induced erosion.

Many streams and rivers are experienced choking sediment loads caused by water erosion. This is due mostly to development and poor land use over the past century. This lesson intends to show students how erosion works and how keeping a “natural” habitat can greatly reduce the sediment load in a given stream or river. The lesson’s simplicity makes it easily understood and applicable to almost any stream ecosystem.

## **Assessment**

Students will be assessed on the following criteria:

- 1.) Participation in classroom discussion of stream ecosystems and their ability to make compare/contrast arguments about stream ecosystems.
- 2.) Participation in fieldwork. (i.e. setup of the lab, performance during lab, and completion of data tables)
- 3.) Ability to draw conclusions based on acquired data.
- 4.) General attitude during all sections of the lesson.

## **Lesson Context**

This lab exercise will fit with the following lessons in the IB curricula:

- 1.) **Ecology of Species and Communities-** students will investigate community structure and factors involved in its maintenance and regulation.  
- Erosion lab exercise

- 2.) **Biodiversity and Conservation**- outline diversity measures in ecology and give reasons for the importance of biodiversity in a variety of ecosystems.
- 3.) **Human impact**- outline global examples of human impact on the environment and discuss measures that can be taken to contain or reduce the impact of those examples.
  - Write a letter to a state senator using an example of land development and persuade that person to see your point of view.

## **References**

Neely, Cathy L. (1998.) *Splashing in Kentucky! An Educator's Guide to Nonpoint Source Water Pollution*. Kentucky Waterways Alliance.

(May 2001) *Planning Together, Expanding Choices: A Guide to Smart Growth in the Tristate*. Smart Growth Coalition for Greater Cincinnati and Northern Kentucky.

## Data Chart and Observation Sheet

**General Observations:**

**Data Table:**

	<b>Empty Box (kg)</b>	<b>Filled Box (kg)</b>	<b>Water/Beaker (kg)</b>	<b>Filter paper/Soil (kg)</b>
<b>1</b>				
<b>2</b>				
<b>3</b>				
	<b>2 Liters of Water (kg)</b>			