

SNC1D/1P Sustainable Ecosystems/ Sustainable Ecosystems and Human Activity

Teacher Demo: Deforestation

Topics	Timing
human impact deforestation clear-cutting erosion	preparation: 20 min demonstration: 20 min

Specific Expectations

SNC1D

A1.8 analyse and interpret qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis, identifying possible sources of error, bias, or uncertainty

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions

B3.5 identify various factors related to human activity that have an impact on ecosystems (e.g., the introduction of invasive species; shoreline development; industrial emissions that result in acid rain), and explain how these factors affect the equilibrium and survival of ecosystems (e.g., invasive species push out native species and upset the equilibrium in an ecosystem; shoreline development affects the types of terrestrial and aquatic life that can live near lake shores or river banks; acid rain changes the pH of water, which affects the type of aquatic life that can survive in a lake)

SNC1P

A1.8 analyse and interpret qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis, identifying possible sources of error, bias, or uncertainty

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions

B3.5 identify some factors related to human activity that have an impact on ecosystems (e.g., the use of fertilizers and pesticides; altered shorelines; organic and conventional farming; urban sprawl), and explain how these factors affect the equilibrium and survival of populations in terrestrial and aquatic ecosystems (e.g., fertilizers change the fertility of soil, affecting what types of plants can grow in it; pesticides leach into water systems, affecting water quality and aquatic life; shoreline development affects the types of aquatic life and terrestrial vegetation that can live by lake shores or river banks; urban sprawl wipes out fields and woods, destroying wildlife habitats)

Introduction

Primary industry has been important to the Canadian economy for hundreds of years. In particular the vast forests in British Columbia and Ontario provide the raw materials for a

billion-dollar industry. Forests are also environmentally important as they remove carbon dioxide from the air and replenish the atmosphere with oxygen. Each forest is a diverse community of different plant and animal species. In addition, the roots of trees and vegetation help to absorb water, limiting rain runoff and reducing soil erosion.

There are a several different logging practices each with economic and environmental advantages and disadvantages:

- Clear cutting: involves the removal of all trees and vegetation in the area. Although it is the cheapest method of logging, the environmental impact is severe.
- Shelter-wood cutting is the staged harvesting of strips of trees. Seed-bearing trees are left to regenerate and wind damage is reduced but erosion along the strips is still a problem.
- Patch cutting involves selectively cutting 100-200 ha patches of trees, leaving connectivity between the remaining forest. It is costly because specialized equipment is required, but less environmentally damaging.
- Selective cutting is the removal of only the most desirable trees from the forest. This has the least impact on the forest however it is very costly.

This demonstration simulates the effects of the removal of vegetation on erosion of soil in an ecosystem.

Materials

2 pieces of cardboard (60 cm × 30 cm)
heavy-duty dark garbage bag
strong tape
3 or 4 large blocks or books
soil

piece of sod (60 cm × 30 cm)
laboratory balance
two 1 L watering cans, or juice or pop bottles
2 clear collecting jars or beakers (1 L or larger)

Safety Considerations

- None

Procedure

1. **Predict**
Ask the students, “How does vegetation affect runoff rate and the erosion of soil?”
2. **Observe**
Cut the garbage bag in half
3. Make a crease dividing the cardboard in half lengthwise, and fold it to make a shallow “v.” This forms the top of the erosion board (Fig.1).
4. Use one half of the garbage bag to cover the cardboard. Tape the bag firmly to the cardboard so that it does not slide off when the soil and sod is added.
5. Using the blocks or books, raise the cardboard so that it is tilted at an angle of 30–40°. The lower end should be higher than the rim of the 1 L container.
6. Place the clear 1 L jar at the low end so that it collects the water that drains.
7. Repeat steps 3–6 for a second board.

8. Add some loose soil to a depth of 4 cm to both boards and lightly tap it down. (Do not pack it down firmly.)
9. Cut a piece of sod to fit in one of the boards. Weigh the sod then fit it on top of the soil on the first erosion board. Lightly tap it down.
10. Measure out a mass of soil equal to the mass of the sod. Add this mass of soil to the second erosion board (in addition to the 4 cm already in place) and press it down lightly.
11. Add 1 L of water to each of the two watering cans.
12. At the same time and at the same pouring rate, sprinkle the water at the top end of the erosion boards.
13. Observe the rate of water runoff and compare the colour of the runoff.

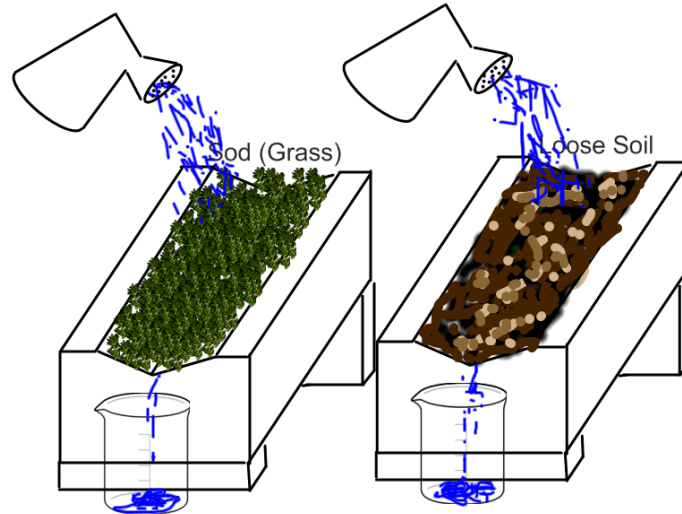


Fig.1 The suggested set-up is a simpler version of this apparatus.

14. **Explain**

Discuss answers to the following questions with the students.

- Which erosion board had the quickest runoff? Which had the most water runoff?
- Which collecting container had the clearest runoff?
- What effect did the grass have on soil erosion and runoff? Why?
- Based on the results of this activity, which logging practice would have the greatest effect on soil erosion and runoff? Which logging practice would have the least effect?

Disposal

The sod could be composted. The soil could be sealed in a container and used for another time or returned to the place from which it was taken. The cardboard and plastic bag could be recycled or, if they are in good condition, stored for later use. Clean the collecting containers and watering cans and store them for future use.

What happens?

The erosion board with the sod will have a slower runoff, less total water runoff, and clearer water collected compared to the erosion board with just soil.

How does it work?

The erosion board with the sod has a slower runoff because the water does not have a direct path through the environment: the grass redirects and slows the runoff. The grass roots also hold the soil together and absorb some of the water, reducing the total runoff and reducing the amount of soil that is eroded away. In comparison the board with only soil does not have any controls over water flow and the water quickly runs through the soil, eroding it away.

Teaching Suggestions/Hints

1. Tap the soil down lightly on the erosion boards. If it is packed down too firmly the water will run off across the top of the soil and the impact of erosion will not be as evident: the water will be clearer.
2. The board must be tilted so that the runoff is quick enough (a low tilt will result in very slow runoff) but not tilted too much so that the soil and sod slides off the board. Experiment with the angle prior to performing the demo to be certain to get it right.
3. Experiment by placing different objects, blocks, small sticks in the soil to see how this affects drainage or erosion.

Next Steps

Students could use the erosion stands to investigate erosion for different soil types, contour farming or different logging methods (for example shelter-wood cutting lengthwise with the slope or on an angle, clear cutting, and selective cutting).

Students could research government policies and local issues regarding runoff and erosion problems.

Additional Resources

1. How Stuff Works: Deforestation - <http://science.howstuffworks.com/environmental/green-science/deforestation.htm>