
SYNOPSIS:

During the late 19th and early 20th centuries, demand for minerals to supply rapid growth in manufacturing and building rose at an incredible rate. To accommodate this demand, surface miners stripped billions of tons of minerals from the earth. In the process, the land was also stripped of vegetation and topsoil—and often, its ability to support plant and animal life.

This program looks at the great strides science has taken to reclaim this land, or restore its life-giving and life-sustaining qualities; and new insights which are helping today's mining companies meet ever greater demands for our vital mineral resources while avoiding the ecological mistakes of the past.

CURRICULUM UNITS:

Biology
Biotechnology
Chemistry
Earth Science
Ecology
Environmental Science
Geology
Physical Science

CAREER OPPORTUNITIES:

Biologist
Biotechnologist
Chemist
Ecologist
Environmental Scientist
Geologist
Land/Resources Manager
Mining Engineer

PROGRAM OVERVIEW:

Our modern civilization must have minerals and to get them it is necessary to open up the earth and remove them. In earlier times, when demand was great and open land was plentiful, areas that had been mined were often abandoned, with little or no attempt made to restore them to their original state. Where topsoil and turf were re-introduced to barren sites, the plants often failed to thrive and disappeared, followed by the topsoil. Environmental scientists discovered that layers of shale brought to the surface by mining activities gradually turn to clay with rainfall. As clay deposits increase, plant growth decreases. Students learn how introducing organisms such as bacteria and earthworms into the soil can bring about the conditions needed to sustain new vegetation, helping hold the soil together and making it more resistant to erosion. As biodiversity in the soil increases, so does the vitality of the soil.

This program shows how environmental scientists are using living organisms in organic cleanup methods which fall under the heading of "bioremediation." It has been found that some plants will absorb the heavy metals often present in the soil at mining sites. Alpine pennycress, for example, absorbs zinc from the soil and stores it in its leaves. The zinc can be recovered from the harvested plants. Biotechnologists are now attempting to create gene-altered plants to absorb mercury, one of the most toxic and difficult metals to remove.

Scientists are also using bacteria to clean up contaminated waters on mining sites. As water flows through reeds harboring various kinds of bacteria, including anaerobes, toxic wastes such as arsenic and uranium are absorbed. Researchers are testing whether they can remove other substances such as cadmium, copper, and acid sulphate.

Working with environmental scientists and regulatory agencies, using new non-invasive explorative techniques and beginning remediation and reclamation early in the mining process, modern surface miners continue to supply the minerals we need and often leave the land in better condition than it was before it was mined.

ISSUES & CRITICAL THINKING:

- 1) After showing the program, ask your students the following:
 - a. What is reclamation?
 - b. What is one of the first steps in reclamation?
 - c. How do organisms such as bacteria and earth worms contribute to the reclamation process?
 - d. What is bioremediation?
 - e. What are some ways bioremediation can be used in the reclamation process?
- 2) Recall the video segment in which researchers run water over sections of bare and planted soil. Have your class create a similar experiment to study the erosion process.
- 3) Compare soil taken from a well-trodden pathway to garden soil.
- 4) Assign students projects involving the collection and analysis of soil and vegetation samples.
- 5) Have the class make a list of the types of minerals that are normally surface-mined and their uses. Which, if any, are mined in your state?
- 6) Have students research other kinds of reclamation, and possibilities for bioremediation.

GLOSSARY:

Reclamation- The process of reclaiming something from loss or from a less useful condition.

Bioremediation- The use of microorganismal metabolism to remove pollutants.

Minerals- A mineral is a naturally occurring solid chemical substance that is formed through geological processes and that has a characteristic chemical composition

Organisms- Any contiguous living system (such as animal, plant, fungus, or micro-organism). Organisms have five basic needs. They need air, water, nutrients (food), energy and a place to live. Animals and plants are organisms.



ENVIRONMENTAL SCIENCE: RECLAMATION - RESTORING THE LAND

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