Saving Our Soil

Teacher's Guide

Missouri Department Of
Natural Resources

Soil and Water
Conservation Program

Teacher's Notes

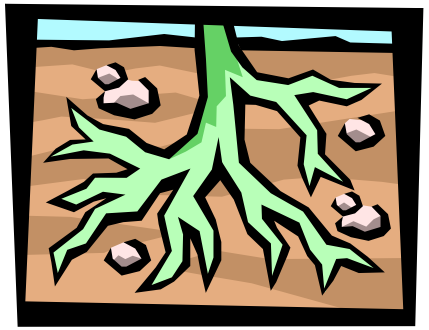
Saving Our Soil

Missouri continues to battle the problem of soil erosion. With the passage of the one-tenth of one percent Parks and Soils Sales Tax in 1984, added monies have been available to intensify this fight on agricultural land.

Soil erosion affects all Missourians, whether they live on farms, in rural areas, or in the cities. Agricultural production of the food we all need depends upon the soil. Soil and water conservation districts (SWCDs), work hand-in-hand with the Missouri Department of Natural Resources and the federal Natural Resources Conservation Service. This three-way partnership of local, state, and federal agencies continues to improve the condition of Missouri's agricultural land.

Educating the citizens of tomorrow is one of the best ways to ensure that the progress Missouri makes today carries on. This three-part video on soil in Missouri is designed to do just that. The series introduces the subject of soil and the importance of protecting and conserving for future generations.

This guide is intended to supplement the **Saving Our Soil** video on Missouri soils, erosion, and conservation. This video is divided into three sections which can be shown at one time or on different days. In addition to the information in the video, this guide also provides several activities that teachers may use to demonstrate the concepts presented.



Objectives:

Upon completion of a unit on soils, erosion, and conservation, including viewing the **Saving Our Soil** video, students will be well exposed to the following concepts:

Section I A Natural History

1) The five factors of soil formation
2) Components of soil

Section II The Human Element

1) The effects of wind and water erosion on soil
2) How soil erosion can be reduced or prevented

Section III The Future

1) Why soil conservation is important
2) Ways that people can work to conserve soil

Vocabulary:

agriculture
alluvium
bedrock
clay
conservation plan
contour planting
erosion
fertilizer
glaciers
gully erosion
humus
landscape
loess
microorganisms
mulch
nitrogen
no-till planting
nutrients
organic matter
prairie
residue
residuum
rill erosion
sand
sheet erosion
silt
sod
topsoil
waterways

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Reference/Support Materials

Do you have special activities you like to use in your class that help teach them about soil? Please share them with us to be passed on to other teachers. Or you might have some feedback for us on what has worked well or did not work at all. We would love to hear from you.

Contact your local soil and water conservation district for additional materials or outside instruction. Some districts provide teachers' workshops for continuing education credit, as well. Many districts have someone available to make class presentations at no cost.

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Activities:

Global Soil Resources "The Apple Demonstration"

All living things depend on soil as a source of food, either directly or indirectly. Unfortunately, soils appropriate for the production of our food and fiber are limited. This activity illustrates just how limited these soils are.

Our food-producing land remains the same and yet the world population continues to grow. Consequently, each person's food portion becomes smaller and smaller. It is the responsibility of each generation to use the soil wisely to insure the future. Your students will see this concept vividly.

Materials:

Large Apple (softer apples work better)
Paring knife (or heavy plastic knife)

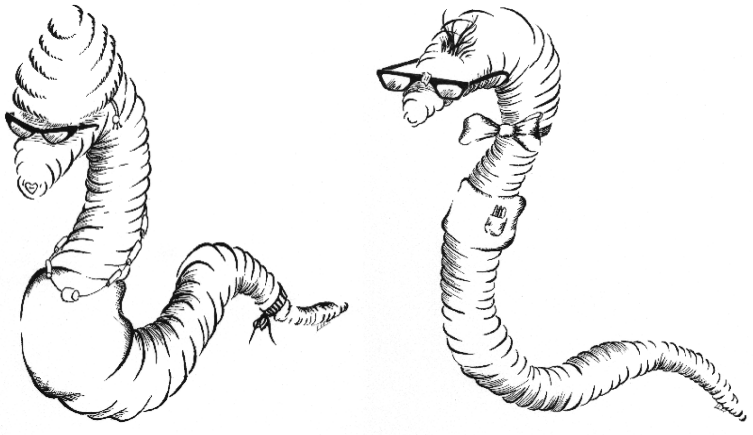
Procedures:

1) Cut the apple into four equal parts. Three parts represent the oceans of the world. The fourth part represents the land area.
2) Cut the land section in half lengthwise. Now you have two 1/8th pieces. One section represents land such as deserts, swamps, Antarctic, arctic, and mountain regions. The other 1/8th section represents land where man can live but may not grow food.
3) Slice this 1/8th section crosswise into four equal parts. Three of these 1/32nd sections represent the areas of the world which are too rocky, too wet, too hot, or where soils are too poor for production, as well as areas developed by man.

4) Carefully peel the last 1/32nd section. This small bit of peeling represents the soil of our earth on which man depends for food production.

Using Soil Surveys

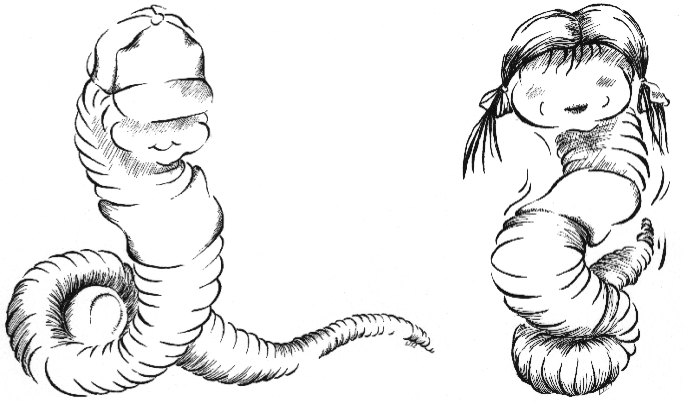
Distribute copies of a soil survey, preferably of your county. (Soil surveys are available FREE from your soil and water conservation district.) Select a section of the survey and assign students different land uses. For example, one could plan to put in a septic system, another could plan to raise corn. Have students use the tables on the survey to determine what uses the soil can support or what is the best use of the soil.



open space left in the jar with the last layer being soil. Place about 20 small worms in the jar. Don't add any uncooked oatmeal on the final layer of soil. Punch holes in the lid of the jar with a hammer and nail before placing the lid on the jar. (Don't punch holes into the lid when it is on the jar!) Cover the jar with the dark cloth. Place the worm farm out of direct sunlight. After a week, remove the dark cloth and observe how the worms have mixed the soil and sand in their search for food.

<u>Keep your worms happy:</u>

This can be a longer-term project. It is important to always keep your worms cool and moist. Be careful not to make the soil too wet, or your worms may drown. Every six weeks or so, add a small amount of oatmeal for your worms to eat. This can be a good classroom job for deserving students. Who has worm duty this week?



soil functions. Soil-inhabiting plants and animals are largely responsible for converting nutrients in undecayed organic matter to inorganic forms that growing plants can more readily use.

Quart Jar Worm Farm

Along with recycling food waste, worms play an important role in moving and mixing soil. Worms make and live in holes, which help reduce compaction by making the soil looser. The worm's burrows also let air into the soil. Plant roots and animals that live in the soil use the air. The burrows also help rain water to soak into the soil. Plants use this water to live and grow. Students will enjoy making a simple worm farm to see how worms move and mix soil.

Materials:

Glass jar with lid – quart size or larger
Soil
Sand
Worms
Hammer and large nail
Dark cloth
Uncooked oatmeal

Directions:

Put a one-inch layer of moist soil into the glass jar. Sprinkle about a teaspoon of oatmeal on top of the soil. Add a one-inch layer of moist sand. Continue this sequence until there is about 2 inches of

How Alive is Soil?

The video very clearly says that soil is alive. Why not take a soil assay yourself? This activity is best suited to springtime.

Materials:

Large sheets of white paper
Three large, heavy paper shopping bags
Rulers
A small spade
Six or more small bottles with lids or corks
A small magnifying glass will also be helpful
One foot square of 1/4" hardware cloth (optional)

Instructions:

1) Measure off an area one-foot square and collect the soil to a depth of 2 or 3 inches from each of the following places:
   - Below the leaves in an ungrazed and unburned woodland.
   - A pasture or fence row, just below the surface.
   - A badly eroded field where subsoil is exposed.
2) As you remove the soil, watch for burrows of worms and other animals. You may also find the eggs of certain insects singly or in masses or pods.
3) Examine the samples, either indoors or outdoors. If you examine them indoors, small specimens will not be blown away by the wind and you can use a microscope to look for small organisms. Transport samples in shopping bags.
4) Pour out the samples on separate pieces of the large sheets of white paper.
5) Carefully sort the soil, watching closely for small living things. One-foot squares of 1/4" hardware cloth or window screen will be helpful in making this examination. Place the different kinds of animal life in separate

bottles. Count the animal life belonging to each of the following groups:

- Worms (such as earthworms or night crawlers having no legs)
- Grubs (any worm-like animal with legs)
- Snails (snails without animal shells are called slugs)
- Insects (any hard-shelled, soft-shelled, or winged animal with three pairs of legs)
- Spiders, mites, ticks (animals with four pairs of legs)
- Animals with more than four pairs of legs
- Others (any animal not falling into one of the above groups)

6) Figure the total number of animals per acre for each group from each of the sampled areas. (There are 43,560 square feet in an acre.) Calculate the grand total of all of the animals for one acre. No matter how large the total number of visible animals you find in the soil, it is small compared to the number of microscopic plants and animals, particularly bacteria, present in the soil.

Interpretation:

The soil is home to innumerable kinds of plant and animal life that range in size from those that are microscopic to large ones such as earthworms. Most of the living organisms in the soil are so small you will not be able to see them without a microscope.

These living organisms have a marked effect on the characteristics of the soil itself. At the same time, such soil characteristics as the granulation (structure) of soil, how well air moves through the soil, the moisture content, how much organic matter it contains, whether it is sweet or acid, and how the farmer handles the soil, all directly impact the number of organisms in the soil.

Plant life that is too small to be seen without a microscope includes bacteria, fungi, and algae. Bacteria (one-celled organisms) may be present to the extent of one to four billion per gram of soil. Fungi, which includes molds, do not contain chlorophyll and therefore cannot manufacture their own food. A gram of soil contains from 8,000 to 1 million of these tiny plant life. Soil algae are microscopic plants that contain chlorophyll and may run as high as 100,000 per gram of soil.

Animal life in the soil includes protozoa, microscopic animals larger than bacteria; nematodes, larger and more complicated than protozoa but some still too small to be seen without a microscope; and earthworms, ants, snails, spiders, mites, and various other worms and insects. It is only specimens of this last group, and possibly some of the larger nematodes, that you will see in this study.

Earthworms are the most important group of the larger animals. They live in soils that are high in organic matter and not too sandy. The number of earth worms may range from a few hundred to more than a million per acre. Between 200 and 1,000 pounds of earthworms may be present in a single acre of soil.

The earthworms in an acre of soil pass several tons of soil through their bodies each year and in so doing, make certain nutrients available to plants. Burrows left by earthworms let water and air move freely thorough the soil. Earthworms also bring soil from lower levels to the surface, thus mixing the soil.

In addition to earthworms, some rodents, ants, snails, spiders, mites, millipedes, centipedes, and various other worms and insects spend all or part of their lives in the soil. For the most part, effects of these animals on the soil is beneficial. Burrowing habits, for example, cause a lot of soil mixing to take place. Burrowing improves soil aeration and drainage. Some animals, however, feed on the farmer's crops. But it is evident that the animals in the soil are vital and generally contribute in a positive way to the