

### Follow-up Discussion

Research indicates that students will retain their previous misconceptions about a topic, in preference to new information, until they actively recognize and correct their own errors. Therefore, it is important to have your students re-examine the facts/beliefs they put on their "Everything We Think We Know About..." list. It might also be helpful to review the list by marking each entry with a "+" or "-" to show which facts were correct and which were incorrect.

Thought-provoking discussions provide a good way to assess the overall depth of student understanding. The following are some suggested discussion topics.

- Many acres of tropical rain forest are being destroyed every hour. Why is this problematic to soil?
- Could humans live on Earth with no soil? Explain your answer.
- What type of soil would make the best habitat for an earthworm? Why do you think so?

### Follow-up Activities

- Have students bring in soil samples from their neighborhoods. Students can carefully sort through the soil and examine the particles with a magnifying glass. Encourage students to record the properties of their soil. Is the soil fine or coarse? What color is the soil? How large are the particles? Does the soil contain organic material, rock fragments, sand or clay? In small groups, students can determine how their soil samples are similar and different.
- Conduct a class experiment comparing the growth of plants in different types of soil (sandy, rocky, clay, rich in humus). Generate and test hypotheses about the most effective soil for growing plants. Students should record growth observations and compare their results.
- The erosion of topsoil can be extremely problematic for farmers. Have students research agricultural techniques for reducing soil erosion, such as crop rotation. Students can also brainstorm their own ideas for ways to protect topsoil for farming.

### Suggested Internet Resources

Periodically, Internet Resources are updated on our Web site at [www.libraryvideo.com](http://www.libraryvideo.com)

- <http://www.gsfc.nasa.gov/globe/index.htm>

The "Soil Science Education Home Page" presents information about soil, including soil fertility, the uses of soil, and soil structure and texture. Images of different types of soil are also available.

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- [www.kcpt.org/olin/odyssey.html](http://www.kcpt.org/olin/odyssey.html)

"Captain Olin's Odyssey" is a Web site that describes the travels of Captain Olin through space. One of the "Voyages of Destiny" describes the captain's investigation into soil science and provides several soil activities.

- [www.fmnh.org/ua/](http://www.fmnh.org/ua/)

The "Underground Adventure" site hosted by the Field Museum provides an interesting look at the world underneath our feet. This site offers a tour through the underground world and a virtual terrarium, which enables you to watch the interaction of plants, animals and soil. (You will need to download the free plug-ins offered on the Web site to use it effectively.)

### Suggested Print Resources

- Appelhof, Mary, Mary Frances Fenton and Barbara Loss Harris. *Worms Eat Our Garbage: Classroom Activities for a Better Environment*. Flower Press, Kalamazoo, MI; 1993.
- Snedden, Robert. *Rocks and Soil*. Raintree Steck-Vaughn, Austin, TX; 1999.
- Winckler, Suzanne and Mary Rodgers. *Our Endangered Planet: Soil*. Lerner Publications, Minneapolis, MN; 1994.

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## Soil

### Grades 5-8

Students in grade 5-8 classrooms possess a wide range of background knowledge. Student response to this video program is sure to be varied, so the teachers at these grades need all the help they can get! This guide has been designed to help the 5-8 science teacher by providing a brief synopsis of the program, previewing and follow-up questions, activities, vocabulary and additional resources.

**Before Viewing:** Extensive research tells how important it is for the teacher to discover what the students know — or think they know — about a topic, before actually starting a new unit. Therefore, after prompting discussion with the pre-viewing questions, lead your class to create an "Everything We Think We Know About..." list. You may also wish to preview key vocabulary words, and have students raise additional questions they hope will be answered.

**After Viewing:** Have your students share video excerpts that fascinated or surprised them, then challenge your students to prove or disprove the accuracy of the facts they put on their "Everything We Think We Know About..." list. Discuss what else they learned and use the follow-up questions and activities to inspire further discussion. Encourage students to research the topic further with the Internet and reading resources provided.



## Program Summary

Take a closer look at the ground under your feet — you may be standing on soil! Soil is the loose top layer of the Earth's surface in which plants grow. Soil supports the roots of plants and provides nutrients, air and water for roots to absorb. Two characteristics of soil that influence its ability to hold air and water are pore space and permeability. Pore space is the opening between soil particles that allows for the absorption of water and the movement of air, both of which are essential for plant growth. Permeability describes how easily water flows through soil, which also determines how fertile soil can be.

It can take hundreds of years to create fertile soil! Soil consists of the distinct layers that scientists call horizons. These layers all begin with the weathering of rock. Parent rock is weathered slowly, creating the tiny fragments that are needed as a base for soil. Immature soil consists mostly of these rock fragments and is not good soil for growing plants. A relatively small portion of Earth's surface is covered with fertile, mature soil. Mature soils can support plant growth because of the addition over time of humus, fungi, bacteria, insects and other small animals. Each of these materials contributes to the richness of mature soil!

Climate is the principal determinant of soil quality; therefore, scientists have named soil types after climate types. Tropical soil, found in areas with high temperatures and heavy rainfall, is not fertile enough to sustain crops for long because nutrients are washed away too quickly. Grassland soil is very fertile and supports the growth of grass, but not many trees. Forest soil can support trees and shrubs, but isn't fertile enough for crops. Desert soils are high in mineral level, but low in moisture. This type of soil can be very fertile when watered. Arctic or tundra soil cannot support large plants because it is frequently too frozen or wet. Over the years, farmers and scientists have learned how to use fertilizers and planting techniques, which can enhance and conserve the Earth's topsoil. Because soil is so important for sustaining life, we must learn how to protect and conserve it.

## Vocabulary

The following words are included for teacher reference or for use with students. They are listed in the order in which they appear in the video.

**soil** — The loose top layer of the Earth's surface in which plants grow.

**topsoil** — The uppermost layer of soil that is the richest, most mature layer, containing humus & decomposers. Topsoil is in the soil layer called Horizon A.

**humus** — The part of the soil that consists of decaying organic material from dead plants and animals.

**pore space** — The gaps between soil particles that are created by the shape of the rock fragments that make up the soil. These spaces can hold air and water.

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**fertile** — Capable of supporting growth. Fertile soil is well suited to sustaining plant growth.

**permeability** — The ease with which water can move through soil.

**drainage rate** — A number that represents the permeability of a soil sample. The drainage rate is calculated by dividing the amount of water drained through the soil sample by the number of seconds it took to drain.

**weathering** — The breaking of rock and other materials of the Earth's surface into smaller pieces. Weathering can be described as either physical or chemical and can be caused by forces such as changing temperatures, ice, wind, water and gravity.

**parent rock** — The original rock from which weathered fragments are used to create new soil.

**immature soil** — Soil in the process of becoming fertile, mature soil. This type of soil is made mostly of rock fragments without humus.

**mature soil** — Soil that has developed to the point at which it can support and sustain the growth of plants. It can take thousands of years for soil to become mature.

**decomposers** — Life forms such as bacteria, fungi, insects and other small creatures that create humus in soil by breaking down organic materials like dead plants and animals.

**horizons** — Separate layers of soil.

**tropical soil** — The type of soil found in areas with high temperatures and rainfall. Tropical soil is not very fertile because nutrients are washed away too quickly.

**grassland soil** — The type of soil found in areas with sufficient amounts of rain for supporting grass but not trees. Grassland soil is the most fertile for growing crops.

**forest soil** — The type of soil found in areas with moderate rainfall and cool seasons. Forest soil is good for trees, but not for crops.

**desert soil** — The type of soil found in areas where the climate is very dry. Desert soil is high in minerals, low in moisture.

**tundra soil** — Also called Arctic soil, this type of soil is found at high elevations or in areas near the Earth's poles. Tundra soil cannot support any tall plants because it is often too frozen or wet.

**fertilizer** — A substance that can be added to soil to increase crop yield. Fertilizer can consist of animal wastes, humus or compost, or chemical fertilizers.

**compost** — A mixture of decayed organic materials used to fertilize land.

**erosion** — The removal and relocation of Earth's materials, like soil, from their original location. Erosion can be caused by gravity, wind, running water, waves and glaciers.

## Pre-viewing Discussion

Before students generate their list of "Everything We Think We Know About..." for this topic, stimulate and focus their thinking by raising these questions so that their list will better reflect the key ideas in this show:

- How does soil form?
- What are the main components of soil?
- What are some different types of soil?

After the class has completed their "Everything We Think We Know About..." list, ask them what other questions they have that they hope will be answered during this program. Have students listen closely to learn if everything on their class list is accurate and to hear if any of their own questions are answered.

## Focus Questions

1. What is soil?
2. Why is soil important for plants?
3. What components are contained in soil?
4. What is topsoil? How is it different from immature soils?
5. What is humus? How is it created? What is its value?
6. What are the qualities that make soil fertile?
7. What is pore space in soil? What determines the amount of pore space in a soil sample?
8. Why is pore space important for plant growth?
9. Why are soils made of rounded rock particles potentially more fertile?
10. What is permeability? How is it linked to pore space and drainage rate?
11. Why is permeability an important factor for farmers?
12. What are the stages in soil development?
13. How is climate linked to soil quality?
14. What causes drainage rates to increase in a soil sample?
15. What is a parent rock and why is it important for soil development?
16. What are the developmental stages in soil formation?
17. Why does it take thousands of years to create mature soil?
18. Why is there so little mature soil on Earth?
19. What are soil horizons? Why is it important to understand soil horizons?
20. What are some characteristics of each soil horizon (Horizon A, B, C)?
21. What is the linkage between soil type and climate? Give examples of how climate affects soils. Which type of soil is best?
22. How do farmers and scientists conserve soil?