Dirt: Secrets in the Soil

Special project of
Utah Agriculture in the Classroom
in cooperation with
Utah State University Extension
and the
Utah Foundation for Agriculture in the Classroom

Introduction

How to use this instructional interactive program...

Welcome to Dirt: Secrets in the Soil! This interactive program is a special project of Utah Agriculture in the Classroom. Agriculture in the Classroom seeks to provides teachers with the necessary tools to increase agricultural literacy among their students and at the same time incorporate Utah Core Curriculum Standards. (For more information about Agriculture in the Classroom visit our web site at http://ext.usu.edu/aitc.) This instructional unit was designed specifically for use in the 4th grade but translates well into 5th grade natural resource standards, and 9th grade Earth Systems course standards.

The video and lesson plans are an interactive package. The video is divided into six segments and correspondingly this Educators Guide is divided into six sections. The video introduces and discusses some of the concepts in each section in the Educators Guide. On pages 83 and 84 you will find "Interactive Video Questions." These questions cover the major concepts in the segments and help your students in developing note taking skills *(the answers are noted on page 82)*. This Educators Guide contains several activities that can be conducted to solidify core objectives. All the objective in the State Core are covered in this program. But there is more than the core here. Several supplemental activities have been added to integrate science with writing, literature, math, and yes, even art! These lessons and activities were pilot tested by teachers and reviewed by soil scientists, soil technicians, the Utah State Office of Education, and education staff from Utah State University and Brigham Young University.

A number of additional activities and resources are noted in the back of this guide. Answers to worksheets, if necessary, are located in the lessons. Answers to the activities in the Resource section and the "What I know about soils" test are located on page 82. The test, "What I know about soils," is found on page 85. These questions *are not* duplicates of the ones found on the state core test, but will help your students to prepare for that test. One of the justifications for developing this program was to increase student scores on the "state core" test. These questions review concepts and objectives in this guide and on the video.

Workshops will be conducted over the next several years to assist educators who will be teaching soils. Workshop attendees will receive instruction on these lessons, soil samples, and explore the issues related to soils and the environment. Information about how to increase agricultural literacy will also be discussed. The video and educators guide may be purchased individually or as a package. For additional copies or questions contact:

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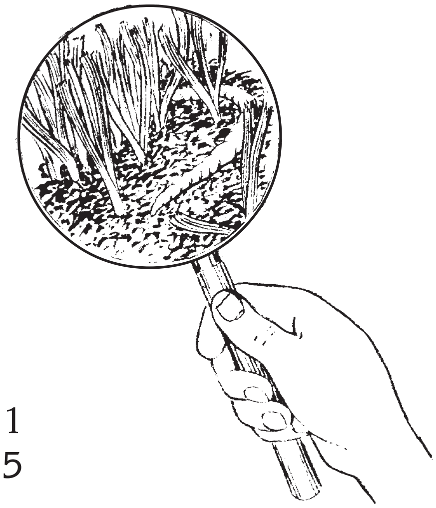
Dirt: Secrets in the Soil



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The Soil Chain

It's Your Food Dude!

Objectives

Students will be able to identify their relationship to the soil.

Students will be able to draw a flow chart from common objects to soil.

Materials

- paper
- pencils
- stapler or glue
- scissors
- paper for chain
- flow chart transparency

Time

Activity 1: 60 minutes
Activity 2: 30 minutes

Getting Started
Gather materials.

Procedures

Activity 1- My Soil Family

1. Show the students the list of 30 objects on page 3. For a variation, you may ask students to help you make a list of 30 objects, things they use everyday.
2. Ask them to pick five of the objects (or more) and using a flow chart, like the one on the bottom of the transparency, "link" the objects back to the soil. (A flow chart uses lines and arrows to show the relationships or direction of flow between an object or group of objects.)
3. Many of the objects will be linked back to the soil. Some may not. That's okay. The transparency depicts two of the more difficult objects students may choose to link the soil.
4. After the students have completed their flow charts, have them select one object (or pick a new one) to create a soil chain. Instruct students to cut out strips of paper that will become links in a chain. Each link should be labeled as one of the "connections" showing the objects relationship to the soil. You might challenge students to create the longest chain and the shortest chain. Note: It is easier to label the links before the ends are stapled or glued together to make the chain.

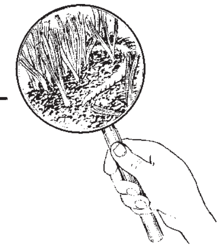
Activity 2- Ranking the Importance of Soil

1. Show the students statements on the transparency master on page 4. Ask them to rank the statements in order of importance.
2. Form groups of five or six students and ask the groups to rank the statements. Ask them to be prepared to explain why they ranked them in that order.

Discussion

1. What can you conclude about the role of soil in your life?
2. What would life be like without soil?

Dirt: Secrets in the Soil



Background

Soil is one of our most useful natural resources. From the soil we get food, clothes and materials for the houses we live in. From gardens and truck farms we get vegetables. Fruit grown on trees and vines come from orchards, groves, and vineyards. Trees also give us valuable lumber and the wood can also be used to make paper, paints and numerous other products. Planted field crops of wheat and corn are used for making flour to make our bread, crackers, pasta, and so many other foods. Nuts and berries come from our farms and forests.

Our animal food also comes from the soil. Cows eat grass, hay, silage, and grain to produce milk, meat, and leather products. All animals eat plants; plants grow in the soil. In addition to the products listed above, animals supply us with by-products that are used in paints, camera film, pet food, rubber, crayons, lotions, soaps, leather, medicines, and, the list is long.

The fuel that warms our houses comes indirectly from the soil. Coal is made from plants that grew ages ago. Oil and gas also originate from organic materials, possibly including the remains of animals. Some of these things grew in the soil at one time or lived on things that grew in the soil.

Fish from the sea, rivers and lakes live on plants (some on other fish). And these plants require dissolved minerals that are washed into the sea, rivers, and lakes from the soil.

There are a few exceptions to linking things back to the soil. Here are a few examples: a volcano, the ocean (even though plants are part of the water cycle), and the sky (although plants give off oxygen for the air in the atmosphere).

Vocabulary

soil: Particles of minerals, organic matter (plant and animal), water, and air; that is found on most surfaces of the land.

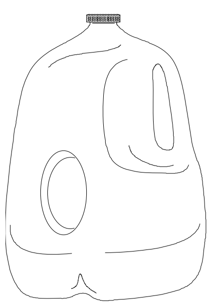
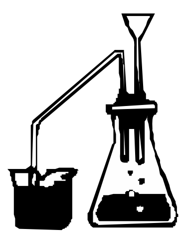
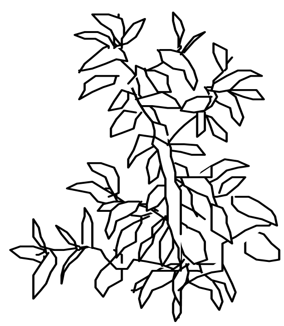
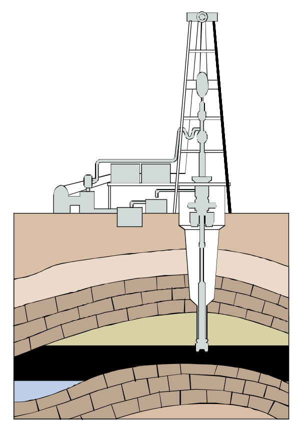
dirt: misplaced soil, i.e., soil on your clothes, your kitchen floor, and under your fingernails is called dirt.

Draw a flow chart back to the soil for...

butter
wool blanket
ice cream
leather shoes
electricity
vegetable oil
farmer's bank account
well water
chocolate cake
glass plate

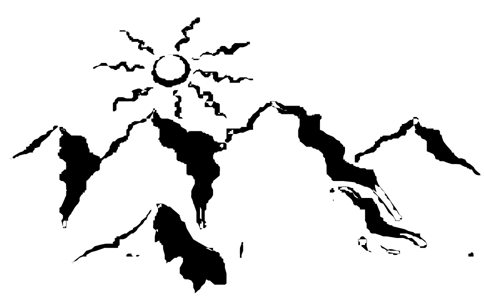
plastic cup
book
brick house
skateboard
toothbrush
turkey sandwich
egg
blue jeans
candy bar
bicycle

table
bubble gum
baseball
pickle
cereal
rope
road
apple
soda pop
pencil

plastic jug ⇨ **oil extraction** ⇨ **old decay of plants & animals** ⇨ **oil under layers of rock & old soil**





bicycle, metal ⇨ **extracted from rocks** ⇨ **weathered rocks become soil**

Rank the following statements in order of their importance. Be prepared to explain why you ranked them in that order.

Soil is important to me (or us)...

___ a) to grow plants (for food, oxygen, paper, lots of things).
___ b) to filter out pollutants that may contaminate drinking water.
___ c) to provide income for farmers, food companies, clothing companies and grocers, to name a few.
___ d) as a surface for building roads, sidewalks, and the places where we live.
___ e) to provide food for livestock.
___ f) to walk on.
___ g) to provide wildlife and insect habitat.
___ h) . . . make up your own

Soil in My Food Web

It's Your Food Dude!

Objectives

Students will be able to draw and explain soils role in the food web.

Student will be able to discuss the importance of soil to life.

Materials

- Soil Food Web Activity sheet
- yarn
- index card or construction paper
- hole-punch
- scissors
- crayons or markers

Time

Activity 1: 30 minutes
Activity 2: 30 minutes
Activity 3: 30 minutes

Getting Started

Gather materials, make necessary copies, and transparencies.

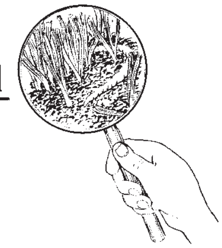
Procedures

Activity 1 - My Soil Food Web

1. Provide each student with the handout "My Soil Food Web" on page 7.
2. Students should write the name of 10 things they have used or come in contact with that day in each box.
3. Ask each student to complete the Soil Food Web by drawing arrows between themselves, the items, and their direct connection to the soil. The item closest to the soil should be something that has actual contact. For example, milk can be traced to cows, cows are not directly connected to the soil except through plants, like alfalfa and grains. These are directly traced to the soil, and should be included as the closest object to the soil.
4. Students should draw boxes around the items they add to make the connections to the soil.

Activity 2 - The Yarn Web Game

1. Ask each student to pick one of the 10 items they listed for their food web and write the items name (big) on a half sheet of paper or on an index card. You may want to assign the students their "parts" so you don't get 10 cows and 10 wheat plants. They should write the name as large as possible, preferably with marker or crayon. Then using a piece of yarn and a hole-punch, make a necklace to hang the sign around each students neck. One student or the teacher must wear a sign that says "soil."
2. Pick any student to begin by tossing a ball of yarn to someone else that they are related to in the food web. If they are not related to any one of the other items, the yarn can always be tossed to the person wearing the "soil" sign. An intricate web should be woven. Several students should be tossed the yarn more than once. When everyone has been included in the web, take a look at how they are all connected to the soil.



Activity 3 - What does soil mean to a . . .

1. Working in groups or as individuals, each group of students should answer the questions, "What do you think soil means to a . . . " (see page 8). Discuss the answers.

Discussion

1. What can you conclude about the role of soil in your life?
2. Whose perspective is closest to yours when you look at the soil? Why?
2. What would life be like without soil?

Background

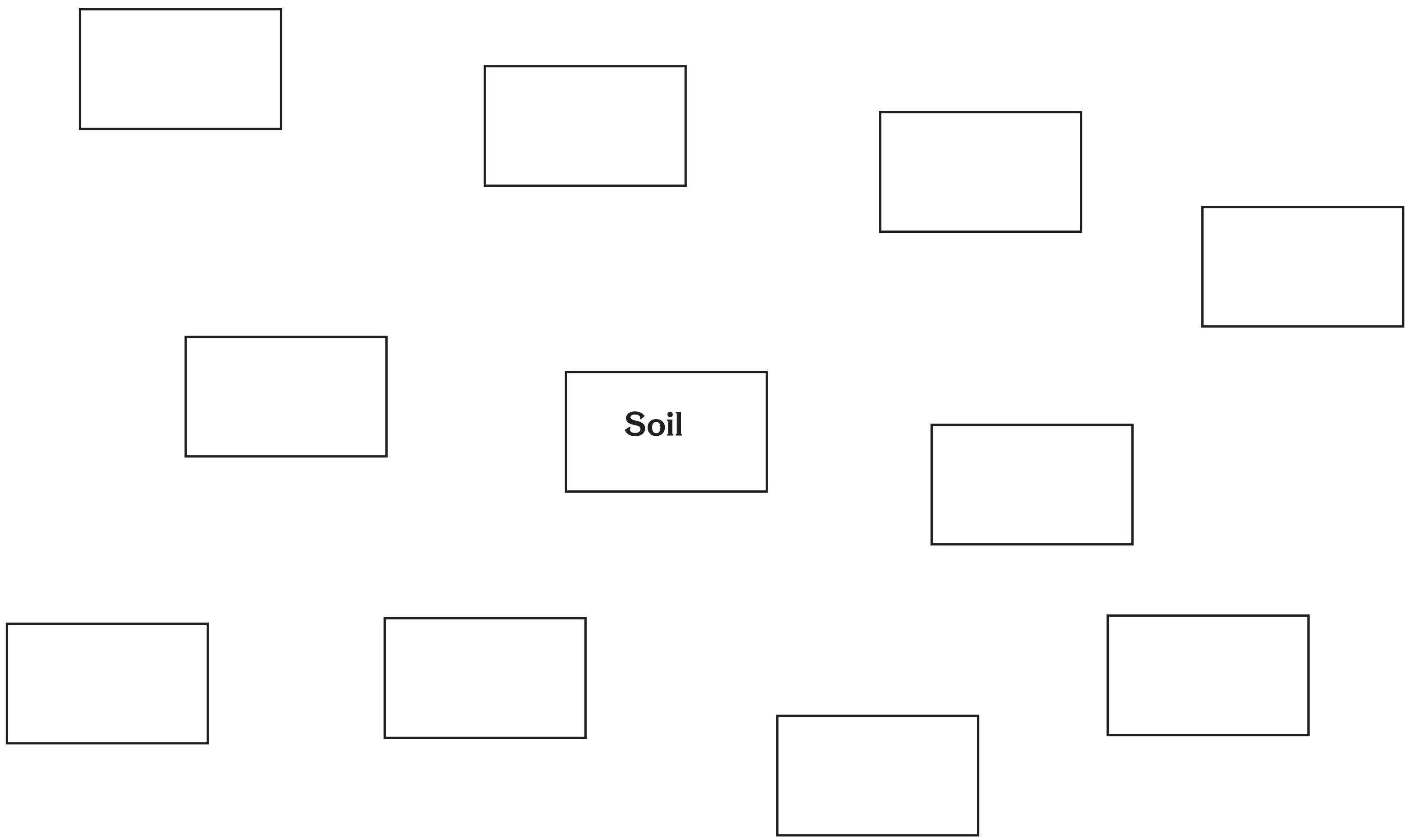
Soil means something different to every organism, including people, depending on the perspective. In this activity, students are asked to look at soil from 10 different perspectives (soil food web) and explore why each perspective is different (Activity 3). Regardless of our point of view, all things in the food web rely upon the soil and energy from the sun to thrive.

Vocabulary

food web: Explains the relationships of various organisms on Earth.
civil engineer: engineer who designs roads, bridges, and works on buildings.
geologist: occupation that involves the study of rock, minerals and Earth's formations and landscapes.
hydrologist: occupation that involves the study of water and its many interactions on Earth.

My Soil Food Web

Write an item in each box that you use or need everyday. Then with arrows, create a “Soil Food Web.” The lines and arrows show the interactions and connections you have to the soil. Add more boxes to your web if you need to connect your 10 items to other things before making the connection to the soil



What does soil mean to . . .

Soil means something different for each of us. What do you think soil means to a:

a) farmer?
b) construction worker?
c) civil engineer?
d) geologist?
e) earthworm?
f) owner of a dry cleaning business?
g) bird?
h) hydrologist?
i) maple tree?
j) you?

What's in Soil?

Soil Isn't a Dirty Word

Objectives

Students will be able to list the four components of soil.

Students will be able to estimate the amount of minerals and organic materials in a given soil sample.

Students will be able to demonstrate that soil contains air and water.

Materials

- small plastic bag of loose, crushed, soil for each pair of students
- newspaper
- hand lenses
- tissue paper or thin paper towel (thick school brown paper towels do not work)
- overhead projector
- water
- 2-cup containers: plastic or paper cups, soup cans or beakers.
- 1 cup measuring cups
- Soil Components transparency

Time

Activity 1: 30 minutes
Activity 2: 10 minutes
Activity 3: 20 minutes

Getting Started

Gather materials, make necessary copies, and transparencies. For Activity 3, cut a 6-inch piece of yarn or string and tape one end to the center of the "Soil Pie: Components of the Soil." The other end should remain loose so that you can move it up or down to show how the percentage of water and air changes depending on climatic conditions.

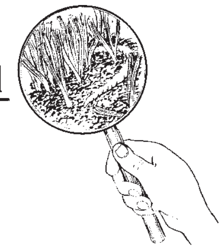
Procedures

Activity 1 - Soil Inventory

1. Divide students into pairs. Give each pair a small plastic bag of soil (students could have brought samples from home, but make sure that it is really soil not a soilless media like some potting mixtures, which is for the most part organic matter). Ask them to dump their sample out onto a newspaper.
2. Using a hand lens, ask each pair of students to write down what they see or feel (moisture) in their sample. You may want to let them know that the small, bead-like, particles they see are called **mineral matter**. Depending on the samples, they should see mineral pieces (little rocklike pieces), organic matter, (leaves, sticks, straw, worms, beetles, etc.), water (moisture, unless the soil is totally dry) and air (which they will probably not mention, because they cannot see it).
3. Show students the "Components of Soil" transparency. All of the items they have inventoried should fit into one of the four soil component categories.

Activity 2 - Soil Moisture

1. Pick one of the soil samples that feels moist or appears to have the most organic matter.
2. Place a paper towel on your overhead. Notice that it blocks out the light. Place a drop of water on the paper towel, some of the light now shines through.
3. Place the moist soil sample on the paper towel and after a few minutes (depending how wet your sample is) dump off the soil. Check to see if the soil left any moisture in the towel by placing it on the lit overhead. Soils do hold moisture.



Activity 3 - Soil Air

1. Ask each student group or pair to place 1 cup of ***dry*** soil into a 2-cup container.
2. Students should slowly pour 1 cup of water into the soil container until the soil is "saturated" or all the dry soil is "mud." While they were pouring the water they should notice the "air bubbles" that are rising to the surface.
3. Students should measure the amount of water left and subtract it from 1 cup.
4. Lead students to infer that the amount of water in the soil sample was approximately the amount of air that was displaced. As the students added the water to the sample, they should have seen bubbles, until the sample was saturated.
5. Have students compare the amount of water that they were able to pour into their soil samples. There will be differences depending on the soil texture and organic matter. What is the percentage of air in the soil sample? If they were able to add a 1/4 cup of water, the sample contained 25 percent air.
6. Using the components of the soil transparency, and the movable yarn, explain how air and water amounts change.

Discussion

1. What are the components of soil? (mineral matter, organic matter, water, air)
2. Which two components are the most variable? (water and air) Why?
3. Why do worms come up to the surface after a drenching rain? (to breathe)

Background

Soil is naturally occurring, unconsolidated or loose material at the surface of the earth, which is capable of supporting plant and animal life. In simple terms, soil is comprised of three components: solid, liquid, and gas. The solid phase which accounts for approximately 50 percent of the volume in a typical soil is a mixture of ***mineral*** and ***organic matter*** and gives soil its mass. Soil particles fit loosely (depending on the particle size) leaving "empty" pore spaces. The pore spaces are then filled with water (liquid) and air (gas). The water and air in an "average" soil make up the other half of the soil's volume.

All soils are made up of the four major components; however the portions will vary. The **mineral matter** is derived from the weathering of hard rock at the earth's surface. An "average" soil is made up of approximately 45 percent mineral content by volume, the amount and size of mineral particles vary.

In an "average" soil, the amount of **organic matter** (living and dead organisms) will range between 1 and 5 percent. Organic matter is mostly composed of dead plant and animal remains. This decay in the upper layer of soil, or topsoil, is the major source of plant nutrients and other organisms. Organic matter is what makes a soil fertile. Soils high in organic matter do not compress as tightly allowing for more air spaces. Organic particles also hold the moisture by absorbing water. Water is held in the small air spaces between soil particles. Sand does not hold water because there is no organic matter to hold water and because the spaces between particles is large.

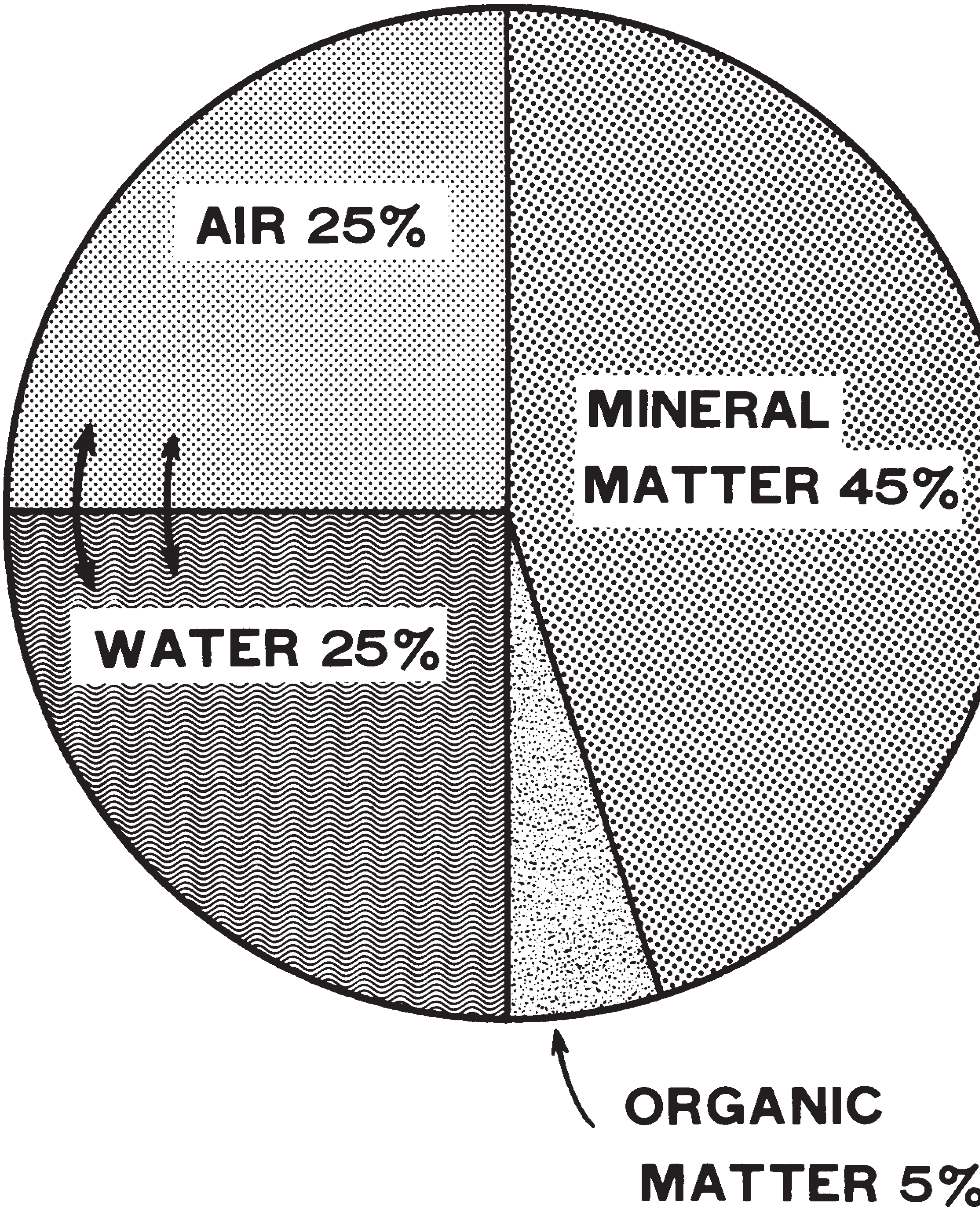
Approximately 50 percent of the soil is made of **pore space**. In an "average" soil the pore space is occupied by *25 percent air and 25 percent water*. Of course when it rains or during a drought these percentages change drastically. You can demonstrate this by using the "Components of the Soil" transparency and yarn, as explained in the teacher preparation section. Show how weather patterns affect the air and water percentages. (The yarn, representing the line between the two components is easily moved.) Water and air in the soil is very important to the plants and animals that live in this ecosystem. Water carries the nutrients to the plants. Both water and air are necessary for life and growth processes of plants and animals. Plants and animals breathe. Plants consume carbon dioxide through their roots and animals take in the oxygen.

Vocabulary

mineral matter: small pieces of weathered of rock (parent material), broken down over thousands of years.

organic matter: products derived from living organisms, like plants and animals.

Soil Pie: Components of Soil



What Makes Up Your Profile?

Soil Isn't a Dirty Word

Objectives

Students will be able to determine soil changes in relationship to depth.

Students will explain how soils are formed.

Materials

- overhead projector
- water
- clear plastic cup for each student
- different types of cereal
- 1/2 gallon of milk
- spoons
- sandstone or lime-stone
- river rock (rounded)
- 1 quart glass jar
- vinegar
- metal tongs
- ice water
- hot plate
- Soil Profile transpar-ency
- Factors That Build Our Soil transparency

Time

Activity 1: 30 minutes
Activity 2: 30 minutes
Activity 3: 30 minutes

Getting Started

Gather materials, make necessary copies, and transparencies. Ask your students to bring in a ziploc bag of cereal, or purchase three to five different kinds of bagged bulk cereal. *Other food or nonfood items may be substituted for the cereals.* For Activity 3 you will need some sandstone. Sandstone is relatively easy to find, especially in Southern Utah. However, if you have difficulty finding sandstone, pieces of brick or concrete can be substituted.

Procedures

Activity 1 - What's Your Profile?

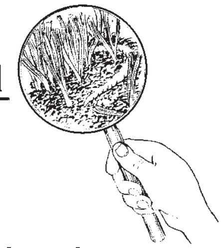
1. Draw a profile of one or of each student by asking them to stand, perpendicular, in front of an overhead projector. Trace their profile on the chalk board or on a piece of paper which you have taped to the screen. Explain to students that this is their profile. What do they think a "soil" profile would look like?
2. Begin with some opening questions: When you dig into the ground under the grass in your yard, you'll find soil. But what happens if you keep on digging? If you dug far enough, would you run out of soil? How far would you have to dig before you ran out? And what would you find there?
3. Using the soil profile transparency, and the background information, explain the differences in each layer of the soil profile. The video also shows many different soil profiles.

Discussion

1. Where do you think most soil life exists? Why?
2. Can a soil profile tell you how well plants might grow in that soil?

Activity 2 - Soil Profiles

1. Place the cereals brought in (or that you have purchased) on a table.
2. ***Students need to wash their hands***. They will be eating their creation. This is a good early morning activity.



3. Ask students to construct a soil profile complete with parent material, subsoil, and topsoil (based on what they have seen in the video and what you have explained from the background information, topsoils are usually darker and finer, etc.).
4. Students may want to crush the cereal to create their topsoil. Simply place the cereal in a bag or between two paper towels and they can crush it easily using their hands. Students could also mix cereals to get their desired colors and textures.
5. Allow each student to share their "profile." Then, milk acting as water, can be poured onto the cereal and students can see how pore space is taken up by the milk and how percolation occurs.
6. Pass out the spoons and *bon apetit!*

Discussion

1. Some layers in some soil profiles are difficult to see because the colors are very similar. What other ways could you determine where one layer begins and another ends? (By the amount of organic matter and rocks. (Chemical tests could also be used.)

Activity 3- Making Soil

1. Demonstrate how parent material can be broken into smaller pieces by rubbing two pieces of sandstone together over a white piece of paper. Particles of sand will fall off. (If you have enough sandstone for groups of students, they can conduct the activity on their own, with a little guidance).
2. Explain to students that you are using sandstone because it is easier to experiment with, other rocks need more force and time. Nature provides for these over time in the environment, but your school day will end in a few hours, not a few centuries.
3. Place the sandstone into some water, rub the stone with your finger. Particles come off. You could demonstrate how water running over the stone will also wash away mineral particles, but using your finger conserves water. Water erosion on rocks takes gallons of water and many years. Your school day will be over soon. Show a river rock, note the smoothness.
4. Heat a small piece of sandstone or limestone on a hot plate. You may want some safety glasses for this next part. ***Ask everyone else to stand back!*** Pick up the rock with metal tongs and quickly drop it into ice water. The rock should break or crack as it contracts after its expansion by heating. (To further demonstrate how rocks break down you could fill a small glass jar with water, cap it tightly, and the place it in a freezer. Be sure to put the jar in a bag so pieces of glass won't be all over the freezer.)
5. Put some small pieces of limestone or sandstone in a little vinegar. Heat the vinegar on a hot plate and notice how bubbles form on the pieces of stone. These bubbles are carbon dioxide gas caused chemically by the acid in the vinegar. If you continued this process for a long time the entire stone would gradually break down.

Discussion

1. How long does it take to make soil?
2. What factors help to make soil?
3. Is soil a renewable resource?
4. What kind of chemicals or acid might be in the soil to break down rocks?

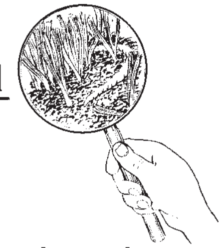
Background

If you dug deep enough, you would hit solid rock. This is called bedrock. But before you got there you would have to dig through three or four different layers of soil (the profile). The layers are often referred to as horizons. The first horizon or layer is usually darker in color and contains most of the organic matter. Organic matter is the layer formed by plants and animals. In Utah, and the western U.S.A., in general, we have less organic matter and in many rocky places it may be nonexistent. In an area where there is more moisture and plant life you will find a deeper layers of organic matter. The first layer of soil is called ***topsoil***. The topsoil is where plants take root and grow. For good reason, this is where plants can absorb water, nutrients (minerals), and air (carbon dioxide).

Minerals come from rocks. Minerals have several different ways of getting into the soil. Sometimes they come from volcanic eruptions. Usually the minerals come from rocks that have broken apart. Water from rain flows into the cracks of rocks. When the water freezes, it expands and causes the cracks in the rocks to get bigger and little bits of the rock break off. Sometimes the roots of plants will grow into "soft" rock and cause them to break. Water and wind carry the tiny bits of rock along until they get trapped by the soil. You can see how weather and climate (physical forces) can play a big role in the development of soils. Chemistry also plays a role in developing soils. Many rocks are broken apart by lichens–tiny "crusty, coral-like" plants (green, orange, gray, etc.) that live on rocks. Lichens secrete an acid that dissolves some minerals. Also organic matter is acidic. When water and organic matter mix, they form a slightly acidic solution that breaks down rocks in the soil, like the vinegar in Activity 3. That is why soils in the eastern United States are more acidic than soils in the west. They contain more organic matter. Eastern topsoil are also generally deeper. Organic matter is good for plants, it keeps topsoil in its place, keeps soil particles together, retains soil moisture, and speeds up soil formation. It takes between 100 and 500 years for just 1-inch of topsoil to form depending on the type of rocks and climate.

In Utah, our topsoil depths range from 1-12 inches. However, topsoils can be several feet deep depending on their location. Because our topsoils are so shallow, farmers, ranchers and others who are charged with caring for the land, must use practices that conserve topsoils and hold them in their place. Soil is considered a ***nonrenewable*** resource because it takes them so long to form. Topsoil is the thin line or layer that sustains life.

If enough of the topsoil blows or washes away we are left with ***subsoil***. The subsoil is the layer below the topsoil. It is usually lighter in color and less productive than topsoil.



Minerals here are not in a form that are easy for plants to use. The subsoil is mostly made up of clay or sand and has very little organic material. Plants grow poorly in subsoil. That's why farmers must work hard to conserve their topsoil.

Between the subsoil and the ***bedrock*** is a layer of small rocks that have started to break off the bedrock. This layer is called the ***parent material*** of the soil. That is because most of what makes up the soil was once part of the rock.

Vocabulary

bedrock: a more or less solid rock, may be beneath the soil or at the surface (Zion National Park)

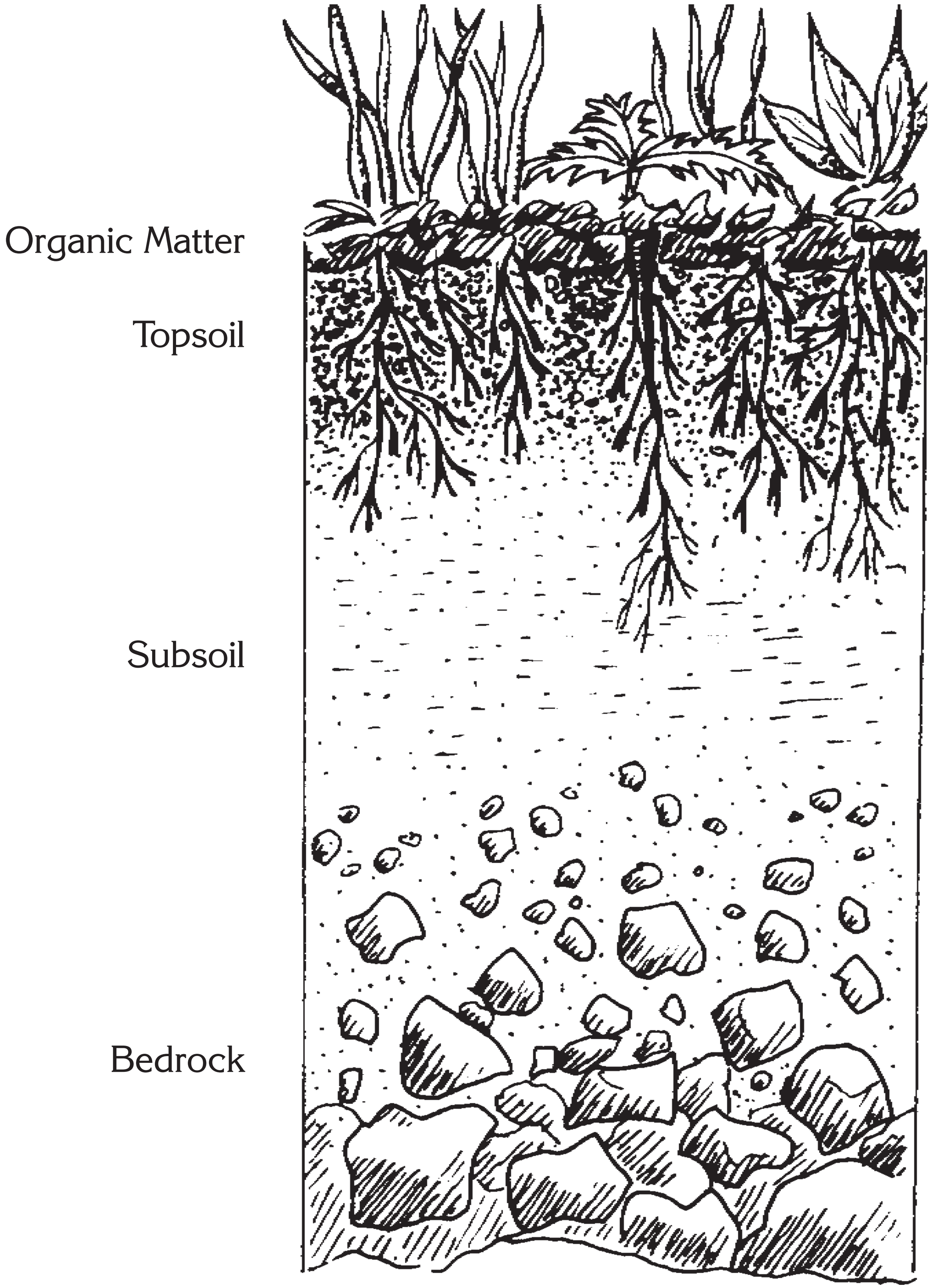
nonrenewable resources: limited natural resources that cannot be replaced.

parent material: layer in the soil that contains broken up pieces of bedrock.

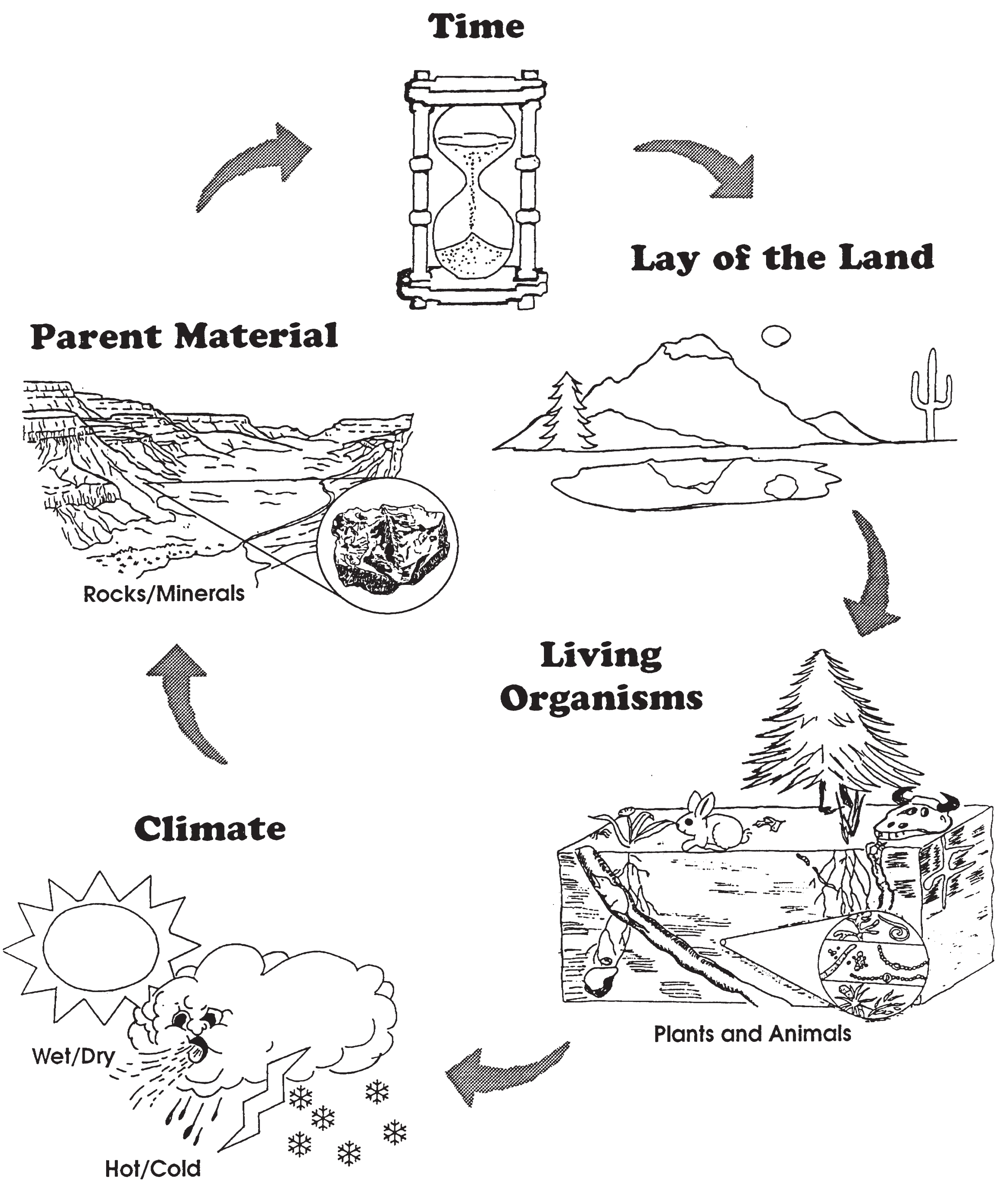
subsoil: the layer of horizon of earth below the topsoil.

topsoil: fertile upper layer of soil which is rich in organic matter.

Soil Profile



Factors That Build Our Soil



Types by Texture

Soil Isn't a Dirty Word

Objectives

Students will be able to determine soil types by texturing several soil samples.

Materials

- Soil samples of sand, silt, and clay loam (included with video package)
- Soil samples brought in by students from home, about 1 cup)
- 1 quart jar
- ruler
- alum *(optional)*
- small bowls
- spoons
- water
- bucket
- Particle Size and Textural Triangle transparencies
- newspaper

Time

Activity 1: 20 minutes, with 3 short follow-ups
Activity 2: 45 minutes

Getting Started

Gather materials, make necessary copies and transparencies. Soil samples of sand, silt, clay, and loam can be obtained from Utah Agriculture in the Classroom. One of each sample is included with this Educators Guide. Soil samples can be used over and over if allowed to dry after each use. In each subsequent use the samples can be moistened to a paste and textured as explained. If you would like students to see what the soils look like dry, expose the sample to air, dry thoroughly. Then using a motar and pestle (a wooden dowel or carriage bolt and plastic bowl will work) pulverize the sample to its "original" dry, loose state.

Procedures

Activity 1 - Dirt Shake

1. Divide the students into groups of three or four.
2. Provide each group with a soil sample or instruct each group to use one of the samples brought from home. ***Caution!*** This activity will not work with most potting soil. Potting soil is made up of mostly organic matter. This activity is designed to determine soil texture. By evaluating soil (mineral) particle size.
3. Place 1-inch of soil into a 1 quart jar. Add water until the jar is 2/3 - 3/4 full. Add one teaspoon of alum (***optional*** water softener, found on the spice aisle of most grocery stores, it does help the soil settle faster, but is not necessary) Be sure the lid is tight. (You may use 3 or 4 inches of soil if you would like to see "larger" layers. This may facilitate measuring. Be sure to record the depth you start with so you can accurately estimate percentages.)
4. Shake the jar vigorously until all the particles have been sufficiently wet and separated by the water, about 2 minutes.
5. Set the jar down and allow the soil to settle. (See page 23)
6. After 1 minute measure the amount of soil on the bottom of the jar. Record this information
7. Allow the sample to settle for 3 to 4 hours, then measure again and record the level of the silt. This is your second layer. This would be a good time to explain that soil pieces,

which students saw in a previous activity, are comprised of different size particles. Use the background information and Particle Size transparency.

8. The rest of the soil (or clay particles) may take the next couple of days to a week to settle depending on the amount of clay in the sample. But because you know that each sample started with 1 inch you can determine the amount of clay because you know the amount of organic matter that is floating on top (this may be difficult to measure), sand, and silt.
9. Convert the measurements into percentages. Students may need help with this. If you used 1 inch of soil and the first layer measured 1/2 an inch, that would be equal to 50% sand, a 1/4 inch measured in the second layer would be 25% silt, and the remainder would be 25% clay, to make 100%. If the sample has 5% organic mater, you may only have 20% clay. If you started with 4 inches of soil and 2 inches settled out as sand, 50% of that sample would be sand, 1-inch of silt would be 25%, 1-inch of clay would be evaluated as 25% clay.
10. Determine the soil type by using the Texture Triangle transparency.

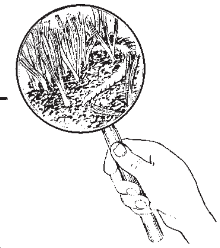
Discussion

1. Why do the larger particles settle out first?
2. What is the stuff floating in the jar?
3. How does each persons sample compare?

Activity 2 - Soil Textures By Feel

Classroom management note for Activity 2: Divide the class into groups of four. Invite each group, **one at a time**, back to the table where the soil samples are set up in the bowls on newspaper. Cover the entire surface with newspaper. Place a bucket of water on the table for rinsing hands between texturing samples. Have paper towels available for the final rinse and dry. The bucket of water should be placed in the middle of the table so muddy hands will not have a chance of being hung out over the floor. Before students rinse their hands, as much of the sample as possible should be returned to the sample bowl. Hands must be rinsed between samples so as not to confuse the sampler, and mix up the sample for the following students. While each group is working at the texture sampling area, provide the other students with some other type of "at your desk" activity. You may want to have them work on a crossword or word search puzzle provided in the back of this guide. The teacher should try to remain with the texturing group as much as possible to guide them through the activity and clarify questions the students may have.

1. Place at least three different soil types into four bowls. (a sand, silt, and clay, loam).
2. Introduce the soil "Textural Triangle." Show the students there are different names for different types of soil. It will be the task of your students to determine the texture of the supplied soil samples.



3. Explain to the students that each sample is different and explain how the different particles feel by reading the background information. Ask them to determine the type of soil in each sample.
4. Moisten soils to the consistency of “pasty” mud. Do not get them too wet and soupy.
5. Each student should place a teaspoon of the “mud” into the palm of his or her hand.
6. Instruct students to rub some of the soil between their index fingers and thumbs feeling for the presence of sand, silt, and clay.
7. As they continue to feel the sample, ask them evaluate how much sand, silt, or clay is present. Do they think it mostly sand or silt or clay? Is it half sand or silt or clay? Students should feel a mixture and then try to determine the relative amounts of sand, silt and clay. Students should record their analysis of the soil: sandy, silty, or clayey or an evenly mixed type of loam.
8. After all students have sampled the soils discuss with them what their analysis should have been. You may want to show them how to use the “Textural Triangle” and together determine the soil types.

Discussion

1. What is the name of a soil that contains a mixture of sand, silt, and clay?
2. How does sand, silt, and clay, feel?

Background

Remember that soils are made of tiny pieces of rock or minerals. But not all of the particles are the same size. Gravel particles are greater than 2.00 mm, ***sand*** is classified between 2.00 and 0.05 mm, ***silt*** is a particle that is between 0.05 and 0.002 mm, and ***clay*** is any mineral particle less than 0.002 mm. Students should have seen the different particle sizes in the “What’s in Soil” activity. To determine a type of soil, particles are analyzed. Most soils are a mixture of sand, silt, and clay and are said to be ***loams***. If the sample has more sand it is a “sandy loam,” more silt a “silty loam,” more clay a “clay loam.” Depending on the amounts of sand, silt, and clay, the soil type may be further classified as a “sandy clay loam,” “silty clay loam,” “silty clay,” etc.

Activity 1 is a “hydrology test” that, with the use of water, simply separates the soil particles. Sand is the largest particle in a soil sample (gravel is not small enough to be considered soil) and is a heavier, denser, particle and will settle out in the water within 1 minute. Silt (the next largest particle) will settle out in 3 to 4 hours and clay will take a few days or as long as a week to completely settle. Scientist will shake soil samples in water for 24 hours. This is to ensure that “tightly” bound clay particles are thoroughly separated, but for the classroom experiment the 2 minute shake will work. Organic matter will be the “debris” floating on top of the water, if the sample was dry. This usually is a very small amount that can’t be measured. Measuring the sand, silt, and then surmising what the clay will be will help to determine the type of soil in the jar. For example, if the sample measures 1/2 inch after settling for 1 minute, the sample is 50 percent sand and is considered a sandy type (probably sandy loam) soil.

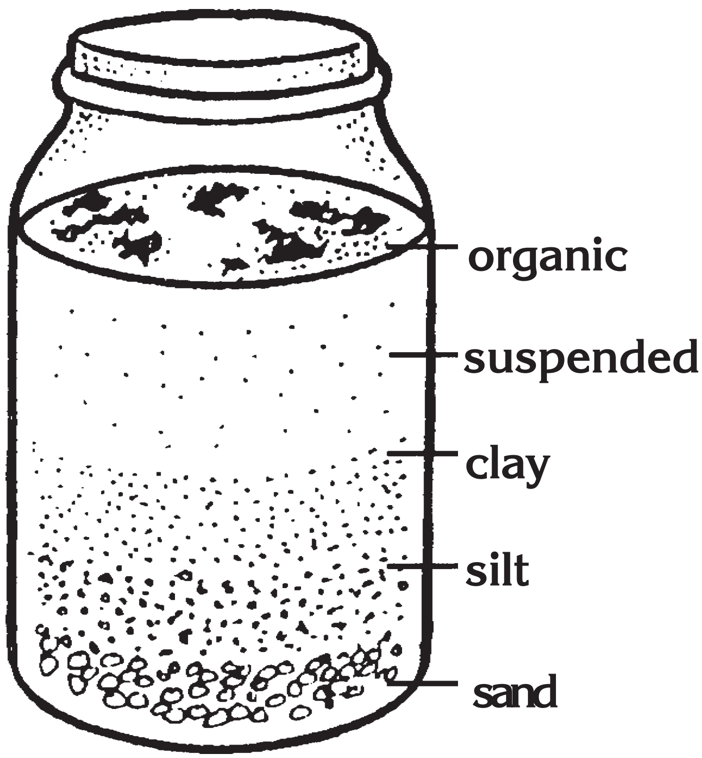
Within 2 days the students should be able to see the different layers easily. The layers may be easy to see or difficult depending on the color of the minerals in a given soil sample. Soil color is determined by the minerals in the soil, not the texture. Red soil can be sandy or made of clay.

When texturing soil samples by hand students should follow this criteria. **Sand feels gritty. Silt feels smooth, soft, somewhat slick, like the smooth silkiness of baby powder. Clay feels sticky, and often stains the fingers.** Soil samples containing a lot of clay will also be able to be pressed together through the thumb and forefinger to create a "ribbon" of soil. Clay soils stick together. Most of us have worked with potters clay. Potters clay is not quite as sticky, but a truly clay soil will hold together is a similar fashion. You cannot determine soil texture by color or where it is found in the soil profile. The touch method and hydrology tests determine soil texture.

Vocabulary

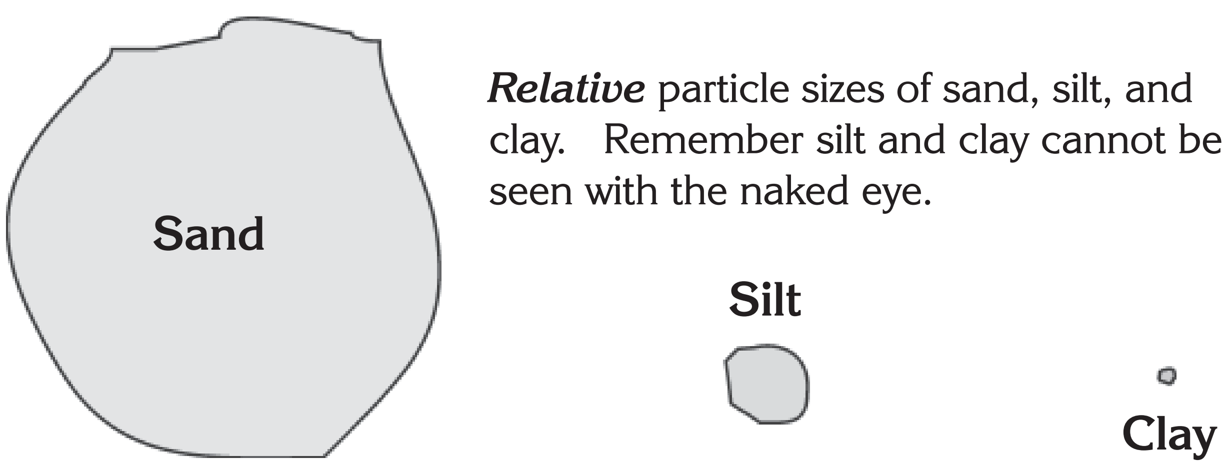
sand: soil particle that is classified between 2.00 and 0.05 mm
silt: a soil particle that is between 0.05 and 0.002 mm
clay: any soil mineral particle less than 0.002 mm.
loam: a mixture of sand, silt, and clay. (See the Textural Triangle)

Dirt Shake



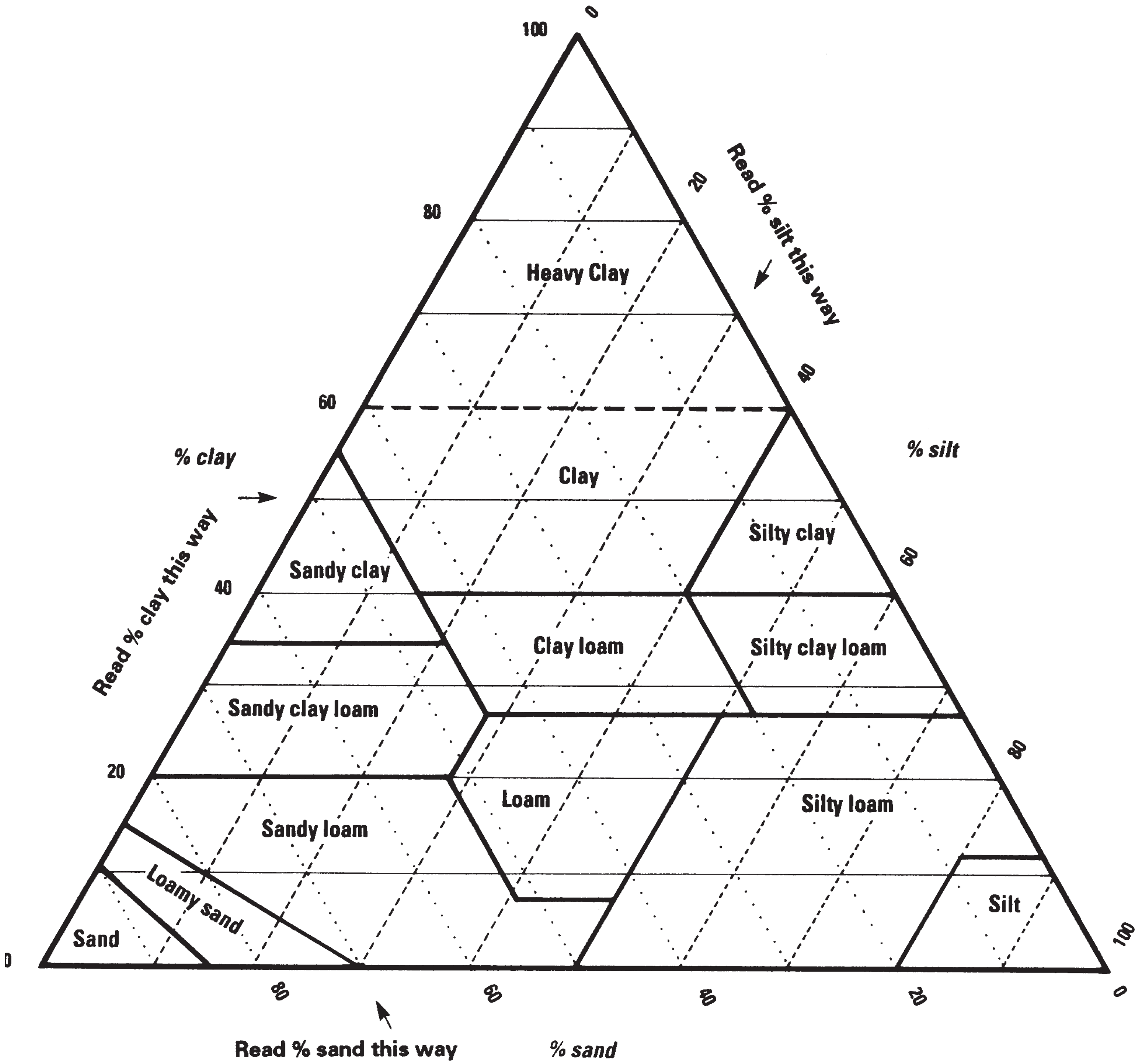
Particle Size

Relative particle sizes of sand, silt, and clay.   Remember silt and clay cannot be seen with the naked eye.



Soil Textural Triangle

To find the texture of your soil, read percentages of sand, silt, and clay in the direction of the arrows at the sides. For example, a soil with 20% clay and 40% each of sand and silt is a loam.



Dark Days

The Dust Bowl Is Not Played on New Years Day

Objectives

Students will be able to interpret and explain the modern and historical importance of agriculture and soil erosion in a local site, Utah in general, and the United States.

Students will research and report on soil erosion at a local site.

Materials

- Make copies of Dark Days story sheets.

Time

Activity 1: 60 minutes

Adapted from materials provided by Oklahoma Agriculture in the Classroom.

Getting Started

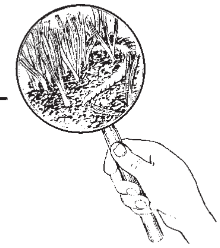
Make the necessary copies. Gather books from the library on the dust bowl. *Out of the Dust*, by Karen Heese, from Scholastic Trade, is a series of poems, written by a 15 year-old, that relates the hardships of living on her family's wheat farm in Oklahoma. Numerous other books are available. If possible search the Internet for additional resources. Here are a few places to begin: *Voices from the Dust Bowl*, http://lcweb2.loc.gov/ammem/afctshtml/tshome.html, and *The American Experience: Surviving the Dust Bowl*, http://www.pbs.org/wgbh/pages/amex/dustbowl.

For ***Additivity 2***, contact someone at your local Soil Conservation District (Zone) office or Utah State University Extension Agricultural Educator (phone numbers are located on page 88). Ask them to visit your class or provide you with some pictures of erosion that has occurred on a local site. It may be erosion from construction, on a home site, agriculture, mining, or nature (Bryce Canyon). Also ask them to discuss what has or is being done to correct the erosion problem. You could also go out with your camera and take some local erosion pictures of your own. This activity may also be conducted as a field trip.

Procedures

Activity 1 - Soil Stories

1. Share with students the background information. Use one or more of the books, the "Dirt: Secrets in the Soil" video, or web sites mentioned above to show students dust bowl scenes and illustrations of soil erosion.
2. Divide the class into five groups (or this activity may be conducted on an individual basis).
3. Provide each group with a photocopy of one of the photographs. Instruct groups to study and discuss the photographs. Explain that they are going to use the pictures to create a story. (pg. 30 is Black Sunday, pg. 31 is a farm in Oklahoma, pg. 32 is before and after scenes in Grantsville, Utah, pg. 33 is a "dust fence" in Grantsville, and pg. 34 is a



haystack full of dust in Grantsville.

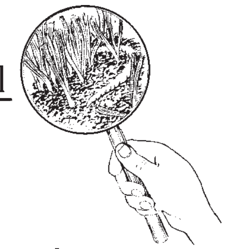
4. Give each group 5 minutes to develop a partial storyline about the photograph. One group member should record the group's thoughts and the group should condense those thoughts into one sentence. Encourage each group to write clear sentences that others will be able to understand.
5. After 5 minutes, each group should pass its final sentence, along with the photograph, to another group. A member of the next group should read the unfinished storyline to the group. The new group should then pick up the storyline and develop it one step further. A new recorder should condense the second plot development into another sentence. Instruct groups to choose a new recorder each time so everyone has the opportunity to assist in the writing process.
6. When each photograph and storyline has been to all but one group, instruct groups to bring the stories to some type of closure.
7. Have one person in each group stand up and read one of the final stories out loud.
8. Discuss the pictures and the impact they had on the tone of the stories.

Activity 2 - What's Your Soil Story?

1. Ask a local Soil Conservation District member or Utah State University Extension Agricultural Educator to visit your classroom, or provide your students with photographs of local erosion (discussed in the Getting Started section). If a field trip to the site is possible, the questions could be discussed on site.
2. Divide the class into groups or use the same groups that were made in Activity 1, ask the students to try and determine:

    1) How the soil erosion might have occurred?
    2) What the soil texture might have been (if possible bring in a sample from the area)?
    3) How the erosion could have been prevented?
    4) What if anything is being done to stop the erosion on the site?

3. One person in each group should record the groups response for each question. This will be their report.
4. Ask a spokesman from each group to share the group's report on the site. Compare reports from the groups by constructing a "Factors Possibilities chart." The four questions are the factors, and the possibilities are the groups answers or responses. For example your chart may look like the example chart on page 29.
5. When all the possibilities are listed, ask the students to vote as an individual, which possibility they think is most likely for each factor or question. They can choose any possibility not just their groups possibility.



6. Once the votes are tallied, ask a local expert to elaborate on their "votes" or explain to your students what an expert told you about the given erosion site. Were the classes conclusions correct?

Discussion
1. Ask students to discuss the way the stories were completed. Were students happy with the different twists the stories took as they passed from group to group?
2. Is another "Dust Bowl Possible?"

Background

The "Dust Bowl" is a term sometimes used to describe both a time and a place. The dust bowl region of the United States is the southern portion of the Great Plains, including parts of Texas, Oklahoma, New Mexico, Colorado, and Kansas. But Dust Bowl—with a capital D and B—refers to the time during the 1930's when drought, prairie winds, and poor land use practices combined to make life in this region miserable and farming nearly impossible.

On Sunday afternoon, April 14, 1935, clouds of dust moved through the dust bowl area and turned the sky black. People had to cover their noses and mouths so they could breathe. The day was to go down in history as ***Black Sunday***. Robert E. Geiger was a writer for the Associated Press who visited the area during that time. In a series of firsthand articles for the Washington Evening Star, Geiger described "pelting winds full of topsoil" and was the first to call the area "The Dust Bowl."

Dust storms were common on the Great Plains, but the west has had its own areas of dust storms and soil erosion. In Grantsville, Utah, (in the heart of the Tooele Valley) also during the 1930's, dust storms occurred that caused the same economic and ecological problems as the ones occurring in the Great Plains. The Grantsville dust bowl was caused from over grazing and drought. The Great Plains dust bowl was caused by similar conditions; however, farmers in the region had also been using a newly invented steel plow that dug up acres of prairie grasses. During the early 1900's gas-powered tractors and combines enabled farmers to cultivate million of acres and to enjoy bountiful harvests. But few farmers knew what they were doing exposed soil to wind and rain, setting the stage for mass erosion.

In Grantsville most residents recall the mid 1930's as dark and dirty. The Tooele Valley was first settled about 1847. Grass covered the valley floor. The grass was abundant. The Tooele Valley became one of the most popular winter grazing areas in the west. More and more livestock were allowed to graze in this grassy valley. Large outside trail herds making their way to Idaho and Nevada traveled across the valley lingering as long as possible to pick up any available feed. Slowly the grass disappeared and sage took its place. Over-grazing stunted and scattered the sage until what was once a range of plenty became almost barren.

From time to time, hot destructive brush fires swept through the valley, destroying what little perennial vegetation was left. Residents of the valley needed to increase their income. They plowed up many acres, that without irrigation couldn't yield crops on the yearly rainfall of 12 inches or less. The wind whipped up small dust clouds sending them into the city. Then, there came a drought. This was a recipe for an ecological disaster. Suffering from the catastrophe was not confined to the 1,200 citizens of Grantsville. The other 6,000 residents of the valley also breathed the dust. Soil from the Tooele Valley settled as far away as Salt Lake City, Ogden, and Logan. Idaho even got some of Utah's dust.

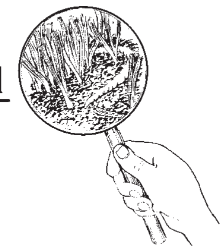
In the case of both dust bowls the situation was reversed largely due to government actions. And by the time rains returned, the situation had already improved dramatically. A special branch of the United State Department of Agriculture (USDA), the Soil Conservation Service (SCS) was created and went to work. The SCS used carefully-planned conservation methods and wiser farming techniques to restore grasses. With the help of state Cooperative Extension Services, SCS taught farmers how to conserve topsoils. Local Soil Conservation Districts were established and still, today help and promote conservation on public and private lands. Today the SCS is called the Natural Resource Conservation Service (NRCS).

Once the land was restored with vegetation farmers and ranchers moved back onto the land. Using improved farming and grazing management practices agriculture has returned to the Tooele Valley and the Great Plains.

Even today, the Dust Bowl is remembered as one of the most severe tragedies to affect both nature and people in this country's history. In the mid 1990's parts of Texas experienced a few years of drought. Farmers, ranchers and conservationists moved quickly to remove livestock to keep as many plants as possible on the range. Livestock can graze on rangelands if they are managed properly. Ranchers and public land managers must be able to move livestock when weather and range conditions will not allow the germination of new plants. We can learn from our mistakes!

Vocabulary

drought: a rain-less period of time.
grazing: livestock eating plants growing on open land.



Example of Factors Possibilities Chart

	Possibilities				
Factors	Group 1	Group 2	Group 3	Group 4	Group 5
Question 1	someone left a hose running	it rained very hard before grass was planted.	the land should have been leveled.	same as group 1	same as group 2
votes	*13*	*9*	*5*		
Question 2	sandy loam	silt loam	same as group 1	same as group 1	loam
votes	*22*	*0*			*5*
Question 3			***Etc.***		
votes					
Question 4					
votes					

Dark Days

Write a story about the photograph below.

Photo by G.L. Risen, Haskell Pruett Collection, courtesy of Oklahoma Historical Society, 207790.ST.DU.1.4.

1. ______________________________

____

2. ______________________________

____

3. ______________________________

____

4. ______________________________

____

5. ______________________________

____

Dark Days

Write a story about the photograph.

Photo by B.C. McLean, Edd Roberts Collection, courtesy of Oklahoma Historical Society, 20778.AG.SCS.OKLA.197

1. ______________________________

____

2. ______________________________

____

3. ______________________________

____

4. ______________________________

____

5. ______________________________

____

Dark Days

Write a story about these two the photographs of the same land.

Grantsville, Utah, 1935
Courtesy of Granstville Soil Conservation District

Grantsville Utah, 1937
Courtesy of Grantsville Soil Conservation District

1. ______________________________

____

2. ______________________________

____

3. ______________________________

____

4. ______________________________

____

5. ______________________________

____

Dark Days

Write a story about the photograph.

Courtesy of Grantsville, Utah, Soil Conservation District

1. ______________________________

____

2. ______________________________

____

3. ______________________________

____

4. ______________________________

____

5. ______________________________

____

Dark Days

Write a story about the photograph.

Courtesy of Grantsville, Utah, Soil Conservation District

1. ______________________________

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2. ______________________________

____

3. ______________________________

____

4. ______________________________

____

5. ______________________________

____

Caring for the Land

The Dust Bowl Is Not Played on New Years Day

Objectives

Students will be able to explain how people can have different opinions on soil management.

Students will identify cause and effect relationships in issues relating to agriculture and the environment.

Materials

• Worksheet copies

Time

Activity 1: 60 minutes

Adapted from materials provided by Oklahoma Agriculture in the Classroom.

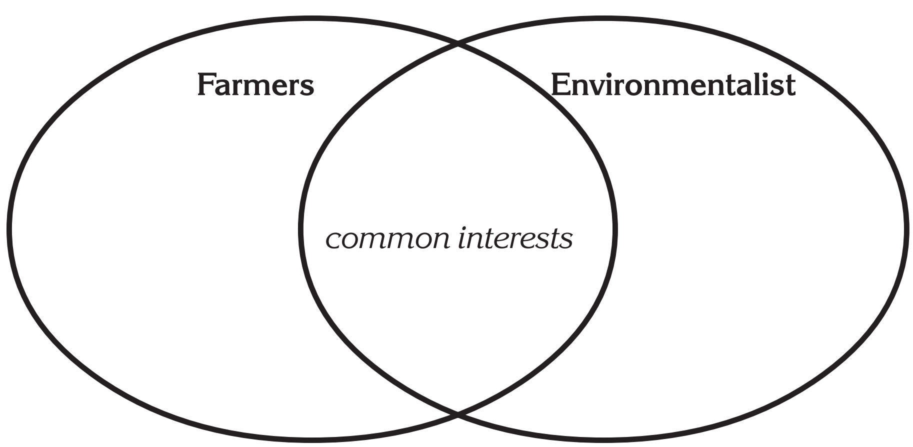
Getting Started

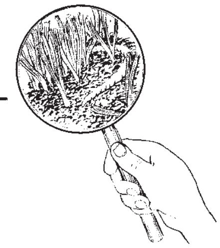
Make the necessary copies.

Procedures

Activity 1 - Soil Stories

1. Begin the lesson by asking students to describe and define in their own terms; "farmer," "environmentalist," and "environmental activist."
2. Ask students if they have heard any news reports about conflicts between farmers and environmental activists (endangered species, grazing on public lands, wetlands, etc.).
3. Draw Venn diagram on the chalkboard (see the example below), and ask students to list things on which farmers and environmental activists disagree and things they have in common. (Both care about the land, both need food to eat. You may have to make very large circles.)
4. Share the background material and discuss problem/solution and cause/effect relationships.
5. Divide your class into three groups, and hand out copies of one of the worksheets to each group.
6. Students should read the situations on the student worksheet and identify the cause and effect and the problem and solution in each one. Students should also identify the alternatives and their effects.





Discussion

1. Why do we need farmers? (food, clothes, shelter, for other manufacturing goods)
2. Who should decide how to use the land?
3. How should we decide how to use the land?

Background

The land is the livelihood of farmers. Most people, farmers included, try to avoid practices which might harm or destroy their way of life. Despite this fact, agriculture is blamed for many environmental problems.

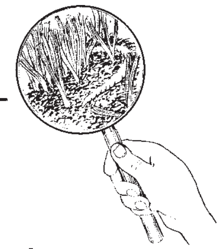
People began polluting long before they knew that was what they were doing. Early settlers in this country dumped their trash into rivers and streams without considering the harm it might do. Before gasoline-powered tractors began releasing exhaust fumes into the rural countryside, work horses were creating pollution problems of their own. The average farm horse produced 35 pounds of manure or solid waste and 2 gallons of liquid waste each day. Although horse manure can be an excellent fertilizer when spread across a field, large amounts in small areas can create high concentrations of nitrogen and bacteria which may filter through the soil into the underground water supply.

Thousands of years ago people began to farm because they found they could produce more food that way than they could by hunting and gathering. Over the years people discovered that some farming practices hurt the land. Cutting down trees, clearing away vegetation and letting animals overgraze left topsoil unprotected so winds and water could erode it away. Planting the same crop on the same field year after year used up all the soil's nutrients. As a result, the fields lost their ability to produce good crops.

Early farmers learned from their mistakes and developed better farming methods. They learned to farm on the contour and build terraces—ridges of soil built across the slope to slow the runoff of water. They learned to rotate their crops—move them from one field to another to let the land rest. They learned how to spread animal manure on their fields to restore organic matter and nutrients.

When European settlers came to the New World, they were dazzled by what seemed like endless ***resources*** **—**acres and acres of rich soil which had never been used for farming. Many farmers abandoned the methods their ancestors had learned for protecting the land. When one field began to produce poor crops, the farmer would simply abandon it and move farther into the wilderness.

As more people moved in, they began farming sloping lands that could easily wash away and soils that could easily blow away. In the early 20th Century, farmers began plowing up the native grasses of the Southern Plains to plant wheat. Since that land had never been farmed before, farmers had no way of knowing that their hard work would be the first step toward creating what came to be known as the ***Dust Bowl.*** A severe ***drought*** dried up the exposed soil. With no grass roots to hold the sandy soil in place, it simply blew away with the strong summer winds.

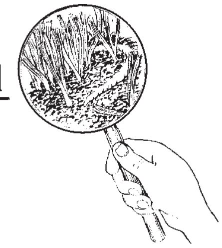


Recognizing a problem is the first step toward solving it. Farmers didn't know plowing up the Plains would cause the soil to blow away. Once they saw what had happened, they did what farmers have been doing for thousands of years. They began thinking of different farming methods they could use that would protect the soil.

One method involved using chemicals on weeds instead of turning the soil with a plow. For many years, this method seemed like an excellent way to keep the soil in place while producing the food people needed. Then scientists discovered the chemicals were getting into the water supply and making birds, fish, animals and people sick. Today farmers and agricultural researchers are working on ways to solve that problem and many more.

Vocabulary

chemical (inorganic) fertilizers: synthetic materials, including nitrogen, phosphorus and potassium compounds, spread on or worked into soil to increase its fertility.
contaminate: to make impure by contact or mixture with harmful bacteria, fungi, or dangerous chemicals.
farmer: an individual who works with the land, plants and animals to produce raw materials for food, clothing, shelter, and other products that are used in industry and manufacturing.
decompose: to decay or break down into small pieces.
environmental activist: a person who cares about the environment, involved in shaping public perceptions and making policy. May or may not have educational training in environmental science.
environmentalist: a person who cares about the environment and the relationships in the environment. Usually has studied environmental science.
legume: a family of plants which, with the aid of symbiotic bacteria, convert nitrogen from the air to build up nitrogen in the soil. Legumes include many valuable food and forage species, including peas, beans, peanuts, clover, and alfalfa.
organisms: any living individual, plant or animal.
pesticides: word used to describe a variety of substances used to control insects (insecticide), plants (herbicide), or animals (rodenicide for mice, etc.).
rotating crops: to plant or grow crops in a fixed order of succession.



Answers to cause and effect relationship worksheets.

Soil Erosion

Problem:	soil erosion
Cause:	overgrazing, clearing vegetation from soil
Solution:	rotational grazing, no-till farming
Effect(s):	soil washes or blows away
New Problem:	use of the wrong amount of pesticides and fertilizers may cause water pollution.

Chemical Fertilizers and Pesticides

Problem:	overuse of chemicals
Cause:	using chemical fertilizers and pesticides
Solution:	Integrated Pest Management
Effect(s):	increase production, pollutes water
New Problem:	none identified in text

Wetlands

Problem:	loss of wetlands
Cause:	draining or filling in wetlands
Solution:	passing laws to protect wetlands
Cause:	draining or filling in wetlands
Effect(s):	flooding, loss of habitat for wildlife, loss of natural water purification
New Problem:	people are unable to use their property as they wish

Caring for the Land

Identify the problem and the solution and the main cause and effect relationship in the information below.

Soil Erosion

Soil erosion is what happens when soil is washed or blown away. In most places, trees, grass and other plants hold soil in place. In Utah annual rainfall is low, the state average is 14 inches a year. Erosion in our state is primarily caused by wind. During the 1930's livestock in Tooele County were allowed to overgraze the range and farmers plowed up some of the remaining land and planted ***grains*** (wheat, barley, etc.). Between 1933 and 1935, the area had even less rainfall than usual. With large areas of land having no grass root system to anchor it, much of the soil blew away. The dust storms and sand storms buried roads and houses. During this same period of time the Great Plains were also experiencing a dust bowl. Clouds of dust from this area reached as far east as Washington, D.C.

In response to the disaster, the federal government created the Soil Erosion Service and the Civilian Conservation Corps to find ways to recover the land. Workers replanted grass, planted trees and showed farmers better agricultural methods to help them protect the soil. As time has progressed, the Soil Erosion Service became the Soil Conservation Service, and in 1996 changed its name to the Natural Resource Conservation Service. Citizens of a local area, in each state, that concern themselves with the conservation of soils belong to a governing board called the Soil Conservation District. Today in Utah, with the help of Conservation Districts and Utah State University Extension, farmers and ranchers learn how to better manage the land.

One method of grazing livestock is to place large numbers of animals out to graze on one piece of land for a short period of time and then move them to a new pasture. This allows the animals to get the nutrition they needed while cutting down on overgrazing and erosion. This practice is known as rotation grazing. Another method being used by farmers is no-till farming. A farmer using this method plants seeds directly into a field that still has last years plant stems, stalks and leaves on or in the ground. For this method to work, the farmer must use herbicides to kill unwanted grass and weeds. This method helps stop soil erosion, but some people worry that the herbicides used might pollute the underground water supply.

Problem

Cause

Solution

Effect(s)

Does the solution create another problem? If so, what is it?

Caring for the Land

Identify the problem and the solution and the main cause and effect relationship in the information below.

Chemical Pesticides and Fertilizers

In the natural plant cycle, plants take nutrients from the soil and return them when leaves and other plant parts die and *decompose*. When people take plant matter (grains and hay) from the soil, they are also removing *nutrients*. Over time, if the nutrients aren't replaced, the soil can no longer provide enough nutrients for plants to grow. In early years, farmers replaced these nutrients by adding animal manure, growing a *legume* crop, resting fields or *rotating crops* from year to year so fields could restore some of their nutrients through natural processes.

In the 1920s, farmers began using tractors instead of horses and mules. They began using *inorganic* nitrogen fertilizers to replace the organic nitrogen the fields had been getting from animal manure. Nitrogen is one of the major nutrients plants need to grow. In the 1940s, farmers learned to use chemicals to kill insects and weeds. These chemicals now help one American farmer provide food and fabric for 130 non-farmers.

Chemicals have caused some problems, too. Chemical *pesticides* can kill other *organisms* besides the ones for which they are intended. Some of the organisms they kill are useful ones that help crops grow. *Chemical fertilizers* also cause reactions in the soil that, over time, can make the soil less desirable for plant growth. Chemicals used in agriculture can also *contaminate* the water we drink. Sometimes they move through the soil and enter the underground water supply, and sometimes they are carried by rainwater into lakes, rivers and streams. Farmers are concerned about these problems. They are trying new methods that will help them grow enough food for all the people to eat without damaging their land and water supplies. These methods help farmers use fewer chemicals on their fields. One method is *Integrated Pest Management*. Under this method, farmers first find out how many and what kinds of pests they have. They don't use chemical pesticides unless there are enough pests to cause economic crop damage. They often choose environmentally-friendly pesticides or beneficial insects to control the pests.

Another method makes use of a computer installed in the farmer's tractor. The farmer takes soil samples from his or her fields and has them chemically tested at a laboratory. The computer receives mapping information from a satellite in space and then uses the results of the soil tests to tell the fertilizer spreader where to place the fertilizer and how much to use. This is called "precision farming."

Problem

Cause

Solution

Effect(s)

Does the solution create another problem? If so, what is it?

Caring for the Land

Identify the problem and the solution and the main cause and effect relationship in the information below.

Wetlands

Wetlands are low areas that are saturated with water. Marshes and swamps are wetlands. Wetlands cover only a small part of Utah but provide critical aquatic habitat in an arid environment as well as economic and other benefits. Utah wetlands include the shallows of small lakes, reservoirs, ponds, and streams; riparian wetlands; marshes and wet meadows; mud and salt flats; and playas. The largest wetlands in the State surround Great Salt Lake. Because of the importance of Great Salt Lake and its associated wetlands to migratory waterfowl and shorebirds, in 1991 the lake was designated a Hemispheric Reserve in the Western Hemisphere Shorebird Reserve Network.

Wetlands are an important part of the earth's ecosystem. They act like sponges to store water during the wet times of the year and release it into the aquifers and underground streams where we get most of our drinking water. When there are no wetlands to soak up the water, rains are more likely to turn into floods which destroy homes, businesses and farms. Plants that grow in wetlands hold the soil and help keep it from being washed away.

Wetlands also help purify water. They filter out harmful chemicals and wastes. Dirty water gets a good cleaning when it flows through a wetlands

Wetlands provide homes for many birds and animals that need wet places to grow and reproduce. They are important rest and food stops for many migrating birds. Many endangered plants and over l/3 of our endangered animals live in or use wetlands.

At the time of European settlement, there were about 215 million acres of wetlands in the lower 48 states. In the last 200 years over 54 percent of these wetlands have been lost. Most were converted to agricultural uses. For many years people thought of wetlands as obstacles to farming and breeding grounds for mosquitoes. The government even encouraged landowners to turn wetlands into dry lands.

Now we know more about wetlands. We realize how much they help the environment, wildlife and humans. Federal laws have been passed to protect and preserve them. Some people don't like the wetland laws. People who have wetlands on their property think they should be able to use their property to earn money to support their families.

Problem

Cause

Solution

Effect(s)

Does the solution create another problem? If so, what is it?

Perkin' Through the Pores

Slip Slidin' Away

Objectives

Students will be able to determine the water holding and draining capacities of different soils.

Students will investigate how organic matter increases the amount of water soil will hold.

Materials

- Comparison Graph sheet
- 4 cups of four or five different dry soil samples (make sure one is quite sandy and another quite clayey)
- 5 cups of potting soil
- funnel (2 liter bottles cut in half)
- coffee filters (cupcake shape)
- water
- measuring cups
- stopwatches or a clock with a second hand.

Time

Activity 1: 40 minutes
Activity 2: 30 minutes
Activity 3: 30 minutes

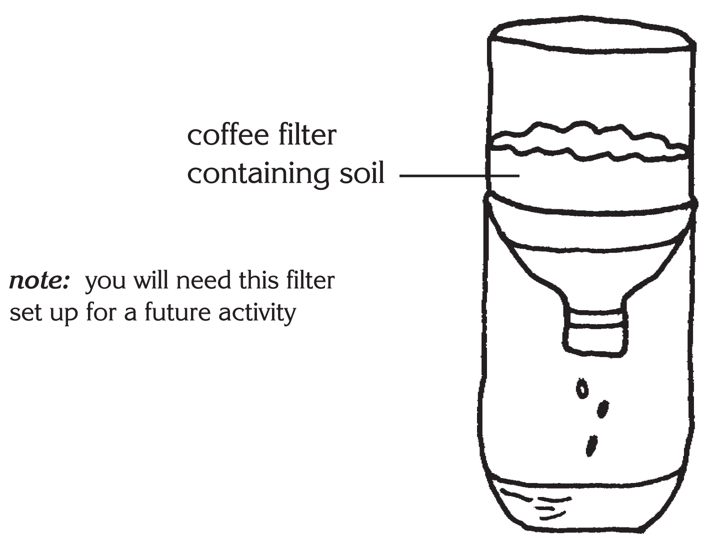
Getting Started

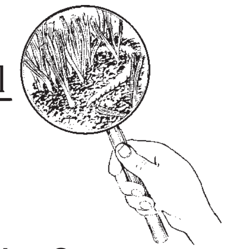
Gather materials, make necessary copies, and the Comparison Chart transparency. Prepare the 2-liter funnels as shown in the picture below. Place the bottle on a table and measuring up from the table surface, place a mark at 5-1/2 inches. This is where you should cut the bottle in half. If you need help obtaining different soil samples, contact a local resource person or contact the Agriculture in the Classroom Coordinator, numbers are noted on page 88.

Procedures

Activity 1 - Mark, Get Set, Go

1. Divide the class into four or five groups, depending on how many soil samples you have.
2. Provide each group with a funnel and bottom (made from a 2 liter bottle), two coffee filters, 1 cup of one of the soil samples, a measuring cup and water.
3. Place one coffee filter into the funnel and then to measure and add 1 cup of soil into the filter. Cover the sample with another filter. This will ensure even coverage and avoid splashing.
4. One person in each group needs to be designated as the time keeper, another as the water pourer.
5. When the time keeper says go, the water pourer should pour 2 cups of water into the funnel.

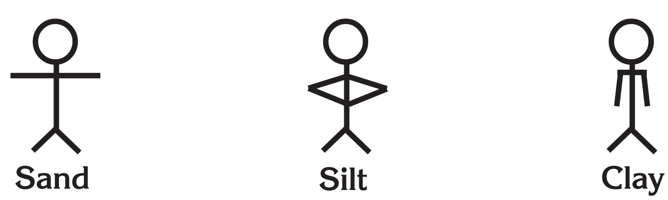




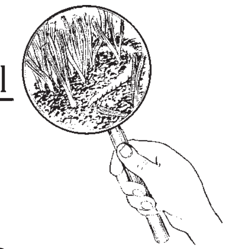
6. Time should be kept until most of the water has gone through the soil sample. Some will go through quite quickly while other could take 30 minutes or more. So proceed with Activity 3 keeping an eye on the samples.
7. Compare the time it took for water to percolate through each sample. Add the data to the Comparison Graph.
8. Pour out and measure the water that percolated through the sample. Record this on the graph.

Activity 2 - Adding Organic Matter
1. Duplicate steps 1 through 4 in Activity 1.
2. Add one cup of potting soil (high in organic matter) to each filter. One student should mix in the organic matter with his or her finger being careful not to puncture the filters.
3. Duplicate steps 5 through 8 in Activity 1. Be sure to record the data on the Comparison Graph.
4. Discuss the background material and ask students to identify which sample had the most sand and which had the most clay. Add this evaluation to the Comparison Graph.

Activity 3 - Pick a Path
1. Remind students about what they learned about particle sizes (Types by Texture lesson).
2. Divide the class into four groups. Assign each group one of the following titles: water, sand, silt, and clay.
3. Soil particles should position their arms like the examples in the drawing below.
4. Group the sand particles together so that each particle is touching another (finger tip to finger tip). Now tell students in the water group to try and run through the sand group (under their arms). They should be able to run through will little difficulty.
5. Repeat the above step for silt and clay. Silt particles should be touching elbows, and clay particles should be touching shoulders. Discuss the results.
6. Mix up the sand, silt and clay particles (students) to make a loam. Ask the water group to run through. Discuss the results.



Discussion
1. In the "Pick a Path" game which group did the water have a more difficulty running through?
2. Which types of soils hold more moisture?



3. Does the amount of organic matter effect the water holding capacity of soil?
4. Looking at the Comparison Chart which soil had the most sand? Which had the most clay?
5. Can you figure out the water holding capacity of the soil?
6. Who needs to know about how water percolated through the soil? Why?

Background

Sand, silt and clay are inorganic materials. Sand is made up of larger particles which can be seen with the naked eye. It has a coarse feel and allows water to move through very quickly. Silt particles are too small to see with the naked eye. Silt is often found in places that have flooded and dried out again. Clay is made up of very tiny particles. The particles fit together so closely that it is difficult for water to flow through.

The best kind of soil for plants allows water to move through slowly enough so that some of it stays in the soil for the plants to use. Water moves too quickly through sand. It moves very slowly through clay, but clay holds the water so tightly that plants can't get to it. Soil that is good for plants has a mixture (a loam) of sand, silt, clay and organic material, or humus. Humus acts like a sponge to help the soil capture water. Humus is formed when plants and animals die.

When organic matter is used up, soil packs together in clods. A cloddy soil has fewer air spaces. A soil with more organic matter will be crumbly. Not only does a crumbly soil take in water faster than a cloddy one, it holds more. The thoroughly decomposed organic matter (humus) in a crumbly soil can absorb lots of water. On a dry weight basis, this humus has a water-holding capacity of several hundred percent and acts like a sponge. In addition to the water held by the organic matter, water held in the pores between the soil particles and between the soil granules is greater. Hundreds of very fine soil particles are glued together by the organic matter into soil granules.

This increased water-holding capacity of soils high in organic matter makes a big difference in the intake of water. These well-managed soils can absorb most of the rain and snowmelt (if the soil is not frozen). This means there will be less erosion. Streams will run clear. Of course, when the soil is saturated by a long period of rainfall, any additional water then runs off. But until the soil is saturated it will store up water and let it go gradually.

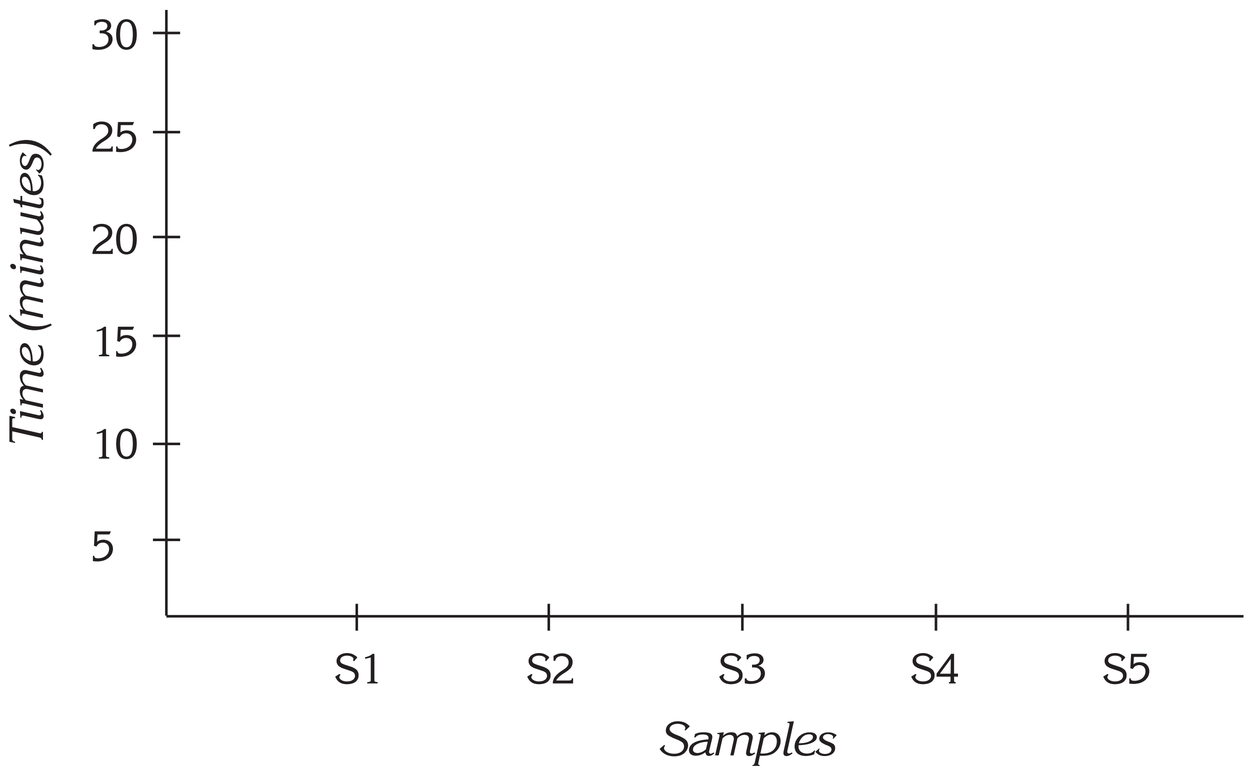
Crops use lots of water. Vegetables use an average of 2 acre-feet, or 650,000 gallons an acre. Cotton takes 800,000 gallons an acre. An acre of alfalfa needs over a million gallons. To produce one ear of corn takes over a barrel of water. Organic matter helps soil store more water and helps prevent erosion and produces better crops.

Vocabulary

humus: thoroughly decomposed organic matter

organic matter: products derived from living organisms, like plants and animals.

Perkin' Through The Pores Comparison Graph



What was the amount of water collected after percolation in each sample?

________	________	________	________	________
S1	S2	S3	S4	S5

1. Which sample do you think had the most sand? __________________

2. Which sample had the most clay? ______________

3. Which sample had the most organic matter? _______________ *(hint: compare the amount of water collected and the speed of percolation and the visual evidence)*

Keeping Soil in Its Place

Slip Slidin Away

Objectives

Students will be able to demonstrate rain drop splash or splash erosion, and determine its impact on bare soil.

Students will be able to visually identify types of erosion.

Materials

- Splash Zone Target (these could be made on a transparency, this way they could be washed and used year after year)
- Graph handout
- Soils on the Move handout
- 5 teaspoon of dry soil
- eyedroppers
- water
- rulers
- Erosion Control Practices transparency
- Soil on the Move transparency

Time

Activity 1: 40 minutes
Activity 2: 20 minutes
Activity 3: 20 minutes

Getting Started

Gather materials, and make the necessary copies.

Procedures

Activity 1 - Splash Zone

1. Divide the class into five groups.
2. Give each group a Splash Zone Target, eyedropper, and a small container of water.
3. Instruct student to put enough soil (about a teaspoon of dry soil) in the center of their target to just cover the center circle.
4. Fill the eyedropper with water
5. Hold the eyedropper about 12 inches (30 cm) above the soil sample.
6. Drop 5 drops of water directly onto the soil sample. If a drop misses the soil, continue until 5 drops hit the soil.
7. Record the number of water "splashes" drops containing soil in each zone.
8. Complete the graph to show your results.
9. Discuss questions in Discussion section before moving on to Activity 2.

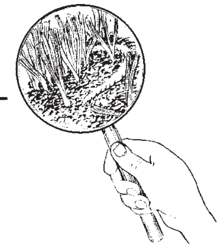
* *You may want to repeat this activity with drops from 1 meter high. Also try the activity with wet soil.*

Activity 2 - Soils on the Move

1. Introduce students to the types of erosion using the erosion section in the "*Dirt:* Secrets in the Soil" video and the background information.
2. Provide each student with a copy of the "Soils on the Move" handout or make a transparency.
3. Label the handout or transparency. Discuss how each type of erosion differs.

Activity 3 - Methods for Controlling Soil Erosion

1. Introduce students to the methods for controlling erosion using the erosion section in the "*Dirt:* Secrets in the Soil" video and the background information. You could also duplicate the demonstration using the erosion trays "turkey pans" in the video.



2. Student should complete the Erosion Control Practices activity sheet, or use it as a transparency for discussion.
3. Discuss the various methods and why they are used.
4. Answers: 1) streambank erosion, 2) gully erosion, 3) wind erosion, 4) rill erosion, 5) sheet erosion.

Discussion

1. What did you observe? How did the soil particles move from the center of the target? (they were picked up and moved with the water)
2. Which zone contained the most number of water drops with soil particles? Why?
3. Which zone contained the least number? Why?
4. What would happen if the drops were larger? (splashes would travel further)
5. How might you prevent splash erosion? (plant vegetation, cover the soil with mulch)
6. How do farmers decide which erosion control methods to use? (it depends on the slope, soil types, and what he or she wants to plant)

Background

Erosion is a naturally occurring process. Erosion has given us some of our most beautiful landscapes. There are beautiful erosion formations such as the Grand Canyon, Kolob Canyon (Zion National Park) the San Rafael Swell (Emery County) or Bryce Canyon, to name a few. Erosion is the loosening, transportation and relocation of soil particles from one place to another. Erosion occurs primarily due to the action of wind and water. The rate and extent of erosion are determined by soil type and condition, slope of the land, plant cover, land use and climate.

Erosion does not occur only on wilderness landscapes, and the effects are not always positive, especially when you are talking about productive topsoil. Landslides, can bury towns and claim thousands of lives. Streams or rivers loaded with eroded soil can turn sources of clean drinking water into major health hazards.

Water erosion includes raindrop splash, sheet erosion, rill erosion, gully erosion, and slumping or mass erosion. ***Raindrop splash*** is the most obvious on bare ground during a torrential rainstorm. The raindrops strike the ground and upon impact break soil particles apart, splashing these particles into the air. The impact of raindrops can be lessened by plant cover. Plants break the fall of the raindrops and allow for water infiltration or percolation.

Sheet erosion is the washing away of a thin surface layer of soil over a large area of land. Because sheet erosion occurs evenly, it is generally not obvious until most of the topsoil is removed.

Rill erosion may be noticeable on sloping bare ground after a rainstorm. Water forms small, well defined channels that carry soil away from the sides and bottom of these channels. The rills of channels erode more soil as they move downslope and increase in size.

When rills become large, the process is called gully erosion. This severe form of soil erosion removes tones of soil from the sidewalls and bottom of the gully.

Streambank (and coastal erosion) erosion is the cutting away of the banks by water. It is generally a slow process which represents the normal situation occurring along most streams. It is most active during floods when the amount and velocity of water are the greatest and when the bank soils are submerged under water and saturated.

To control erosion plant cover is usually the best solution. But to grow our food farmers make ***furrows*** in the land for ***row crops***. A farmer can use a variety of methods to "keep soil in its place." A farmer may plant his of her crops around the curve of a hill rather than up and down the hill, this is call ***contour planting***. Plowing will also be done on the contour. Farmers may also build ***terraces***. Terraces are wide ridges that go around a hill to prevent water from rushing down the hill too fast. On steep hillsides, rather than clear the area for cropland, farmers will maintain the area in ***forest and grass***. Water always runs down hill, farmers do not plow in these low areas where water collects, instead they maintain these low ditch areas as ***grassed waterways***.

Soils susceptible to wind erosion should be kept covered with some kind of vegetation. If this cannot be done year-round, a ***windbreak*** of trees and shrubs may be planted. Windbreaks are rows of trees planted to slow down the wind and prevent soils from blowing in the wind.

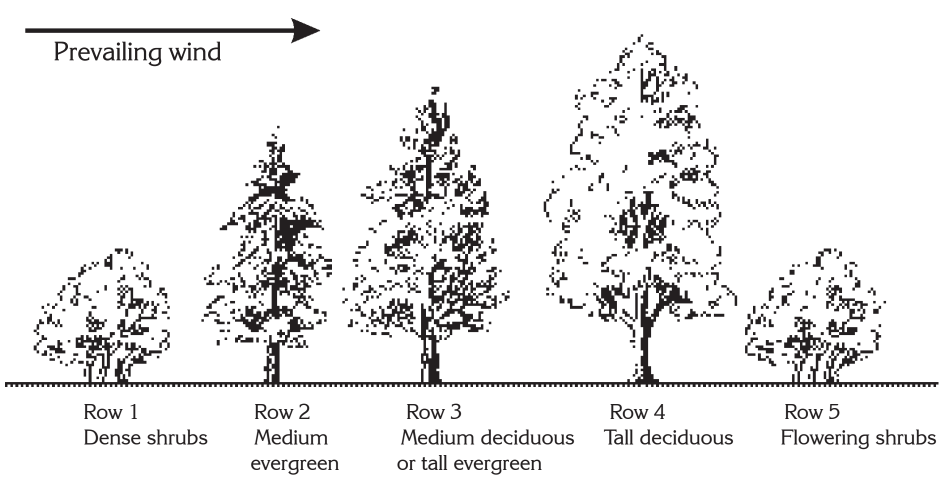
Vocabulary

mulch: a covering placed on bare soil to keep it from eroding, loose leaves, straw, bark chips etc.

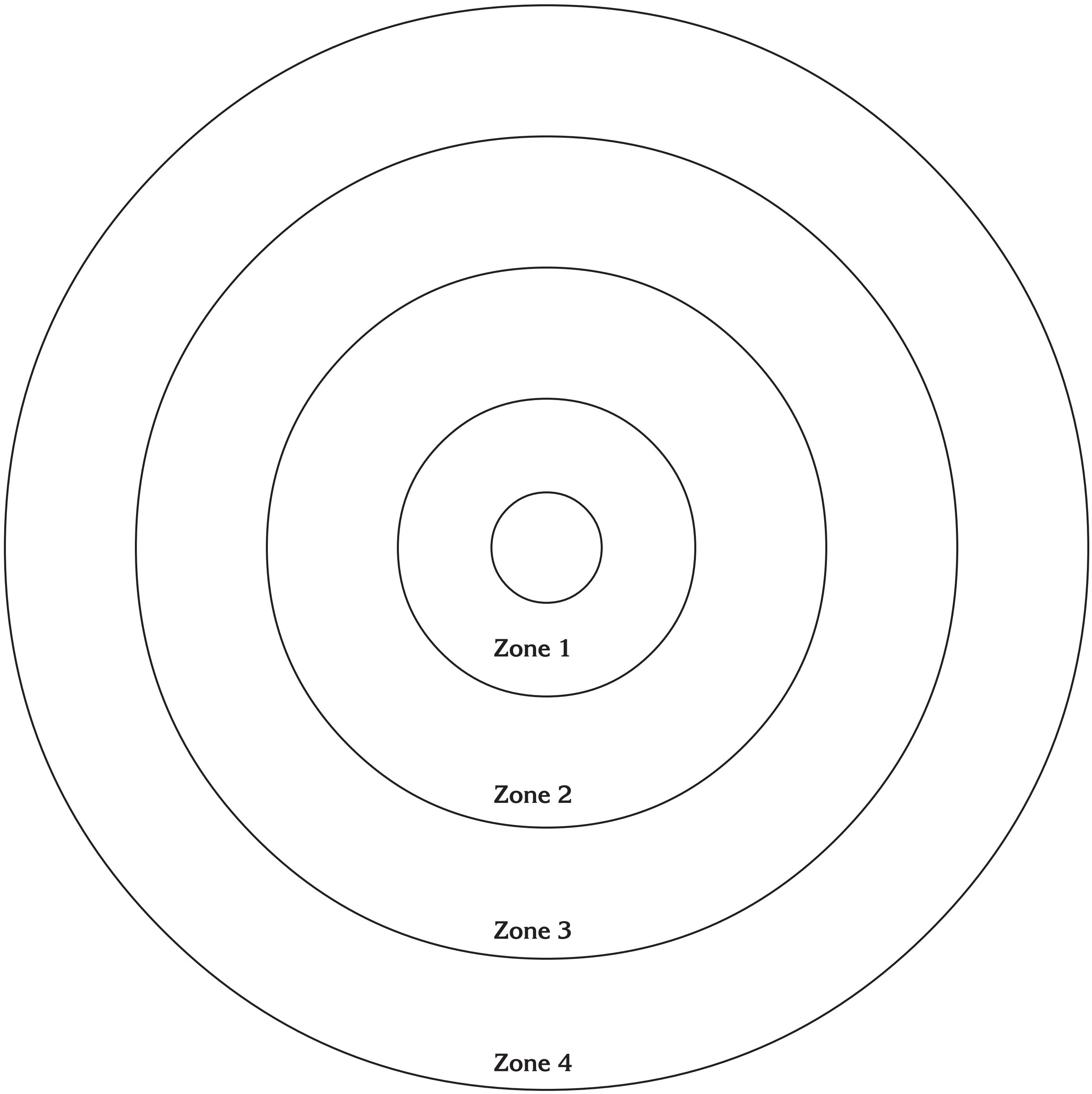
furrows: small ditches (2-6 inches deep) between the rows of plants used to convey water.

row crops: plants planted in a row to facilitate harvesting and watering.

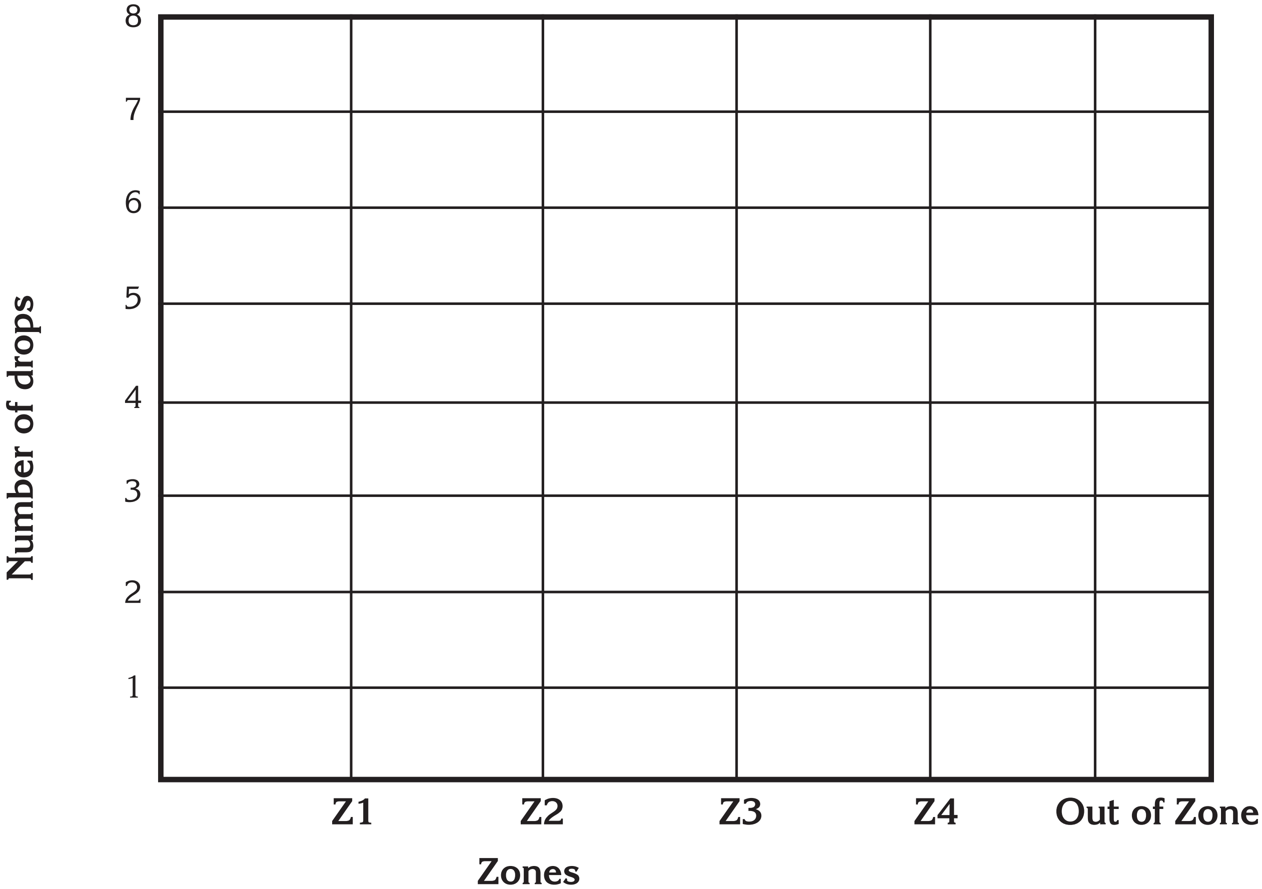
Windbreak



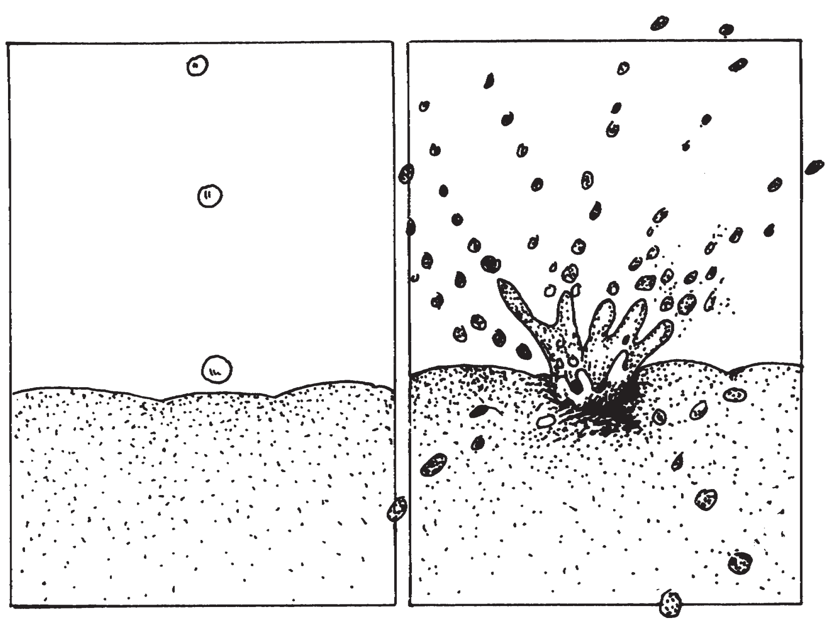
Splash Zone Target



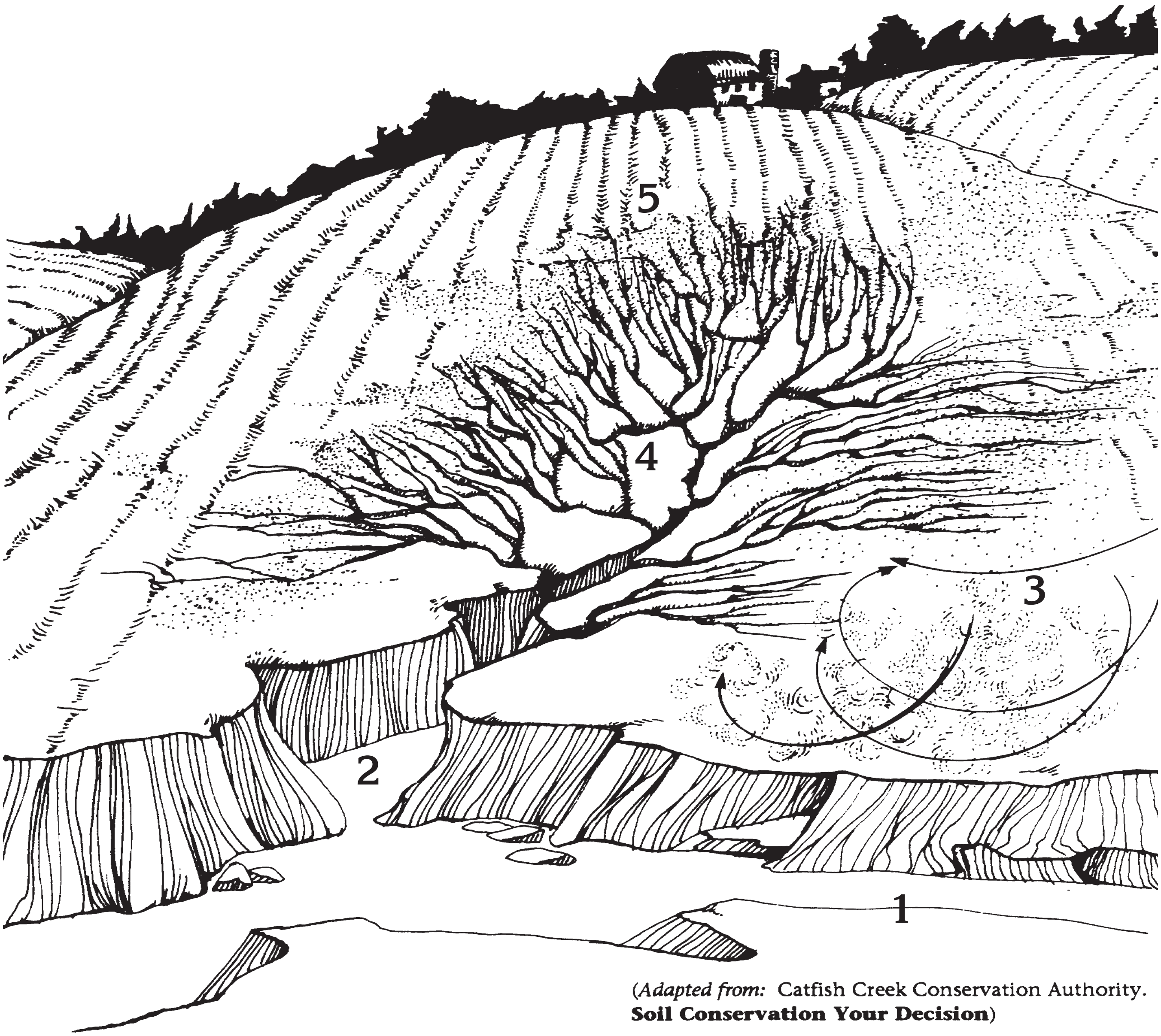
Splash Zone Graph



Raindrop splash



Soils on the Move



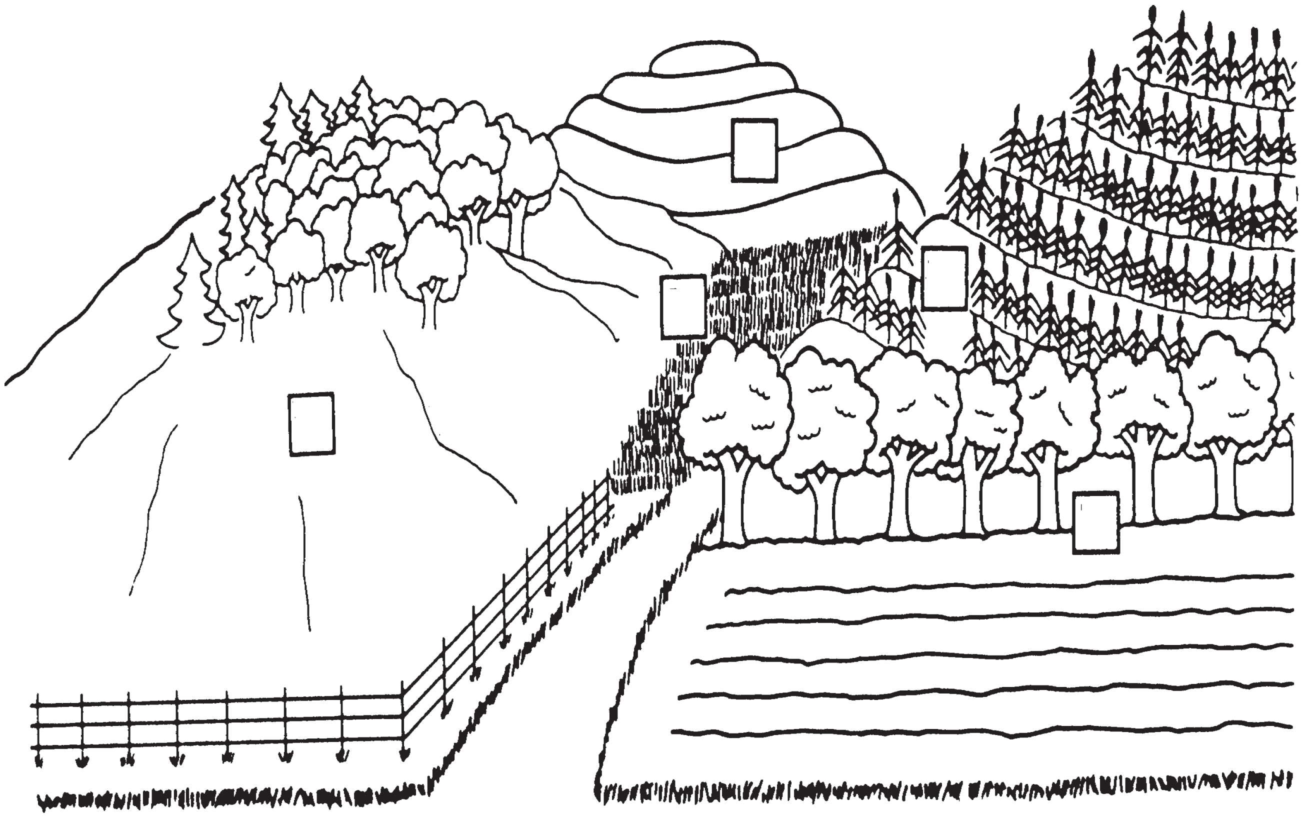
(*Adapted from:* Catfish Creek Conservation Authority. **Soil Conservation Your Decision**)

Identify which area is:

____ wind erosion ____ gully erosion ____ rill erosion

____ streambank erosion ____ sheet erosion

Erosion Control Practices



Farmers use several methods to conserve soil. Match the number of practices below in the correct box in the picture.

1. **Contour Planting:** plant crops around the curve of a hill rather than up and down the hill.
2. **Terraces:** wide ridges that go around a hill to prevent water from rushing down the hill too fast.
3. **Forest and Grass Areas**: keep steep hillsides in trees or grass rather than clear for cropland.
4. **Grassed Waterways:** plant grass and don't plow low areas in a field where water usually runs.
5. **Windbreak:** rows of trees planted to slow down the wind and prevent soils from blowing.

How Much Is Dirt Worth?

Hitting Pay Dirt

Objective

Students will appreciate topsoil and be able to communicate soils economic value.

Materials

- large apple
- knife
- cutting board
- Earth's Soil Resource pie chart activity sheet

Time

Activity 1: 15 minutes
Activity 2: 20 minutes

Adapted from materials provided by Oklahoma Agriculture in the Classroom.

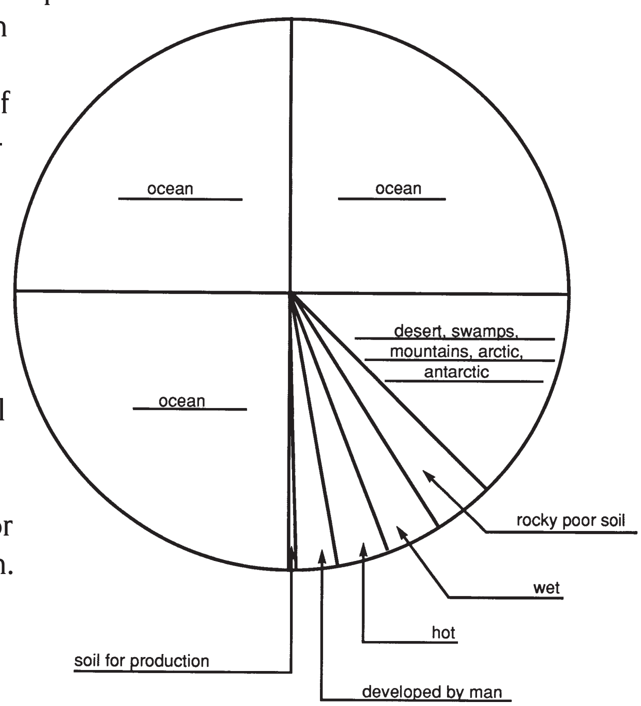
Teacher Preparation

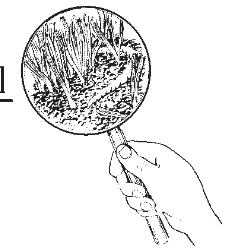
Gather materials, and make the necessary copies.

Procedures

Activity 1 - Slicing-up Earth's land resources.

1. Demonstrate the following: Imagine that the apple is planet earth.
2. Students should fill in their pie chart as you begin to tell them what each slice means.
3. Cut the apple in quarters. Oceans occupy 3/4 of our earth. One quarter of our earth is our land area. Take this quarter and cut it in half, now you have two 1/8th sections of land. One-eighth of our land is not suitable for producing food, this is the deserts, swamps, mountains and the Arctic and Antarctic regions. The other eighth represents land where people can live. Slice this 1/8th section lengthwise into four equal parts. Now you have four 1/32nd of an apple. The first section represents the areas of the world which have rocky soil that is too poor for any type of food production. The next two sections represents land that is too wet or too hot for food production. The fourth section represents the area of the world developed by man. Carefully peal the last 1/32nd section. This small bit of peeling represents all the soil of our earth which humans depend upon for food production.





Activity 2 - Cost versus Value

1. After reading the background material. Demonstrate the following problem and scenario on the board:

    Let's say you have 1 acre of land and 7 inches of topsoil. If every inch is worth $10.00 (working with round numbers make the math a bit easier) your topsoil would be worth $70.00.

2. Because of erosion you lose 1/2 an inch of topsoil each year. How much in dollars would you be losing each year? ($5.00 of topsoil from an acre).
3. What is your topsoil now worth? ($65.00)
4. Discuss what other losses would occur. (Because of lost topsoil, crops will not be as productive and your income would go down. You've lost topsoil and money!)
5. At your current rate of topsoil loss, how many years will go by before all 7 inches of topsoil are gone? (14 years)

Discussion

1. Since soils provide our food, how is it we can place a value on them?
2 What is an acre of pristine farmland worth?
3. How do we decide what to pay for an acre of land?
4. What can you do to minimize the loss of topsoil?

Background

Agriculture is the nations largest employer. Roughly 20 out of 100 people rely on farms and farming for their livelihood. The United States exports more farm products than any other country in the world. It costs the farmer more to produce good crops on poor soil and this cost is passed on to the consumer "you" in higher prices at the grocery store.

Look at the economics or the money earned by our productive soils. Soils produce our food, keeping us alive. How do we place a value on human life? Food production or agriculture employs 20 out of every 100 people in the United States. Agricultural exports are translated into billions of dollars for United States trade. The soils on this planet are essential to our survival! Good soils are a limited resource and because it takes an average of 100 to 500 years to make 1 inch of topsoil, soil is considered a nonrenewable resource. It is difficult to place a value on our soils. The best thing to do is conserve what we have. Soil loss or erosion effects our country's economics and our lives.

Famine and economic depression is the end result of lost topsoil. So good farmers use conservation measures such as ***strip cropping***, crop rotation, grassed waterways, wind breaks, ***cover crops***, contour planting, terracing, and other methods to control wind and water erosion.

In Utah 5 tons of topsoil is lost each year. What does this mean? Some of our most productive soils are being lost each year. We have slowed erosion over the past 30 years, but we are still losing some of our topsoil. Fertile topsoil is what gives us higher yields or more food per acre. What will we do when our topsoil is gone? Farm the subsoil and get lower yields? That's a possibility, but that is why agricultural scientists are working hard to find out how we can sustainably grow and produce food. This area of agricultural research is called sustainable agriculture. ***Sustainable agriculture*** involves studying methods and practices to keep topsoil in its place, increase soil fertility, and use lower energy inputs to produce our food. Soil is important economically and for our very survival!

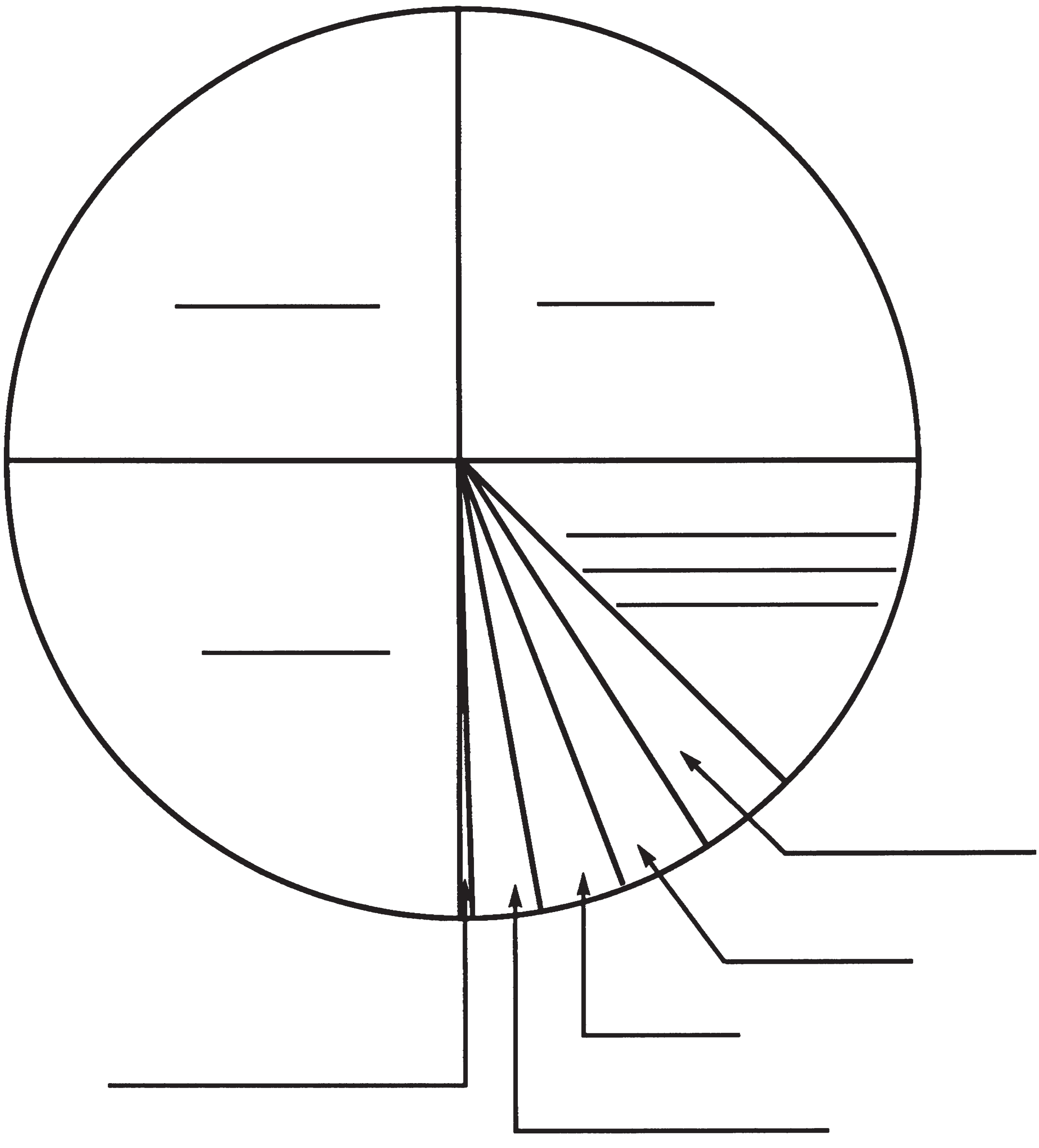
Some good news, half a ton of topsoil is made each year. Topsoil loss is greater than our gain, but farmers buy time with conservation methods. We still lose topsoil, just at a slower rate. The goal of farmers and researchers is to find methods whereby we lose no more topsoil than what is made. Sustainable practices such as adding compost, managing cover crops, and no-till (tillage) farming are methods currently being used and studied to save our topsoil. But really, how can we put a value on soil or land, it's kind of like placing a value on human life.

Vocabulary

Strip cropping: planting crops in strips, several rows, alternating with other crops that have a different root type. Fibrous roots hold the soil better than crops with tap roots.

Cover crops: land that is planted with a fibrous root crop (like clover, various grasses, vetch, etc.) that will hold soil and is usually a legume that will add nitrogen to the soil.

Earth's Soil Resources



What Land Works Best?

Hitting Pay Dirt

Objectives

Students will be able to identify the crops grown in all Utah counties.

Students will be able to explain how climate, water and soil type help to determine where plants and crops are grown.

Students will be able to identify the major crops grown in the United States.

Students will learn map reading techniques.

Materials

- Utah Agricultural Products Map
- Utah Agricultural Products Map Questions.
- "Where in the U.S. did my food come from?" map.
- Roof-top Farming Transparency

Time

Activity 1: 50 minutes
Activity 2: 30 minutes

Getting Started

Gather materials, and make the necessary copies. The Agriculture Products Map should be copied on a copier that handles 11 by 17 inch paper. Reducing the map makes it difficult to read.

Procedures

Activity 1 - Utah Grown

1. Share some of the background information with your students.
2. Give each student a copy of the Utah Agricultural Products Map to complete.
3. Post the Map Questions on the overhead, feel free to make up some of your own. Ask your students to complete the tasks and answer the questions.

Activity 2 - Where does my food come from?

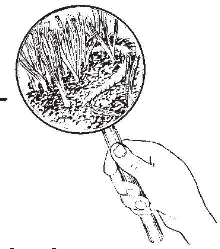
1. Give each student a copy of the United States activity map to complete.
2. Discuss the regional patterns.

Discussion *(use the Roof-top Farming transparency)*

1. What determines which crops are grown where? (water availability, soil type, slope, climate, elevation, etc.)
2. Who determines what farmers grow? (markets, meaning consumers, government quotas and farmers also have favorites and traditions)
3. Using the U.S. map can you identify where the corn belt, and wheat belt are located?

Background

Utah has 54 million acres of land, and is the 13th largest state. Approximately 65 percent of the state is owned by the federal government. About 22% of Utah's land area is in farms and ranches, but less than 3% is cropland. Crops account for about 30% of the value of Utah's agricultural output. Most crop farms are concentrated in a narrow strip (the Wasatch Front) extending roughly about 100 miles north and south of Salt Lake City at the base of the Wasatch Range. The melting



snows provide irrigation water for the valleys below. This is also where some of the best soils in the state are located. Three-fifths of the cropland is devoted to wheat and hay. Hay is the number one crop grown. Native grass and ***alfalfa*** are the most popular kinds of hay to grow. Alfalfa grows best under irrigation, cold winters and warm summers. It is drought-resistant, which means it can grow even when there's not much rain.

A large area of mountainside terraces is occupied by fruit orchards, especially in Box Elder County. Box Elder County is home to the Utah Fruitway. This area grows some of the finest peaches, apricots, melons, squash and other fruits and vegetable anywhere. Utah County is also known for its fruit production. To the north and east in Cache Valley, unirrigated grain is grown among irrigated fields of alfalfa. Another popular crop grown in Utah is onions. Most of the onions grown in Utah end up in restaurant food chains. Davis and Weber counties lead in the production of onions.

Livestock and livestock products account for about 70% of the state's annual agricultural output. Dairy farming is very important in the irrigated valleys west and north of Salt Lake City. Beef cattle graze wherever adequate grass and water exist. Sheep are raised in less-favored environments, particularly the desert basins of the west. Sanpete County is known for it large number of turkeys. Some of Utah's best farmland is being lost to rapid growth and development. Between 1988 and 1998 Utah lost 300,000 acres (500 square miles) of farmland, a sizable amount for a state where only 5 percent of the land is considered good to excellent for agricultural production.

Throughout the nation there is a lot of concern about the loss of farmland to development. It is reported that every day over 2,450 acres of forests, farms, and countryside disappear as a result of eradication by suburban sprawl, roads and highways and industrial development. The breakdown of that acreage shows 1,320 acres for housing, 660 acres for paved highways, 300 acres for warehouses and factories and 170 acres bulldozed for shopping malls and industrial parks.

Much of the land being taken is prime agricultural land. Years ago, our communities were built next to the best ground so farmers would be near their farms. Today, 85 percent of the nation's fruit and vegetables and nearly 80 percent of its dairy products are produced in counties subject to urban pressure. (See the Roof-top Farming Transparency. Your class can help you with the caption, something like, "Who decides where farmers farm?" or "Watch your next right turn!")

Many people think that the loss of farmland is primarily a farmer issue. Loss of farmland should be of concern to everyone, it can affect food prices, property taxes and the environment we live in. By the year 2050 food prices are projected to increase three to five fold. When development takes place, government receives an increase in taxes, but usually spends more on services to support that development.

Vocabulary

alfalfa: legume crop high in protein, especially desired by dairy farmers.

Answers to selected Utah Agricultural Products Map Questions

1. Simply put, in Utah crops are grown where we have water. Water is primarily located geographically around the mountains. Crops are grown in the valleys with adequate water, adequate (loam) soils, and in areas where slopes are at a minimum. Orchards are an exception. Many orchards in Utah are planted on the foothills, still, they are near water.

2.

3.

4.

5. Hay is drought tolerant. Hay is also needed to feed the states large livestock industry.

6. Utah has a lot of rangeland. The plants that grow on the ranges produce good beef but the grass is not high enough in protein to produce a high volume and quality of milk.

More Fun Using the Utah Agricultural Products

1. Geographically, where are the largest variety of crops grown?

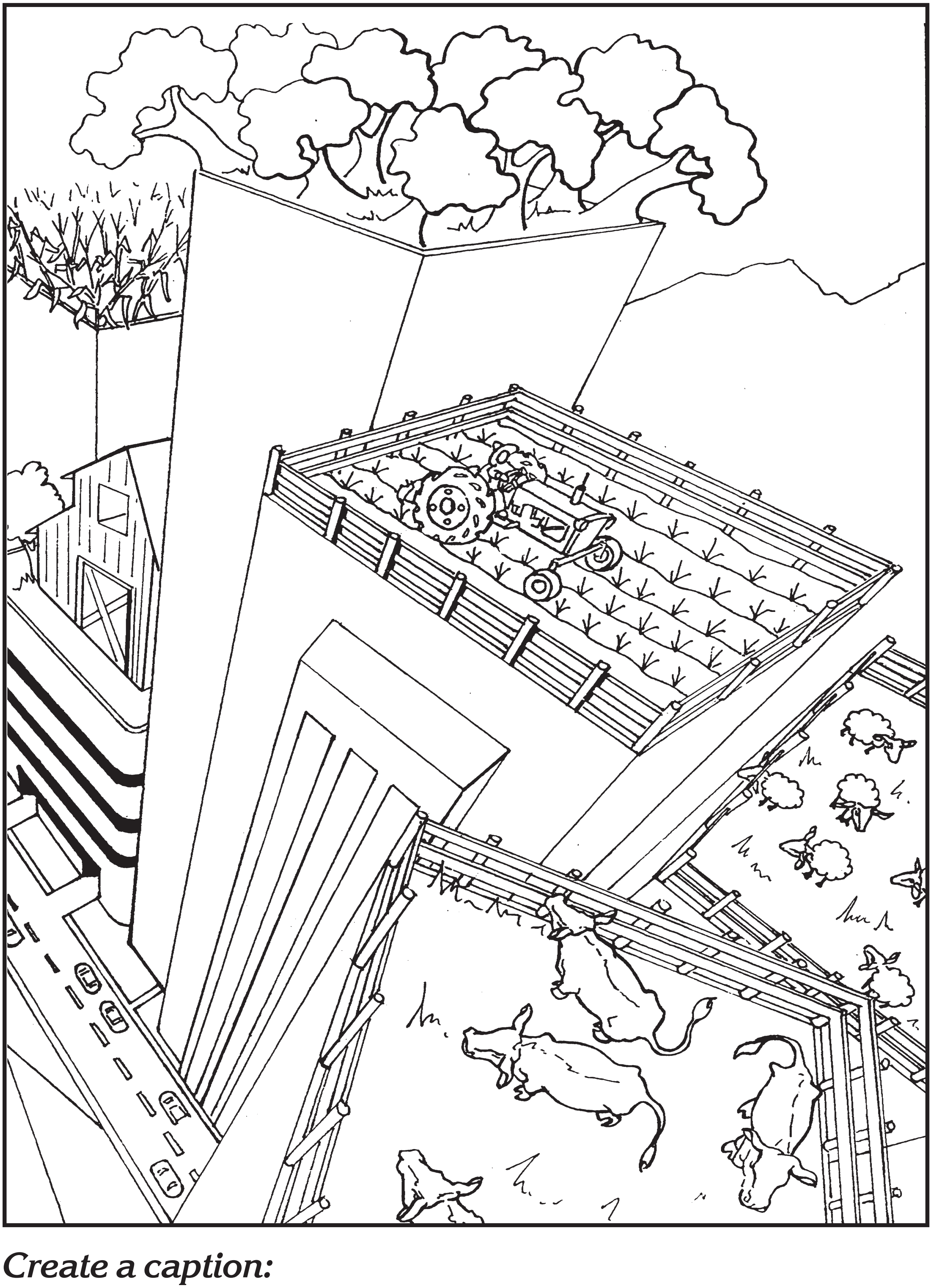
2. Using the scale and a ruler, how far is it in miles from the northern part of Box Elder County to the most southern side of Kane County? (How long is the state of Utah)

3. Using the scale and a ruler, how far is it in miles from the western side of Millard County to the eastern side of Grand County?

4. Using the scale and a ruler, how far is it in miles from the southern part of Washington County to the southern tip of Salt Lake County?

5. Why do you think hay is produced in most counties?

6. Why do you think there are more beef cows than dairy cows in Utah?



Create a caption:

Utah Agricultural Products Map

Where in the United States did my food come from?

Where did your lunch come from? Some of the foods you eat every day are produced here in Utah. Most states produce their own milk, eggs, fruits, vegetables, and grains. Some states produce so much of a particular crop or animal that they have become famous for their agricultural products. Color the small circle on the legend and then color a small circle on the map to match the legend of our most productive states in the United States. Do you see some regional patterns?

- O Corn: Illinois, Iowa, Nebraska, Indiana, Minnesota, & Ohio.
- O Dairy Products: Wisconsin, California, New York, Pennsylvania, & Minnesota.
- O Beef: Texas, Nebraska, Kansas, Colorado, Iowa, Oklahoma, & California.
- O Soybeans, major oil crop used in salad dressings and mayonnaise: Illinois, Iowa, Nebraska, Indiana, Minnesota, & Ohio.
- O Pork: Iowa, Illinois, Minnesota, Nebraska, Indiana, North Carolina, & Missouri.
- O Chickens: Arkansas, Georgia, Alabama, North Carolina, Mississippi, & Texas.
- O Wheat: North Dakota, Kansas, Montana, Oklahoma, Washington, & Minnesota
- O Eggs: California, Georgia, Arkansas, Indiana, Pennsylvania & Texas.
- O Potatoes: Idaho, Washington, California, North Dakota, Maine, & Wisconsin.
- O Tomatoes: Florida, California, Virginia, Ohio, Georgia, & Michigan.

Secrets to Healthy Soils

Healthy Food from Healthy Soil

Objectives

Students will be able to infer that the diversity of life in soil contributes to soil fertility.

Materials

- sample of soil from top layer of soil high in organic matter
- funnel and capture container (same ones used in "Perkin Through the Pores"
- small piece of coarse screen, 1-1/2 inch square
- light source with a shade (direct light)
- hand lenses
- wet paper towel
- ziploc bag
- soil nutrient testing kit *(optional)*
- Creatures in the Soil transparency

Time

Activity 1: 50 minutes
Activity 2: 30 minutes

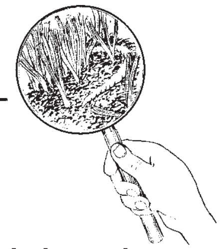
Getting Started

Gather materials, and make the necessary copies. For this activity, you will need a sample of soil for each group of students. The best results will be obtained if soil is collected from late spring to early fall by the students. Samples should be taken from the topsoil in area with higher organic matter will yield better results. Cultivated gardens or fields may not yield as much diversity of life unless compost of other organic material has been added. Great collections can be obtained under logs, under greenhouse benches, or around compost piles. Students should watch for signs of life while collecting the soil and record any observations. Keep the soil samples moist until you conduct the in-class part of this activity. The first day is spent setting up equipment to separate out larger organisms. The second day is spent looking at microorganisms with a magnifying glass. After the activity, return the soil samples and the organisms to their environment. For the second activity, samples may be sent to the USU Soil Testing Lab or soil testing kits can be obtained from Utah Agriculture in the Classroom or purchased from science supply catalogs.

Procedures

Activity 1 - The living soil

1. Divide the class into four or five groups.
2. Each group should designate someone to collect the soil sample or go on a walking trip around your school to make the collection.
3. Watch for signs of life as you collect the soil for this activity. Dump the sample on a piece of white paper. Record your observations and make note of the number of different invertebrates you see.
4. Back in the class, assemble the apparatus as shown on page 62. Make sure the lamp is 1/2 to 3/4 of an inch away from the soil otherwise it will dry out too fast and cause some organisms to die.
5. Place wet paper towel in the bottom of the container under the funnel, and then place the screen inside the funnel and fill loosely with your soil sample. Label jar with your groups name.



6. Turn on the light source and leave it overnight. Most soil dwellers do not like light and they will try to dig deeper to escape the lamp.
7. The next day, turn off the light source and collect the organisms that have been forced into the jar below the funnel. Observe the specimens with your magnifying glass and under a light microscope. Identify as many different types of creatures as you can.
8. When you are finished, return all organisms and the soil to a suitable environment.

Activity 2 - What nutrients are in my soil?

1. Send to the USU Soil Testing Lab (4830 University Blvd., Logan, UT 84322-4830) or test with the samples with a classroom soil testing kit the sample that had the <u>largest</u> number of organisms and the soil that had the <u>least</u>. Which one will have the highest plant nutrient value?
2. If you have a classroom testing kit, conduct the tests as instructed.

<u>Discussion</u>

1. Based on the amount of soil life in your samples can you predict the nutrient value? (yes, but not exactly, the more organic matter the more soil life and the higher the nutrient value of the soil)
2. Why are soil nutrients important? (plants need them to grow)
3. How do you think you can increase the nutrient value of soils? (by adding organic matter)

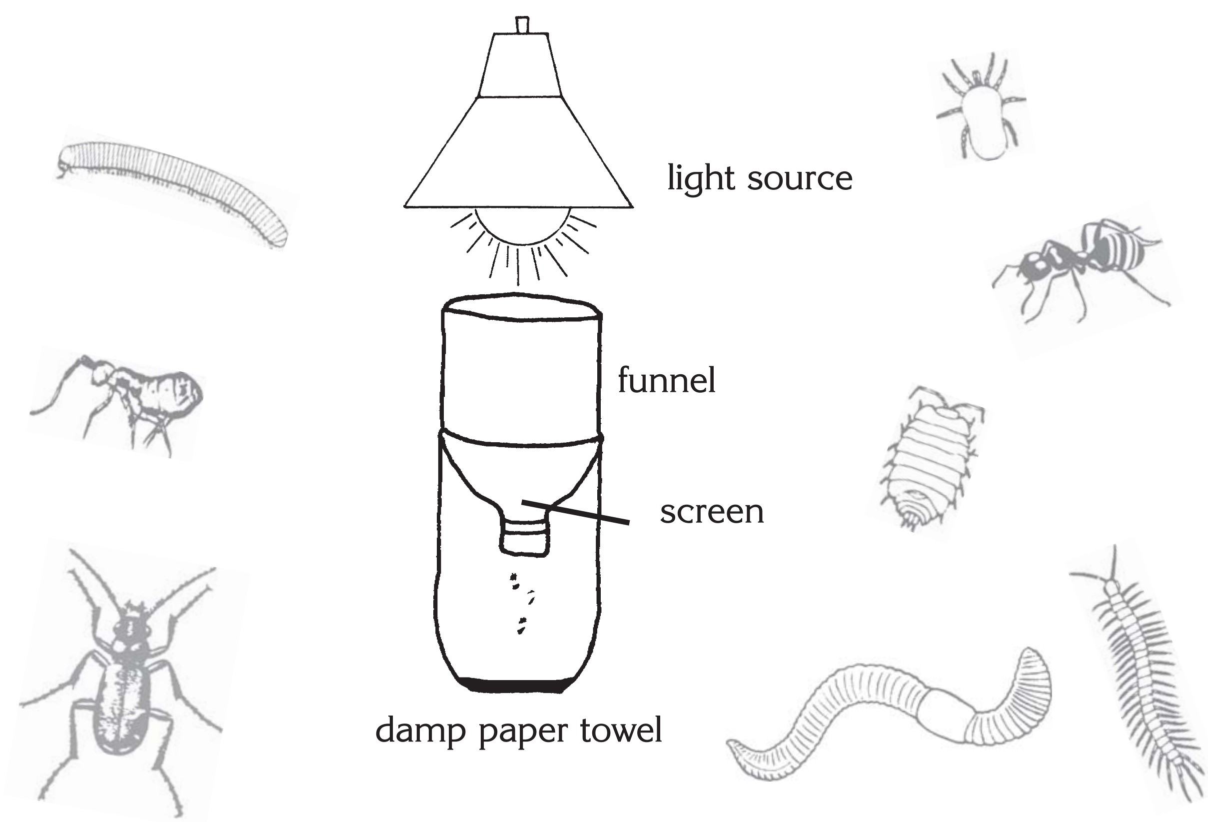
<u>Background</u>

Plants and animals play a major role in soil development. Plants are the primary source of organic matter. They provide a protective covering which traps water and allows it to enter or infiltrate into the ground. The protective covering also lessens the erosion of the developing soil underneath. But perhaps most important, plants accelerate the process of chemical weathering through the release of carbon dioxide from respiring plant roots. In soil, carbon dioxide (from the plants roots) combines with water to form weak carbonic acid which chemically decomposes mineral matter releasing plant nutrients and other constituents into the soil solution.

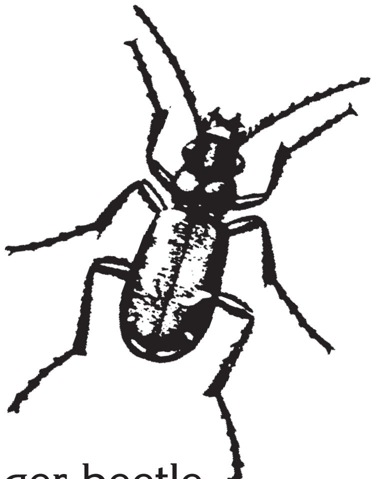
A multitude of animals, insects, and microorganisms also contribute to the process of soil formation. The burrowing, eating, and mixing activities of invertebrates such as insects and earthworms, and small mammals allow organic matter on the surface to become incorporated into the soil. However, of the billions of organisms in a handful of earth, 99.99 percent are microscopic decomposers that play the important role of recycling nutrients within the soil ecosystem. As nematodes, protozoa, bacteria and countless other microorganisms (you'll need a microscope to see these) attack organic matter in search of their own food, they release nutrients into the soil and water for uptake by plants. Fungi, which feed primarily on wood and leaf tissues, are important since a considerable amount of plant material cannot decay without their initial action.

An interesting contribution to soil formation is provided by the "work" of lichen (pronounced like-en). On bare rock, lichen are usually the first plants to be established. They are able to cling to rock with tiny hairlike roots. In order to get the nutrients they need, lichen secrete chemicals into the surface of bare rock. This weathers the rock and creates a thin layer of broken mineral matter or parent material, thus beginning the process of soil formation. As lichen die, more organic matter accumulates. Debris brought by wind and water gets caught in the lichen. Eventually there is enough soil formed for mosses to grow and later ferns, grasses and other herbaceous plants. Therefore, lichen play a crucial role in the development of soil on bare rock. Lichen are very interesting to look at close up with a hand lens.

Vocabulary
bacteria: single cell organisms
fungi: mostly multicellular organisms, and consisting of filaments (tiny root like structures)
nematodes: tiny roundworms that live in the soil, can be devastating to crops.
protozoa: single cell organisms that are usually motile.

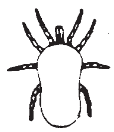


Creatures in the Soil



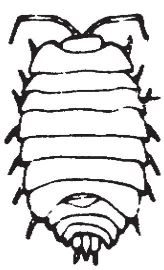
tiger beetle

millipede

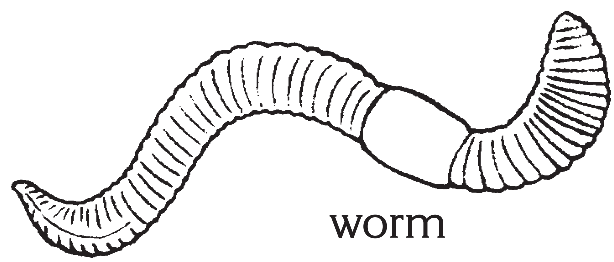


mite

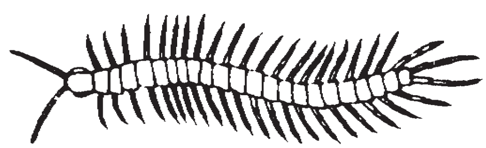
nematode



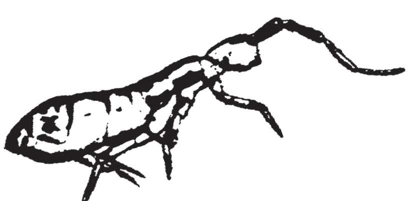
pillbug or sowbug



worm



centipede



springtail

ant

The Rotten Truth

Healthy Food from Healthy Soil

Objectives

Students will demonstrate and explain the decomposition process.

Students will be able to list the methods and ingredients for making compost.

Materials

- ziploc quart bag
- Decay Buffet: fruit and vegetable peelings, leaves, plastic bag, paper bag, waxed utensils, hay, straw or grass, plastic utensils, paper cups, milk cartons, straws, paper napkins, and other stuff.
- tape
- scissors
- soil
- mister bottles or bowls of water
- gloves (food handlers will work)
- Composting Containers transparency
- My Compost Pile activity sheet
- crayons

Time

Activity 1: 30 minutes, initial, 20 minutes for final analysis.
Activity 2: 20 minutes

Getting Started

Gather materials, and make the necessary copies.

Procedures

Activity 1 - Decay and Decomposition

1. Divide the class into pairs.
2. Provide each pair of students with a ziploc quart bag and ask them to write their names on some tape and then stick the tape on the bag.
3. Set up a "Decay Buffet" of items noted in the list of materials to be placed in the bags.
4. Students should place one small piece of each item at the "Decay Buffet" into their bags. Have them cut up items, if necessary. ***Stress that they not add any meat to their bags as potentially harmful bacteria could grow***.
5. One student can place the items in the bag and the other student can record the exact contents.
6. The recorder should also note his or her partner's predictions as to what will happen to each item over time. Will the item rot? Smell yucky? Remain the same?
7. ***Optional***. You may want the students to switch roles and create a second compost bag with a list of contents and predictions.
8. Ask the students to add about 1/2 a cup of soil to their bags and to lightly mist the contents with a plant mister. (Adding a teaspoon of water and mixing the contents will work the same way.)
9. Have the students blow into the bags (to inflate slightly) and carefully seal them.

Once the bags are sealed, leave them in bags for 2-8 weeks. You may decide to keep the bags together, or place them in various locations with differing conditions. (If you let the students choose their compost bag's location, be sure to have everyone register their locations on a class master list or you may be unpleasantly surprised when a missing bag finally makes its presence known.)

10. Have students create compost bag journals. Ask them to observe their bags periodically and record what they see happening inside. **Remind students that they are not to open the bags until the designated date**.
11. On the designated date, have the students take their bags outside. Distribute plastic gloves to the students to wear while sorting through the contents of their bags with their partners. **Caution: students with known allergies to fungus and fungal spores should not participate!**
12. Record any items still identifiable and in their present state. Provide misters or water bowls so items can be cleaned off for closer observation and identification.
13. Are any items missing? Check the list and note the items missing.
14. How did the results compare with the predictions?
15. Define and discuss the process of decomposition or decay.

Activity 2 - Containers and layers for composting
1. Provide each student with a My Compost Pile activity sheet.
2. Using the dirt video and the background information, review the methods for making a compost pile. (More information about composting can be found at http://www.ext.usu.edu.)
3. Discuss the different type of composting containers using the transparency.
4. *Optional:* Create your own school compost pile!

Discussion
1. What are some things you have thrown away over the past couple of days? What happens to these things? Do they disappear? Decompose? Remain in the same form forever?
2. Will placing the bags in various conditions have an effect on what occurs in the bags?
3. Can you think of any other types of compost containers that would get the decomposition job done?

Background

Decomposition is a fundamental process on which all life depends. We'd all be knee deep in garbage without it. Bacteria, fungi, and other microscopic organisms that live in the soil, air, and water are responsible for turning once living plants and animals into nutrients that can be used again and again. Think of them as nature's recyclers. They have the ability to produce special enzymes which allow them to break down dead plant and animals and use them as food. No job is too big as they enlist the help of friends and family. As they eat, they grow and multiply at an amazing rate, In just 4 hours, one bacteria can grow to a colony of 5,096. And at days end their are millions and billions of them working together. Why, in 1 teaspoon of soil, there are more bacteria and fungi than all the people on Earth! Despite their microscopic size you've probably seen evidence of them right in your own homes. Remember that orange with blue-green mold in the back of the refrigerator? Or that black or white fuzzy slice of bread? Or those damp old gym socks, that you left in a plastic bag, newly spotted with black and pink. These are colonies of our microbial friends hard at work at the fine art of decomposition.

There are many containers suitable for making compost, provided they are accessible, resist decay, and allow air flow. How do you decide which containers will work best? Consider the amount of time and space you have, and the quantity of materials you will be composting. Most compost containers fall into one of these categories: heaps (simple stacked piles), hoops (caged enclosures), bins (boxed enclosures), and barrels (drum enclosures).

For fast, hot compost, the ideal pile size is 1 cubic yard (3 feet x 3 feet x 3 feet). This volume effectively retains the heat generated by the bacteria. The volume of a single pile should not exceed 2 cubic yards in order to maintain proper ventilation of the pile. If space is a limiting factor, the pile sides can be insulated so that higher temperatures can be maintained in a smaller volume. Once you have selected the container and location for your compost pile remember 1 part green (grass clippings, kitchen scraps, no meat or dairy, etc.) to 2 parts brown (straw, aged manure, dry leaves, etc.). Layering helps the pile to get going, but stirring the pile is important and will accelerate the decomposition of your dead plants and scraps into beautiful, earth-like smelling (not stinking) compost.

Vocabulary

biodegradable: capable of being broken down by living microorganisms into simpler compounds.

compost: well-rotted plant and animal waste prepared by people to be used as a soil conditioner or fertilizer.

decomposer: an organism that digests organic waste and dead organisms by breaking them down into simpler compounds and absorbing soluble nutrients.

decomposition: the process of breaking down dead plants, animals, and animal waste into simpler nutrients.

nutrient: any element an organism needs to grow and reproduce.

My Compost Pile

Color a legend for your compost pile. List the type of dry and wet ingredients you are going to add. Then create a compost pile by drawing a pile in the bin. Remember to use the colors you have selected showing the different layers.

☐ Moisture

Dry Ingredients

☐ ______________________________

☐ ______________________________

☐ ______________________________

☐ ______________________________

Wet Ingredients

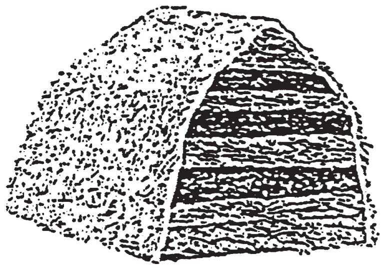
☐ ______________________________

☐ ______________________________

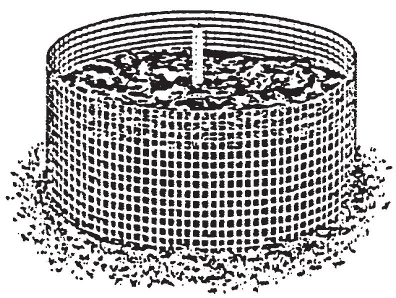
☐ ______________________________

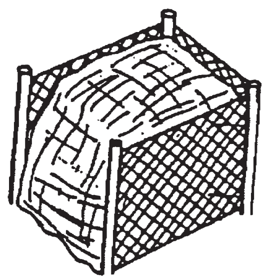
☐ ______________________________

Composting Containers

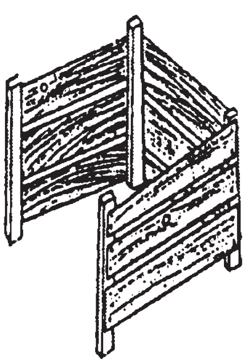


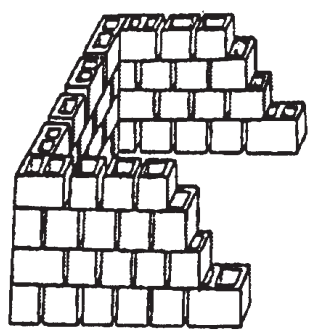
Heap It (no cost, good if you have ample space) Simply pile your materials in heaps. If well constructed, heaps are good for "no turn" composting. Just leave the pile for several months or more.



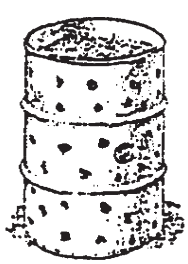


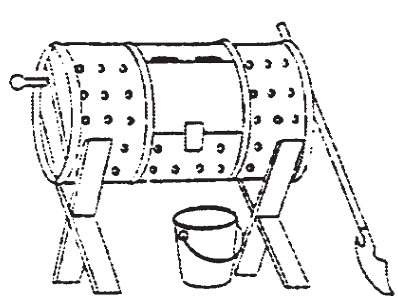
Hoop It (low cost, tidier than heaps) Woven wire mesh or fencing make good enclosures and keep the pile tidy. If you secure it with hooks or twists of wire, you can undo the hoop, set it up next to the pile, and turn the pile back into the hoop in its new location.





Box It (looks good, easy to cover, low to moderate cost) You can use almost any type of scrap or new lumber, bricks, or cinderblocks. Make sure to leave spaces in the sides for air to get through, and make the front removable for easy access to turn or retrieve the compost. Construct several bins side-by-side to facilitate turning of the compost.





Barrel It (good for limited space, easy turning, moderate to high cost) If you don't have enough space for piles or elaborate bins, a modified 55-gallon drum can work very well. By perforating the drum with air holes and cutting an access hatch on the side you can create a system which will compost small amounts of material quickly.

Working Worms

Healthy Food from Healthy Soil

Objectives

Student will investigate how earthworms mix and till the soil.

Materials

- 1 gallon plastic milk jug
- plastic plates
- gravel
- Bedding mixture: peat moss, grass clippings, vacuum cleaner bag, debris, leaves, dryer lint, shredded newspaper, etc.
- earthworms
- Worm Adoption Certificate
- chopped (in a blender) fruit and veggie scraps

Time

Activity 1: 30 minutes, plus follow-up time.

Getting Started

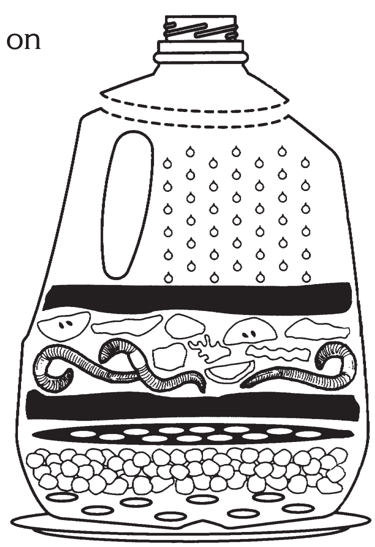
Request that each student bring in a 1 gallon plastic milk jug. Gather the remaining materials, and make the necessary copies. Worms can be ordered via the Internet. Check out these worm farms. Be sure to compare prices. Here is one reputable company, Kazarie Worm Farm, 352-463-7823, http://www.afn.org/~kazarie

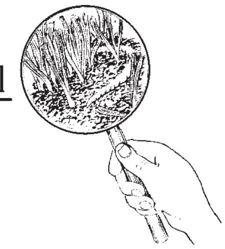
Procedures

Activity 1 - Worms World

Before you begin have students fill out their Worm Adoption Certificate. It will definitely cut down on creature cruelty, and other discipline problems.

1. Cut the top from a clean clear plastic gallon jug. (You will want to do this for the students)
2. Poke holes for drainage in the bottom of the jug. Make sure you have a plastic plate under the jug to collect excess water.
3. Add 1 inch of gravel for drainage. If you provide shredded newspapers, and carefully watch the moisture content in the worm jug, you can omit the gravel.
4. Poke holes in a plastic lid or plate and place over the gravel.
5. Add 1 inch of bedding mixture on top of the plate.
6. Add a few earthworms.
7. Sprinkle some food scraps on top of the worms.
8. Cover with more bedding material. Sprinkle with water. ***Don't soak!***
9. Stir and observe daily. Record what you see in a daily log. Sprinkle with water and add food as needed.





Discussion

1. Will the population of your worms increase or decrease?
2. Were there certain foods the worms liked better than the others?
3. Do you think you will find worms in a "hot compost" pile? (not until it cools)

Background

Earthworms are found everywhere on the earth's surface, except the north and south poles, where it is too cold. They can be so tiny you can't see them without a microscope, or they can be several feet long. They are called by several names, "orchard worm," "rain worm," "angleworm," "red wiggler," "night crawler," and "field worm."

The earthworm has no head, no eyes, no teeth, and no antennae. Its body is made up of many ringlike segments. There is a swollen band, lighter in color that the rest of the body, and the front of the earthworms body. Earthworms have both male and female reproductive organs. They lay egg capsules that must be fertilized by another worm. Each egg capsule contains several baby worms, called wormlets. The wormlets come out of the capsules 3 to 4 weeks after the worm deposits the capsule near the soil surface. When they first appear they look like tiny threads, about 1/16th of an inch in length.

The worm is the gardener's best friend. Night and day worms are burrowing through ***acres*** of soil, swallowing soil as they go. Inside the soil are tiny bits of plants and animals which they then grind up as they eat. Earthworms actually eat the soil. Through the process of digestion, nutrients that are locked up and unavailable are released in their waste called castings. Worm castings are characteristic lumps and bumps of soil that come out as part of the worms waste. Rich in nutrients such as nitrogen, potassium, and phosphorus, worm castings help plants to grow. The average earthworm will produce its weight in casting every 24 hours. One earthworm can digest several tons of soil in one year. Not only do castings add nutrients to the soil, but they also improve the soil's ability to hold water, another bonus for plants. By tunneling through the soil, worms aerate the soil, providing a looser structure and openings for roots to grow. These tunnels provide channels for water to enter the soil and improve drainage. Worms are like small rototillers and bags of fertilizer in a very small, and somewhat slimy, package.

Vocabulary

acre: the unit of measure for land in the United States, 43,560 square feet. The amount of land a man and beast could plow in a day in the early 1800's.

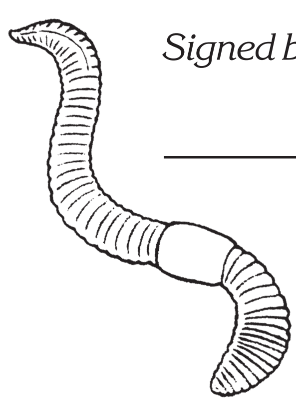
Worm Adoption Certificate

Number of worms adopted: ______________________________

Lengths at adoption: ___________________________________

As the caretaker of these worms, I promise to:

1. Give these worms a comfortable, cool, moist, home, complete with a fresh air supply and curtains to keep out any harmful light rays.
2. Feed my worms a varied diet of healthy foods.
3. Treat my worms with care and respect, not handling roughly, or harming their tender bodies.

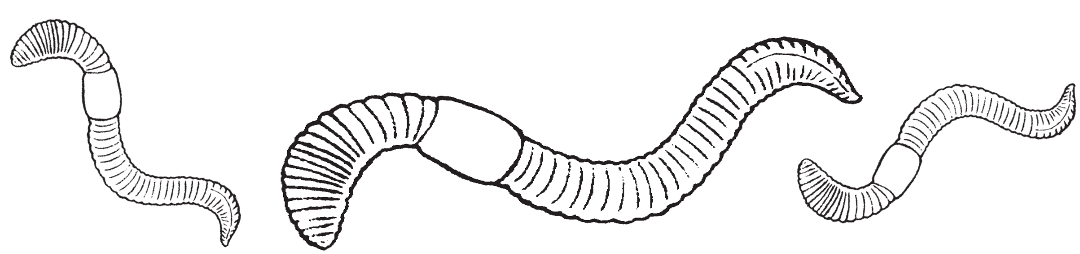


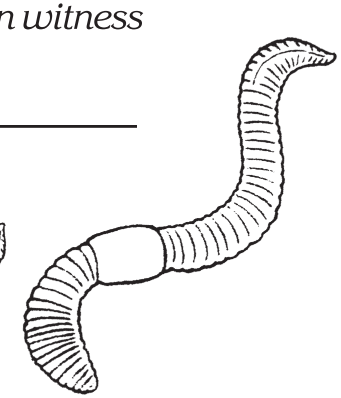
Signed by worm foster parent

____

Signed by official worm adoption witness

____





Resources

GLOSSARY of soil and water terms

conservation - wise use and protection of our natural resources

ecology - science of the relationships between plants, animals and their environments

environment - everything that surrounds us

erosion - loosening and movement of soil by wind, water, ice and landslides

geology - science of the history of the earth

habitat - an area in which plants and animals live, grow and reproduce

mineral - (a natural resource) an inorganic substance with definite chemical and physical properties and definite crystal structure

natural resources - found in nature -- soil, minerals, forests, water, fish, wildlife

nutrient - something that provides nourishment for an organism to live (it can be food or chemicals)

organic matter - plant and animal materials in different stages of decay (decomposition) that may be part of the soil

organism - a living being (people, animals and insects are all organisms)

particle - a very small piece or part of something bigger

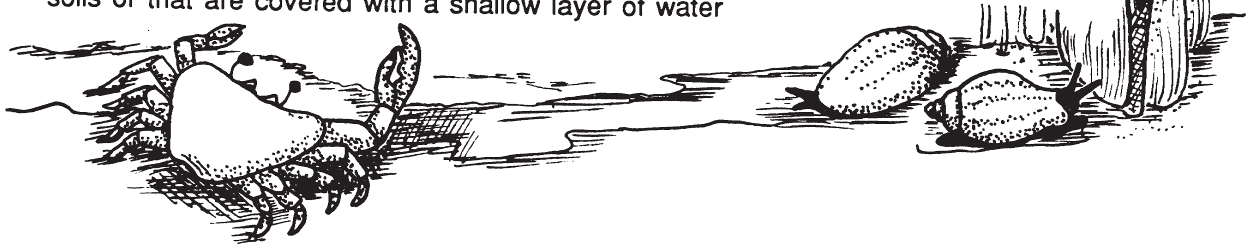
reservoir - a body of water (often a lake) in which water is collected or stored

sediment - bits of sand, soil, pebbles and other material deposited by wind, water and glaciers that washes into rivers, lakes and oceans and piles up layer on top of layer

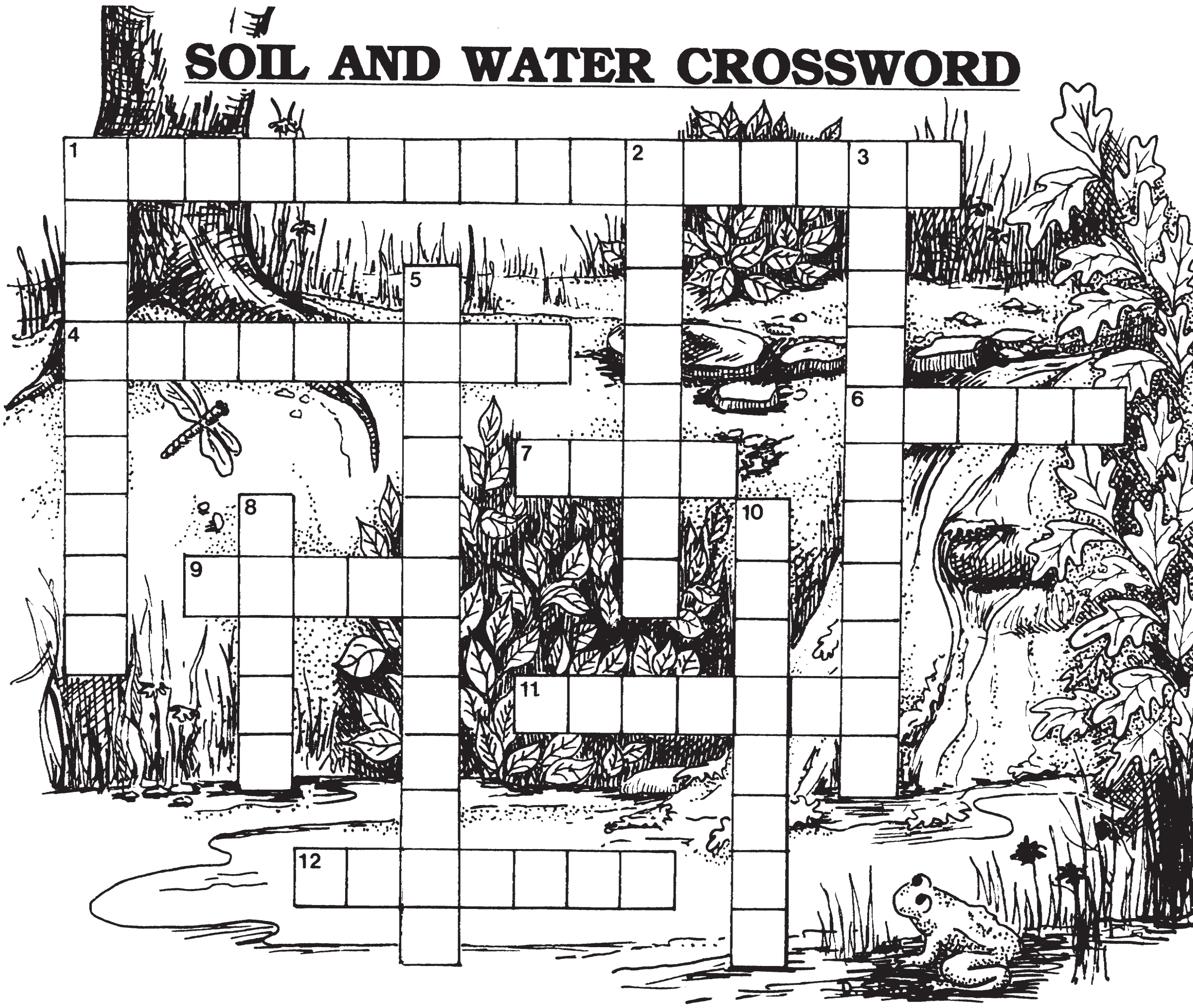
soil - a naturally occurring mixture of minerals, organic matter, water and air that forms the surface of the land

weathering - breaking down of rock by wind, water and living things

wetlands - freshwater or saltwater areas (swamps, bogs, marshes) with waterlogged soils or that are covered with a shallow layer of water



SOIL AND WATER CROSSWORD



ACROSS

1. soil, water, forests, minerals, wildlife, fish -- things found in nature (two words)
4. artificial lake where water is stored
6. weathered particles that become soil
7. natural mixture of minerals, organic matter, water and air that forms land surface
9. liquid we need to live that covers most of the earth
11. loosening and movement of soil by water, ice, landslides and wind
12. science of the history of the earth

DOWN

1. "food" that helps soil grow
2. any living being (people, animals or insects)
3. everything that surrounds us
5. wise use and protection of soil and water
8. planet we live on
10. material deposited by water, glaciers and wind

(hint: use the glossary to help solve the puzzle)

Hidden Words In Soil

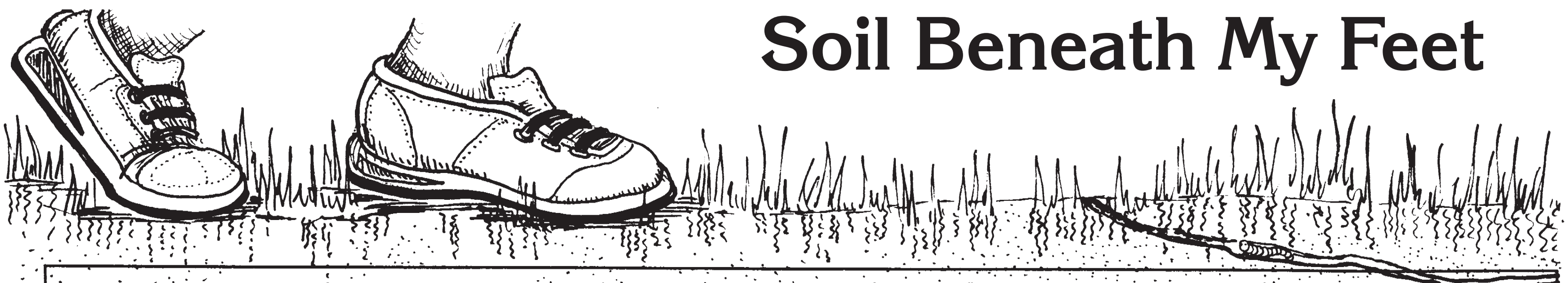
C	O	N	S	E	R	V	A	T	I	O	N	H	V	P
H	Y	S	L	P	R	B	I	V	S	W	X	T	Q	H
P	A	E	A	I	S	O	I	L	Q	O	W	O	B	I
X	L	B	M	I	F	R	S	B	O	R	P	U	O	Z
G	C	A	I	M	X	A	V	I	R	M	L	M	Z	G
P	M	S	N	T	U	T	R	O	O	S	X	B	O	W
I	D	I	A	T	A	L	O	M	C	N	E	L	K	C
Z	W	V	K	R	S	T	C	E	S	N	I	E	O	J
D	X	E	B	E	E	T	K	H	C	E	I	Y	X	D
X	N	D	V	E	J	R	U	C	S	A	D	I	K	M
F	P	A	S	S	D	I	O	F	J	Y	V	U	A	G
D	E	E	S	Z	P	B	W	Y	K	L	G	J	I	T
L	Y	H	L	E	D	Q	A	D	S	H	X	B	A	R
A	U	C	Z	F	C	Q	X	V	I	R	A	M	L	A
J	O	D	H	F	P	U	I	I	F	L	S	X	Y	J

ANIMALS
BIOME
CLAY
COMPOST
CONSERVATION
EROSION
FARMS

HABITAT
INSECTS
LEAVES
MULCH
PLANTS
ROCK

ROOT
SAND
SEED
SOIL
TREES
WORMS

Soil Beneath My Feet



Soil is an important natural resource. Air, water, minerals and other organic matter make up our soil. It takes one hundred to one thousand years to make one inch of soil -- that's why we need to take care of it now.

Conservation is a big job. Everyone needs to pitch in to save our soil since we all use it. What are some uses for soil? Decode the words below to find some answers:

A = x	B = o	C = j	D = l	E = q	F = r
G = e	H = n	I = t	J = w	K = a	L = z
M = p	N = v	O = g	P = u	Q = y	R = m
S = i	T = c	U = b	V = k	W = d	X = s
		Y = h	Z = f		

____
O F K L S H O K H S R K D X

____
T F B M X

____
H K I P F G K F G K X

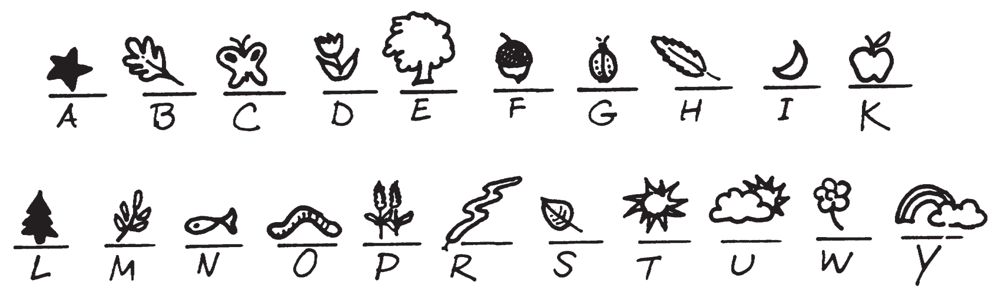
____
T B H X I F P T I S B H

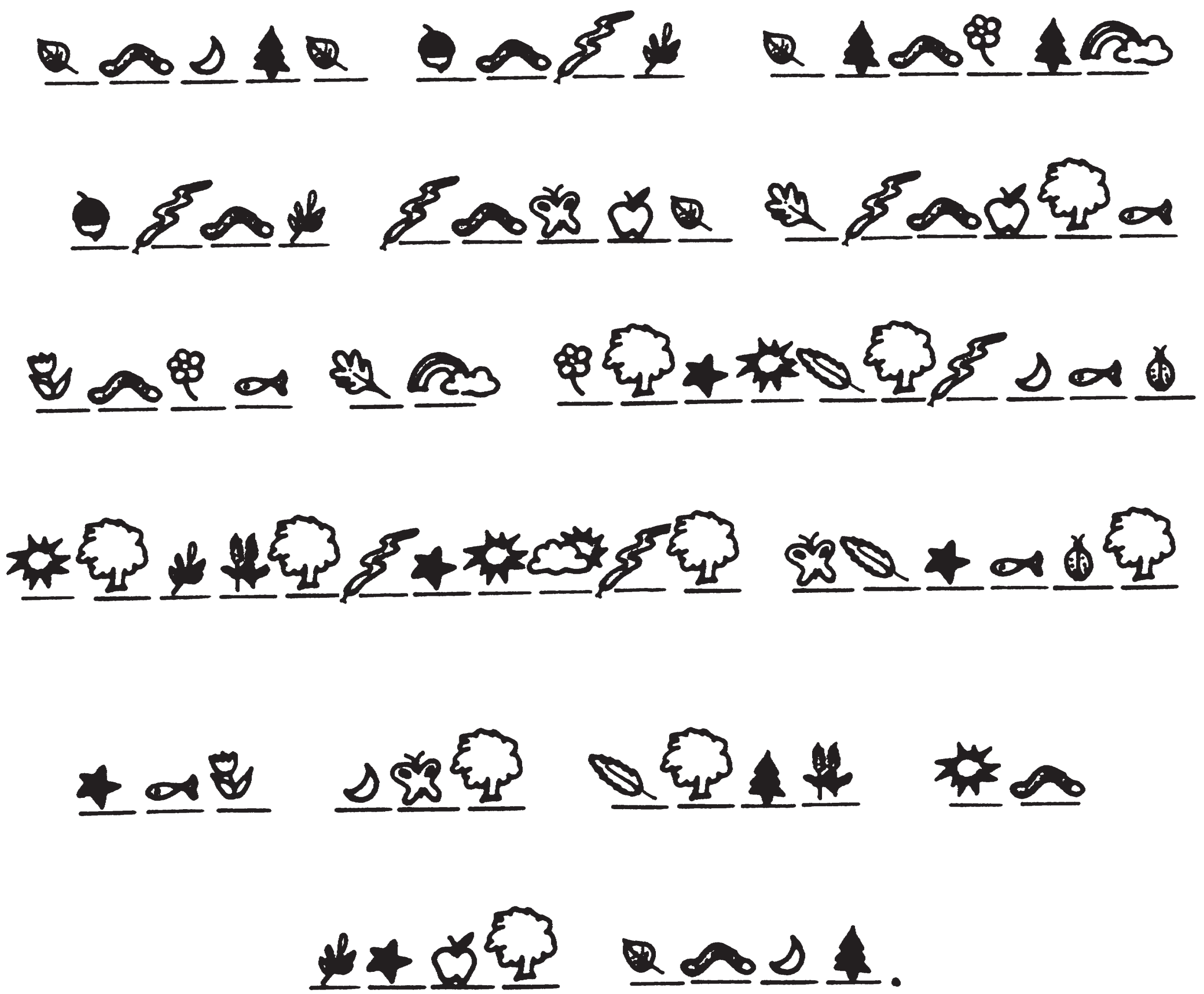
____
W K S F Q B F B I Y G F Z K F R X

____
O K F W G H X

ACTIVITY D: WEATHERING AWAY

In the coded message below, find out what helps make soil. Write the letter of each picture clue under the same picture in the puzzle.





Answers to Puzzles and Fun

"Soil and Water" Crossword

Across
1. natural resources
4. reservoir
6. rocks
7. soil
9. water
11. erosion
12. geology

Down
1. nutrients
2. organism
3. environment
5. conservation
8. earth
10. sediment

"Hidden Words in Soil" Wordsearch

C	O	N	S	E	R	V	A	T	I	O	N	H	V	P
H	Y	S	L	P	R	B	I	V	S	W	X	T	Q	H
P	A	E	A	I	S	O	I	L	Q	O	W	O	B	I
X	L	B	M	I	F	R	S	B	O	R	P	U	O	Z
G	C	A	I	M	X	A	V	I	R	M	L	M	Z	G
P	M	S	N	T	U	T	R	O	O	S	X	B	O	W
I	D	I	A	T	A	L	O	M	C	N	E	L	K	C
Z	W	V	K	R	S	T	C	E	S	N	I	E	O	J
D	X	E	B	E	E	T	K	H	C	E	I	Y	X	D
X	N	D	V	E	J	R	U	C	S	A	D	I	K	M
F	P	A	S	S	D	I	O	F	J	Y	V	U	A	G
D	E	E	S	Z	P	B	W	Y	K	L	G	J	I	T
L	Y	H	L	E	D	Q	A	D	S	H	X	B	A	R
A	U	C	Z	F	C	Q	X	V	I	R	A	M	L	A
J	O	D	H	F	P	U	I	I	F	L	S	X	Y	J

Messages in "Soil Beneath My Feet"

GRAZING ANIMALS
NATURE AREAS
DAIRY OR OTHER FARMS
CROPS
CONSTRUCTION
GARDENS

Decoding in "Weathering Away"

SOILS FORM SLOWLY
FROM ROCKS BROKEN
DOWN BY WEATHERING
TEMPERATURE CHANGE
AND ICE HELP TO
MAKE SOIL

Answers to Interactive Video Questions

It's your food dude!
1. dirt
2. soil

Soil isn't a dirty word
1. profile
2. 1000
3. shallow
4. 45
5. sand, silt and clay, loam
6. gritty, smooth, sticky

The Dust Bowl is not played on New Years Day
1. 1930's
2. Grantsville
3. Black
4. Conservation

Slip Slidin' Away
1. water
2. live
3. contour
4. erosion

Hitting Pay Dirt
1. Football
2. soil or land

Healthy Food from Healthy Soil
1. green, brown
2. dead
3. fungi
4. worms

Answers to "What I know about soils!"

1. d
2. check labeling
3. mineral matter and organic matter
4. b,a,c
5. all *except* "cars & computers"
6. c
7. a
8. c
9. c
10. all *except* "it's a football game & they had no cars"
11. b
12. all *except* "it changes silt to sand &makes soil more rocky"
13. d
14. all *except* "more sunlight & new types of clay discovered"

Name ____________________________

Interactive Video Questions:

Answer the following questions while you watch the Dirt: Secrets in the Soil segments.

It's Your Food Dude!

1. Misplaced soil is called ___ ___ ___ ___ .
2. ___ ___ ___ ___ is one of our most important resources.

Soil Isn't a Dirty Word

1. A side view "slice" of the earth is called the soil ___ ___ ___ ___ ___ ___ ___ .
2. I can take up to ___ ___ ___ ___ years to make one inch of topsoil.
3. Utah has ___ ___ ___ ___ ___ ___ ___ topsoils.
4. Mineral matter makes up about ___ ___ percent of the total volume of soil.
5. Soils are a mixture of ___ ___ ___ ___ , ___ ___ ___ ___ , and ___ ___ ___ ___ particles. This mixture is called a ___ ___ ___ ___ .
6. Wet sand feels ___ ___ ___ ___ ___ ___ , wet silt feels ___ ___ ___ ___ ___ ___, and clay feels ___ ___ ___ ___ ___ ___ .

The Dust Bowl Is Not Played on New Years Day

1. The Dust Bowl took place in the ___ ___ ___ ___'s.
2. In Utah the town of ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ .
3. April 14, 1935 was known as ___ ___ ___ ___ ___ Sunday.
4. The Grantsville Soil ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ District re-seeded the land to help keep topsoil in its place and manages the land to keep the soil resource productive.

Over please...

Slip Slidin' Away

1. Wind and ___ ___ ___ ___ ___ can cause erosion.
2. Soils make it possible for us to ___ ___ ___ ___.
3. On hillsides, farmers usually plant on the
   ___ ___ ___ ___ ___ ___ ___ .
4. Plant cover slows soil ___ ___ ___ ___ ___ ___ ___.

Hitting Pay Dirt

1. An acre is the size of a ___ ___ ___ ___ ___ ___ ___ ___ field.
2. It's hard to put a value on ___ ___ ___ ___ , it means life to you and future generations.

Healthy Food from Healthy Soil

1. When composting a good rule of thumb is 1 part
   ___ ___ ___ ___ ___ to 2 parts ___ ___ ___ ___ ___ .
2. Organic matter is ___ ___ ___ ___ plant material.
3. Bacteria and ___ ___ ___ ___ ___ break down organic matter.
4. Another method for composting kitchen scraps is feeding
   ___ ___ ___ ___ ___.

Name ____________________________

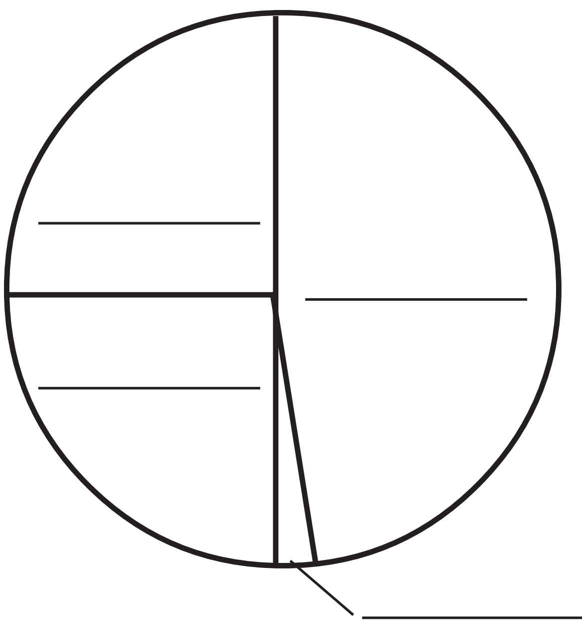
What I Know About Soils!

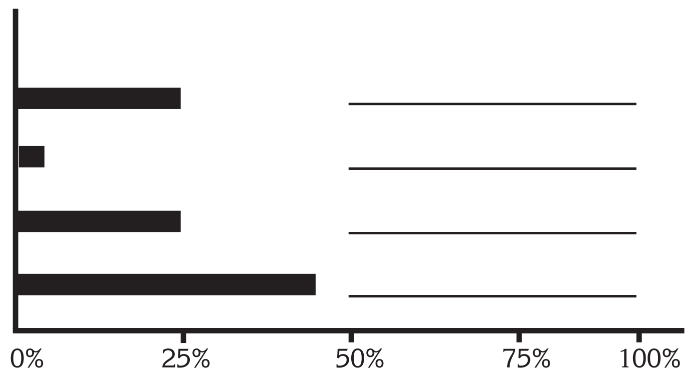
Select the best answer for the following questions.

1. Which of the following have a connection to the soil?

a. plants
b. animals
c. people
d. all of the above

2. An *average* soil is 45% mineral matter, 25% air, 25% water, and 5% organic matter. Label the graphs on the lines provided below to show these percentages.





3. An *average* soil is 50% water and air. What is the other 50% made of?

__________ __________ and __________ __________

4. Match the letter to the correct profile description:

a. topsoil	____	middle layer where some animals make their homes
b. subsoil	____	organic matter is in this "live" zone.
c. parent material	____	broken up pieces of bedrock

5. Circle all the factors that create soil.

parent material plants animals computers cars slope

6. A soil that is hard when dry, but sticky when wet is mostly made of __________.

a. sand
b. silt
c. clay
d. organic matter

7. **Which is the largest particle?**

   a. sand
   b. silt
   c. clay
   d. loam

8. **A mixture of sand, silt, and clay is said to be _______________.**

   a. an organic soil
   b. mud
   c. a loam
   d. stirred up

9. **Which soil would pack together in clods and allow little air and water into the soil?**

   a. sandy loam
   b. silt loam
   c. clay loam
   d. gravel soil

10. **Circle all the statements that are true about the "dust bowl."**

it was during the 1930's	it is a football game
farmers had to move	Utah had it's own dust bowl
they had no cars	dust from topsoil covered many states
weather was part of the problem	farmer began to learn about conservation

11. **If you were looking for a book on soil conservation the book with the most information would be...**

   a. "The World of Water"
   b. "Methods for Controlling Erosion"
   c. "Weeds of Utah"
   d. "Vegetable Growing"

12. **Circle all the statements that are true about organic matter.**

it changes silt to sand	increases the nutrients in the soil
allows soils to drain	floats on water, but eventually gets soaked and holds water
is food for bacteria and fungi	makes soil more rocky

13. **The texture of silt is smooth. Clay may feel smooth at first but becomes _____________.**

   a. gritty
   b. brittle
   c. loose
   d. sticky

14. **Circle all the statements that are true about why farmers produce more today than 25 years ago.**

better machinery	scientists have developed more productive plants
more sunlight today	new crop protection chemicals
new types of clay have been discovered	farmers know more about soil conservation

Local Soil Resources

Beaver
USU Ag Extension Educator (435) 438-6450
Beaver HS, Ag Science Teacher (435) 438-2301
Utah Association of Conservation Dist. (435) 865-0703

Box Elder
USU Ag Extension Educator (435) 734-2031
Bear River HS, Ag Science Teacher (435) 257-5431
Box Elder HS, Ag Science Teacher (435) 723-7087
Utah Association of Conservation Dist. (435) 753-6029

Cache
USU Ag Extension Educator (435) 752-6263
Mountain Crest HS, Ag Science Teacher (435) 245-6093
Sky View HS, Ag Science Teacher (435) 563-6273
Utah Association of Conservation Dist. (435) 753-6029

Carbon
USU Ag Extension Educator (435) 637-4700
Utah Association of Conservation Dist. (435) 384-3209

Davis
USU Ag Extension Educator (801) 451-3402
Clearfield HS, Ag Science Teacher (801) 774-7658
Layton HS, Ag Science (801) 546-7981
Utah Association of Conservation Dist. (801) 572-9315

Duchesne
USU Ag Extension Educator (435)738-2435
Altamont HS, Ag Science Teacher (435) 454-3314
Duchesne HS, Ag Science Teacher (435) 738-2211
Tabiona HS, Ag Science Teacher (435) 848-5635
Union HS, Ag Science Teacher (435) 722-2474
Utah Association of Conservation Dist. (435) 789-2100

Emery
USU Ag Extension Educator (435) 381-2381
Canyon View Jr. HS, Ag Science Teacher (435) 687-2265
Emery County High, Ag Science Teacher (435) 381-2689
San Rafael Jr. HS, Ag Science Teacher (435) 678-2291
Utah Association of Conservation Dist. (435) 384-3209

Garfield
USU Ag Extension Educator (435) 676-8826
Panguitch HS, Ag Science Teacher (435) 676-8805
Utah Association of Conservation Dist. (435) 865-0703

Grand
USU Ag Extension Educator (435) 259-7558
Utah Association of Conservation Dist. (435) 384-3209

Iron
USU Ag Extension Educator (435)586-8132
Canyon View HS, Ag Science Teacher (435) 586-2813
Parowan HS, Ag Science Teacher (435) 477-3366
Utah Association of Conservation Dist. (435) 865-0703

Juab
USU Ag Extension Educator (435) 623-1791
Juab HS, Ag Science Teacher (435) 623-1764
Utah Association of Conservation Dist. (435) 896-8566

Kane
USU Ag Extension Educator (435) 644-2551
Valley HS, Ag Science Teacher (435) 648-2278
Utah Association of Conservation Dist. (435) 865-0703

Millard
USU Ag Extension Educator (801) 743-5412
Delta HS, Ag Science Teacher (801) 864-2745
Millard HS, Ag Science Teacher (801) 743-6201
Utah Association of Conservation Dist. (801) 896-8566

Morgan
USU Ag Extension Educator (435) 829-3472
Morgan HS, Ag Science Teacher (435) 829-3418
Utah Association of Conservation Dist. (435) 572-9315

Piute
USU Ag Extension Educator (435) 577-2901
Utah Association of Conservation Dist. (435) 896-8566

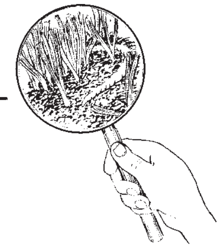
Rich
USU Ag Extension Educator (435) 793-2435
Utah Association of Conservation Dist. (435) 753-6029

Salt Lake
USU Ag Extension Educator (801) 468-3183
Bingham HS, Ag Science Teacher (801) 254-8005
Copper Hills HS, Ag Science Teacher (801) 567-8800
Jordan Tech. Center, Ag Science Teacher (801) 565-7981
West Jordan HS, Ag Science Teacher (801) 565-7576
Utah Association of Conservation Dist. (435) 572-9315

San Juan
USU Ag Extension Educator (435) 587-3239
Monticello HS, Ag Science Teacher (435) 587-2465
Monument Valley HS, Ag Science Teacher (435) 727-3204
San Juan HS, Ag Science Teacher (435) 678-2291
Utah Association of Conservation Dist. (435) 3843209

Sanpete
USU Ag Extension Educator (435) 835-2151
Gunnison Valley HS, Ag Science Teacher (435) 528-7756
Manti HS, Ag Science Teacher (435) 835-2281
N. Sanpete HS, Ag Science Teacher (435) 462-2452
Utah Association of Conservation Dist. (435) 896-8566

Sevier
USU Ag Extension Educator (435) 869-9262 Ext.275
N. Sevier HS, Ag Science Teacher (435) 529-3717
Richfield HS, Ag Science Teacher (435) 896-8909
S. Sevier HS, Ag Science Teacher (435) 527-4651
Utah Association of Conservation Dist. (435) 896-8566



Summit	
USU Ag Extension Educator	(435) 336-4451 Ext.219
N. Summit HS, Ag Science Teacher	(435) 336-5656
S. Summit HS, Ag Science Teacher	(435) 783-4313
Utah Association of Conservation Dist.	(435) 753-6029
Tooele	
USU Ag Extension Educator	(435) 882-9173
Grantsville HS, Ag Science Teacher	(435) 884-4500
Tooele HS, Ag Science Teacher	(435) 833-1983
Utah Association of Conservation Dist.	(801) 572-9315
Uintah	
USU Ag Extension Educator	(435) 781-5452
Uintah HS, Ag Science Teacher	(435) 789-0363
Utah Association of Conservation Dist.	(435) 789-2100
Utah	
USU Ag Extension Educator	(801) 370-8469
American Fork HS, Ag Science Teacher	(801) 789-0909
Lehi HS, Ag Science Teacher	(801) 768-7000
Payson HS, Ag Science Teacher	(801) 465-6030
Pleasant Grove HS, Ag Science Teacher	(801)785-8700
Provo HS, Ag Science Teacher	(801) 373-6550
Spanish Fork HS, Ag Science Teacher	(801) 798-4063
Springville HS, Ag Science Teacher	(801) 489-2870
Utah Association of Conservation Dist.	(801) 377-2262
Wasatch	
USU Ag Extension Educator	(435) 654-3211 Ext.331
Wasatch HS, Ag Science Teacher	(435) 654-2493
Utah Association of Conservation Dist.	(801) 377-2262
Washington	
USU Ag Extension Educator	(435) 652-5815
Dixie HS, Ag Science Teacher	(435) 673-4682
Enterprise HS, Ag Science Teacher	(435) 878-2248
Hurricane HS, Ag Science Teacher	(435) 635-2931
Utah Association of Conservation Dist.	(435) 865-0703
Wayne	
USU Ag Extension Educator	(435) 836-2479
Wayne HS, Ag Science Teacher	(435) 425-3411
Utah Association of Conservation Dist.	(435) 896-8566
Weber	
USU Ag Extension Educator	(801) 399-8208
Fremont HS, Ag Science Teacher	(801) 732-6027
Weber HS, Ag Science Teacher	(801) 786-2000
Utah Association of Conservation Dist.	(801) 572-9315
Statewide Coordinator for Agriculture in the Classroom	**(435) 797-1657** http://ext.usu.edu/aitc