

INTRODUCTION

Soil is the Earth's skin -- a natural covering formed throughout the ages by the forces of nature acting upon native rocks and vegetation. All life is ultimately dependent upon the productivity of soil. Therefore, it is important we understand the capabilities and limitations of this resource.

THE ACTIVITIES

TIME REQUIRED

What Do You Already Know About Soil?	30 to 45 minutes
What's This "Duff" on the Forest Floor?	20 to 30 minutes
"Dirt" Data	45 minutes
Analyze the Duff Data	30 to 45 minutes
Slope -- it's the Aspect	20 minutes
Soil Savvy	45 minutes



COMBINING THE ACTIVITIES

The activities in this unit are displayed singly. Depending upon the time available, and the skill of the participants, you may choose to do only one activity or the entire series. For maximum learning, the activities should be experienced in the order listed in the unit, however, other suggestions are:

Suggestion 1:

Title: Soil, A Basic Part of Our Environment/What's This Duff?/Dirt Data/ Slope

Introduction: Soil is a part of our natural environment that includes rocks, plants, water, wildlife and other natural resources. Their effect is shown by the number and kinds of horizons (layers) that develop in soils. Each horizon has its own characteristics which determine a soil's suitability for a use and thus, its related management problems.

Activity: What's This Duff...?

Transition Statement: We've looked at the surface to discover what makes up soil. Let's look deeper.

Activity: Dirt Data

Transition Statement: Another important factor when looking at soil is the slope of the land. In the next few minutes, we are going to examine slope and experiment with an easy method of determining slope.

Activity: Slope

Transition Statement: We've collected and analyzed numerous amounts of data about soil and slope. Let's apply this information by determining possible land uses for an area.

Suggestion 2:

Title: What Do You Already Know About Soil/with any other activity

Introduction: People already know a lot about soil. This activity helps them search memories and recall experiences that lead to learning even more.

Activity: What Do You Already Know

Transition: Now that you have been thinking about soil, let's examine a concept in depth.

CURRICULUM RELATIONSHIPS

Social Studies

1. Read about early farmers or settlers who homesteaded your state. What resources brought them? Where were the first fruit orchards planted? When?
2. How are soils influenced by the environment in your area? How do mountain ranges affect soil formation in valleys? How are climate, forests, and weather affected by mountain ranges in your state?



3. Use a map to locate agricultural areas in your state. Discuss questions such as: Do crops have different soil requirements? How do soils form in different geographic regions? How are local economies tied to soil types?
4. Find out if soils played an important part in politics. Did homestead acts, railroads, wagon roads, and school land grants help develop our nation? How?
5. Look at soil, climate, and agricultural maps of the world. Draw comparisons.
6. Research soil topics, such as development of the soil survey system, how pH tests and mineral tests were developed. Share your findings in a form appropriate for class activities.
7. Research and share knowledge about land management and conservation practices people use to increase productivity of land and/or wisely use soil resources.
8. What is happening to world soil resources? How are they being used or abused? What is being done to improve soil? Where are these projects taking place? Share your research appropriately.
9. Find out about the geology of your area. What forces shaped the land? What geologic forces are still at work? What forces may work in the future?
10. Construct a geologic landform map of your state and label the major areas by the processes which formed them.
11. Discuss how the landscape in which people settled and built affected their social lives and mobility.
12. How is land classified? What percentage of your state's agricultural income comes from each classification? What classification produces the highest percentage, the lowest? Summarize and graph your findings.

Science

1. Study the processes that produce soil.
2. Play the Web of Life game including soil as a component. This game begins with a ball of yarn. It is held by the "sun" who names an organism it affects and throws it to that organism. That organism names another upon which it depends or affects and throws the yarn ball to it. Each organism holds on to the string, so that after 10 to 20 relationships, the web is apparent to all.
3. Study the relationship of soil and water including such components as pH and suspension.
4. Observe and record plant growth in different environments, i.e. sun, shade, slope, and elevation.
5. Measure the pH reaction in soils around your school, home, and community. Chart your observations and infer why the reaction is what it is.
6. Experiment with water and soil to measure which has the greater force.
7. Different rock types weather at different rates, thereby, forming hills, valleys, and other interesting formations. Design an experiment(s) to show these processes.

Mathematics

1. Use a balance scale to weigh samples of different soil types.
2. Determine the ratio of topsoil thickness to the subsoil and parent material thickness in several soils. Graph your findings. Extend knowledge to relationship of soil depths to plant life growing in the different soils.
3. Measure and calculate the amount of soil erosion in a given area.
4. Determine the amount of water in a given amount of soil. Fill a coffee can with soil and weigh. (Know the weight of the can first). Dry the soil in an oven. Weigh the soil after drying. What percentage of the first weight was water? What is the use of water in the soil?

Language Arts

1. Research and write about different aspects of soil formation.
2. Write a creative essay about how a rock becomes a grain of sand, or choose your own topic after soil study.
3. Using any poetry form, students write poetry about any soil subject.
4. Write and illustrate a story about the formation of soil or any other soil subject for a primary classroom. Use the whole language approach.
5. Write explicit directions for someone else on how to be certain of the pH of a soil sample, or conduct any other kind of soil test.

Creative Arts

1. Sketch and label the soil profile of a road cut.
2. Using any materials, create a mosaic of a soil profile.
3. Construct models of a particular landscape.
4. Sketch landscape scenes showing improper use and/or management of land. Then, sketch the same scenes showing proper use and management.
5. Complete a blind contour drawing of a rocky landscape. Consult the art teacher if you do not know what a blind contour drawing is.
6. Construct a mobile or time line of the geologic history of your area.



WHAT DO YOU ALREADY KNOW ABOUT SOIL?

CONCEPT	Interaction, System, Theory, Organism
PRINCIPLE	Soil is basic to the environment and human life upon the earth. It is, however, often taken for granted and misused. People think of soil as dirt and do not recognize that many of their needs rely on soil.
OBJECTIVE	<ul style="list-style-type: none">• The student will be able to recall and share in groups previous experiences, values, and knowledge about soil and its parts.• The student will cooperatively work in small groups to answer questions based upon previous knowledge and group values and to discover what they know or need to learn more about.
PREPARATION	The teacher may want to assign one or two of these activities in part or all of the actual lesson. The resource person may want to ask the teacher to assign all or part of this as homework prior to his/her classroom presentation. She/he should complete the discussion with the students to be certain what the class knows.
MATERIALS NEEDED	<ul style="list-style-type: none">• Markers• Butcher paper or easel pads
PROCESSES USED	<ul style="list-style-type: none">• Observe• Infer• Hypothesize• Communicate
TIME	30 to 45 minutes



DOING THE ACTIVITY — (indoors or outdoors)

There are five options to meeting the stated objectives. The teacher and/or facilitator should choose the option most relevant to the group. You may want to approach the lesson from more than one viewpoint, so you could use more than one approach. Use cooperative learning as any teaching strategy normally employed in your classroom.

Option 1:

A. Set stage:

Soil, upon which human life depends, is basic to the environment. Most of us have had some experience with soil and probably know more than we think we know.

B. Procedure:

- (1) Let's find out what we already know. Close your eyes and think or imagine:
What's our favorite use of soil? If you could lie on your favorite beach, what would that beach look like? What does soil look like, feel like, or smell like? If you needed to buy a truckload of soil, what would you use it for?
- (2) Students then write their thoughts and rememberings down on paper. Students may share with another if you want them to.

C. Retrieve Data:

Ask students to share their ideas. Record and accept all answers, no order necessary. Total time; about 20 minutes.

Option 2:

A. Set Stage:

Soil is being formed continuously. How much do we already know about how soil is formed?

B. Procedure:

In small groups, brainstorm about how soil is formed and about the processes involved in soil formation. Allow 10 minutes.

C. Retrieve Data:

Groups share charts while facilitator makes a master chart for the entire class. Discussion will probably center around clarification of answers.



Option 3:

A. Set Stage:

What is soil anyway? Let's see if we can develop a definition.

B. Procedure:

In small groups, come to as complete a definition of soil as possible. Write the definition large enough to be seen by the rest of the class. Allow 15 minutes.

NOTE TO TEACHERS: Textbook definitions:

Soil: weathered rock or parent material, usually mixed with organic material and contains water, air, and living organisms.

Organism: a name for any living thing, plant, or animal.

Organic Material: matter which has been related to life, as life processes and is subject to decay by bacteria.

C. Retrieve Data:

(1) Display all definitions for class to see.

(2) Come up with one class definition. If you can't, you may be able to do so after this unit.

Option 4:

A. Set Stage:

Soil has many uses. What uses can you think of?

B. Procedure:

1. Individuals have two minutes to write down all the uses they can think of for soil and/or land.
2. They then have two minutes to check with a partner and add newly thought of uses.
3. Two students volunteer to act as recorders.

C. Retrieve Data:

1. Students alternately record comments working on separate easels as chalk boards. Then discuss.



Option 5 (Use this option if you want to transition to land use or land issue studies.)

A. Set Stage:

Soil is not all the same. It has different characteristics. Let's explore some of the ways soils may be different from each other.

B. Procedure:

1. With a partner, list and discuss at least three soil characteristics that affect land-use.
2. Allow 10 minutes.

C. Retrieve Data:

1. Record answers on a flip-chart or chalkboard.
2. Combine like answers and group.
3. Make a master chart of class responses.

CLOSURE

Use your favorite closure activity combined with the transition you want. This depends upon the option you selected.



WHAT'S THIS "DUFF" ON THE FOREST FLOOR?

CONCEPT	System, Fundamental Entities
PRINCIPLE	Learners involved in this activity will examine part of a forest floor, and through guided discovery, come to an understanding of what materials make up a forest floor.
OBJECTIVE	<ul style="list-style-type: none">• The student will be able to identify some of the materials on the forest floor which compose soil.
PREPARATION	Locate an area of forest floor big enough for your class. Try the activity to make sure you can find all the components you'll be investigating.
MATERIALS NEEDED	<ul style="list-style-type: none">• Activity Sheet A: Look at the Forest• Pencils• Clip board/student group
PROCESSES USED	<ul style="list-style-type: none">• Observe• Infer• Question• Define• Operationally classify
TIME	20 to 30 minutes



DOING THE ACTIVITY (Outdoors or indoors)

A. Set Stage:

To help us learn more about how soil is formed, we will take a closer look at what materials are becoming soil, by examining the forest floor.

B. Procedure:

1. Think back to the last time you walked through a forest. Write down some of the things you saw on the forest floor. What did you expect to see? Record on Activity Sheet A, #1.

ACTIVITY A: Look at the Forest

20 min.
groups

1. Predict what you will find in the top few inches of the area to be studied. List your predictions:

2. Select an area about 2 or 3 feet square on the ground and sift through the top 3 inches, recording the evidence of plants and animals you observe. Replace the ground in as near original condition as possible.

Name or Description of Item in the Soil	Quantity	Possible Effect on Soil

3. The terms: litter, duff, humus, are used to describe organic matter at the top of the soil. From your study above, complete the following chart:

Term and definition	Describe the characteristics, e.g., feel, smell, color	List the identifiable parts of plants and animals you found
Litter (identifiable dead things on surface)		
Duff (partially decomposed organic matter—compacted)		
Humus (almost completely decomposed non-identifiable organic matter)		

Investigating Your Environment
Soil 



2. Discuss answers to questions in #1.
3. Facilitator records answers for all to see.
4. Now, take class to the site for this activity.
5. Ask student pairs to find a site about two feet square to investigate.
6. Students have 15 minutes to complete Activity Sheet A, #2 and #3.

C. Retrieve Data:

Conduct a group discussion asking such questions as:

1. What did you find?
2. In which materials did you find the most animals or evidence? The least? What about plants? What might account for the difference?
3. Under what conditions would you expect to find a different number or kind of animal or plant?
4. What are some ways in which these components affect the soil?
5. What senses did you use to examine your area? What did you notice?

CLOSURE Based upon your observations take 5 minutes to describe soil and identify ways it can be formed.

TRANSITION Many times we use terms, but can't visualize what they are. Now, when someone talks about humus, you should be able to remember not only what it is, but how it feels, smells, and looks. Let's use the knowledge gained from our observations as we learn more about soil.



COLLECT SOIL DATA

CONCEPT	Order, Fundamental Entities, Interaction
PRINCIPLE	Learners have examined the top horizon of soil and discovered that it is made up of different elements. In this activity, they have the opportunity to examine a soil profile, and explore the composition of deeper soil layers and how they are related to each other.
OBJECTIVE	<ul style="list-style-type: none">• The student will be able to determine how many horizons make up a specific soil profile.• The student will be able to discuss soil characteristics of the different horizons and apply that knowledge to specific examples.
PREPARATION	The leader will need to locate and clean off a soil pit, cut bank or expose the stream bank with at least three major horizons. Print the soil micromonolith on card stock.
MATERIALS NEEDED	<ul style="list-style-type: none">• Jelly cups and lids• Can of water• Stapler and staples• Two cans of spray• Activity Sheet B: Analyzing Soil Horizons (print on heavy card stock and Activity B: Soil Horizons Data• Spray bottles• Cans of loam and clay• Measuring device• Thermometer• Pencils• pH kits• Hand lenses• Coffee grounds• Rotten log pieces
PROCESSES USED	<ul style="list-style-type: none">• Classify• Measure• Use numbers• Observe• Communicate• Interpret data
TIME	45 minutes



DOING THE ACTIVITY — (outdoors)

A. Set Stage

The properties or characteristics of a soil layer (also known as horizons) will tell what uses can be made of the land. In the previous activity we examined the top of the soil; in this activity we will examine a cross-section or profile of soil layers.

B. Procedure

1. Begin with a discussion: What things do you notice as you look at this soil profile? What are some things that might be important to know about soil in order to determine its use?
2. Extend the questioning to bring forth as much data as possible.
3. End the discussion by saying: Because various soil characteristics such as color, texture, structure, temperature, and pH affect the ways land can be used, knowing these conditions is essential to land-use planning.

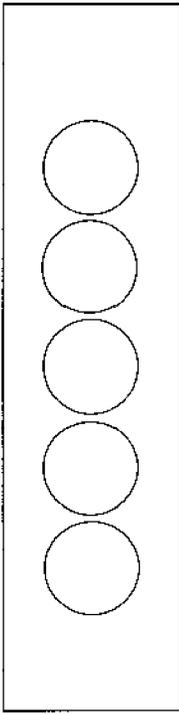
4. Hand each student Activity Sheet B.
Tell the class that they will complete the activity by collecting the information needed. Show equipment to use as needed.

ACTIVITY B: Soil Horizons Data 35 min. continued

ACTIVITY B: Analyzing Soil Horizons individuals

Use the "Soil Horizons Data Sheet" and the available equipment to record your observations below. Make a micromonolith using the materials provided.

Sketch your soil profile, label the layers or horizons, and record the data.

PROFILE SKETCH	DATA
	Air temperatures 3' above surface _____ Just above surface _____ Contents of layers above top soil (if existing): Litter - _____ Duff - _____ Humus - _____ Total depth of layer above top soil _____ Horizon _____ Depth _____ Color _____ Texture _____ Structure _____ Temperature _____ pH _____ Plant roots visible _____
	Horizon _____ Depth _____ Color _____ Texture _____ Structure _____ Temperature _____ pH _____ Plant roots visible _____
	Horizon _____ Depth _____ Color _____ Texture _____ Structure _____ Temperature _____ pH _____ Plant roots visible _____
	Horizon _____ Depth _____ Color _____ Texture _____ Structure _____ Temperature _____ pH _____ Plant roots visible _____
	Horizon _____ Depth _____ Color _____ Texture _____ Structure _____ Temperature _____ pH _____ Plant roots visible _____
Parent Material (C Horizon) Describe type of rock in the bedrock (if present) _____	



5. Go over the information on the Soil Horizons Data Sheet. Model how to collect soil data characteristics, but let participants do most of the observations.
6. Use cans of loam, sand, and clay to demonstrate texture. Then participants have a comparison for textures. Soil must be moistened to get true colors and texture, so spray often with a water bottle.
7. Demonstrate how to use the pH kits on coffee grounds or parts of a rotten log.
8. If the group is constructing a micromonolith, show them a model. Alternative instructions are part of this lesson.
9. Give the students 30 minutes to gather the data and construct the micromonolith. They should complete an individual activity sheet but they should work in groups of 4 in a pit and help each other.
10. Make sure each group determines the number of horizons in their pit or on their cut bank.

C. Retrieve Data

1. Discuss briefly the data recorded on the activity sheet, Possible discussion questions are:
 - (a) What did you find?
 - (b) How did you describe the A horizon? B horizon?
 - (c) What evidence did you find that the parent material was becoming part of the soil? What evidence did you find about the material on the forest floor becoming soil?
 - (d) How might we define soil, now that we have added some information?

CLOSURE Look at your data or micromonolith card and share what you have learned so far about soil.

TRANSITION In the next activity, we will use the information gathered in this activity to complete an analysis of your findings.

ANALYZE SOIL

CONCEPT	Cause and Effect, Change, Order
PRINCIPLE	This activity is a discussion and group analysis of the soil data collected in the previous activity.
OBJECTIVES	<ul style="list-style-type: none">• The student will be able to determine possible land uses by analyzing soil characteristics.• The student will be able to use data collected, and combined with observations and prior knowledge, make basic assumptions about potential land use.• The student will be able to define soil in their own words.
PREPARATION	Information gathered in <u>Soil Data</u>
MATERIALS NEEDED	<ul style="list-style-type: none">• Activity Sheet C: <u>Analyzing Soil Data</u>• Information gathered in Activity C: <u>Analyzing Soil Data</u> and <u>Soil Data Tables</u>• Pencils• Local plant identification books
PROCESSES USED	<ul style="list-style-type: none">• Communicate• Use numbers• Infer• Classify• Observe• Interpret data
TIME	30 to 45 minutes



DOING THE ACTIVITY (indoors, outdoors)

A. Set Stage:

Soil properties have a lot to do with the land's potential to be safely used for different purposes. We will use the data you gathered in the soil pit to further our understanding of soil.

B. Procedure:

1. Hand out Activity Sheet C and accompanying Soil Data Table needed to complete the assignment.



2. Activity C is based upon data collected in Activity B.
3. As groups or pairs work, the facilitator circulates among the groups, keeping them engaged and monitoring their progress. This activity should take between 20 to 30 minutes.

C. Retrieve Data:

1. After all groups have finished ask: Using the observed color of the top layer and Tables 2A and 2B of the Soil Data Sheet, what did you say about the erosion factor of your soil?
2. Using the structure of your soil and Table 4, what did you say about the drainage of water?
3. How well did the plants in the study area conform to the soil pH plant chart?
4. Have groups read how they would set up their own soil pH plant chart. Point out that soil scientists determine soil pH and record the plants growing in the area to construct a table or chart, for use in interpreting soil pH-plant relationships elsewhere.

CLOSURE

Ask how their previous description from Activity A, now that they know more about soil, compares to what they know now.

TRANSITION

Slope is an aspect of land used to determine land use. This next activity explores slope.

SLOPE — IT'S THE ASPECT

CONCEPT	Quantification, Force
PRINCIPLE	Knowing the slope of the land is needed in order to adequately discuss land-use possibilities. This activity provides hands-on experience in determining the slope of a given site.
OBJECTIVES	<ul style="list-style-type: none">• The student will be able to measure the slope of a given site following directions and then calculate the percentage of slope.
PREPARATION	Select an area near the soil pit for slope measurement. Use two areas of different slope to demonstrate how land use can vary according to slope. Practice before teaching if you are not familiar with the technique.
MATERIALS NEEDED	<ul style="list-style-type: none">• For each group: 50" or 100" stick<ul style="list-style-type: none">• Tape measure• Water jars, half full of water• Activity Sheet D: <u>Determine Slope of the Land</u>
PROCESSES USED	<ul style="list-style-type: none">• Measure• Observe• Communicate• Use numbers
TIME	20 minutes



DOING THE ACTIVITY (outdoors)

A. Set Stage:

The slope of the land is an important consideration when determining the potential use of the land.

B. Procedure:

1. Hand out Activity Sheet D and equipment to complete the activity.

10 min.
groups

ACTIVITY SHEET D: Determine The Slope Of The Land

1. Select a place that represents the average slope of the land being studied or take several measurements and average them.
2. Place one end of a 100" stick on the slope you want to measure. Hold stick so it is level.
3. Place a level or jar with some liquid in it on the outright stick. Raise or lower the stick until the water is level level.
4. Measure the number of inches the free end of the stick is off the ground.
5. The number of inches is the slope of the land in percent.
6. Repeat the above steps in several different areas to get an average slope of the land being investigated.

Note: If you use a different length stick, then convert by using the conversion table below.

Stick length (Inches)	Distance the end of the stick is above the ground (inches)	Multiply by conversion factor	Slope (percent)
100"	_____ X	1	= %
50"	_____ X	2	= %
24"	_____ X	4	= %

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2. Demonstrate the techniques.
3. Give students 10 minutes to complete the activity.

C. Retrieve Data:

During the discussion, determine what was the average slope measurement and if participants have any questions about the percentage of the process.

CLOSURE

Let's review what we have accomplished. We've identified some parts of the forest floor, collected and analyzed some observable characteristics of soil layers and determined average slope of a site. Have participants supply this information in a way they are comfortable with.

TRANSITION

Now we are ready to determine some appropriate uses of this land.



SOIL SAVVY

CONCEPT	Cause & Effect, Interaction, System
PRINCIPLE	Land is evaluated by different criteria depending upon what it can be used for. Regardless of the use, criteria is based upon the characteristics of the soil resource.
OBJECTIVES	<ul style="list-style-type: none">• The student will be able to use published criteria to evaluate a piece of land for two potential uses. The student will be able to make inferences about soil management.
PREPARATION	Completion of previous activities by the participants
MATERIALS NEEDED	<ul style="list-style-type: none">• Data from previous investigations• Activity Sheet E: <u>Determine Possible Land Uses</u> and Activity E: <u>Land Use Data Tables</u>• Pencils
PROCESSES USED	<ul style="list-style-type: none">• Interpret data• Use numbers• Communicate• Observe• Infer• Classify• Question• Hypothesize• Interpret data• Use numbers
TIME	45 minutes



DOING THE ACTIVITY (indoors, outdoors)

A. Set Stage:

Different sets of criteria are used to evaluate land for different uses. In this investigation we will evaluate for two uses, agriculture and occupancy.

B. Procedure:

1. Distribute Activity E and Land Use Data Tables to all students.

ACTIVITY E: Determine Possible Land Uses

20 min.
groups

The great diversity of potential land uses requires different sets of criteria that analyze a variety of soil and land factors in different ways. These factors must be considered in determining the most appropriate land use for a given area. The most limiting soil factor will be the major influence in determining the best use of the land. See Land Use Data Table for definition of limiting soil factor.

Using the data from Activity D, E and the Land Use Data Table, answer the following questions.

According to the Land Use Data Tables, this land could be used for agriculture use (list and explain why)

Occupancy:

Land uses

Road and streets

Building sites

Septic tank litter fields

Picnic and camp areas

I feel the best uses of this land would be:

because—

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2. Working in groups, use the information you have gathered and the agricultural use table to determine the best agricultural use. Follow the directions on the table.
3. When you finish agriculture, evaluate the four occupancy uses.



ACTIVITY E: Land Use Data Tables

10 min.
groups

AGRICULTURAL USES

Directions: Circle the item in each of the five columns below that best describes each of the five soil factors in the soil you studied. The most limiting soil factor will determine the best agricultural use of the land. A limiting soil factor can be defined as something that will restrict the use of land for desired activities. The most limiting factor indicates the most appropriate agricultural use.

SOIL FACTORS					Agricultural Uses
Slope (%)	Erosion Hazard	Soil Depth	Drainage	Texture	
0-3	None	Deep	Good	Loam or silt loam*	Farm crops — cultivation good soil management practices
3-20	Slight to moderate	Mod. deep	Somewhat poor	Sandy, loam or silty clay	Farm crops — few to several special cultivation practices
20-50	Severe	Shallow	Poor	Sand or Clay	Occasional cultivation, many special practices
0-2	None to slight	Deep	Good to poor	Stony	Pasture-woodland cultivation; no machinery can be used
30-50	Very severe	Deep to shallow	Good to poor	Sandy, loam, clayey or rocky	Pasture, timber growing, woodland, wildlife, no cultivation machinery
all	None to extreme	Deep to shallow	Extensive to poor	Rockland, river wash, sand dunes	Wildlife, recreation

*Loam is a combination of sand, silt, and clay particles.

Occupancy land uses

Select the most limiting factor for each land use and record the overall limitation (slight, moderate or severe) on Task F.

Land Use and Factors Affecting That Use	Slight Limitation	Moderate Limitation	Severe Limitation
Roads and Streets			
Slope	0-12%	12-30%	Over 30%
Depth	Over 40 in.	20-40 in. (50.8-101.6 cm)	Less than 20 in.
Water Table	Over 20 in.	10-20 in. (25.4-50.8 cm)	Less than 10 in.
Building Sites			
Slope	0-12%	12-20%	Over 20%
Depth	Over 40 in.	20-40 in. (50.8-101.6 cm)	Less than 20 in.
Water Table	Over 80 in.	20-30 in. (50.8-76.2 cm)	Less than 20 in.
Septic Tank Filter Fields			
Slope	0-7%	7-12%	Over 12%
Depth	Over 6 ft.	4-6 ft. (121.9-182.9 cm)	Less than 4 in.
Water Table depth below trench	Over 4 ft.	2-4 ft. (61.0-121.9 cm)	Less than 2 ft.
Picnic and Camp Areas			
Slope	0-7%	7-15%	Over 15%
Stones	0-20%	20-50%	Over 50%
Water Table during season of use	Over 30 in.	20-30 in. (50.8-76.2 cm)	Less than 20 in.

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Soil 

C. Retrieve Data:

Conduct a discussion and find the answers to these questions:

1. Based on the tables, what do you feel is the most appropriate agricultural use? What was the most limiting factor for agricultural use?
2. What types of limitations does this soil impose on occupancy uses?
3. What were some of your thoughts after looking at occupancy use limitations? What might slight, moderate, and severe mean for building a road?
4. So far we've discussed only physical characteristics of land. What other factors would we need to consider in determining other uses for this land?
5. What examples can you recall where some of these factors have affected land use?

CLOSURE

Based on our investigations and discussions, what have we found out about soil? Record on chart as summary to the unit.

ACTIVITY A: Look at the Forest

20 min.
groups

1. Predict what you will find in the top few inches of the area to be studied. List your predictions:

2. Select an area about 2 or 3 feet square on the ground and sift through the top 3 inches, recording the evidence of plants and animals you observe. Replace the ground in as near original condition as possible.

Name or Description of item in the Soil	Quantity	Possible Effect on Soil

3. The terms: litter, duff, humus, are used to describe organic matter at the top of the soil. From your study above, complete the following chart:

Term and definition	Describe the characteristics, e.g., feel, smell, color	List the identifiable parts of plants and animals you found
Litter (identifiable dead things on surface)		
Duff (partially decomposed organic matter—compacted)		
Humus (almost completely decomposed non-identifiable organic matter)		

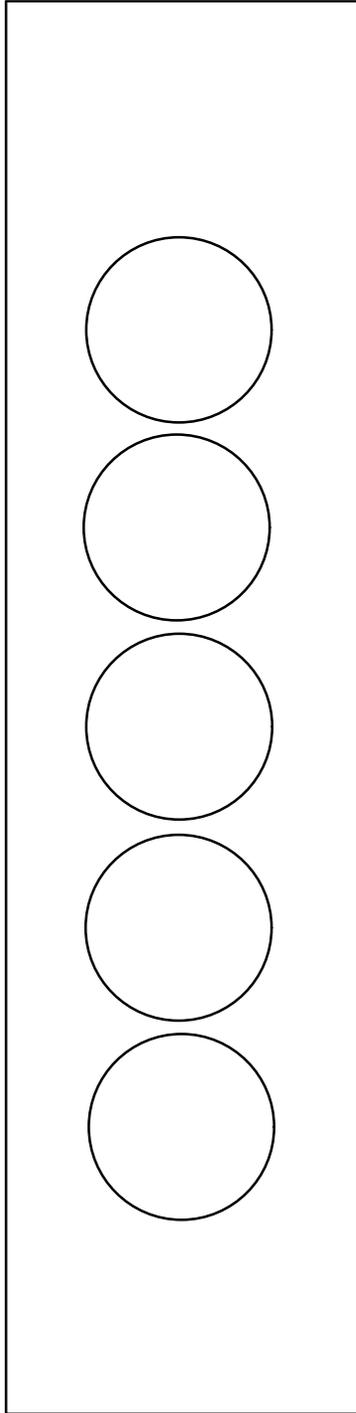


ACTIVITY B: Analyzing Soil Horizons

Use the "Soil Horizons Data Sheet" and the available equipment to record your observations below. Make a micromonolith using the materials provided.

Sketch your soil profile, label the layers or horizons, and record the data.

PROFILE SKETCH



DATA

Air temperatures

3' above surface _____ just above surface _____

Contents of layers above top soil (if existing):

Litter -- _____

Duff-- _____

Humus -- _____

Total depth of layer above top soil _____

Horizon _____

Depth _____ Color _____

Texture _____ Structure _____

Temperature _____ pH _____

Plant roots visible _____

Horizon _____

Depth _____ Color _____

Texture _____ Structure _____

Temperature _____ pH _____

Plant roots visible _____

Horizon _____

Depth _____ Color _____

Texture _____ Structure _____

Temperature _____ pH _____

Plant roots visible _____

Horizon _____

Depth _____ Color _____

Texture _____ Structure _____

Temperature _____ pH _____

Plant roots visible _____

Horizon _____

Depth _____ Color _____

Texture _____ Structure _____

Temperature _____ pH _____

Plant roots visible _____

Parent Material (C Horizon)

Describe type of rock in the bedrock (if present)



Here are some ways to collect information about different soil characteristics.

1. soil layers (horizons)

Mark where the soil changes color and general appearance. Many soils have 3 major layers or horizons; i.e., top soil, subsoil, and parent material. Because soil information has many variables, you may find more or fewer layers.

2. color

Describe the color of each major layer, using your own descriptive terms. Moisten soil to get a more accurate color description.

3. texture (how the soil feels)

Determine the texture of each major layer.

Texture is determined by feel. Rub a moistened sample of soil between thumb and forefinger. Spit on sample to moisten, if water is not available.

- If it feels very gritty and not plastic sandy
- If it feels smooth and slick or somewhat gritty and sticky loamy*
- If it feels smooth, plastic, very sticky clayey

4. structure (how the soil is put together in geometric shapes)

Determine the structure of each major layer.

Carefully break apart a shovelful of soil from each layer and match its characteristics with one of these structure words:

blocky 
 platy 
 columnar 
 granular 

5. temperature

Determine the temperature of each layer. Use the soil thermometer.

6. pH (acidity or alkalinity)

Determine the pH of each major layer. Soil pH is an indication of how well certain plants can grow in the soil.

Put a small sample of the soil to be tested in a porcelain dish. Do not touch the sample. Use just enough pH reagent to saturate the soil sample. Match the color of the pH reagent at the edge of the soil sample with pH color chart.

Each person should **construct a soil micromonolith.** (Activity B) A micromonolith is a small model of a soil profile in which samples of each soil layer are attached to a card.

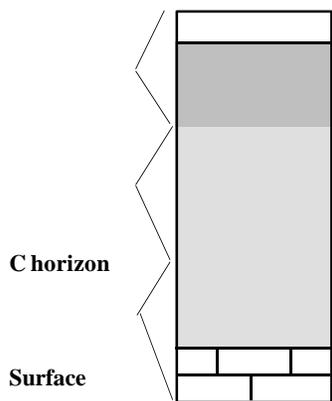
*Loamy is a combination of sand silt and clay particles.

Things to look for in soil:

- 1. Color** —tells about organic matter, drainage, biotic activity, fertility.
- 2. Texture** —the feel;—sandy, silt, clay—tells water holding capacity; looseness, workability of the soil.
- 3. Structure** —the shape—blocky, platy, granular—tells of drainage, aeration, water intake.
- 4. Depth** —the size of the storage bin—moisture; availability of minerals for plants.
- 5. Reaction** —the suitability of plant growth, the amount of acid or alkalinity in the soil.

The general soil profile below is how you might find some of the different layers:

A horizon



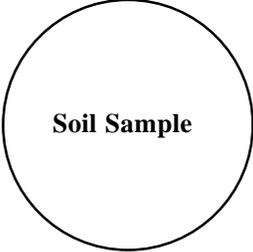
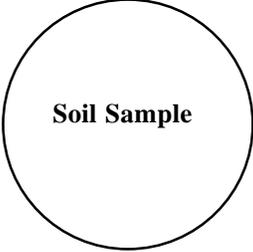
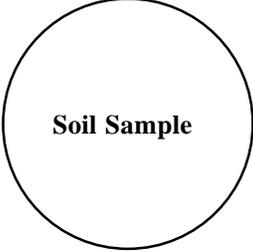
- Subsurface** - Moderately dark—many roots, moderate organic matter, commonly leached. **B horizon**
- Subsoil** - Below plow depth—brown or reddish colored—more clay than surface, fewer roots.
- Lower subsoil** - More yellowish and less clay—fewer roots than subsoil, less aeration than above.
- Parent material** - Unconsolidated—slightly weathered rocky mass from which soil develops. No biotic activity, few roots.
- Bedrock** - Consolidated rock



ACTIVITY C: Analyzing Soil Horizons (alternative)

ALTERNATIVE:

1. Staple as many jelly cup lids to the card as you have horizons.
2. Gather a sample from each level in the jelly cup.
3. Snap the cup to the lid.
4. Complete the written soil data.

SOIL MICROMONOLITH CARD	
 Soil Sample	Horizon _____ Color _____ Texture _____ Structure _____ Depth _____ pH _____
 Soil Sample	Horizon _____ Color _____ Texture _____ Structure _____ Dep _____ pH _____
 Soil Sample	Horizon _____ Color _____ Texture _____ Structure _____ Depth _____ pH _____

ACTIVITY C: Analyze Soil Data

20 min.
groups

Work in small groups.

Using the soil data you collected and the information provided in the soil data tables included in this Activity, complete the following:

1. Based on soil depth, complete the following (Refer to Table 1):

The potential of my soil for water storage is _____

Why? _____

2. Based on color, complete the following (Refer to Table 2):

a. The top soil, or A horizon:

amount of organic material _____

erosion factor _____

fertility _____

b. The drainage in the subsurface soil or B horizon is: _____

3. Based on the texture complete the following (Refer to Table 3):

Lay or horizon	Water holding capacity	Looseness of soil
Top soil A		
Subsoil B		

4. Based on the structure complete the following (Refer to Table 4):

Layer or horizon	Penetration of Water	Drainage	Aeration
Top soil A			
Subsoil B			

5. Based on the pH ranges complete the following (Refer to Table 5):

Some plants could grow here based on the soil pH plant chart	Some plants actually observed growing here

6. Based on the soil temperatures complete the statement below (Refer to Table 6): The plants on my soil have _____ growth taking place now. In 3 months I predict that the growth conditions of the soil based on soil temperature will be _____.
The growing season (frost free days) in this area is about _____ days.

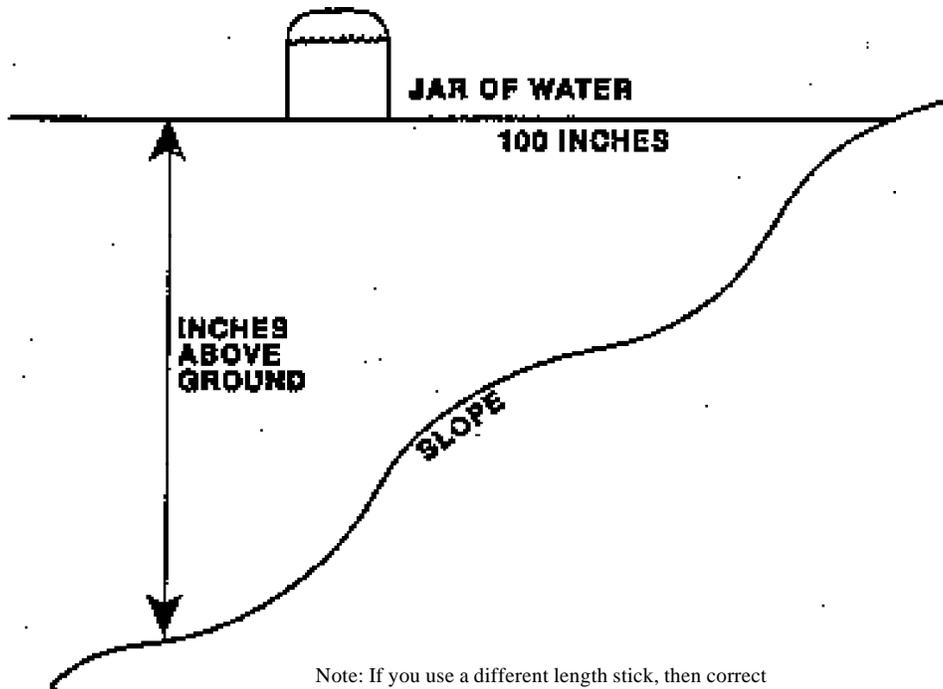


ACTIVITY SHEET D: Determine The Slope Of The Land

10 min.
groups

1. Select a place that represents the average slope of the land being studied or take several measurements and average them.
2. Place one end of a 100" stick on the slope you want to measure. Hold stick so it is level.
3. Place a level or jar with some liquid in it on the outright stick. Raise or lower the stick until the water is level level.
4. Measure the number of inches the free end of the stick is off the ground.
5. The number of inches is the slope of the land in percent.
6. Repeat the above steps in several different areas to get an average slope of the land being investigated.

Note: If you use a different length stick, then correct by using the conversion table below.



Note: If you use a different length stick, then correct by using the conversion table below.

CONVERSION TABLE

Stick length (inches)	Distance the end of the stick is above the ground (inches)	Multiply by conversion factor	Slope (percent)
100"	_____ X	1 =	%
50"	_____ X	2 =	%
24"	_____ X	4 =	%

ACTIVITY E: Determine Possible Land Uses

20 min.
groups

The great diversity of potential land uses requires different sets of criteria that analyze a variety of soil and land factors in different ways. These factors must be considered in determining the most appropriate land use for a given area. The most limiting soil factor will be the major influence in determining the best use of the land. See land Use Data Table for definition of limiting soil factor.

Using the data from Activity D, E and the Land Use Data Table, answer the following questions.

According to the Land Use Data Tables, this land could be used for agriculture use (list and explain why)

Occupancy:

Land uses

Road and streets

Building sites

Septic tank filter fields

Picnic and camp areas

I feel the best uses of this land would be:

because—

ACTIVITY E: Land Use Data Tables

10 min.
groups

AGRICULTURAL USES

Directions: Circle the item in each of the five columns below that best describes each of the five soil factors in the soil you studied. The most limiting soil factor will determine the best agricultural use of the land. A limiting soil factor can be defined as something that will restrict the use of land for desired activities. The most limiting factor indicates the most appropriate agricultural use.

SOIL FACTORS					Agricultural Uses
Slope (1%)	Erosion Hazard	Soil Depth	Drainage	Texture	
0-3	None	Deep	Good	Loam or silt loam*	Farm crops -- cultivation good soil management practices
3-20	Slight to moderate	Mod. deep	Somewhat poor	Sandy, loam or silty clay	Farm crops—few to several special cultivation practices
20-30	Severe	Shallow	Poor	Sand or Clay	Occasional cultivation, many special practices
0-2	None to slight	Deep	Good to poor	Stony	Pasture-woodland cultivation; no machinery can be used
30-90	Very severe	Deep to shallow	Good to poor	Sandy, loam, clayey or rocky	Pasture, timber growing, woodland, wildlife, no cultivation machinery
all	None to extreme	Deep to shallow	Excessive to poor	Rockland, river wash, sand dunes	Wildlife, recreation

*Loam is a combination of sand, silt, and clay particles.

Occupancy land uses

Select the most limiting factor for each land use and record the overall limitation (slight, moderate or severe) on Task F.

Land Uses and Factors Affecting That Use	Slight Limitation	Moderate Limitation	Severe Limitation
Roads and Streets Slopes Depth Water Table	0-12% Over 40 in. Over 20 in.	12-30% 20-4 in. (50.8-101.6 cm) 10-20 in. (25.4-50.8 cm)	Over 30% Less than 20 in. Less than 10 in.
Building Sites Slopes Depth Water Table	0-12% Over 40 in. Over 30 in.	12-20% 20-40 in. (50.8-101.6 cm) 20-30 in. (50.8-76.2 cm)	Over 20% Less than 20 in. Less than 20 in.
Septic Tank Filter Fields Slope Depth Water Table depth below trench	0-7% Over 6 ft. Over 4 ft.	7-12% 4-6 ft. (121.9-182.9 cm) 2-4 ft. (61.0-121.9 cm)	Over 12% Less than 4 in. Less than 2 ft.
Picnic and Camp Areas Slope Stones Water Table during season of use	0-7% 0-20% Over 30 in.	7-15% 20-50% 20-30 in. (50.8-76.2 cm)	Over 15% Over 50% Less than 20 in.