

Unit C: Traits of Soil

Lesson 3: Understanding Soil Color

Student Learning Objectives: Instruction in this lesson should result in the students achieving the following objectives:

1. Identify physical features used to differentiate between soils
2. Identify colors used to describe surface soils
3. Explain factors that determine surface soil colors
4. Identify colors used to describe subsoil
5. Explain factors that determine subsoil colors
6. Explain how parent material, age, and slope determine soil color

Recommended Teaching Time: 4 Hours

Recommended Resources: The following resources may be useful in teaching this lesson

- A PowerPoint has been provided

List of Equipment, Tools, Supplies, and Facilities:

Writing surface
PowerPoint Projector
PowerPoint Slides
Transparency Masters

Terms: The following terms are presented in this lesson (shown in italics and on PowerPoint Slide 2)

- Bright colored
- Color
- Deciduous hardwood forest
- Dull colored
- Humus
- Mottle colored
- Native vegetation
- Structure
- Tall prairie grass
- Texture

Interest Approach: Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Split the students into pairs. Have them discuss what color each one thinks soil is. Have them discuss why they think it is that color. Then have the groups present their discussion notes to the rest of the class. Show how each person thinks soil is a different color because soil can be all different colors.

Summary of Content and Teaching Strategies

Objective 1: Identify physical features used to differentiate between soils

(PowerPoint Slide 3)

- I. Soils have many features that are used to recognize differences between them. They include:
 - A. **Texture**—coarseness or fineness of soil particles
 - B. **Structure**—the way in which soil particles are held together
 - C. Depth of horizons—the depth of each soil
 - D. **Color**—refers to the darkness or lightness of the soil color

Split the students into groups of three or four. Have each group develop a list of features that would make one soil different from another. Give the students 5 minutes then have them discuss with another group and form one top ten list. Then have each set of groups present their top ten list and make one large list.

Objective 2: Identify colors used to describe surface soils

(PowerPoint Slide 4)

- II. Colors associated with surface soils are dependent on the amount of organic matter found in them. Colors may be classified as:
 - A. Very dark—approximately 5% organic matter
 - B. Dark—approximately 3.5% organic matter
 - C. Moderately dark—approximately 2.5% organic matter
 - D. Light—approximately 2% organic matter
 - E. Very light—approximately 1.5% organic matter

Take students outside to collect a soil sample. Have students begin to take soil samples from various areas at different depths. Make sure students clearly document where the sample was taken and at what depth. Once the students have taken these depths, take them back inside and set the soil samples out in the room side by side. Have the students compare the different samples. They can discuss all differences but try to focus on color mostly. Have a sample of “Very Dark”, “Moderately Dark”, and “Very Light” for the students to see. This will give them a reference. Then the students must work individually to classify each sample in the different classes: very dark, dark, moderately dark, light, and very light. Once the students are finished have them compare answers and discuss how different levels of organic matter are found in the different stages or classes of soil color.

Objective 3: Explain factors that determine surface soil colors

(PowerPoint Slide 5)

- III. The amount of organic matter is the factor used to determine the color of the surface soil. The amount of organic matter is determined by the kind of native vegetation.

Native vegetation refers to the type of plant material that grew on the soil. For example, two primary types of native vegetation found in most countries are:

(PowerPoint Slide 6)

- A. **Tall prairie grass**—grasses had abundant roots, which filled the top 1 to 2 feet of the soil. Only partial decay of the roots over a long period of time gave the high organic matter content to prairie soils. These soils are high in **humus**, a type of organic matter that results from the partial decay of plants and animals. They tend to be dark to very dark.
- B. **Deciduous hardwood forests**—a shallow layer of partially decayed leaves, twigs, and fallen logs accumulated on the surface. Because they were on the surface, they decayed more rapidly than those of the prairie grass. This left only a thin, moderately dark top layer. As these soils have been worked, they have been mixed with the lighter soil underneath to produce a lighter color.

Ask students what is meant by native vegetation. Ask them to identify the type(s) of plants they believe once grew in their area and other parts of the Province. Use text materials or the notes above to discuss how the soils formed from the two types of native vegetation differ. Ask if the characteristics of the soil for a particular type of native vegetation is consistent with the soil found in their particular area.

Objective 4: Identify colors used to describe subsoil

(PowerPoint Slide 7)

- IV. Subsoil colors are associated with natural drainage of the soils. This is the drainage condition that existed when the soil was forming. Subsoil colors are classified as:
 - A. **Bright-colored**—brown, reddish brown, or yellowish brown
 - B. **Dull-colored**—gray or olive gray
 - C. **Mottle-colored**—clumps of both bright and dull colors mixed together

Have a sample of the three different colors, Bright, Dull, and Mottle. Have the students examine each one. Then have them decide which color represents good drainage, ok drainage, and poor drainage. Discuss each one as a class. Then have the students make a group and try to explore how these colors were made and what they mean exactly. Explain to them that Gray is the natural color of soil when organic matter, iron, and other elements are removed. The mottles are areas of soil that has had the organic matter and iron relocated to another area. The bright colors are a symbol of everything is in place and has not moved.

Objective 5: Explain factors that determine subsoil colors

(PowerPoint Slide 8)

- V. The color of subsoil is determined by the status of iron compounds. These are determined by the type of drainage found in the soil as it formed.
 - A. Good drainage provides subsoil that is bright in color. This is because the iron found in these soils has been oxidized. This can be compared to metal that

oxidizes or rusts when both moisture and air are present. Rust has a bright or orange color.

(PowerPoint Slide 9)

- B. Poor drainage provides subsoil that is dull or gray in color. This is because the iron found in those soils has not been subject to air or oxygen. The iron compounds do not oxidize. This leaves a grayish color.
- C. Somewhat poor drainage provides subsoils that are mottled. This is because the soil was saturated with moisture for certain periods. This leaves a gray color in some soil clumps. Since the soil was comparatively dry during other periods, it left a bright color in other soil clumps.

Put three different buckets up on a table. Make one a brand new bucket, one older with a little bit of rust and one really old bucket almost completely rusted everywhere. Ask students to describe which bucket compares to “well drained” soil, “somewhat poorly” drained soil, and “poorly” drained soil. Then explain that this rust is the same thing that occurs in the soil. Poor drainage essentially rusts the iron naturally found in the soil.

Objective 6: Explain how parent material, age, and slope determine soil color

(PowerPoint Slide 10)

VI. In addition to organic matter and drainage, soil color may also be affected by other factors:

- A. Parent material. The color of a soil is associated with the kind of material from which it is formed. Soils that are developed from sand or light-colored rock will be lighter. Those developed from darker materials such as peat or muck, will be darker in color.

(PowerPoint Slide 11)

- B. Age. Some soils can be younger than others. As soils age, much of the darker color is lost due to the weathering process. This causes the soil to lose organic matter.
- C. Slope. Soil on top of hills is usually lighter in color than the soil in depressions or on level ground. This is partly due to the darker topsoil being washed off the hills. This leaves the lighter subsurface or subsoil exposed. Also, there tends to be moisture on lower land. This allows more abundant growth of plants in the lower areas, which in turn provides more organic matter and a darker color to lower soils.

Have students split into groups of 3. Each member should come up with a definition on how either parent material, age, or slope, affect soil color. Then each member of the group will present their definition to their group and then in front of the entire class.

Review/Summary: Use the student learning objectives to summarize the lesson.

Have the students respond to the questions on **PowerPoint Slide 12**. Student responses can be used to determine which objectives need to be reviewed.

(PowerPoint Slide 13)

Application: Use the 10 pictures of different soils with different drainages on PowerPoint Slides 14-18. Have the students write down what type of drainage each soil has. Their choices are: well, moderately well, somewhat poorly, or poorly drained soil.

Answers to 10 soil drainages on PowerPoint Slides:

- Picture 1 on Slide 14 - Poor
- Picture 2 on Slide 14 - Well
- Picture 3 on Slide 15 - Moderately Well
- Picture 4 on Slide 15 - Well
- Picture 5 on Slide 16 - Somewhat Poorly
- Picture 6 on Slide 16 - Well
- Picture 7 on Slide 17 - Poor
- Picture 8 on Slide 17 - Well (white sand)
- Picture 9 on Slide 18 - Moderately Well
- Picture 10 on Slide 18 - Poor

Evaluation: A sample test has been provided.

Answers to Sample Test:

Part One: Matching

1=e, 2=d, 3=a, 4=c, 5=f, 6=b

Part Two: Completion

1. organic matter
2. drainage
3. mottle
4. organic matter
5. oxidizes

Part Three: Short Answer

1. Soil on slopes tends to erode which leaves behind the lighter color soil found beneath the surface soil. Also, less moisture on slopes compared to lower or more level areas, allows less plant growth. This in turn leaves less organic matter.
2. The decaying leaves, twigs, etc. accumulated on the surface. This enabled them to decay more rapidly than the roots within the soil of the prairie grass.
3. a. poor drainage
b. somewhat poor drainage
c. good drainage

Test

Unit C Lesson 3: Understanding Soil Color

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | | |
|-----------------------|-----------------|----------------------|
| a. tall prairie grass | c. dull-colored | e. humus |
| b. texture | d. structure | f. native vegetation |

- _____ 1. A type of organic matter.
- _____ 2. Arrangement of soil particles into clusters or peds.
- _____ 3. Vegetation that provided a deep, dark plow layer of soil.
- _____ 4. Used to describe soils that developed under a poor drainage situation.
- _____ 5. Term describing the type of plants once grown naturally in a particular area.
- _____ 6. The coarseness or fineness of the soil particles.

Part Two: Completion

Instructions. Complete the following statements.

- 1. Colors found in the surface layer of soils are determined by the amount of _____ found in them.
- 2. Subsoil colors are determined by the degree of _____ present when they were forming.
- 3. Subsoil colors that show clumps of both bright and dull colors mixed together within a particular area are said to be _____ colored.
- 4. As soils age, the color of the soil tends to become lighter since the amount of _____ declines.

5. When an abundant amount of air was present in the subsoil while it was forming, the iron compounds in the soil _____; giving them a brighter color than those deficient in air.

Part Three: Short Answer

Instructions. Use the space provided to answer the following questions.

1. Explain how slope has an affect on soil color.

2. Explain why soils formed under a deciduous hardwood forest tend to be lighter in color and have shallower organic matter than those formed under the tall prairie grass.

3. Given the following subsoil colors, determine the type of drainage present while the soil was forming:

a. Dull-colored—

b. Mottle-colored—

c. Bright-colored—