Demonstration 1: Soil Texture Determination

for the instructor

INSTRUCTOR OVERVIEW

The following demonstration outline covers the resources and skills used to determine the texture of a given soil sample by feel and to determine the approximate percent of sand, silt, and clay in that sample. First demonstrate how to use the Soil Texture Decision Chart to identify the texture of a given sample. Following this, give students the opportunity to identify the approximate soil textural classification of several additional soil samples. The Soil Texture Triangle is used to help students determine the approximate percent of sand, silt, and clay in their samples. The Soil Texture Descriptions are included to help confirm the accuracy of the determination by providing descriptions of how the soil feels and performs under several tests.

MATERIALS

- Multiple samples of different kinds of soil textures
- Handouts (see below)
    1. The Soil Texture Decision Chart: How soil texture is determined
    2. The Soil Texture Triangle: The percentatges of sand, silt, and clay in each textural classification
    3. The Soil Texture Descriptions: How the soil feels and performs under several tests

DEMONSTRATION TIME

About 1 hour

DEMONSTRATION OUTLINE

A. Demonstrate how to determine the soil texture of a given sample by feel using the Soil Texture Decision Chart (next page)

B. Determine the percentage of sand, silt, and clay in the soil sample using the Soil Texture Triangle (page 27)

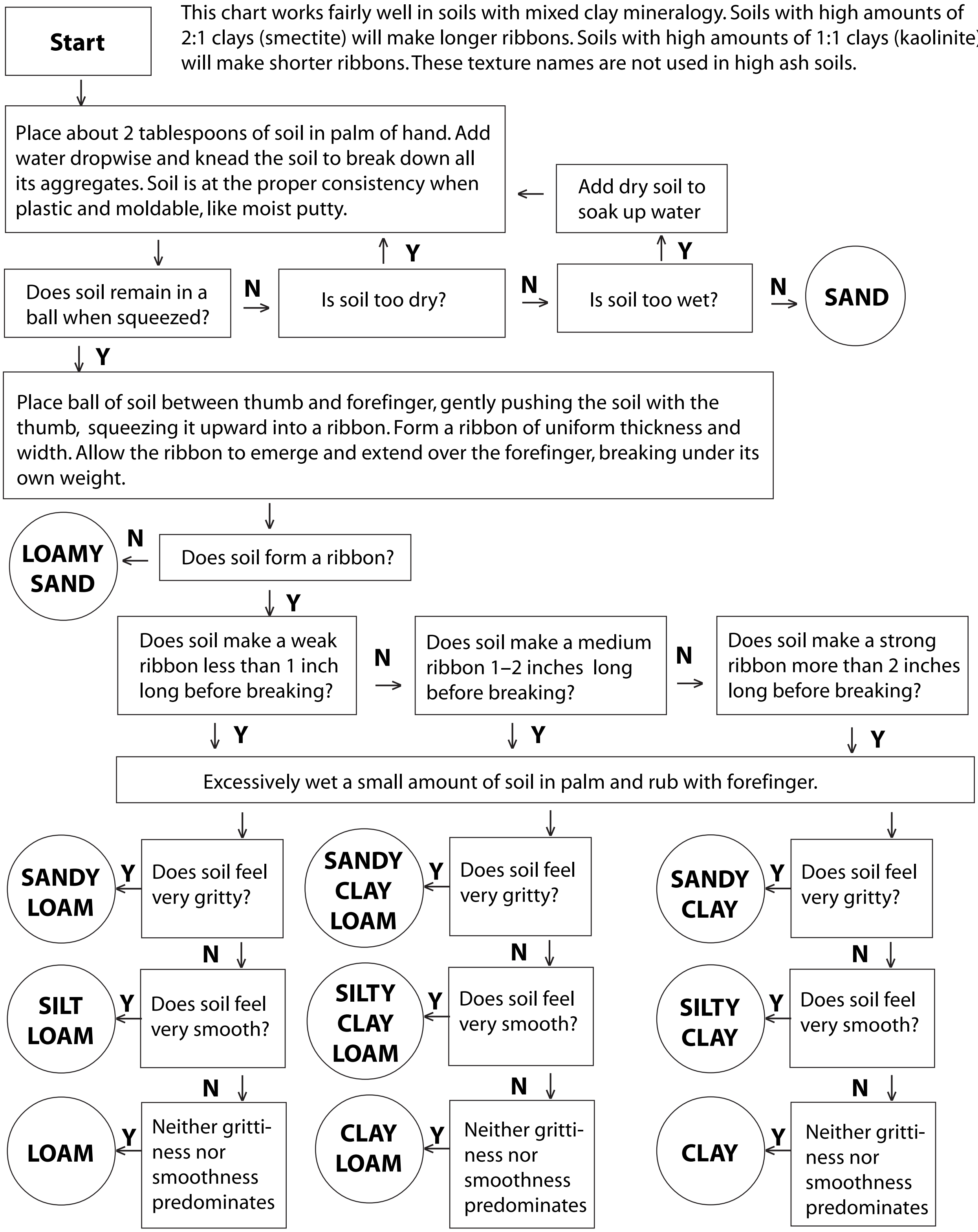
C. Use the Soil Texture Descriptions (pages 28–29) to confirm the accuracy of the textural determination

D. Students practice determining soil texture following the same steps

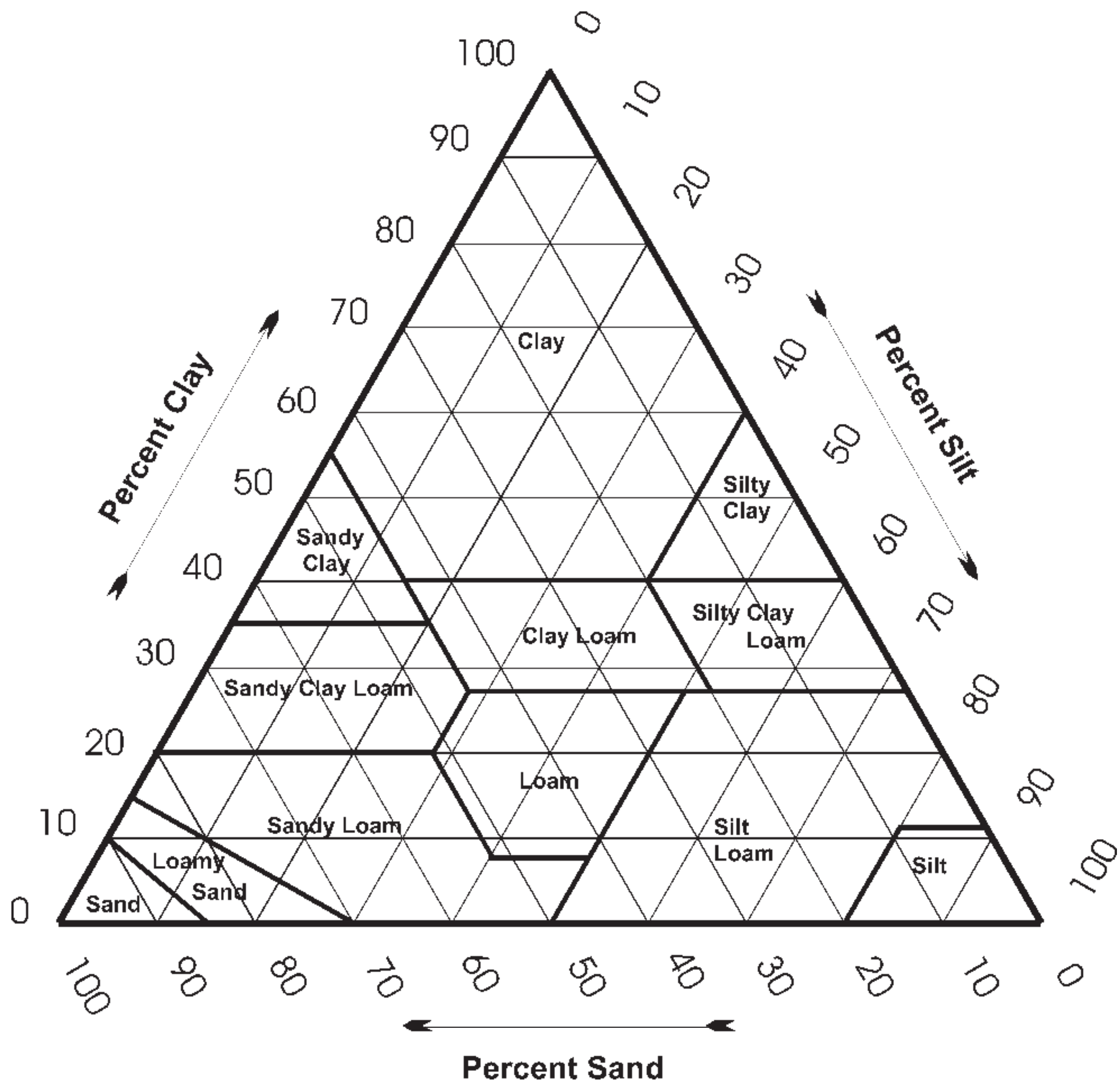
E. Once a texture has been determined, describe/discuss the characteristics of each of the soils

1. Drainage
2. Water-holding capacity/drainage
3. Nutrient-holding capacity
4. Describe/discuss how each of the example soils may be improved using organic farming practices

Soil Texture Decision Chart



Soil Texture Triangle



Soil Texture Descriptions

Edd Russell, Soil Scientist, USDA, Natural Resources Conservation Service

The mineral particles in the soil are divided into the following size classes:

Coarse fragments (gravel, cobbles, stones)	larger than 2 mm
Sand	.05 to 2 mm
Silt	.002 to .05 mm
Clay	smaller than .002 mm

To put these in perspective, if a particle of clay were the size of a BB, then a particle of silt would be about the size of a golf ball, and a grain of sand would be about the size of a chair. Sand, silt, and clay are referred to as soil separates.

Sand is gritty when wet or dry. Sands are the smallest soil particles you can see with the naked eye. Silt is smooth and floury when dry and it is greasy feeling when wet. Clay is hard when dry and it is sticky and plastic when wet. Clay exhibits both cohesion (it sticks to itself) and adhesion (it sticks to other things).

Texture is a word used to describe how something feels. Soil texture refers to the relative proportion of each of the soil separates in a specific soil or horizon (layer) in the soil, because this determines how a soil feels. The texture triangle, shown on page 27, is used to determine which texture class a soil belongs to based on the specific amounts of sand, silt, and clay it contains.

Following is a description of some of the texture classes. There is also a chart at the back of this section that shows you how to determine soil texture.

SAND

Sand is loose and single grained. The individual grains can readily be seen and felt. Squeezed in the hand when dry, it will fall apart when the pressure is released. Squeezed when moist, it will form a cast, but will crumble when touched.

LOAMY SAND

When dry, loamy sand is loose and single grained. When wet it is gritty, it does not ribbon and lacks stickiness, but it may show faint clay stainings. Squeezed when moist, it forms a cast that does not break with very careful handling. Individual grains of sand can be readily seen or felt.

SANDY LOAM

A sandy loam soil forms weak aggregates, it contains 45%–85% sand, but has enough silt and up to 20% clay which makes it somewhat coherent. Individual sand grains can be seen and felt. Squeezed when dry it will form a cast that will readily fall apart, but when moist it will form a cast that will bear careful handling without breaking. It will definitely stain fingers. When placed in water it turns the water cloudy.

LOAM

Loam is a soil having a relatively even mixture of different grades of sand, silt, and clay. It is mellow with a somewhat gritty feel, yet fairly smooth and slightly sticky and slightly plastic. Dry aggregates are slightly hard or hard to break. When moist it will form a cast that can be handled without breaking. It stains fingers. When placed in water it turns the water cloudy.

SILT LOAM

A silt loam is a soil having moderate amounts of the fine grades of sand and less then 27% clay; over half of the particles are silt sized. When dry, aggregates break with some difficulty. When moist it forms a firm ball and ribbons fairly well. Either dry or moist it will form casts that can be freely handled without breaking.

SILT

Silt is a rare textural class that is not easy to find in nature. Silt feels quite floury and soft when dry. When moist it is greasy feeling and is neither sticky nor plastic.

SANDY CLAY LOAM

A sandy clay loam is a soil with 45%–80% sand, 20%–35% clay, and 0%–28% silt. Dry aggregates are hard and break with difficulty. When moist it forms a firm ball and can be squeezed into a ribbon and may show a fingerprint. It is sticky and plastic; it stains fingers and it turns water cloudy.

CLAY LOAM

A clay loam is a moderately fine-textured soil that usually breaks into aggregates or lumps that are hard when dry and friable or firm when moist. The soil ribbons well when moist and shows a good fingerprint; is sticky and plastic and will form a cast that can bear much handling. It stains fingers.

SILTY CLAY LOAM

A silty clay loam handles like silt loam but it is sticky, plastic and friable or firm when moist. Also, when moist the soil shows a good fingerprint and, like clay loam, will form a cast that can bear good handling. It stains fingers. When the soil is pulverized, it feels floury.

SANDY CLAY

A sandy clay is a fine texture soil with 45%–65% sand, 35%–55% clay and 0%–20% silt. Dry, it is very hard—aggregates can only be broken with extreme pressure. Moist, it is sticky or very sticky and plastic and shows a good fingerprint; it ribbons well and stains fingers.

SILTY CLAY

A silty clay soil is a fine-textured soil with 40%–60% silt, up to 20% sand and 40%–60% clay. Dry, it is extremely hard and it feels quite floury when crushed. It is very sticky and very plastic when moist and it shows a good fingerprint. It forms a cast that can bear much handling and ribbons very well, and clouds water and stains fingers.

CLAY

Clay is also a fine-textured soil that usually forms very hard or extremely hard blocks or prisms. It is very sticky and very plastic when moist, it ribbons very well and forms a very good fingerprint. Some clays are very firm or extremely firm when moist.

Demonstration 2: Soil Pit Examination

for the instructor

INSTRUCTOR OVERVIEW

In this demonstration students examine the soil profile and various soil properties exposed in a shallow soil excavation. Discuss the soil profile and how the soil properties observed affect the use of the soil for farming, gardening, and other purposes.

MATERIALS

- Shovel and Pic mattock (to dig pit)
- Munsell soil color book
- Water bottle for moistening soil
- pH kit

SITE PREPARATION

Several hours before the demonstration dig a pit approximately 2–4 feet deep (or until distinct soil horizons are observed). For ease, the pit may be triangular in shape and stepped. Plan to have the soil profile in full sun at the time of the demonstration.

PREPARATION TIME

Approximately 1 hour

DEMONSTRATION TIME

1 hour

DEMONSTRATION OUTLINE

A. Determine Approximate Textural Classification of Soil by Feel

B. Identify Distinct Soil Horizons

1. A Horizon and what defines it
2. B Horizon and what defines it
3. C Horizon and what defines it
4. Identify indicators of soil disturbance (e.g., tillage)

C. Describe/Define the Type(s) of Soil Structure Observed

1. Describe general soil structure and how it is created
2. Identify and provide examples of soil aggregates and how they form

Supplemental Demonstrations and Examples

for the instructor

INSTRUCTOR OVERVIEW

These demonstrations and examples use analogy and models to illustrate various soil physical properties. Note the references to sections of the detailed lecture outline for specific topics.

SOIL EXAMPLES

Lecture Outline Reference: Throughout

PURPOSE

To show examples of certain soil physical properties

MATERIALS: EXAMPLES OF SOIL TO SHOW

- Color (dark = high organic matter, bright = well drained, redoximorphic features = wetness)
- Structure
- Texture (sand, silt, clay, loam, etc.)
- Hard pans

BAKLAVA DEMONSTRATION

Detailed Lecture Outline Reference: C 1 a) iii

PURPOSE

To show layering akin to what is found in phyllosilicate (layer-lattice) clays

MATERIALS

- Baklava, preferably enough so that each student can have a piece

METHODS

Point out that many clay minerals are layered at the microscopic level much the way that baklava is and that cations are adsorbed to the sides of clay particles much the same as the nuts are stuck to the sides of the baklava.

MODELS DEMONSTRATION

Detailed Lecture Outline Reference: C 1 a) iii

PURPOSE

To show the arrangement of molecules in silica tetrahedra and alumina dioctehedra

MATERIALS

- Molecular models or models made from cardboard and tape showing the shape of a tetrahedron and octrahedron

METHODS

If short on time, skip this. This is more than many can comprehend but I use it to illustrate the complexity of the clay minerals.

TARGET DEMONSTRATION

Detailed Lecture Outline Reference: C 1 a) iii

PURPOSE

To show that clay is sticky (adhesion)

MATERIALS

- Moist clay, moistened enough so that it adheres to most surfaces
- A flipchart or blackboard with a target drawn on it
- Moist sandy loam (optional, for contrast)

METHODS

Form the clay into a ball, and throw it at the target (test the surface first to make sure that the clay will actually stick to it). Optionally, you can repeat the process with sandy loam or similar to show that it is not as sticky.

RIBBON DEMONSTRATION

Detailed Lecture Outline Reference: C 1 a) iii

PURPOSE

To show that clay is plastic (cohesion)

MATERIALS

- Moist clay
- Moist sandy loam (optional, for contrast)

METHODS

Squeeze the clay through your thumb and forefinger to create a ribbon. Optionally, repeat the process with sandy loam to show that it does not ribbon as well.

SLINKY DEMONSTRATION

Detailed Lecture Outline Reference: C 1 a) iii

PURPOSE

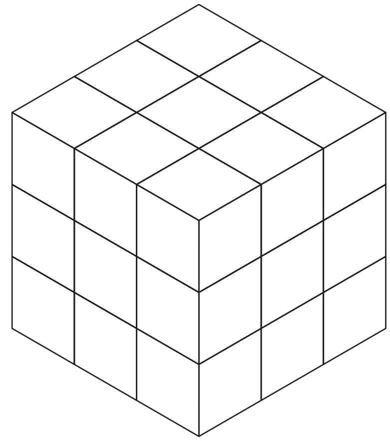
To show how clays shrink and swell by layers becoming separated

MATERIALS

- Slinky

METHODS

Stretch and compress a slinky in your hand while explaining that some clays can shrink and swell as layers get separated when water gets between them



BLOCK DEMONSTRATION

Detailed Lecture Outline Reference: C 1 a) iii

PURPOSE

To show that smaller particles have a larger surface area than a single large particle occupying the same space.

MATERIALS

- 27 wooden blocks

METHODS

1. Form the blocks into a cube: 3 blocks by 3 blocks by 3 blocks. Assume the blocks each have a dimension of 1 on each side. Have the students calculate the surface area of the cube:

   Each side is 3 x 3 = 9
   There are 6 sides, 6 x 9 = 54

2. Have the students then calculate the total surface area of the individual blocks in the cube:

   The side of each block has and area of 1 x 1 = 1

   Each block has 6 sides, and therefore a surface area of 6 x 1 = 6

   There are 27 blocks, so the total surface area is 6 x 27 = 162

COLOR BOOK EXAMPLE

Detailed Lecture Outline Reference: C 6 a)

PURPOSE

To show how soil color is described

MATERIALS

Munsell or Earth Colors soil color charts

METHODS

Show how the color charts and Munsell color notation are used.

PERMEABILITY DEMONSTRATION

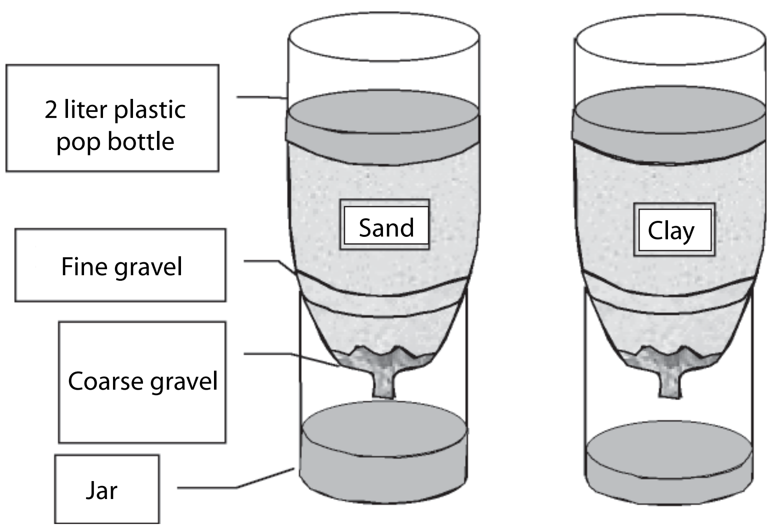
Detailed Lecture Outline Reference: C 11 c) i

MATERIALS

- 4 jars or beakers, about 2 cup size
- 2 2-liter plastic soda bottles
- Coarse gravel, rounded is better, 1/2–1inch, about 1 cup
- Fine gravel, < 1/4 inch, about 1 pint
- Sand, about 1 pint
- Clay, dry and ground, about 1 pint
- Water

METHODS

1. Cut the bottoms out of the soda bottles.
2. Invert the bottles into two of the jars to make funnels. Label one "Sand" and the other "Clay".
3. Place the coarse gravel into the bottom of the funnels, enough to plug the holes so that the fine gravel won't go through.
4. Cover the coarse gravel with about a 1 inch thick layer of fine gravel.
5. Place the sand and clay into the appropriate funnels. You want a layer about 2–3 inches thick.
6. Fill the other jars with about 3/4 to 1 cup of water each.
7. Using both hands, pour the water into the funnels at the same time and rate.
8. See which soil the water passes through faster.



PEAT MOSS DEMONSTRATION

Detailed Lecture Outline Reference: C 11 d) i.

PURPOSE

To show how dry organic matter repels water

MATERIALS

- Dry peat moss (a handful)
- Water

METHODS

Hold up a handful of dry peat moss and pour the water over it, showing how the water runs off rather than soaking in.

SPONGE DEMONSTRATION

Detailed Lecture Outline Reference: C 12

PURPOSE

To provide a conceptual model of available water capacity and field capacity

MATERIALS

- Sponge
- Water in a bowl or pan

METHODS

1. Soak the sponge in water until it is saturated.
2. Hold up the sponge until most of the water stops dripping. Explain that the sponge is analagous to soil. When the water has finished draining from the soil 24 hours after saturation, the soil is said to be at field capacity.
3. Squeeze the sponge to remove as much water as you can. Mention that this water would be analagous to what can be removed by plants and is called available water. There is still some moisture in the sponge and that is analagous to the water that is held so tightly in the soil that plants cannot remove it.

Assessment Questions

TRUE OR FALSE

1. Climate affects how a soil forms.
   True False
2. Air is not an important part of soil.
   True False
3. Clay holds more water than sand.
   True False
4. Platy structure on the surface of the soil is desirable.
   True False
5. Organic matter is not particularly beneficial to the physical condition of the soil.
   True False

MULTIPLE CHOICE

1. Which of the following is not a soil-forming factor?
   a. Time
   b. Parent material
   c. Soil color
   d. Topography
2. Of the soil separates listed below, which has the smallest particle size?
   a. Sand
   b. Silt
   c. Clay
3. Which one of the following is not considered one of the major constituents of soil?
   a. Chemical
   b. Mineral
   c. Organic matter
   d. Pore space
4. Which of the following foods has a structure similar to silicate clays?
   a. Ice cream
   b. Cheese
   c. Cake
   d. Baklava
5. A soil that has a balanced amount of sand, silt and clay has which one of the following for a texture?
   a. Platy
   b. Loam
   c. Silt
   d. Granular
6. Of the following, which is the best to add to a clay soil to help offset the negative effects of the clay?
   a. Sand
   b. Silt
   c. Organic matter
   d. Sodium salts
7. Which one of the following does not contribute to the formation of soil structure?
   a. Biological factors
   b. Amount and type of clay
   c. Iron
   d. Climate
8. Gray or mottled colors in the soil indicate past or present:
   a. Wormholes
   b. Wetness
   c. Drought
   d. Texture
9. The rate at which water moves through the soil is called:
   a. Porosity
   b. Hydraulic speed
   c. Permeability
   d. Saturation potential

10. Which of the following influence the available water-holding capacity of the soil?
   a. Texture
   b. Structure
   c. Organic matter
   d. Salts
   e. a, b and c
   f. a, b, c, and d
   g. a, c and d

ASSESSMENT

1. Why are the "empty" places in the soil so important?

2. Clay contributes many good characteristics to soil, but if there is too much it can cause problems. What are some of the negative effects of too much clay in the soil and how can these effects be overcome?

3. What are some of the negative effects of too much sand in the soil and how can these effects be overcome?

4. Use a soil texture triangle to calculate the soil texture for the following combinations of sand, silt and clay:
   a. 25% sand, 30% silt, 45% clay
   b. 40% sand, 30% silt, 30% clay
   c. 60% sand, 10% silt, 30% clay
   d. 70% sand, 12% silt, 18% clay
   e. 90% sand, 5% silt, 5% clay
   f. 80% sand, 15% silt, 5% clay
   g. 10% sand, 85% silt, 5% clay
   h. 5% sand, 75% silt, 20% clay
   i. 40% sand, 40% silt, 20% clay
   j. 55% sand, 5% silt, 40% clay
   k. 10% sand, 60% silt, 40% clay
   l. 5% sand, 45% silt, 50% clay

5. What surface structure is most desirable? What can you do to help develop this structure and maintain it?

Assessment Questions Key

TRUE – FALSE

1. Climate affects how a soil forms.
   <u>True</u> False
2. Air is not an important part of soil.
   True <u>False</u>
3. Clay holds more water than sand.
   True <u>False</u>
4. Platy structure on the surface of the soil is desirable.
   <u>True</u> False
5. Organic matter is not particularly beneficial to the physical condition of the soil.
   True <u>False</u>

MULTIPLE CHOICE

1. Which of the following is not a soil-forming factor?
   a. Time
   b. Parent Material
   c. <u>Soil Color</u>
   d. Topography
2. Of the soil separates listed below, which has the smallest particle size?
   a. Sand
   b. Silt
   c. <u>Clay</u>
3. Which one of the following is not considered one of the major constituents of soil?
   a. <u>Chemical</u>
   b. Mineral
   c. Organic matter
   d. Pore space
4. Which of the following foods has a structure similar to silicate clays?
   a. Ice cream
   b. Cheese
   c. Cake
   d. <u>Baklava</u>
5. A soil that has a balanced amount of sand, silt and clay has which one of the following for a texture?
   a. Platy
   b. <u>Loam</u>
   c. Silt
   d. Granular
6. Of the following, which is the best to add to a clay soil to help offset the negative effects of the clay?
   a. Sand
   b. Silt
   c. <u>Organic matter</u>
   d. Sodium salts
7. Which one of the following does not contribute to the formation of soil structure?
   a. Biological factors
   b. Amount and type of clay
   c. <u>Iron</u>
   d. Climate
8. Grey or mottled colors in the soil indicate past or present:
   a. Wormholes
   b. <u>Wetness</u>
   c. Drought
   d. Texture
9. The rate at which water moves through the soil is called:
   a. Porosity
   b. Hydraulic speed
   c. <u>Permeability</u>
   d. Saturation potential
10. Which of the following influence the available water-holding capacity of the soil?
    a. Texture
    b. Structure
    c. Organic matter

d. Salts
e. a, b and c
f. a, b, c, and d
g. a, c, and d

ADDITIONAL QUESTIONS

1. Why are the "empty" places in the soil so important?
   - *Place for air and water to move and be stored*
   - *Place for roots to grow*
   - *Place for organisms to live*
   - *Place for nutrients to be stored*

2. Clay contributes many good characteristics to soil, but if there is too much it can cause problems. What are some of the negative effects of too much clay in the soil and how can these effects be overcome?

   Effects
   - *Hard to work when wet*
   - *Hard to work when dry*
   - *Tendency to seal up when wetted*
   - *Hard for roots to grow*

   How to overcome
   - *Only work soil when the moisture is right*

     Add lots of organic matter, even coarse material
   - *If irrigating, do so gently*

3. What are some of the negative effects of too much sand in the soil and how can these effects be overcome?

   Effects
   - *Droughty*
   - *Low fertility*
   - *Structure collapses easily*

   How to overcome
   - *Add lots of organic matter*
   - *Don't till any more than necessary*

4. Use a soil texture triangle to calculate the soil texture for the following combinations of sand, silt and clay
   a. 25% sand, 30% silt, 45% clay
   clay
   b. 40% sand, 30% silt, 30% clay
   clay loam
   c. 60% sand, 10% silt, 30% clay
   sandy clay loam
   d. 70% sand, 12% silt, 18% clay
   sandy loam
   e. 90% sand, 5% silt, 5% clay
   sand
   f. 80% sand, 15% silt, 5% clay
   loamy sand
   g. 10% sand, 85% silt, 5% clay
   silt
   h. 5% sand, 75% silt, 20% clay
   silt loam
   i. 40% sand, 40% silt, 20% clay
   loam
   j. 55% sand, 5% silt, 40% clay
   sandy clay
   k. 10% sand, 60% silt, 40% clay
   silty clay loam
   l. 5% sand, 45% silt, 50% clay
   silty clay

5. What surface structure is most desirable for gardening? What can you do to help develop this structure and maintain it?
   - *Granular or crumb structure is most desirable*
   - *Add lots of organic materials and encourage biological activity*
   - *Don't till the soil any more than necessary*
   - *Only till under the proper moisture conditions*
   - *Avoid compacting the soil with excessive traffic*
   - *Rotate with a cover crop*
   - *Use proper irrigation techniques*

Resources

PRINT RESOURCES

BOOKS

Brady, N. C., and Weil, R. R. 1999. *The Nature and Property of Soils,* 12th edition. Upper Saddle River, NJ: Prentice-Hall, Inc.

A good general soils text, used for introductory soils classes at universities. Might be too technical for some.

Buol, S. W., F. D. Hole, R. J. McCracken, and R. J. and Southard. 1997. *Soil Genesis and Classification, Fourth Edition.* Ames, IA: Iowa State University Press.

College textbook used to teach soil classification.

Dixon, J. B., and S. B. Weed, eds. 1989. *Minerals in Soil Environments.* Madison, WI: Soil Science Society of America.

Very technical reference on soil minerals. Only the most hardy go here.

Dubbin, William. 2001. *Soils.* The Natural History Museum, London. Available from Iowa State University Press, Ames, Iowa.

Short overview of soil science. Easy to read and understand, lots of color photos.

Gershuny, Grace. 1993. *Start with the Soil.* Emmaus, PA: Rodale Press.

A general book on soils and soil management geared toward organic gardeners. Easy to read and understand.

Gershuny, Grace. 2000. *The Soul of Soil: A Soil-Building Guide for Master Gardeners and Farmers, Fourth edition.* White River Junction, VT: Chelsea Green Publishing.

Provides essential information on soil ecosystem management for organic growers. Topics include organic matter management, building and maintaining humus, on-site composting, green manures and crop rotations, cultivation and weed control, nutrient balances and soil testing, and using mineral fertilizers.

Magdoff, Fred and Harold Van Es. 2000. *Building Soils for Better Crops, Second Edition.* Sustainable Agriculture Network, Handbook Series Book 4. Beltsville, MD: National Agricultural Library.

An introductory overview of organic management of soil fertility covering the basics of soil organic matter, physical and chemical properties of soil, ecological soil and crop management. Practical and accessible information. Available from www.sare.org

Stell, Elizabeth P., 1998. *Secrets to Great Soil.* Pownal, VT: Storey Communications, Inc.

An easy-to-read primer on soils, composting and basic gardening techniques. Lots of diagrams.

SOIL SURVEYS

These can be obtained from Natural Resource Conservation Services offices. They are also available in many libraries.

Soil Survey Staff, Natural Resources Conservation Service. 1999. *National Soil Survey Handbook, title 430-VI.* United States Department of Agriculture, Washington, D.C., U.S. Government Printing Office.

Contains all the technical details about making soil surveys and entering soil properties into the National Soils Information System (NASIS). Available online at:

www.statlab.iastate.edu/soils/nssh/.

Soil Survey Division Staff. 1993. *Soil Survey Manual.* United States Department of Agriculture, Washington DC., U.S. Government Printing Office.

This is the manual that soil scientists use to carry out soil survey work. The most definitive guide on how to describe the physical properties of soil. Available online at:

www.statlab.iastate.edu/soils/ssm/gen_cont.html

Soil Survey Staff, Natural Resources Conservation Service. 1999. *Soil Taxonomy.* United States Department of Agriculture. Washington, D.C.: U.S. Government Printing Office.

The reference used to classify soils. Highly technical, used mainly by soil scientists. Available online at:

www.statlab.iastate.edu/soils/nsdaf/

WEB RESOURCES

California NRCS home page

www.ca.nrcs.usda.gov

Canadian Soil Information System

res.agr.ca/CANSIS

Glossary of Soil Science Terms

www.soils.org/sssagloss/index.html

Index of all USDA databases

www.ncg.nrcs.usda.gov/nsdi_node.html

National soils databases

www.statlab.iastate.edu/soils/nsdaf

Science of Soils on-line journal

link.springer.de/link/service/journals/10112/index.htm

Soils of Canada

quarles.unbc.edu/nres/soc/soc.htm

EDUCATION LINKS

nscss.org/teach.html

INSTITUTIONS

Cooperative Extension Service or Farm Advisors office

Staff from these offices will be aware of crop nutrient needs and problems in your area. They can assist you with nutrient deficiency symptoms and known plant nutrition problems in your area.

US Department of Agriculture–Natural Resources Conservation Service (USDA–NRCS) field offices

Information about soils in your area can be obtained from NRCS field offices. They are usually listed in the U.S. Government pages of the phone book under US Department of Agriculture. They may also be listed as USDA Service Center. Some areas do not have NRCS offices but do have Resource Conservation District offices that can provide the same information.

Glossary

REFERENCES USED FOR TERMS

[1] From the standard glossary used in soil survey reports

[2] National Soil Survey Handbook. 1998. Available online at www.statlab.iastate.edu/soils/nssh/

[3] Glossary of Soil Science Terms.1996, Soil Science Society of America. Available online at www.soils.org/sssagloss/

[4] Merriam-Webster Online. www.m-w.com/

Absorption
: *Uptake of matter or energy by a substance*[3]

Adsorption
: *The process by which atoms, molecules, or ions are taken up from the soil solution or soil atmosphere and retained on the surfaces of solids by chemical or physical binding.*[3]

Acidity
: *Refers to the condition of the soil when the exchange complex is dominated by hydrogen and aluminum ions*

Acidity, salt-replaceable
: *The aluminum and hydrogen that can be replaced from an acid soil by an unbuffered salt solution such as KCl or NaCl* [3]

Acidity, total
: *The total acidity including residual and exchangeable acidity. Often it is calculated by subtraction of exchangeable bases from the cation exchange capacity determined by ammonium exchange at pH 7.0. It can be determined directly using pH buffer-salt mixtures (e.g., $BaCl_2$ plus triethanolamine, pH 8.0 or 8.2) and titrating the basicity neutralized after reaction with a soil.*[3]

Aeration, soil
: *The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.*[1]

Aggregate, soil
: *Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.*[1]

Alkali soil
: *(i) A soil with a pH of 8.5 or higher or with a exchangeable sodium ratio greater than 0.15. (ii) A soil that contains sufficient sodium to interfere with the growth of most crop plants.*[3]

Anion
: *A negatively charged ion (has surplus electrons)*[3]

Anion exchange capacity
: *The sum of exchangeable anions that a soil can adsorb. Usually expressed as centimoles, or millimoles, of charge per kilogram of soil (or of other adsorbing material such as clay).*[3]

Aspect
: *The direction in which a slope faces*[1]

Atom
: *The smallest particle of an element that can exist either alone or in combination*[4]

Available water capacity (available moisture capacity) (AWC)
: *The volume of water that should be available to plants if the soil, inclusive of fragments, were at field capacity. It is commonly estimated as the amount of water held between field capacity and wilting point, with corrections for salinity, fragments, and rooting depth. It is commonly expressed as inches of water per inch of soil.*[2] *The following classes are used in California, based on the AWC of 60 inch depth (or depth to a limiting layer):*

AWC Class	*AWC/60 inches or limiting layer*
Very low	*0 to 2.5*
Low	*2.5 to 5*
Moderate	*5 to 7.5*
High	*7.5 to 10*
Very high	*more than 10*

AWC
: *See available water capacity*

Base saturation

The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity[1]

Boulders.

Rock fragments larger than 2 feet (60 centimeters) in diameter[1]

Bulk density

A measurement of the oven-dried weight of the less than 2 mm soil material per unit volume of soil. Common measurements are taken at a water tension of 1/10 bar; 1/3 bar; or 15 bar. Bulk density influences plant growth and engineering applications. It is used to convert measurements from a weight basis to a volume basis. Within a family particle size class, bulk density is an indicator of how well plant roots are able to extend into the soil. Bulk density is used to calculate porosity.[2]

Calcareous soil

A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid[1]

Calcium carbonate equivalent

The quantity of carbonate (CO_3) in the soil expressed as $CaCO_3$ and as a weight percentage of the less than 2 mm size fraction[2]

Capillary water

Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.[1]

Cation

An ion carries a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.[1]

Cation-exchange capacity (CEC)

The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.[1]

CEC

See cation exchange capacity

Clay

As a soil separate, the minerals soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.[1]

Claypan

A dense, compact, slowly permeable layer in the subsoil, with a much higher clay content than overlying materials from which is separated by a sharply defined boundary. A claypan is usually hard when dry, and plastic or sticky when wet.[2]

Coarse fragments

See Rock fragments

Coarse textured soil

Sand or loamy sand[1]

Cobble (or cobblestone)

A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter[1]

Colloid

A particle, which may be a molecular aggregate, with a diameter of 0.1 to 0.001 µm. Soil clays and soil organic matter are often called soil colloids because they have particle sizes that are within, or approach colloidal dimensions.[3]

Compaction

The process by which the soil grains are rearranged to decrease void space and bring them into closer contact with one another, thereby increasing the bulk density[3]

Compound

Something formed by a union of elements or parts; especially: a distinct substance formed by chemical union of two or more ingredients in definite proportion by weight[4]

Consistence, soil

Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the Soil Survey Manual.[1]

Deep soil

See Depth

Depth, soil

Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.[1]

Drainage class (natural)

Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized: excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the Soil Survey Manual.[1]

Duripan

A subsurface soil horizon that is cemented by illuvial silica, usually opal or microcrystalline forms of silica, to the degree that less than 50 percent of the volume of air-dry fragments will slake in water or HCl[3]

EC

See electrical conductivity

Edaphology

The science that deals with the influence of soils on living things; particularly plants, including human uses of land for plant growth[3]

Electrical conductivity (EC)

The electrolytic conductivity of an extract from saturated soil paste[2]

Element

Basic unit of matter that can't be broken down by chemical means. They are the building blocks of nature. Any of more than 100 fundamental substances that consist of atoms of only one kind and that singly or in combination constitute all matter.[4]

Eluviation

The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.[1]

Exchangeable anion

A negatively charged ion held on or near the surface of a solid particle by a positive surface charge and which may be easily replaced by other negatively charged ions (e.g., with a Cl^- salt)[3]

Fertility, soil

The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable[1]

Field moisture capacity

The moisture content of a soil, expressed as a percentage of the oven dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity[1]

Fine textured soil

Sandy clay, silty clay, or clay[1]

Fragments

Unattached cemented pieces of bedrock, bedrock-like material, durinodes, concretions, and nodules 2 mm or larger in diameter; and woody material 20 mm or larger in organic soils[2]

Genesis, soil

The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.[1]

Gravel

Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.[1]

Gravelly soil material

Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter[1]

Great group

A group of soils that is characterized by common characteristics usually developed under the influence of environmental factors (as vegetation and climate) active over a considerable geographic range and that comprises one or more families of soil—called also great soil group.[4] See Soil Classification.

Gypsum

The percent, by weight, of hydrated calcium sulfates in the <20 mm fraction of soil[2]

Hardpan

A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.[1]

Horizon, soil

A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the Soil Survey Manual. The major horizons of mineral soil are as follows:[1]

O horizon = An organic layer of fresh and decaying plant residue.

A horizon = The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon = The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon = The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon = The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon = Soft, consolidated bedrock beneath the soil.

R layer = Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus

The well decomposed, more or less stable part of the organic matter in mineral soils[1]

Impervious soil

A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.[1]

Infiltration

The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material[1]

Infiltration capacity

The maximum rate at which water can infiltrate into a soil under a given set of conditions

Infiltration rate

The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.[1]

Iron depletions

Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.[1]

Leaching

The removal of soluble material from soil or other material by percolating water.[1]

Loam

Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles[1]

Loamy

Texture group consisting of coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, and silty clay loam soil textures[3]

Medium textured soil

Very fine sandy loam, loam, silt loam, or silt[1]

Microrelief

(i) Generically refers to local, slight irregularities in form and height of a land surface that are superimposed upon a larger landform, including such features as low mounds, swales, and shallow pits. See also gilgai, shrub-coppice dune, tree-tip mound, tree-tip pit.

(ii) Slight variations in the height of a land surface that are too small to delineate on a topographic or soils map at commonly used map scales (e.g., 1:24 000 and 1:15 840)[3]

Mineral soil

Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.[1]

Moderately coarse textured soil

Coarse sandy loam, sandy loam, or fine sandy loam[1]

Moderately deep soil

See Depth

Moderately fine textured soil

Clay loam, sandy clay loam, or silty clay loam[1]

Molecule

The smallest particle of a substance that retains all the properties of the substance and is composed of one or more atoms[4]

Morphology, soil

The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile[1]

Mottling, soil

Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance: few, common, and many; size: fine, medium, and coarse; and contrast: faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).[1]

Muck

Unconsolidated soil material consisting primarily of highly decomposed organic material in which the original plant parts are not recognizable (i.e., "sapric" in Soil Taxonomy). It generally contains more mineral matter and is usually darker in color, than peat.[2]

Munsell notation

A designation of color by degrees of three simple variables: hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil

A soil having a pH value of 6.6 to 7.3 (see Reaction, soil)[1]

Nutrient, plant

Any element taken in by a plant that is essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.[1]

OM

See Organic matter

Order

The highest level (most general) of soil classification according to Soil Taxonomy. There are twelve orders: andisols, alfisols, aridisols, entisols, gelisols, histosols, inceptisols, mollisols, oxisols, spodosols, ultisols and vertisols.

Organic matter (OM)

Plant and animal residue in the soil in various stages of decomposition[1]

Oxidation

The loss of one or more electrons by an ion or molecule[3]

Pan

A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, hardpan, fragipan, claypan, plowpan, and traffic pan.[1]

Parent material

The unconsolidated and more or less chemically weathered mineral or organic matter from which the solum is developed by pedogenic processes[2]

Peat

Unconsolidated soil material consisting largely of undecomposed, or slightly decomposed, organic matter (i.e., "fibric" in Soil Taxonomy) accumulated under conditions of excessive moisture[2]

Ped

An individual natural soil aggregate, such as a granule, a prism, or a block

Pedogenesis

See Genesis, soil

Pedology

Soil science, especially the study of soils as a natural body

Pedon

The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.[1]

Percolation

The downward movement of water through the soil[1]

Permeability

The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the Soil Survey Manual. In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows: [1]

Permeability class	rate per hour
Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value

A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)[1]

Plowpan

A compacted layer formed in the soil directly below the plowed layer[1]

Ponding

Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.[1]

Potential rooting depth (effective rooting depth)

Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.[1]

Profile, soil

A vertical section of the soil extending through all its horizons and into the parent material[1]

Reaction, soil

A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are: [1]

Reaction class	pH
Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3

Slightly alkaline	*7.4 to 7.8*
Moderately alkaline	*7.9 to 8.4*
Strongly alkaline	*8.5 to 9.0*
Very strongly alkaline	*9.1 and higher*

Redoximorphic concentrations

Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.[1]

Redoximorphic depletions

Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.[1]

Redoximorphic features

Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha, alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduction

The gain of one or more electrons by an ion or molecule[3]

Relief

The relative difference in elevation between the upland summits and the lowlands or valleys of a given region[3]

Rock fragments

Rock or mineral fragments having a diameter of 2 millimeters or more; for example, gravel, cobbles, stones, and boulders[1]

Root zone

The part of the soil that can be penetrated by plant roots[1]

Runoff

The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called groundwater runoff or seepage flow from groundwater.[1]

Saline soil

A nonsodic soil containing sufficient soluble salt to adversely affect the growth of most crop plants. The lower limit of saturation extract electrical conductivity of such soils is conventionally set at 4 dS/m (mmhos/cm) at 25°C. Actually, sensitive plants are affected at half this salinity and highly tolerant ones at about twice this salinity.[3]

Saline-sodic soil

A soil containing sufficient exchangeable sodium to interfere with the growth of most crop plants and containing appreciable quantities of soluble salts. The exchangeable sodium ratio is greater than 0.15, the conductivity of the soil solution, at saturated water content, of greater than 4 dS m (at 25ºC), and the pH is usually 8.5 or less in the saturated soil.[3]

Salinity

A measure of the "saltiness" of the soil expressed as the electrical conductivity of a saturation extract in decisiemens per meter (dS/m=mmhos/cm) at 25ºC.

The following salinity classes are recognized:[2]

Salinity class	*mhos/cm*
Non-saline	*0 - 2*
Very slightly saline	*2 - 4*
Slightly saline	*4 - 8*
Moderately saline	*8 - 16*
Strongly saline	*> 16*

Sand

As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.[1]

Sandy

Texture group consisting of sand and loamy sand textures.[3]

SAR

See sodium adsorption ratio

Saturation

Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.[1]

Series, soil

A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement (see soil classification).[1]

Shallow soil

See Depth

Silica

A combination of silicon and oxygen. The mineral form is called quartz.[1]

Silt

As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.[1]

Slick spot

A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is silty or clayey, is slippery when wet, and is low in productivity.[1]

Slope

The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.[2]

Slope aspect

The direction toward which the surface of the soil (or slope) faces[2]

Sodic (alkali) soil

A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted[1]

Sodicity

The degree to which a soil is affected by exchangeable sodium.[1] *See sodium adsorption ratio. The following categories are commonly used in California:*

Sodicity	*SAR*
Slight	*less than 13:1*
Moderate	*13-30:1*
Strong	*more than 30:1*

Sodium adsorption ratio (SAR)

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.[2] *SAR is calculated from the equation:*

SAR = Na / [(Ca + Mg)/2]0.5

Soil

A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.[1]

Soil classification

The systematic grouping of soils based on their characteristics. The system used in the United States is called Soil Taxonomy. Soil Taxonomy uses the following levels grouping (from most general to most specific): order, suborder, great group, subgroup, family and series.

Soil separates

Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:[1]

Name	*Size in mm*
Very coarse sand	*2.0 to 1.0*
Coarse sand	*1.0 to 0.5*
Medium sand	*0.5 to 0.25*
Fine sand	*0.25 to 0.10*
Very fine sand	*0.10 to 0.05*
Silt	*0.05 to 0.002*
Clay	*less than 0.002*

Stones

Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat[1]

Stony

Refers to a soil containing stones in numbers that interfere with or prevent tillage[1]

Structure, soil

The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are: platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).[1]

Subgroup

See Soil Classification

Suborder

See Soil Classification

Subsoil

Technically, the B horizon; roughly, the part of the solum below plow depth[1]

Surface layer

The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."[1]

Surface soil

The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.[1]

Texture, soil

The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."[1]

Tilth, soil

The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration[1]

Topsoil

The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Very deep soil

See Depth

Very shallow soil

See Depth

Water table

The upper surface of ground water or that level below which the soil is saturated by water. Also the top of an aquifer.[1]

Weathering

All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.[1]