2021 LEBANON COUNTY ENVIROTHON
MIDDLE SCHOOL

SOILS & LAND USE OBJECTIVES
WETLANDS

ESSENTIAL TOPICS

I. **Basic Soils Knowledge**
- Formation & drainage
- Basic chemical and physical properties of soil
- Types & effects of soil erosion
- Observing and identifying soil properties/textures
- Importance of soils
- Soil quality indicators
- Wetland hydrology

II. **Land Use & Conservation**
- Tradeoffs: economic vs. environmental
- Land Capabilities: prime farmland, unique lands, preservation
- Topographic Map features & effects
- Ways to improve soil quality

III. **Application: Using a soil survey**
- Soil Interpretations

LEARNING OBJECTIVES

Upon completion of the soils unit, the students should be able to:

1. **Basic Soils Knowledge:**
   - Describe how soils are formed and how soil drainage/percolation is affected depending on soil types/textures.
   - Identify the components of soil and how these components determine its function.
   - Explain how the type of soil and topography affects soil erosion.
   - Identify the 3 main soil particles by sight, touch, and characteristics.
   - Identify various types of soil.
   - Identify the soil found in a wetland.
   - Define and be familiar with the characteristics of hydric soils.

2. **Land Use:**
   - Identify features/symbols on a topographic map and interpret slope/drainage/land uses.
   - Apply basic soil knowledge in making environmentally sound land use decisions when given a set of known facts. (e.g. build a landfill or septic field on Weikert soil - **soil survey**; OR buy land to grow crops on a steep slope - **topo map**)
   - Identify land capabilities/uses by soil type and topography.
   - Identify key characteristics in soils which are used in determining the health/quality of the soil.

3. **Application:**
   - Use a soil survey to describe and interpret: soil uses, soil types, drainage, average temperatures and rainfall in Lebanon County, crop yields, woodland management, building site & sanitary development. (**Soil Survey** Tables pp. 96-121).

TESTING RESOURCES:

1. Lebanon County Soil Survey: **(***Soil Surveys provided in past, no longer in print.)*
   - Web Soil Survey at http://websoilsurvey.nrcs.usda.gov/app/ (click "Start WSS" button)
   - **1981 Archived** copy at http://www.nrcs.usda.gov/wps/portal/nrcs/surveylist/soils/survey/state/?stateId=PA

2. Topographic Map – (Web Applications)

   - Topographic Map Symbols - https://www.topozone.com/topographic-map-legend-symbols/

   - https://www.usgs.gov/faqs/what-a-topographic-map
   - https://www.usgs.gov/core-science-systems/national-geospatial-program/topographic-maps
   - https://www.rei.com/learn/expert-advice/topo-maps-how-to-use.html
   - https://www.thoughtco.com/topographic-maps-overview-1435657

Soil Biota- Resources & Publications:
*These and other references are available at http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/resource

3. **Note 3: Rangeland Soil Quality Information Sheets:**

   - No. 8: Soil Biota
     https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051289.pdf

4. **Note 8: Soil Quality Information Sheets (5 total):**

   - Soil Quality Introduction
     https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052207.pdf
   - Organic Matter
     https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051288.pdf
   - Compaction
     https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051594.pdf
   - Soil Erosion
     https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051278.pdf
   - Sediment Deposition on Cropland
     https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052488.pdf

5. Infiltration: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053289.pdf

6. Guide to Texture by Feel & Soil Textural Triangle:
   http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054311

7. Introduction to Pennsylvania Soils book – Penn State Extension (*These were provided to advisors at the 2016 event*)
   Also available here: http://www.envirothonpa.org/documents/AnIntrotoSoilsofPA_000.pdf

8. Restoring America's Wetlands: A Private Lands Conservation Success Story
   http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1045079.pdf
   (You will not be tested on the specific case studies from this document. It is provided to enhance your knowledge of the reoccurring theme of general wetland characteristics, their functions and benefits, etc.)

9. Wetlands Overview: https://nepis.epa.gov/Exe/ZyPDF.cgi/500025PY.PDF?Dockey=500025PY.PDF

10. America's Wetlands: Our Vital Link Between Land and Water:
https://babel.hathitrust.org/cgi/pt?id=umn.31951p009737960;view=1up;seq=1

11. A Guide to Hydric Soils in the Mid-Atlantic Region
http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052291.pdf
Chapters 1, 2, 3, 6, 7, & 9. *You will not be tested on technical specifics from this resource. Pay attention to general reoccurring themes and hydric soils overview. Refer to Learning Objective 1 for specific requirements.

These and other references are available at:

- http://soils.usda.gov/sqi/
- http://websoilsurvey.nrcs.usda.gov/app/
- http://www.envirothonpa.org/station/soils-and-land-use/

ENVIROTHON
SOILS INFORMATION PROVIDED BY JOHN CHIBIRKA
RESOURCE SOIL SCIENTIST, USDA, NRCS
(*THIS INFORMATION PROVIDED TO ASSIST WITH THE SOILS OBJECTIVES*)

ESSENTIAL TOPICS

1. BASIC SOILS KNOWLEDGE

- Formation
- Water in soils
- Soil horizons
- Hands on investigation
- Soil quality, fertility, and chemistry
- Soil biology and diversity

2. UNDERSTANDING MAPS, SURVEYS, AND LANDFORMS

- Soil survey maps and data tables; Websoilsurvey
- Topographic maps
- Landforms and geologic terms

3. LAND USE

- Agriculture and conservation practices
- Current environmental concerns and land use issues
- Soils and history
- Pollution remediation
- Identification and benefits of wetlands
- Carbon sequestration

4. DECSION MAKING AND PROTECTION OF SOILS

- Scenarios
- Actions at home and school

IMPORTANCE OF SOILS

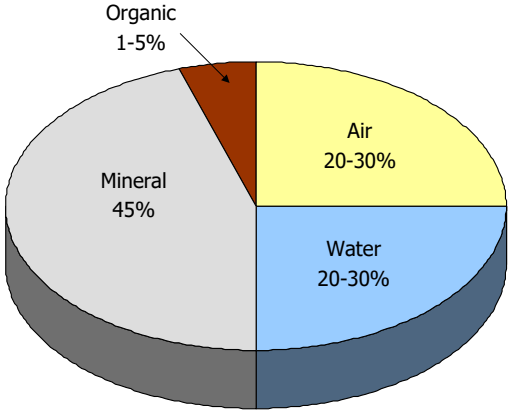
- Food – directly or indirectly
- Fiber (trees, cotton, etc.)
- Fuel (wood, ethanol, corn & pellets)
- Buildings - foundations
- Recycles and detoxifies waste

SOIL DEFINITION

- A living, naturally occurring dynamic system at the interface of air and rock. Soil forms in response to forces of climate and organisms that act on parent material in a specific landscape (topography) over a period of time.

WHAT IS SOIL COMPOSED OF?

- Mineral Material
- Organic Matter (dead plants, animals, microorganisms)
  Soil teaspoon -100 million bacteria – 50,000 species (kinds)
- Living Organisms
- Air
- Water



HOW SOILS ARE FORMED? – SOIL FORMING FACTORS

Soil forming factors

- Climate
- Organisms (biological factors)
- Parent Material
- Topography (also called relief or landscape position)
- Time
  *memory trick (Clorpt)

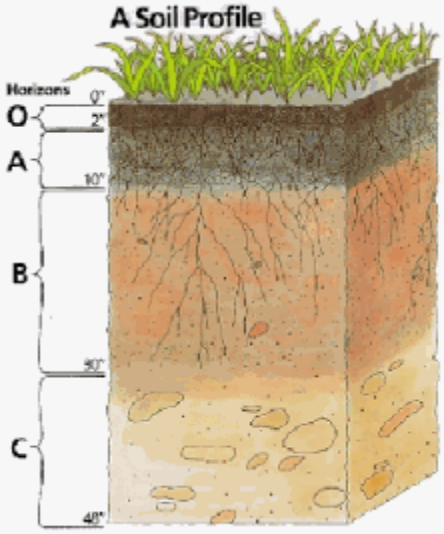
MAJOR TYPES OF PARENT MATERIALS:

- Minerals and rocks
  - Residual (weathered in place)
  - Transported - Colluvial
- Water transported – alluvial (floodplains, alluvial terraces)
- Glacial deposits (transported by ice)
- Wind deposits (loess, eolian sand)
- Marine (sea) and lacustrine (freshwater lakes) deposits

SOIL HORIZONS

A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil forming processes.

Used to classify the soil and make interpretations.



O	Organic layer.
A	Organic matter accumulation.
E	Zone of eluviation – loss of clay, Fe, Al, etc.
B	Zone of accumulation (clay, Fe, Al, CaC03, salts…). Forms below O, A, or E horizon.
C	Little pedogenic alteration. Commonly it is unconsolidated parent material or soft bedrock.
R	Hard, continuous bedrock.

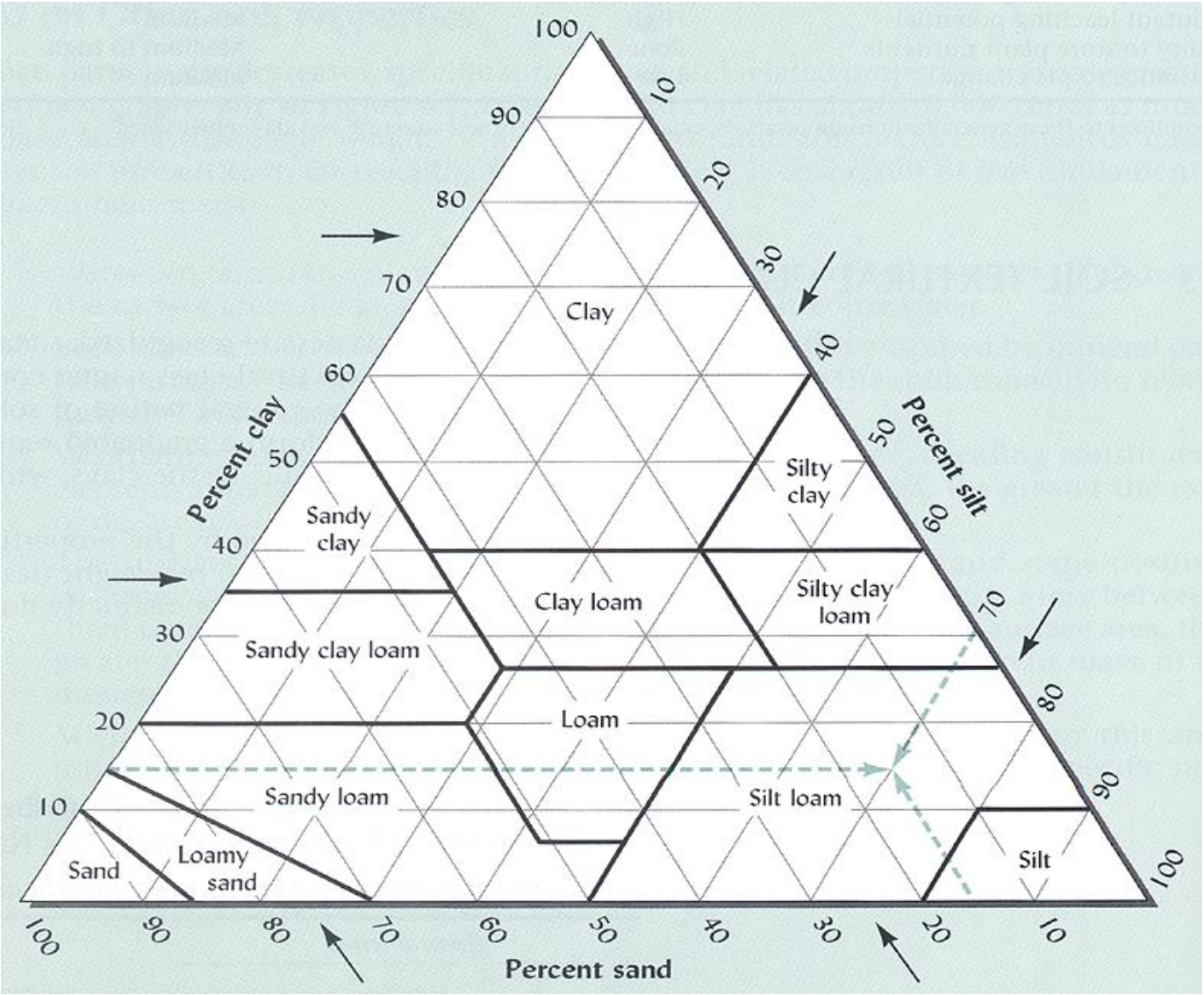
- The above horizons are common in Pennsylvania. Most soils do not contain every horizon.
- How do we differentiate horizons? (changes in color, texture, structure, roots, redoximorphic features (mottling) or other.

SOIL TEXTURE – SAND, SILT, CLAY

- Sand - feels gritty
- Silt - feels floury
- Clay - sticky when wet
- Loams – mixture of materials

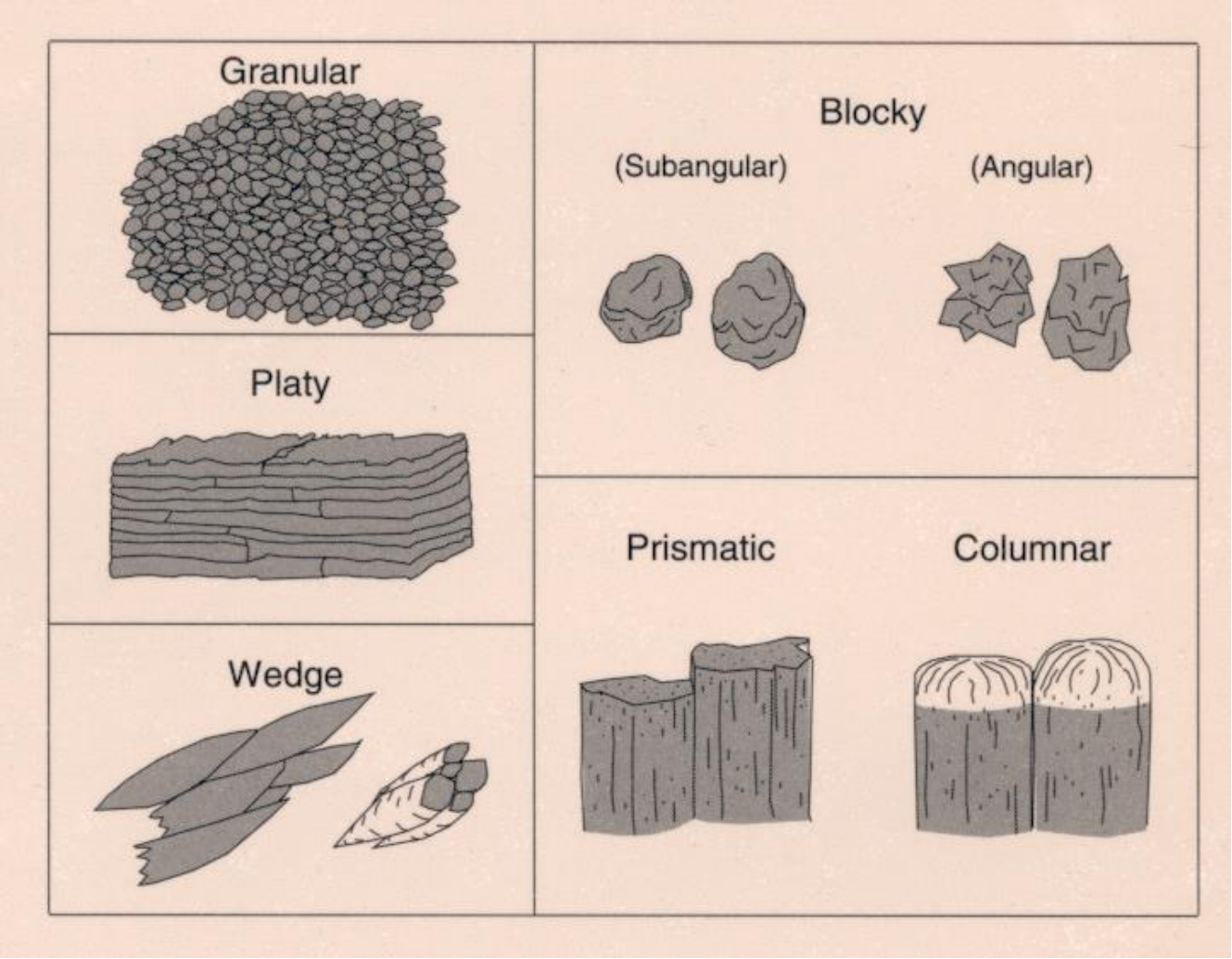
- High silt soils and loams are most conducive to plant growth
- How does texture affect water in soils?
- The soil textural triangle and the key to soil texture by feel are to be available for the test.

Soil Textural Triangle



SOIL STRUCTURE

- The naturally occurring arrangement of soil particles. Each individual unit is called a ped. Near surface soil structure is often influenced by land use and management.



SOIL COLOR

Determined by air and water drainage, organic matter, parent material

- Topsoil – dark organic matter – vegetation, soil critters
- Subsoil – less OM
- Red soils – often high iron, well-drained (example of a rusty pipe)
- Wet Soil - Lack of oxygen (air) – leads to grey colors and redoximorphic concentrations and depletions (mottling)

SOIL pH

- Soil pH thus affects the availability of several plant nutrients.
- A pH range of 6 to 7 is generally favorable for plant growth sources. This is considered neutral to slightly acidic.
- Great diversity of pH difference in Pennsylvania, although soils are more likely to be acidic than alkaline.
- Low pH soils can be adjusted by adding lime. High pH soils can be adjusted by adding sulfur or sulfuric acid.

Soil Survey

Designed to:

- Delineate different soils across the landscape
- Predict soil behavior for different uses
- Highlight limitations and hazards inherent in the soil

Includes:

- Text
  - General description
  - Map units descriptions
  - Use and Management
- Interpretive tables
- Maps

Over 70,000 different kinds of soil have been delineated in the United States. In a soil survey, soils are classified into map units which consist of one or more soil series within a slope class. A soil series (or soil type) has a combination of traits unique to it such as parent material, texture, drainage, and landscape position.

Slope gradient (or slope) is the steepness of the land. It is the rise or fall in a given distance and is usually measured in percent. Example: If a hillside is 100 feet long and drops 10 feet in elevation from the top of the slope to the bottom of the slope, then the slope is 10%.

Delineated on the maps are individual Map units. These show the different soil series (types) across the landscape. The first letter denotes the soil series and special feature, the last large letter denotes the slope phase.