Soils-Natural Lawn Care Basics

Illinois Lake Management Association

Soil and Water Conservation District
of Lake County

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March 3, 2010

Why Are We Talking About Soils?

- How does soil relate to natural lawn care?
- What's underneath our feet? A short introduction to understanding soils
- How to find out your Soil type?
- Soil Sampling-How to Sample your lawn!

Soil Basics: Soils Are A Medium For The Growth Of Plants

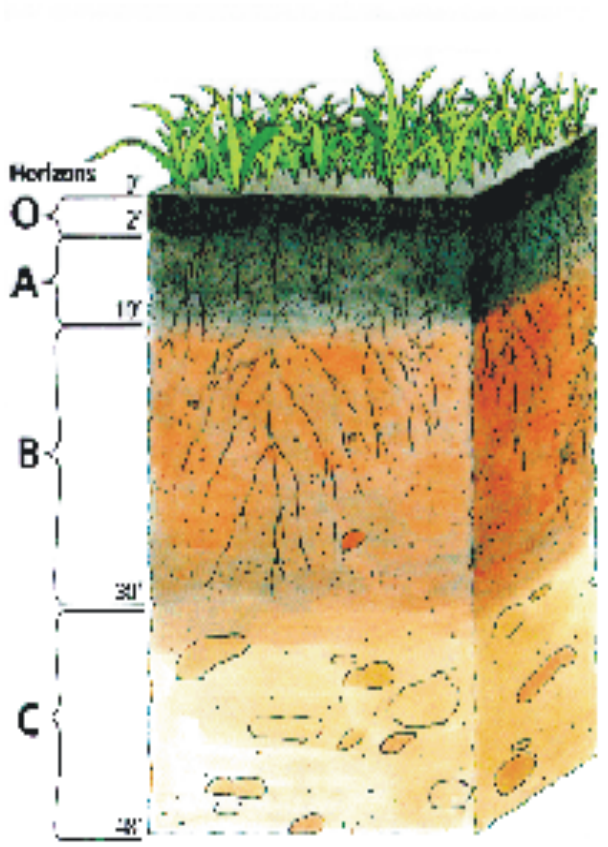
- Plants cannot sustain life without soil
- Plant roots in soil
  - Foundation for roots
  - Regulate temps
- Key nutrient elements supplied
- Soil pores
  - Supply roots with O_2 and allow CO_2 to vent off
  - Allow roots access to water
- Soil types strongly influence/determine the nature of the vegetation present in a given area
  - Can also prevent the growth of certain plants

Basic Soil Lingo

- Soil Profile
  - vertical section exposing layers or horizons of a soil
- Soil Horizons
  - distinctive, yet highly variable soil layers, typically parallel the ground surface
- Soil Texture
  - How the soil feels, broken down in percentages of sand, silt, and clay.

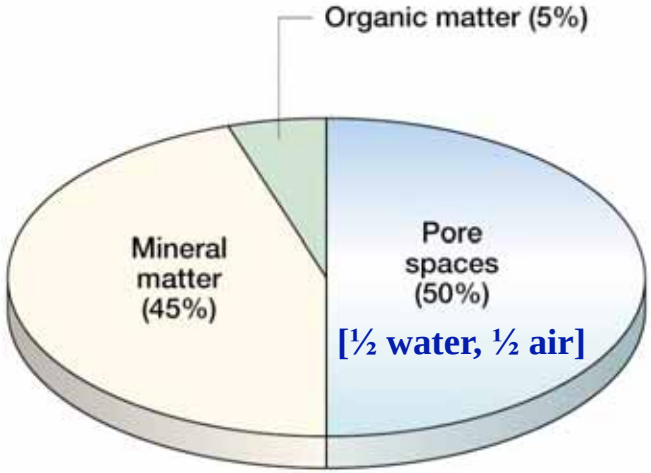
Soil Horizons

- O = undecomposed or decomposing organic matter, usually at the surface of forest soils.
- A = organic material and mineral matter; darker colors; commonly called ***topsoil***.
  - The preferred soil horizon for plant growth
- E = leached zone; usually lighter color
- B = zone of accumulation of clays, iron and aluminum oxides, gypsum, or $CaCO_2$
  - Very hard, lightly colored compacted soil (silty clay loam)
- C = relatively unweathered, unconsolidated parent material
- R = rock parent material



What is Soil Composed Of?

- Mineral = inorganic materials derived from weathering/erosion of rock.
- Organic Matter = comes from living organisms, remains of dead organisms, and other organic compounds (influence fertility, water-holding abilities).



- Water = held within soil pores; contains dissolved organic and inorganic substances (really a soil solution); its pH is crucial for plant growth.
- Air = also held within soil pores; varies within a soil; high relative humidity is common; CO_2 is higher, O_2 lower than atmosphere; displaced by water.

How Is Soil Formed?

Soil Forming Factors

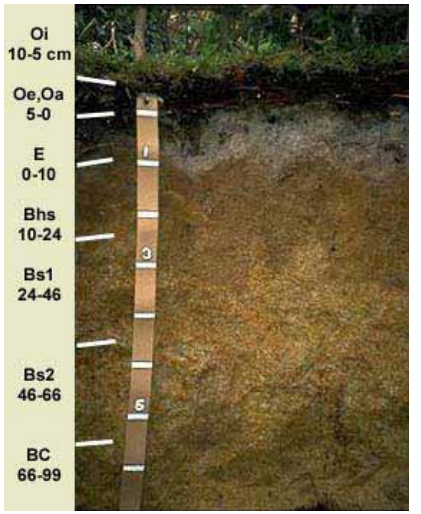
- 1.) Parent Material
  - Vary greatly and their nature has a profound influence on soil characteristics, especially things like texture, and chemical and mineral composition.
  - Three types of Parent Material: Residual, Transported, and Organic
- 2.) Climate
  - Effects on soil development are seen
    - directly in the form of effective precipitation and temperature, and
    - indirectly through its influence on natural vegetation
- 3.) Biota
    - Living Organisms: Plants and Animals
- 4.) Topography
  - Influences: soil loss, water infiltration, local climate, drainage, and parent materials
- 5.) Time
  - Glaciers have impacted the amount of time in soil development

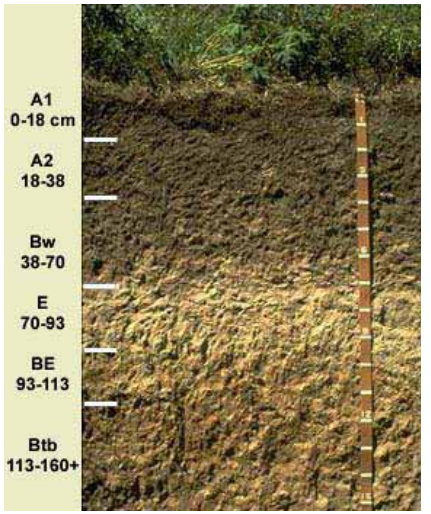
Parent Material

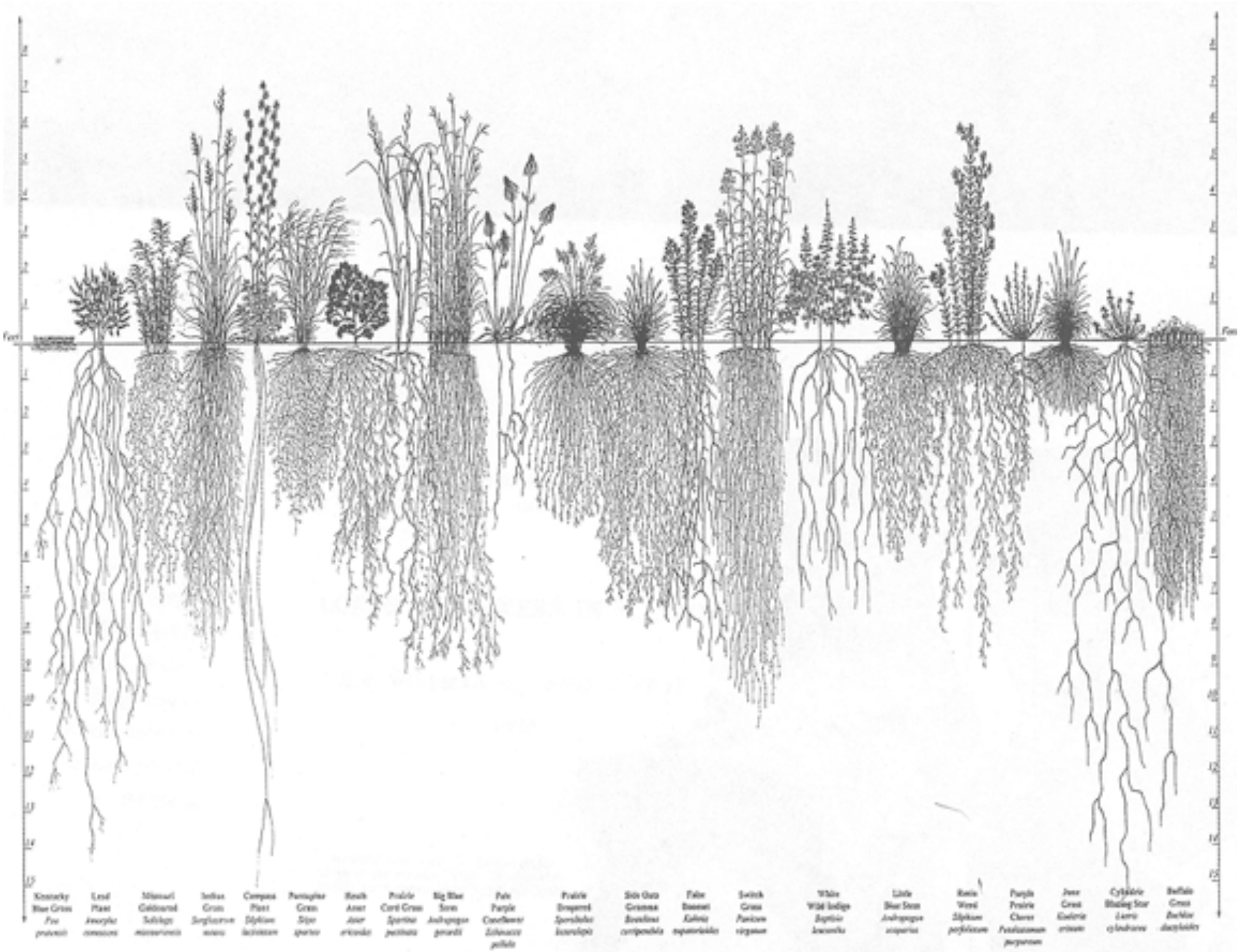
- Parent material has had a great impact on the soils of northeastern Illinois
- Is a major factor in determining the pH of the soil

Biota: A-Horizon Development Grassland vs. Forest Soils (A Classic Comparison)

- Grassland soils have a tremendous amount of organic matter added to them due to the root systems of grassland plants.
  - A horizons tend to be very dark and thick.
- In forests, organic matter is added to soils primarily by leaf accumulation.
  - Much thinner A horizons or may be missing entirely.






Kentucky Blue Grass
Poa pratensis
Leadplant
Amorpha canescens
Missouri Goldenrod
Solidago missouriensis
Indian Grass
Sorghastrum nutans
Compass Plant
Silphium laciniatum
Porcupine Grass
Stipa spartea
Rough Aster
Aster oolentangiensis
Prairie Cord Grass
Spartina pectinata
Big Blue Stem
Andropogon gerardii
Pale Purple Coneflower
Echinacea pallida
Prairie Dropseed
Sporobolus heterolepis
Side Oats Grama
Bouteloua curtipendula
False Boneset
Kuhnia eupatorioides
Switch Grass
Panicum virgatum
White Wild Indigo
Baptisia leucantha
Little Blue Stem
Andropogon scoparius
Rosin Weed
Silphium perfoliatum
Purple Prairie Clover
Petalostemum purpureum
June Grass
Koeleria cristata
Cylindric Blazing Star
Liatris cylindracea
Buffalo Grass
Buchloe dactyloides

Soil Properties

- Soil Color
  - Condition Indicator
- Soil Texture
  - Texture Triangle
  - Texture by Feel
- Soil Structure

Mollisol

Alfisol

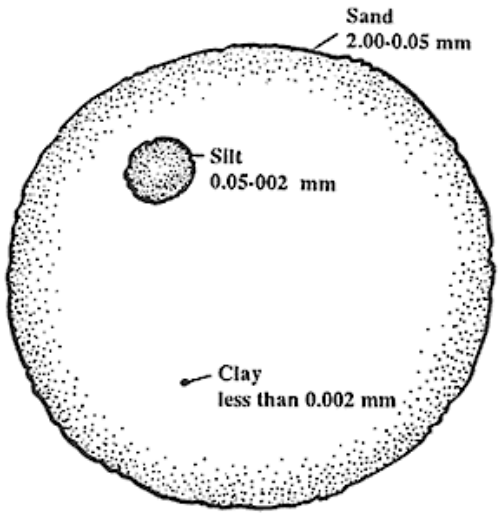
Soil colors may indicate a number of things:

- Black or dark brown
  - organic matter-rich
  - soils found in northern Illinois
- Gray, bluish, grey-green (gleyed)
  - Anaerobic conditions
  - soils found in wetlands
- White or light grey
  - leaching in humid climate
  - or calcium carbonate in arid, semi-arid climates
- Orange or red
  - iron-rich

PLATE 10 Spodosols—a Humic Cryorthod from southern Quebec. Albic horizon at about 10 cm. Bar = 10 cm.

Soil Texture-Mineral Soil

- Proportion of different sized mineral particles (textural classes).
  - Refers to a major size class of individual soil particles or soil separate (sand, silt, clay).
  - Usually applies to proportion of different particles in fine earth fraction (particles <2 mm in diameter).
- Soil Particle Sizes
  - Sand
    - Size: 0.05 mm to 2mm
  - Silt
    - Size: 0.002 mm to 0.05 mm
  - Clay
    - Size: Less than 0.002 mm

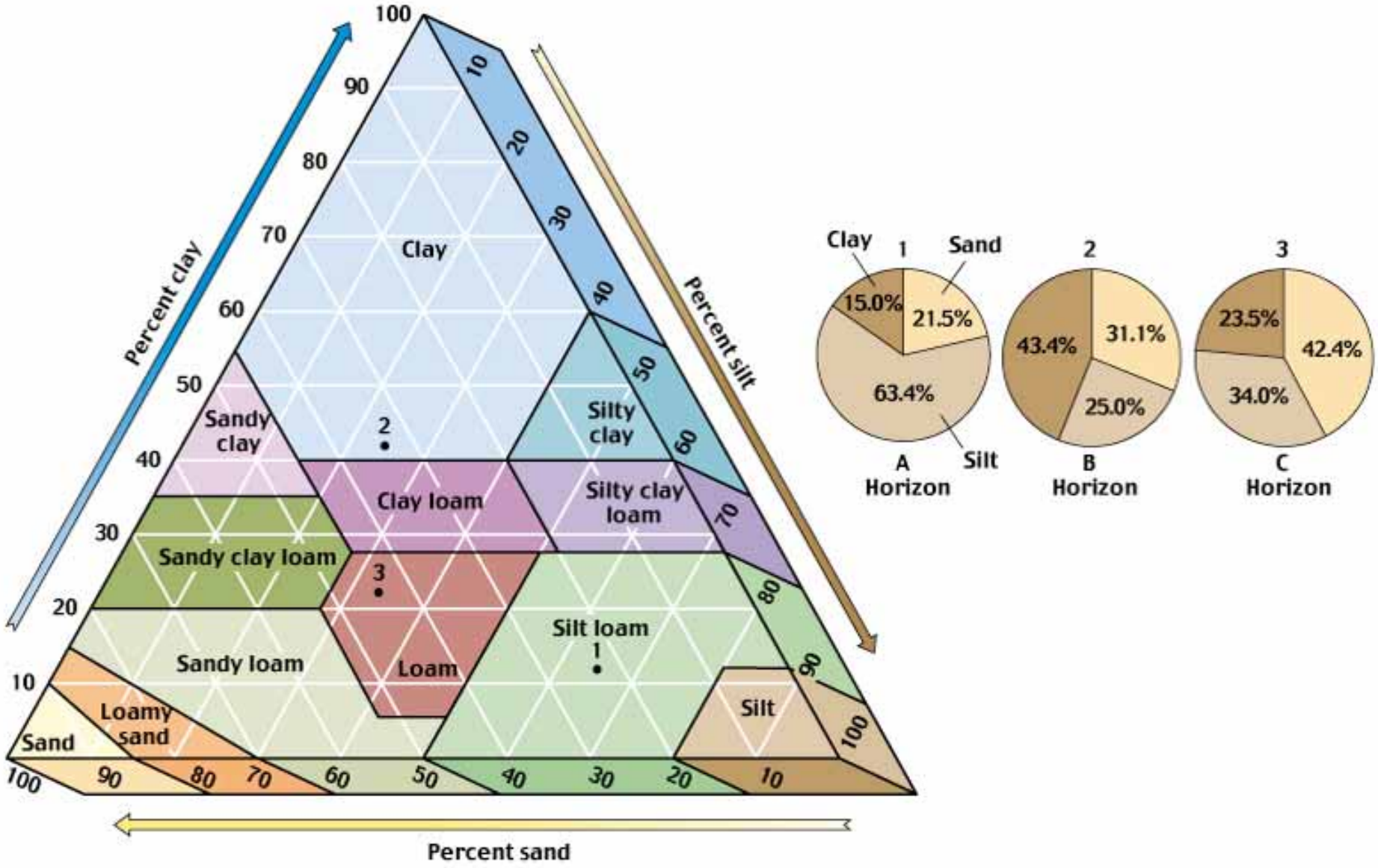


Soil Particles

- Sand
  - Soil voids between sand grains are large, surface area is relatively low (compared to other smaller sized particles)
  - Noncohesive
    - the individual particles do not stick together
  - Water moves through sand easily and the particles do not hold much water, which means sandy soils tend to be droughty.
- Silt
  - Pores between silt particles are smaller than in sand, consequently silt holds more water but has slower infiltration rates than sand.
  - Low stickiness (cohesion), low plasticity (malleability) means silts are easily washed away by flowing water (high potential for fluvial erosion).
- Clay
  - Particles have tremendously large surface area
    - means they have the largest water holding capacity
  - Very sticky (cohesive) and high plasticity (malleability)
  - May behave as colloids
    - stay suspended indefinitely in fluids (like blood cells in blood stream)
  - Movements of water and air are very slow.

Soil Texture Classes

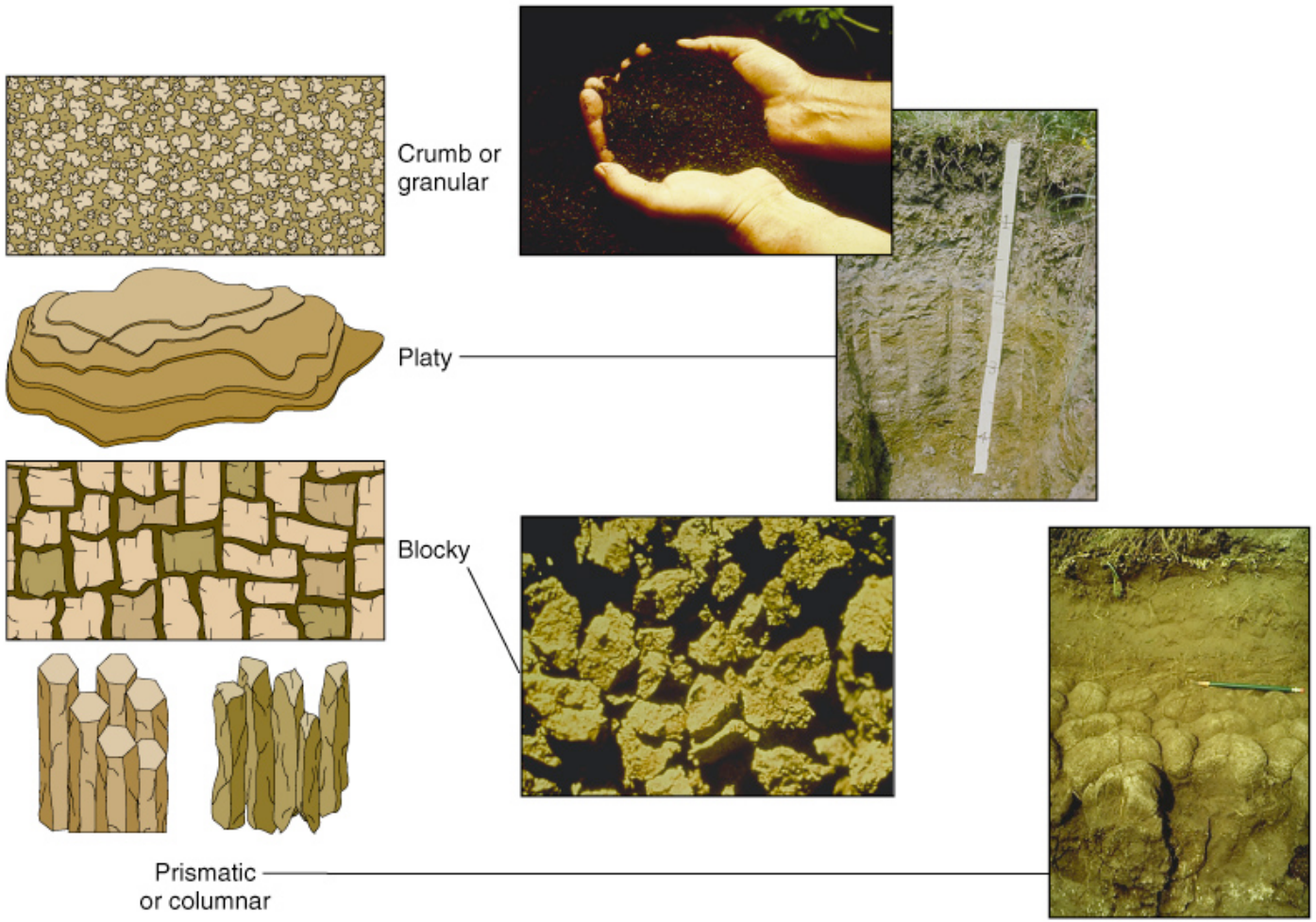
- 12 textural classes, keyed to textural triangle:
  - sand, loamy sand, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, sandy clay loam, silty clay loam, clay loam, sandy clay, silty clay, clay
- Loam (only term not self-explanatory)
  - mix of sand, silt, and clay exhibits properties of these textures in equal amounts (doesn't mean an equal mix).
  - Modifiers indicate which particular separate is dominant in the loam.


Percent clay
Percent silt
Percent sand
Clay
Sandy clay
Silty clay
Clay loam
Silty clay loam
Sandy clay loam
Sandy loam
Loam
Silt loam
Silt
Loamy sand
Sand
1
2
3
Clay
Sand
Silt
15.0%
21.5%
63.4%
A Horizon
43.4%
31.1%
25.0%
B Horizon
23.5%
42.4%
34.0%
C Horizon

Determining Soil Texture-Hand Texturing by the "Feel" Method

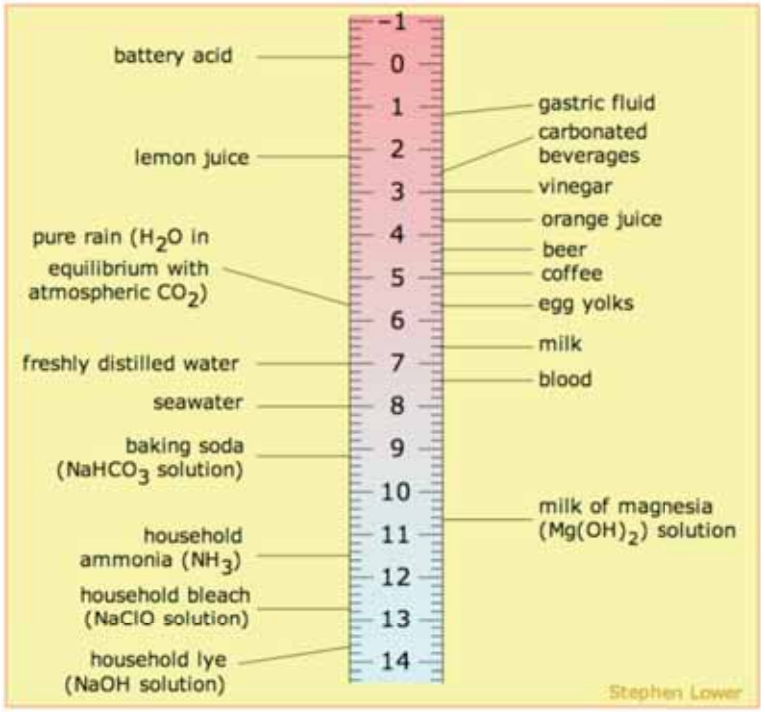
- Textural classes determined in field by hand.
- Process involves a great deal of practice, but some soil scientists become experts at it.
- For example,
  - sand has a gritty feel to it, will not form a ball;
  - silt is non-gritty, feels like flour (smooth and silky), and will form a ball and short ribbon when moist;
  - clay feels greasy, will form long ribbon when moist.

Soil Structure



Soil pH

- pH is the measure of the acidity or alkalinity in the soil.
- Ranges from 0 – 14, below 7 is considered acidic, and above 7 is considered alkaline
- Most common soil pH classes:
  - Extremely acid 3.5 – 4.4
  - Very strongly acid 4.5 – 5.5
  - Moderately acid 5.6 – 6.0
  - Slightly acid 6.1 – 6.5
  - Neutral 6.6 – 7.3
  - Slightly alkaline 7.4 – 7.8
  - Moderately alkaline 7.9 – 8.4
  - Strongly alkaline 8.5 – 9.0

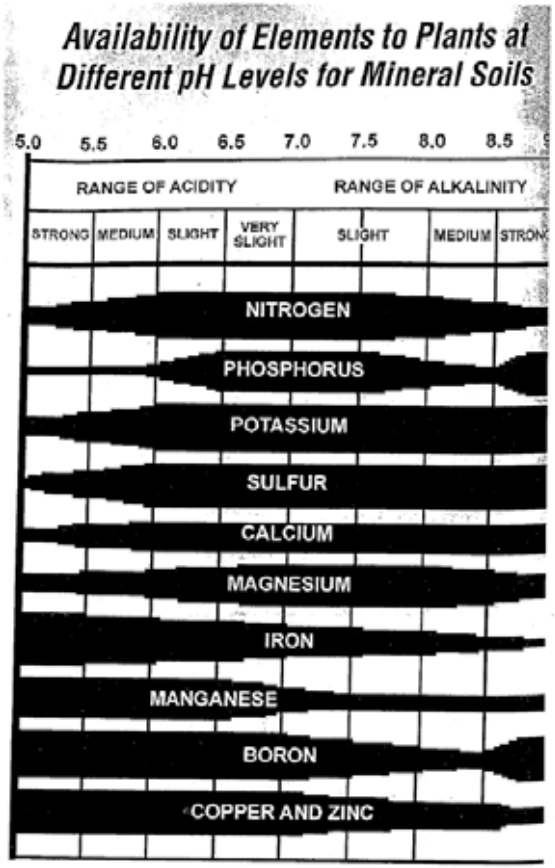


What Controls the Soil pH?

- The acidity or alkalinity in soils have several different sources.
- pH is affected (naturally) variably by:
  - Mineralogy (Bedrock/Substrate)
  - Climate
  - Weathering
- pH is also affected by soil management
  - Fertilizers (acid-forming nitrogen fertilizers)
  - Organic Matter

Soil pH-Availability of Nutrients

- Soil pH influences the solubility of nutrients, thus affecting the availability of several important plant nutrients.
- pH range of 6 to 7 is generally most favorable for plant growth because plant nutrients are most readily available in this range.
- Soils with a soil pH below 5.5 have low available calcium, magnesium, and phosphorus, while solubility is high for iron, aluminum and boron.
- At pH of 7.8 or more, calcium and magnesium are abundant, while phosphorus, iron, copper, boron have inadequate availabilities



Adapted from: Ankerman, D., & Large, R., Soil and Plant Analysis. *A & L Agricultural Laboratories, Inc.*

Soil pH-Some Plant Preferences

- The optimum pH for most plants and soil microorganisms is between 6.0 and 7.0
- However, some plants have niches, and can thrive in fairly alkaline or acidic soils
- Look to native plants of a region
- Some examples of plants in extreme pH's
  - Alkaline Soils: Alfalfa, Aster, Geranium, Carnation, Sunflower, Lewisia, Magnolia, Yew, Barberry, Juniper, Boxwood, Spirea, Lilac, Currant, Smoke Tree, Mountain Ash, Maple, Hawthorn, Sumac
  - Acidic Soils: Alyssum, Crocus, Ferns, Strawberry, Blueberry, Witch Hazel, Ivy, Rhododendrons, Birch, Magnolia, Crabapples, Spruce, Hemlock, Fir, Pine

pH Amendments

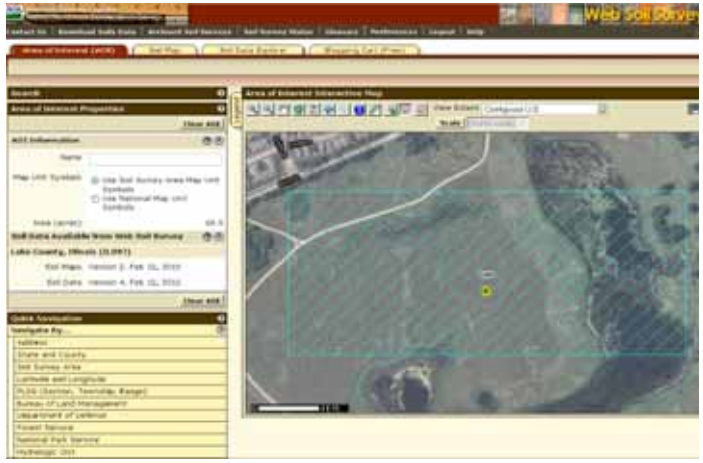
- Myth: Lime is the cure-all soil amendment
- Raising the pH
  - Palletized lime-weaker substitute for crushed limestone
  - Agricultural (crushed) limestone
  - ***Rule:*** if the limestone is finely ground, the reaction is faster
  - Wood Ash
  - Mushroom Compost
- Reducing the pH-Chemical amendments that contain sulfur generally form an acid, which lowers the soil pH
  - Aluminum sulfate
  - Elemental sulfur
- Generally, sulfur/sulfate is not recommended unless pH is above 7.50

Soil Nutrients

- Primary Nutrients-are needed in large quantities
  - Nitrogen (N): Nitrate-Nitrogen: 20-60 lbs/acre
  - Potassium (K): 300 lbs/acre
  - Phosphorus (P): 40-60 lbs/acre
- Secondary Nutrients-needed in lesser quantities
  - Calcium (Ca)
  - Magnesium (Mg)
  - Sulfur (S)
- Micronutrients-required in very small amounts
  - Zinc (Zn)
  - Manganese (Mn)

Finding Your Soil Type-Soil Survey

- County Soil Survey
  - Contact your local Soil and Water Conservation District office for a digital (CD) or paper copy of the soil survey
- Web Soil Survey
  - Soil Survey information is available online through the USDA-Natural Resources Conservation Service
  - http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

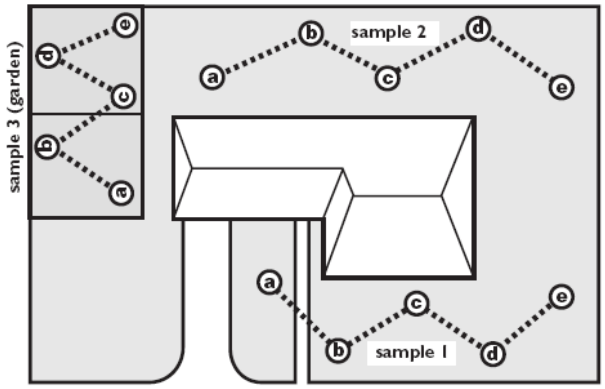


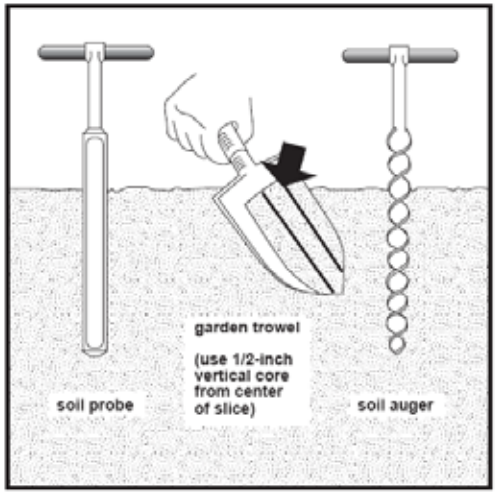
Soil Testing-Why and When to Sample

- Why should you get your soil tested?
  - Periodic soil testing will help to correct nutrient deficiencies, avoid excess fertilizer applications and maintain a healthy lawn.
- When should you get your soil tested?
  - Before establishing a new lawn, whether from seed, sod, or sprigs.
  - Every three years on established lawns (late summer or fall is best time).
    - Majority of people get their soil tested in the spring
  - Annually when attempting to correct a nutrient deficiency or change the soil pH.
  - When fertilizers containing phosphate or potash have been used on a regular basis for a number of years.

Sampling Lawn and Garden Soils for Testing

- Sampling Lawns
  - 5-10 random locations throughout yard
  - Each hole should be 4 inches deep
  - Remove any turf at the top of the sample
- Sampling Gardens
  - 3-5 random locations through garden
  - Each hole should be 6-8 inches deep
- Equipment Needed:
  - Clean Bucket
  - Garden Trowel, Shovel, or Soil Probe
  - Ziploc Bags
  - Wax Paper or Newspaper





Lake County SWCD Soil Testing Program

- Test for pH, phosphorus, and potassium.
- Also provides the soil color, soil texture, and soil color of the sample.
- Test samples from gardens, lawns, and flower beds
- Provides recommendation on remediation of the soil which includes fertilizer rates of application.
- Cost for each Sample is $20
- Results will be returned within 10 days.
- Visit www.lakeswcd.org/Soil%20Testing.htm for more information.

Questions?

Thank you!

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