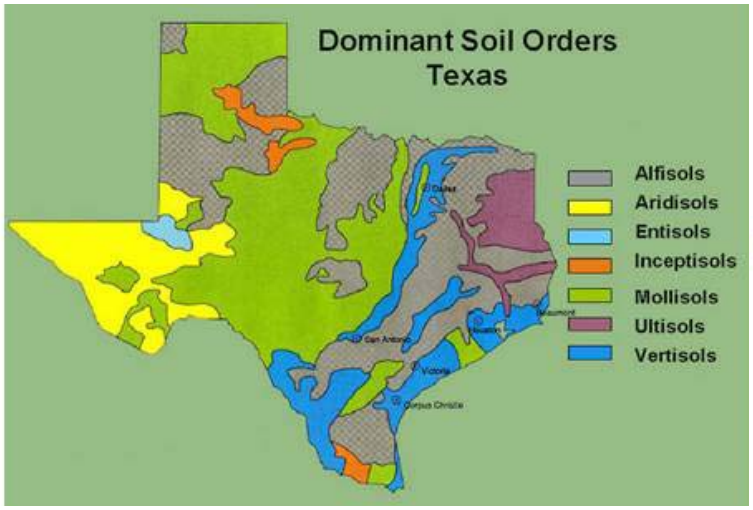
Due: 1 October 2012 Name _____

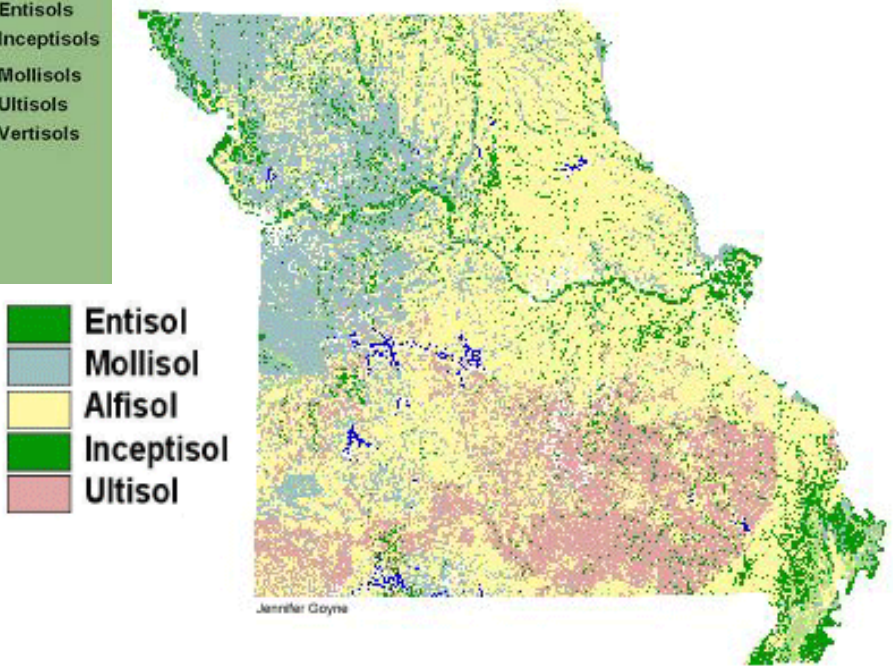
1) a. Using the soil taxonomy poster, surface map, and geologic maps, what can you hypothesize about the classification and diversity of Indiana soils?

   b. What about the soils of your home state/region? (If your home state is IN, hypothesize about another location!)

2) Explain the soil order distribution of
   a. Texas

   b. Missouri



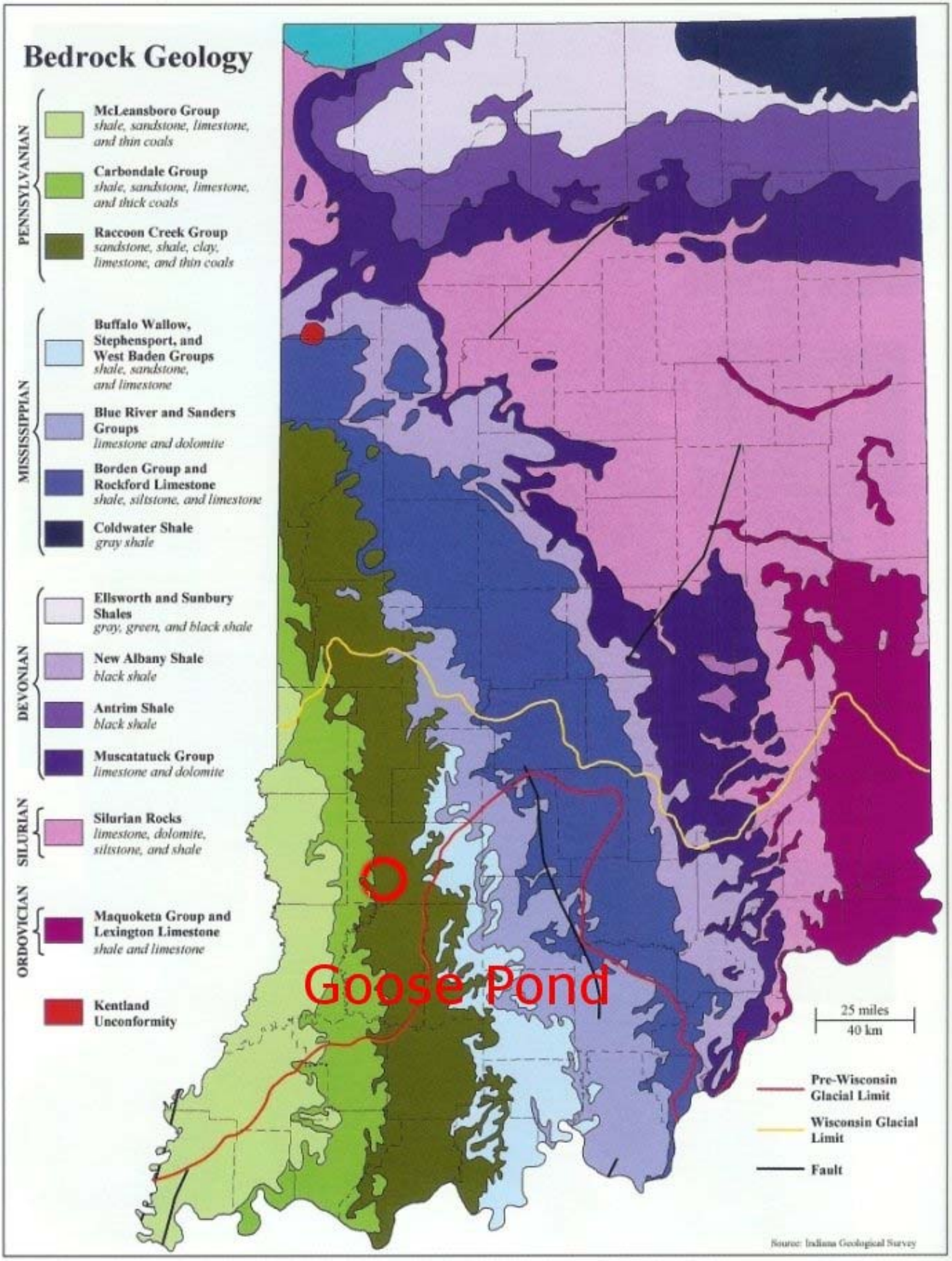


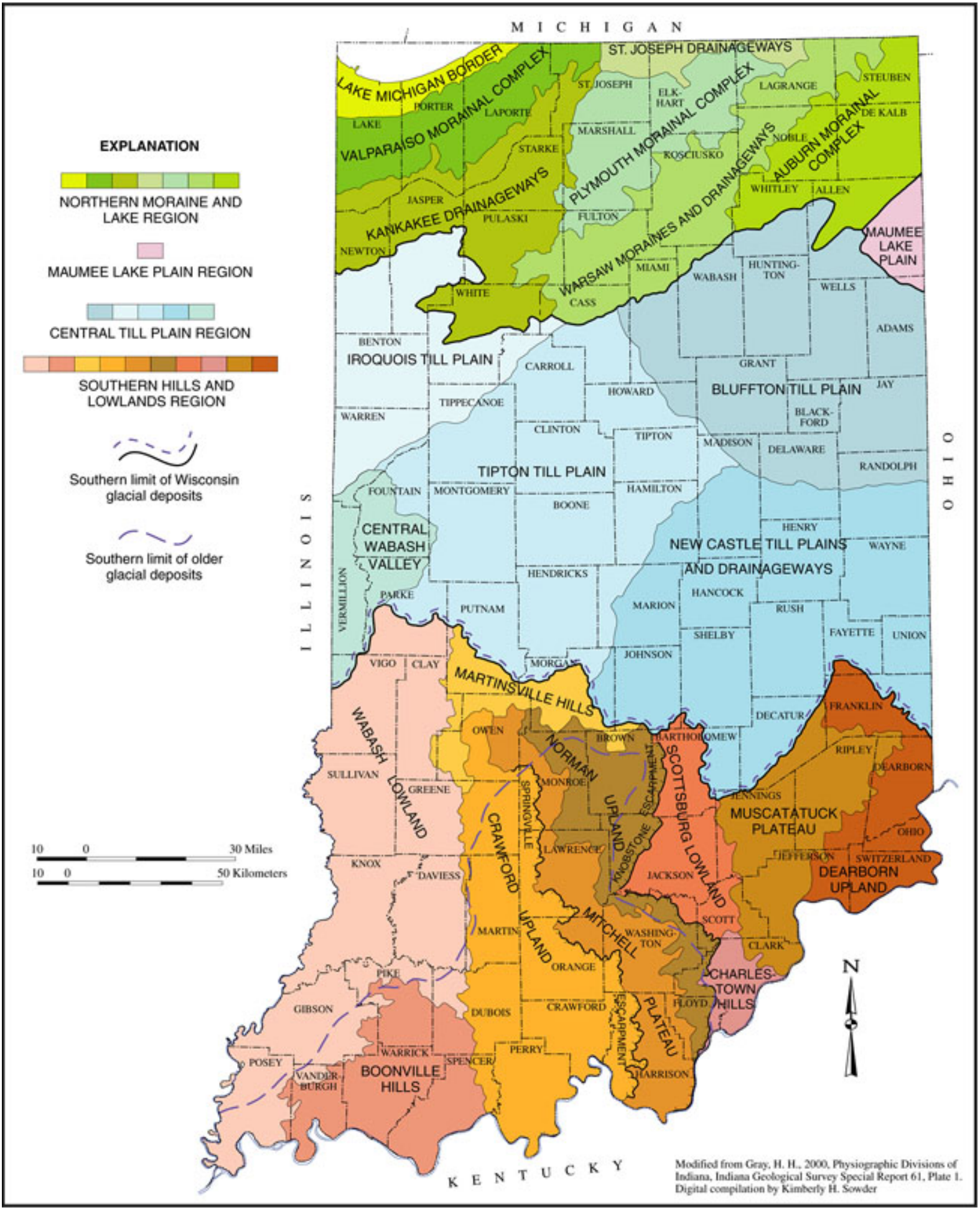
3) Use the guide and flow chart to determine the textural class and approximate sand, silt, and clay proportions of the following samples:
   a. unknown light material
   b. Planting Experiment Soil 1
   c. Planting Experiment Soil 2
   d. Planting Experiment Soil 3

4) Do you think you might get different answers if you performed the analysis again? Why or why not?

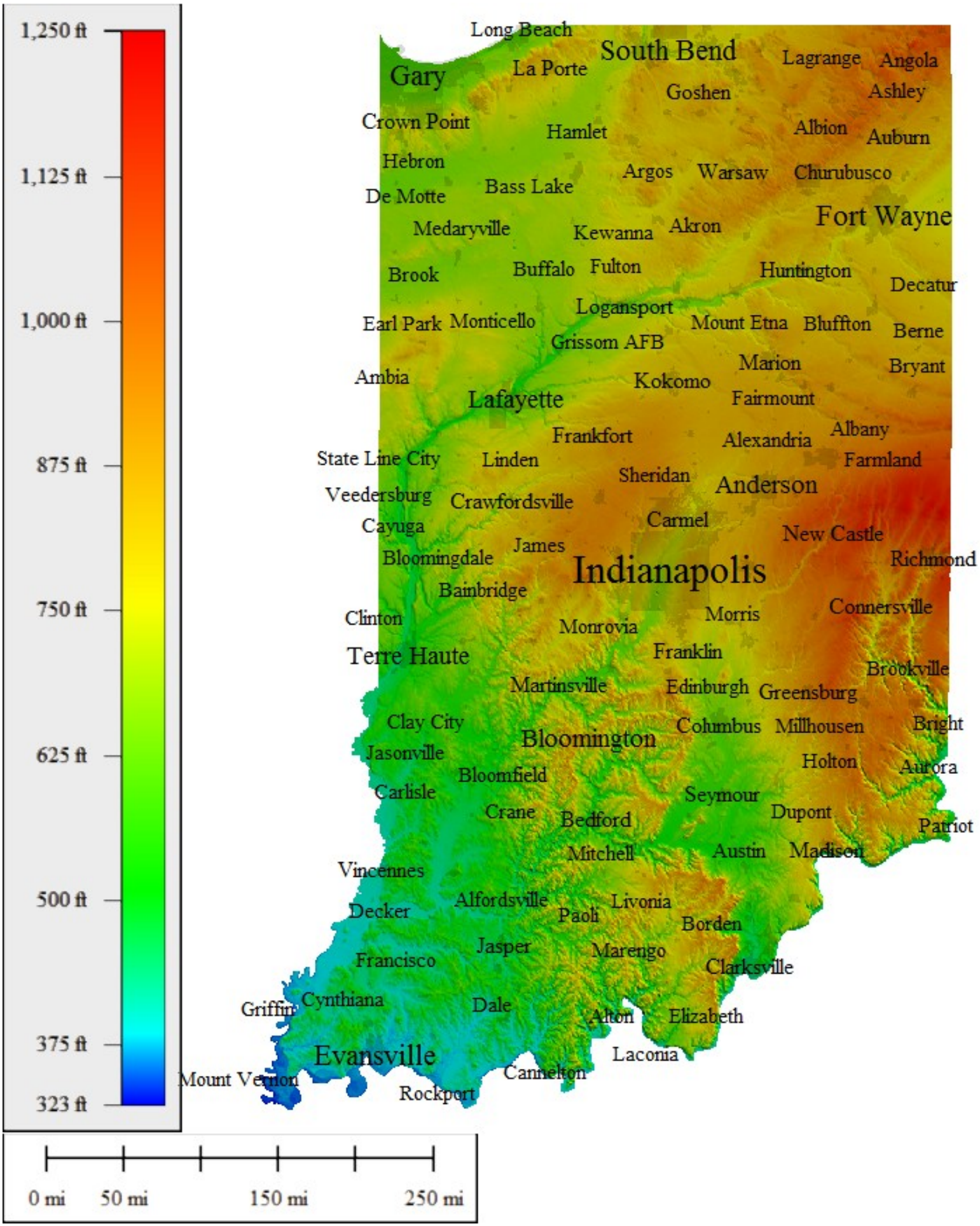
5) According to your own experience, and the definitions discussed in class and in your text, are these materials *soils*? Explain your answer.

6) Do you think testing the same soil by feel and by quantitative/mechanical analysis (e.g., sieve, hydrometer, laser diffraction, etc.) might yield different textural classes for any of these samples? Why or why not? If so, which assessment would you consider more v


Bedrock Geology
PENNSYLVANIAN
McLeansboro Group
shale, sandstone, limestone, and thin coals
Carbondale Group
shale, sandstone, limestone, and thick coals
Raccoon Creek Group
sandstone, shale, clay, limestone, and thin coals
MISSISSIPPIAN
Buffalo Wallow, Stephensport, and West Baden Groups
shale, sandstone, and limestone
Blue River and Sanders Groups
limestone and dolomite
Borden Group and Rockford Limestone
shale, siltstone, and limestone
Coldwater Shale
gray shale
DEVONIAN
Ellsworth and Sunbury Shales
gray, green, and black shale
New Albany Shale
black shale
Antrim Shale
black shale
Muscatatuck Group
limestone and dolomite
SILURIAN
Silurian Rocks
limestone, dolomite, siltstone, and shale
ORDOVICIAN
Maquoketa Group and Lexington Limestone
shale and limestone
Kentland Unconformity
Goose Pond
25 miles
40 km
Pre-Wisconsin Glacial Limit
Wisconsin Glacial Limit
Fault
Source: Indiana Geological Survey



Modified from Gray, H. H., 2000, Physiographic Divisions of Indiana, Indiana Geological Survey Special Report 61, Plate 1. Digital compilation by Kimberly H. Sowder


1,250 ft
1,125 ft
1,000 ft
875 ft
750 ft
625 ft
500 ft
375 ft
323 ft
0 mi
50 mi
150 mi
250 mi
Long Beach
South Bend
Lagrange
Angola
Gary
La Porte
Goshen
Ashley
Crown Point
Hamlet
Albion
Auburn
Hebron
Argos
Warsaw
Churubusco
De Motte
Bass Lake
Fort Wayne
Medaryville
Kewanna
Akron
Brook
Buffalo
Fulton
Huntington
Decatur
Logansport
Earl Park
Monticello
Mount Etna
Bluffton
Berne
Grissom AFB
Marion
Bryant
Ambia
Kokomo
Lafayette
Fairmount
Frankfort
Alexandria
Albany
State Line City
Linden
Sheridan
Farmland
Anderson
Veedersburg
Crawfordsville
Carmel
Cayuga
New Castle
James
Bloomingdale
Indianapolis
Richmond
Bainbridge
Clinton
Morris
Connersville
Monrovia
Terre Haute
Franklin
Brookville
Martinsville
Edinburgh
Greensburg
Clay City
Columbus
Millhousen
Bright
Bloomington
Jasonville
Holton
Aurora
Bloomfield
Carlisle
Seymour
Crane
Bedford
Dupont
Patriot
Mitchell
Austin
Madison
Vincennes
Alfordsville
Livonia
Decker
Paoli
Borden
Jasper
Marengo
Francisco
Clarksville
Griffin
Cynthiana
Dale
Alton
Elizabeth
Evansville
Laconia
Cannelton
Mount Vernon
Rockport

The Twelve Orders of Soil Taxonomy

Alfisols

Alfisols are to semiarid to moist areas.

These soils result from weathering processes that leach clay minerals and other constituents out of the surface layer and into the subsoil, where they can hold and supply moisture and nutrients to plants. They formed primarily under forest or mixed vegetative cover and are productive for most crops.

Alfisols make up about 10% of the world's ice-free land surface.

Andisols

Andisols form from weathering processes that generate minerals with little orderly crystalline structure. These minerals can result in an unusually high water- and nutrient-holding capacity.

As a group, Andisols tend to be highly productive soils. They include weakly weathered soils with much volcanic glass as well as more strongly weathered soils. They are common in cool areas with moderate to high precipitation, especially those areas associated with volcanic materials.

Andisols make up about 1% of the world's ice-free land surface.

Aridisols

Aridisols are soils that are too dry for the growth of mesophytic plants. The lack of moisture greatly restricts the intensity of weathering processes and limits most soil development processes to the upper part of the soils. Aridisols often accumulate gypsum, salt, calcium carbonate, and other materials that are easily leached from soils in more humid environments.

Aridisols are common in the deserts of the world.

Aridisols make up about 12% of the world's ice-free land surface.

Entisols

Entisols are soils that show little or no evidence of pedogenic horizon development.

Entisols occur in areas of recently deposited parent materials or in areas where erosion or deposition rates are faster than the rate of soil development; such as dunes, steep slopes, and flood plains. They occur in many environments.

Entisols make up about 16% of the world's ice-free land surface.

Gelisols

Gelisols are soils that have permafrost near the soil surface and/or have evidence of cryoturbation (frost churning) and/or ice segregation.

Gelisols are common in the higher latitudes or at high elevations.

Gelisols make up about 9% of the world's ice-free land surface.

Histosols

Histosols have a high content of organic matter and no permafrost. Most are saturated year round, but a few are freely drained. Histosols are commonly called bogs, moors, peats, or mucks.

Histosols form in decomposed plant remains that accumulate in water, forest litter, or moss faster than they decay. If these soils are drained and exposed to air, microbial decomposition is accelerated and the soils may subside dramatically.

Histosols make up about 1% of the world's ice-free land surface.

Inceptisols

Inceptisols are soils of semiarid to humid environments that generally exhibit only moderate degrees of soil weathering and development.

Inceptisols have a wide range in characteristics and occur in a wide variety of climates.

Inceptisols make up about 17% of the world's ice-free land surface.

Mollisols

Mollisols are soils that have a dark colored surface horizon relatively high in content of organic matter. The soils are base rich throughout and therefore are quite fertile.

Mollisols characteristically form under grass in climates that have a moderate to pronounced seasonal moisture deficit. They are extensive soils on the steppes of Europe, Asia, North America, and South America.

Mollisols make up about 7% of the world's ice-free land surface.

Oxisols

Oxisols are highly weathered soils of tropical and subtropical regions. They are dominated by low activity minerals, such as quartz, kaolinite, and iron oxides. They tend to have indistinct horizons.

Oxisols characteristically occur on land surfaces that have been stable for a long time. They have low natural fertility as well as a low capacity to retain additions of lime and fertilizer.

Oxisols make up about 8% of the world's ice-free land surface.

Spodosols

Spodosols formed from weathering processes that strip organic matter combined with aluminum (with or without iron) from the surface layer and deposit them in the subsoil. In undisturbed areas, a gray eluvial horizon that has the color of uncoated quartz overlies a reddish brown or black subsoil.

Spodosols commonly occur in areas of coarse-textured deposits under coniferous forests of humid regions. They tend to be acid and infertile.

Spodosols make up about 4% of the world's ice-free land surface.

Ultisols

Ultisols are soils in humid areas. They formed from fairly intense weathering and leaching processes that result in a clay-enriched subsoil dominated by minerals, such as quartz, kaolinite, and iron oxides.

Ultisols are typically acid soils in which most nutrients are concentrated in the upper few inches. They have a moderately low capacity to retain additions of lime and fertilizer.

Ultisols make up about 8% of the world's ice-free land surface.

Vertisols

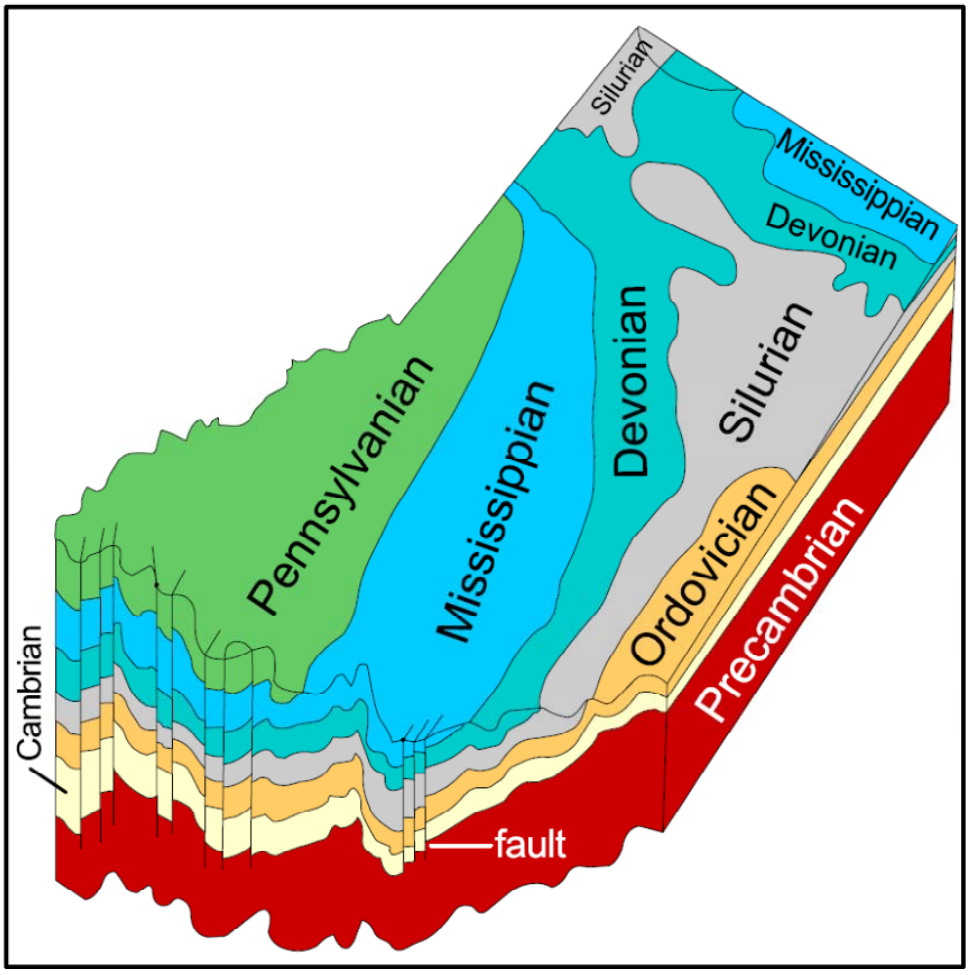
Vertisols have a high content of expanding clay minerals. They undergo pronounced changes in volume with changes in moisture. They have cracks that open and close periodically, and that show evidence of soil movement in the profile.

Because they swell when wet, vertisols transmit water very slowly and have undergone little leaching. They tend to be fairly high in natural fertility.

Vertisols make up about 2% of the world's ice-free land surface.

USDA

NRCS Natural Resources Conservation Service



Block diagram illustrating southwesterly dip of the Sedimentary rocks that make up the bedrock in Indiana. Notice the outcrop and subcrop pattern that has resulted from erosion on the gently dipping bedrock surface.

Guide to Texture by Feel

Modified from:
Thien, S.J. (1979). A flow diagram for teaching texture by feel analysis. *Journal of Agronomic Education*. **8**:54-55.

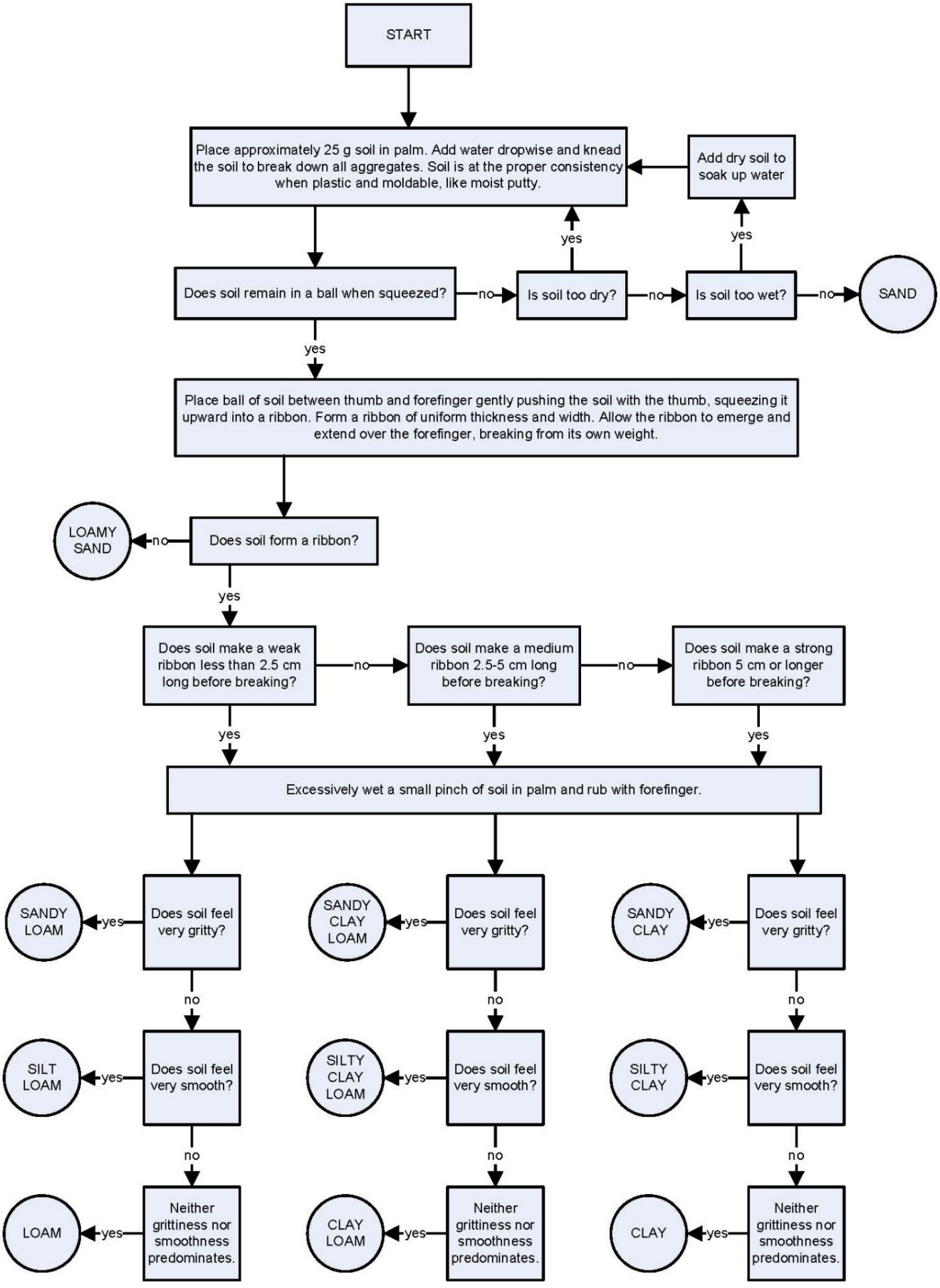
Texture class is one of the first things determined when a soil is examined. It is related to weathering and parent material. The differences in horizons may be due to the differences in texture of their respective parent materials.

Texture class can be determined fairly well in the field by feeling the sand particles and estimating silt and clay content by flexibility and stickiness. There is no field mechanical-analysis procedure that is as accurate as the fingers of an experienced scientist, especially if standard samples are available. A person must be familiar with the composition of the local soils. This is because certain characteristics of soils can create incorrect results if the person does not take these characteristics into account.

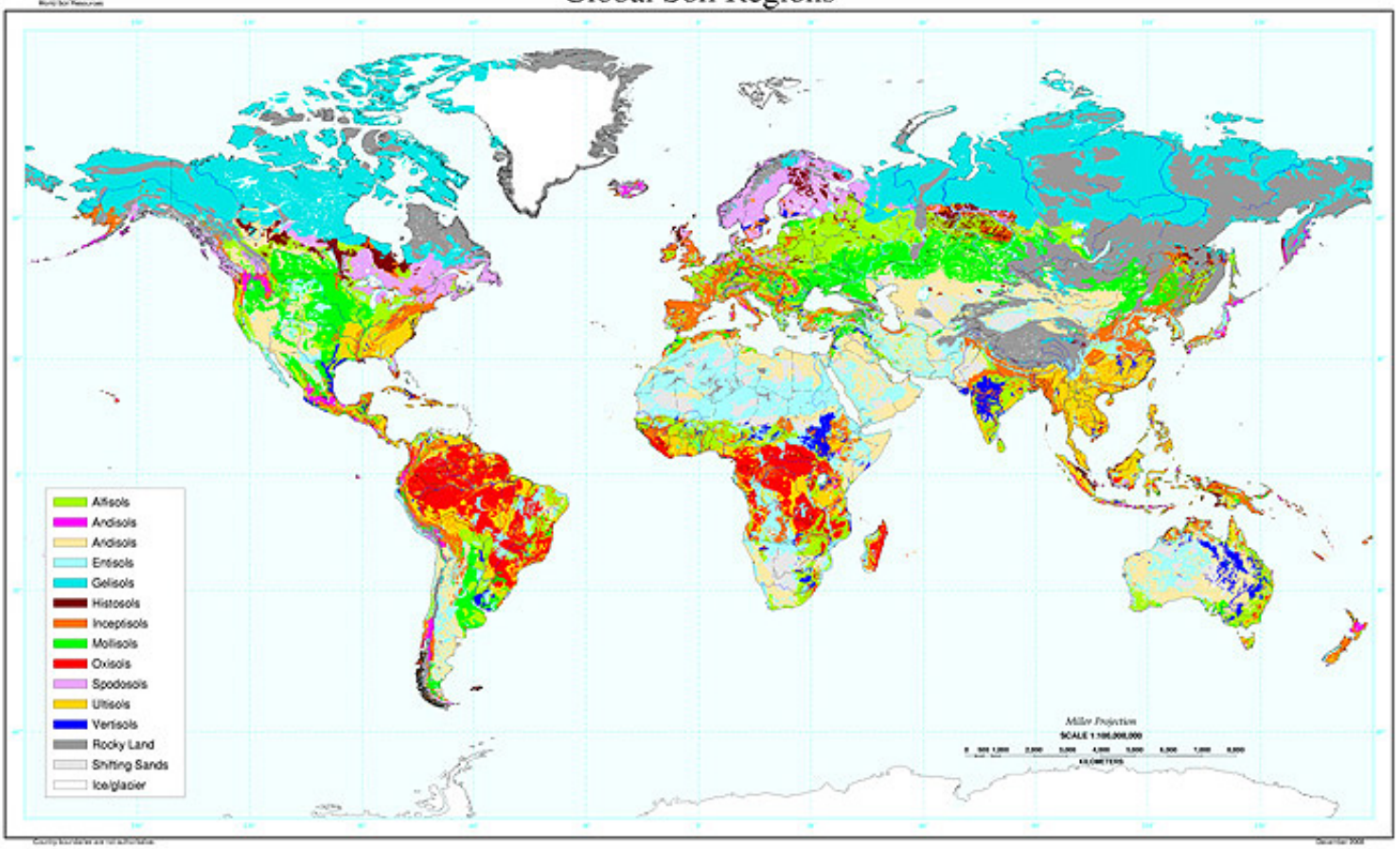
In some environments clay aggregates form that are so strongly cemented together that they feel like fine sand or silt. In humid climates iron oxide is the cement. In desert climates silica is the cement and in arid regions lime can be the cement. It takes prolonged rubbing to show that they are clays and not silt loams.

Some soils derived from granite contain grains that resemble mica but are softer. Rubbing breaks down these grains and reveals that they are clay. These grains resist dispersion and field and laboratory determinations may disagree.

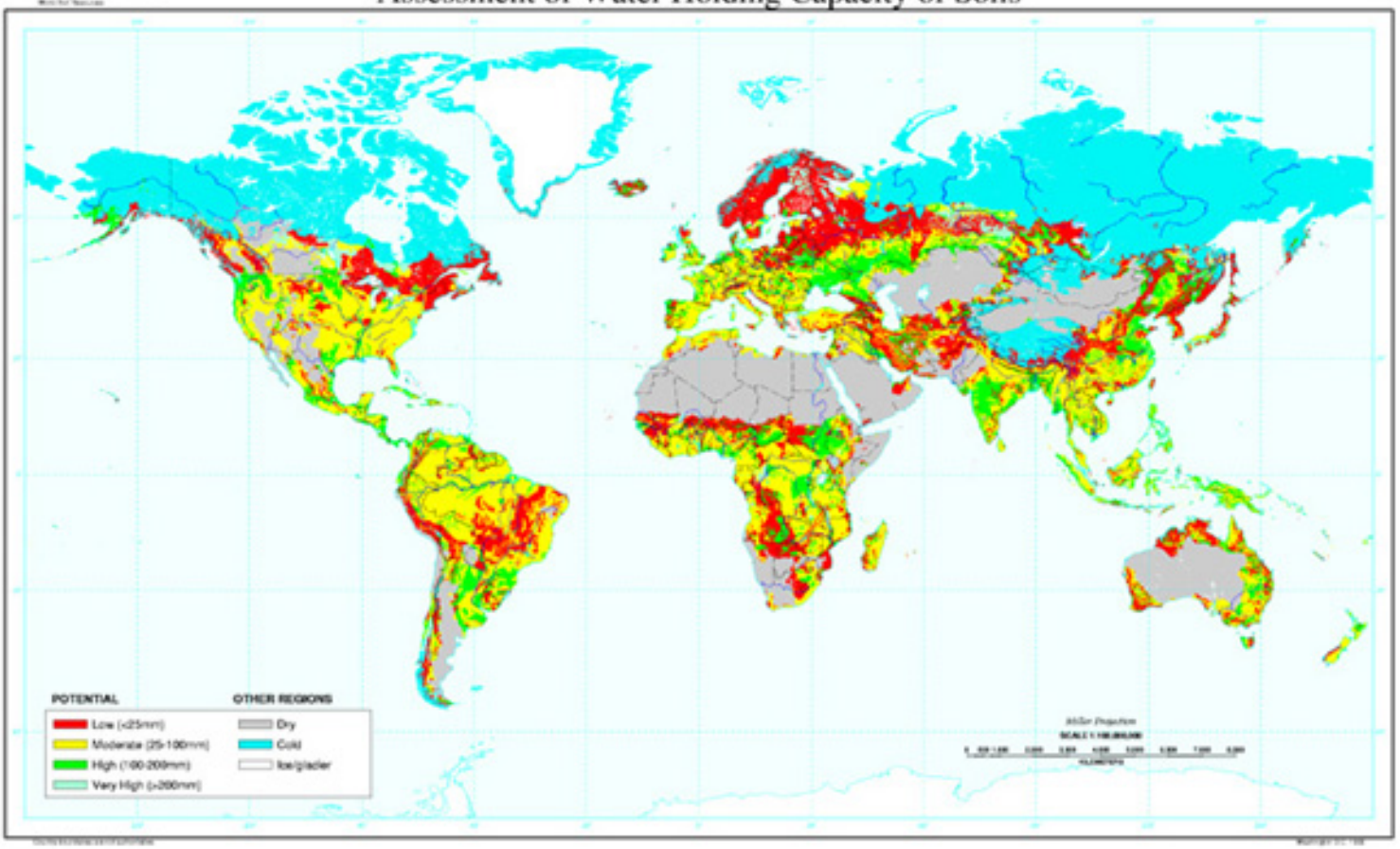
Many soil conditions and components mentions earlier cause inconsistencies between field texture estimates and standard laboratory data. These are, but not limited to, the presence of cements, large clay crystals, and mineral grains. If field and laboratory determinations are inconsistent, one or more of these conditions is suspected.


START
Place approximately 25 g soil in palm. Add water dropwise and knead the soil to break down all aggregates. Soil is at the proper consistency when plastic and moldable, like moist putty.
Add dry soil to soak up water
yes
yes
Does soil remain in a ball when squeezed?
no
Is soil too dry?
no
Is soil too wet?
no
SAND
yes
Place ball of soil between thumb and forefinger gently pushing the soil with the thumb, squeezing it upward into a ribbon. Form a ribbon of uniform thickness and width. Allow the ribbon to emerge and extend over the forefinger, breaking from its own weight.
LOAMY SAND
no
Does soil form a ribbon?
yes
Does soil make a weak ribbon less than 2.5 cm long before breaking?
no
Does soil make a medium ribbon 2.5-5 cm long before breaking?
no
Does soil make a strong ribbon 5 cm or longer before breaking?
yes
yes
yes
Excessively wet a small pinch of soil in palm and rub with forefinger.
SANDY LOAM
yes
Does soil feel very gritty?
SANDY CLAY LOAM
yes
Does soil feel very gritty?
SANDY CLAY
yes
Does soil feel very gritty?
no
no
no
SILT LOAM
yes
Does soil feel very smooth?
SILTY CLAY LOAM
yes
Does soil feel very smooth?
SILTY CLAY
yes
Does soil feel very smooth?
no
no
no
LOAM
yes
Neither grittiness nor smoothness predominates.
CLAY LOAM
yes
Neither grittiness nor smoothness predominates.
CLAY
yes
Neither grittiness nor smoothness predominates.

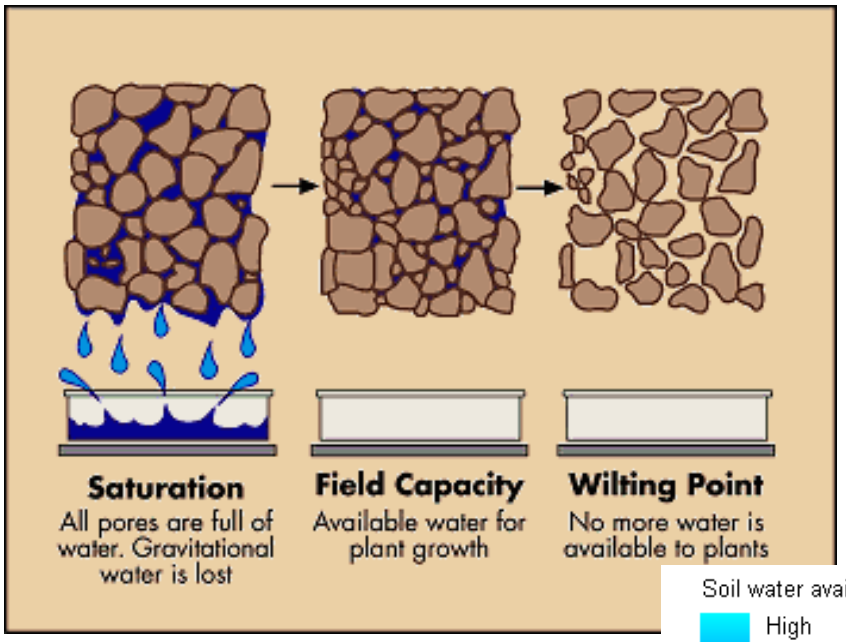
Global Soil Regions

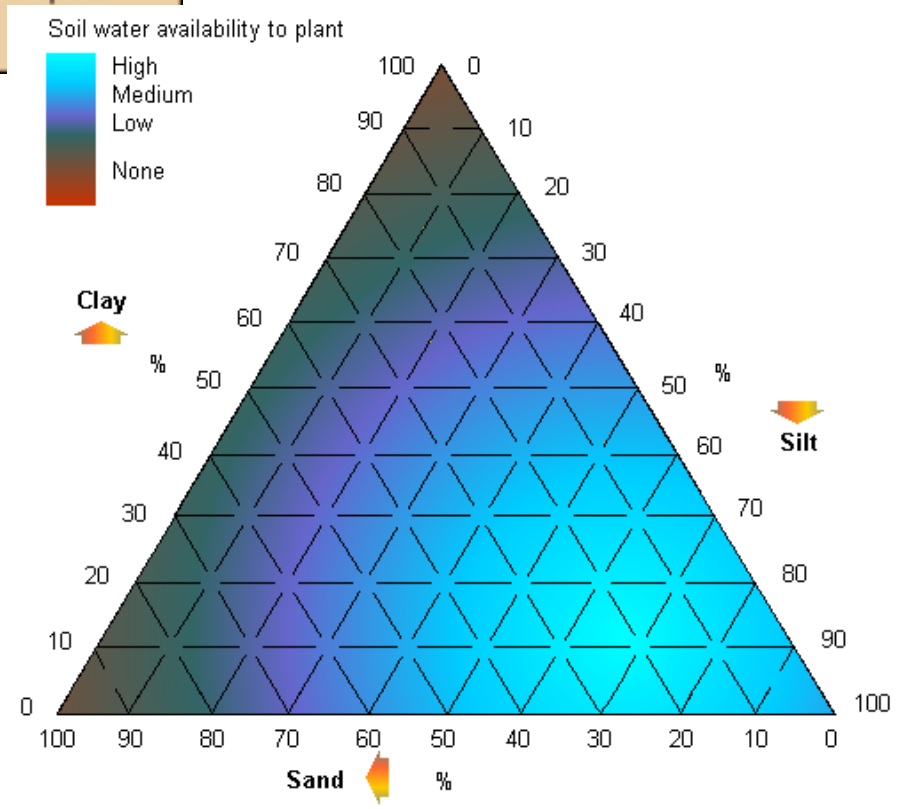


Assessment of Water Holding Capacity of Soils



getting a feel for soils





Soil Textural Triangle