Family Environmental Fun Pack

The Scoop on Soils: Celery Bog Nature Area

A project of EDCI 506,
Environmental Education

Professor: Daniel P. Shepardson
Department of
Curriculum and Instruction
Purdue University

West Lafayette Parks and Recreation

In cooperation with
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Supported by a Purdue University service learning grant from the Office of Engagement

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The Family Environmental Fun Packs

The following Family Environmental Fun Packs are available for checkout from the Lilly Nature Center. It may require several visits to complete all of the activities in a pack.

Nature Drawing: Families explore Celery Bog Nature Area through observing and drawing the trees, wildlife, and landscapes of Celery Bog, learning simple drawing techniques. Families visit three different sites; requires about one hour per site.

The Scoop on Soils: Families explore the soils of Celery Bog Nature Area using soil science tools and techniques, learning about wetland and woodland soils. Families visit three different sites; requires about one hour per site.

Trees of Celery Bog: Families explore the trees of Celery Bog Nature Area using forestry tools and techniques, learning about sugar maples, black cherry, tulip and other trees that grow in the Celery Bog Nature Area. Families visit three different sites; requires about one hour per site.

Please return the pack to the Lilly Nature Center

Please stay on the trails unless completing an activity

The Scoop on Soils

OBJECTIVES

- Families will observe the different soils that are found throughout Celery Bog Nature Area.
- Families will learn about soil properties and their influence on plant growth.
- Families will be introduced to the importance of soils.

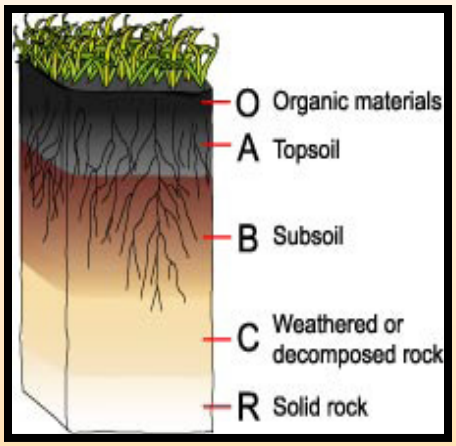
Age
Upper elementary through adult

OVERVIEW

By learning to use soil science tools and techniques you will investigate the different soils of Celery Bog Nature Area.

By investigating the soils of Celery Bog Nature Area you will learn about different soil properties.

Personal connections to the natural world will be developed as you identify and observe the different soils of Celery Bog Nature Area.



BACKGROUND

Light, soil, and moisture are critical environmental (i.e., abiotic or nonliving) factors that influence the health and development of plant life. Soil is made up of three earth materials: sand, silt, and clay. The combination of these determines the type of soil present and influences the plant types that can grow in the area. Soil composition also plays an important part in determining the amount of moisture soil can hold. Some soils are better able to absorb and hold moisture than others. Soil scientists divide soil into different *horizons* or layers. The top horizon (O) contains organic matter, the living as well as dead and decaying organisms. The next horizon (A) contains the topsoil, a mixture of soil and organic matter. The B horizon is called the subsoil, which contains less organic matter. The C horizon is weathered rock and the R horizon is solid rock, or the parent material. In your exploration of Celery Bog soil you will be looking mostly at the O, A, and perhaps the B horizons at different locations. You will be investigating several soil properties or soil morphology at each site you visit.

The Scoop on Soils

Site Map

MATERIALS

Check for the following items in the backpack before starting:

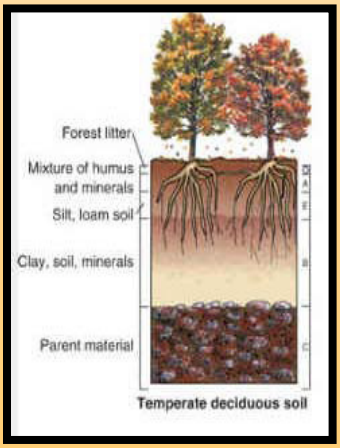
- √ Clipboard
- √ Soil sampling tube
- √ Globe Color Guide
- √ Garden trowel
- √ Soil moisture meter
- √ Squirt bottle with water
  (Be sure and fill the bottle before leaving the nature center)
- √ Record sheet
- √ Magnifying glass
- √ Ruler
- √ Soil thermometer
- √ Soil pH meter
- √ Containers with beads

Safety Note

- Avoid poison ivy. Not only does it grow on the ground but it also vines up on trees: you can get a rash even when the leaves are off.
- Wear proper clothing and protect yourself from mosquitoes, chiggers, and ticks by using bug spray.

ACTIONS

1. Follow the Site Map, hike to Site #1 with the "Soils" backpack.
2. Complete the activities for Site #1. You should allow about an hour to complete the activities. Note: You will conduct the same activities at all three sites, so that you can compare the different soils.
3. Continue to Site #2 and complete the activities for Site #2. You should allow about an hour to complete the activities.
4. Continue to Site #3 and complete the activities for Site #3. You should allow about an hour to complete the activities. After you have completed the activities for Site #3, you will compare your observations with those obtained at Sites 1 and 2.



SITE 1. WOODLAND SOILS

At this site you will learn about woodland soils. Most local forest soils developed from *glacial till*; the soil was created and mixed by glaciers that moved across the landscape more than 10,000 years ago. Such soils are typically stony, fine-textured soils. Trees depend upon soil for stability, nutrients, and water. At the same time, trees help sustain the soil, re-supplying the soil with nutrients. When leaves, roots, and branches die and decay they add nutrients back to the soil. Different tree species are adapted to different types of soils. For example, sugar maples will grow on just about any soil, whereas butternut will only grow on loamy soils.

Soil Texture

Soil texture refers to the size of the particles (sand, silt, and clay) that make up the soil. The amount or percentage of sand, silt, and clay in soil determines its texture. Although there are sophisticated ways of determining soil texture, one can easily determine soil texture by feeling the soil.

How Does It Feel?

Sand particles feel gritty
Silt particles feel floury
Clay particles feel sticky

Use the sample tube; take a soil sample by twisting or pushing the tube all the way into the ground and pulling it out. Analyze the soil sample at depths of 1, 3, and 6 inches. Remove between 25-50 grams (about 5 Tablespoons) of soil from each depth for analysis. Follow the procedures on the *Soil Texture Chart* to determine the type of soil and then use the *Soil Triangle* to estimate the percentage of sand, silt, and clay content.

The sand, silt, and clay particles that make up the soil give the soil its texture or feel. Sand particles are larger than silt and clay particles and silt particles are larger than clay particles.

Think about it

1. Based on the soil triangle, what type of soil is found at this site?
2. How might soil texture influence how much moisture a soil type can hold?
3. Does the soil texture change with depth?
4. Based on the soil triangle, why would a silt loam soil hold more water than a sandy loam soil?

PARTICLE SIZE DEMONSTRATION

The containers hold different sizes of beads, representing different sizes of particles—large, medium, and small. The large beads represent sand, the medium beads silt, and the small beads clay.

- Which sizes have the most amount of space between beads?
- Which sizes have the least amount of space between beads?
- Based on the bead demonstration, which soil particle—sand, silt, or clay—would have the most amount of space between particles?

Soil Temperature

Using the soil thermometer measure the soil temperature about 1 inch deep. Be careful when pushing the thermometer into the soil. Using the garden trowel, remove about 3 inches of soil and measure the soil temperature. Now remove 3 more inches of soil (a total of 6 inches) and measure the soil temperature. When finished, carefully replace the soil.

Depth	1 inch	3 inches	6 inches
Temperature			

Think about it

1. What is the relationship between soil temperature and depth?
2. What surrounding environmental factors might affect the soil's temperature?
3. How might soil temperature affect plant growth?

Soil Color

Soil color can tell us a lot about the condition of the soil. The darker the surface soil, the more organic matter (dead and decaying matter) is present. Color also indicates the wetness and aeration conditions of the subsoil. Reddish and brownish colors indicate good aeration and percolation (little water logging). Grayish and olive colors suggest much water logging. Mottled or splotchy soils indicate fluctuating wet and dry periods. Soil that remains waterlogged for long periods of time only allow specially adapted plants (hydrophytes) to grow.

Use the sample tube; take a soil sample by twisting or pushing the tube all the way into the ground and pulling the tube out. Use the *Globe Color Guide* and analyze the color of the soil sample at different depths—1, 3, and 6 inches.

Depth	1 inch	3 inches	6 inches
Color			

Think about it

1. Does the color change by depth?
2. Why might the color change by depth?
3. Based on color, is the soil mostly waterlogged or well drained?

SOIL pH

Soils provide the nutrients that plants need to grow. Soil pH, soil acidity or alkalinity, influences a plants ability to absorb nutrients from the soil. Different plants have adapted to different soil pH levels.

Use the pH meter (probe) to determine the pH of your soil sample at 1, 3, and 6 inches.

Soil pH

Soil pH equal to 7 is neutral.
Soil pH less than 7 is acidic.
Soil pH greater than 7 is alkaline.

Depth	1 inch	3 inches	6 inches
pH			

Think about it

1. Does soil pH change with depth?
2. How might you explain why the pH changed or did not change with depth?

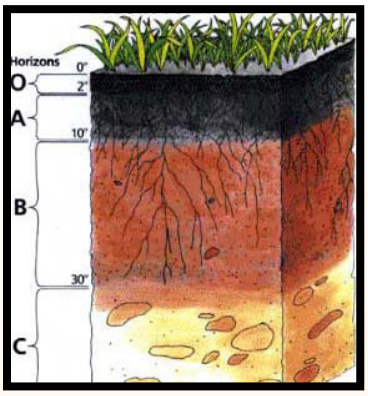
SOIL MOISTURE

Use the soil moisture meter (probe) to determine the moisture level of your soil sample at 1, 3, and 6 inches.

Depth	1 inch	3 inches	6 inches
Moisture			

Think about it

1. Does soil moisture change with depth?
2. How might you explain why the soil moisture changed or did not change with depth?
3. How might the time of year change soil moisture?



SITE 2. WETLAND SOILS

At this site you will learn about wetland soils. Soils that are waterlogged (saturated) for several months or longer during the year are called *hydric* soils. Hydric soils are associated with wetlands. Because water logging fluctuates with weather patterns and with the seasons, hydric soils may not be waterlogged year-round. Soils that remain waterlogged for long periods of time only allow specially adapted plants (hydrophytes) to grow.

Soil Texture

Use the sample tube; take a soil sample by twisting or pushing the tube all the way into the ground and pulling the tube out, analyze the soil sample at a depth of 1, 3, and 6 inches. Remove between 25-50 grams (about 5 Tablespoons) of soil from each depth for analysis. Follow the procedures on the *Soil Texture Chart* to determine the type of soil and then use the *Soil Triangle* to estimate the percentage (range) of sand, silt, and clay found in the soil sample.

Think about it

1. Based on the soil triangle, what type of soil is found at this site?
2. How might soil texture influence the amount of moisture a soil type can hold?
3. Does the soil texture change with depth?
4. How does the texture of the wetland soil compare to the texture of the woodland soil?

Soil Temperature

Using the soil thermometer measure the soil temperature about 1 inch deep. Be careful when pushing the thermometer into the soil. Using the garden trowel, remove about 3 inches of soil and measure the soil temperature. Now remove 3 more inches of soil (a total of 6 inches) and measure the soil temperature. When finished, carefully replace the soil.

Depth	1 inch	3 inches	6 inches
Temperature			

Think about it

1. What is the relationship between soil temperature and depth?
2. Which surrounding environmental factors might affect the soil's temperature?

Soil Color

The darker the surface soil, the more organic matter (dead and decaying matter) is present. Reddish and brownish colors indicate good aeration and percolation (little water logging). Grayish and olive colors suggest much water logging. Mottled or splotchy soils indicate fluctuating wet and dry periods.

Use the sample tube; take a soil sample by twisting or pushing the tube all the way into the ground and pulling the tube out. Use the *Globe Color Guide* and analyze the color of the soil sample at different depths—1, 3, and 6 inches.

Depth	1 inch	3 inches	6 inches
Color			

Think about it

1. Does the color change by depth?
2. Why might the color change by depth?
3. Based on color, is the soil mostly waterlogged or well drained?
4. How does the color of the wetland soil compare to the color of the woodland soil?

Soil pH

Use the pH meter (probe) to determine the pH of your soil sample at 1, 3, and 6 inches.

Depth	1 inch	3 inches	6 inches
pH			

Think about it

1. Does soil pH change with depth?
2. How might you explain why the pH changed or did not change with depth?
3. How does the pH of the wetland soil compare to the pH of the woodland soil?

Soil Moisture

Use the soil moisture meter (probe) to determine the moisture level of your soil sample at 1, 3, and 6 inches.

Depth	1 inch	3 inches	6 inches
Moisture			

Think about it

1. Does soil moisture change with depth?
2. How might you explain why the soil moisture changed, or did not change, with depth?
3. How might the time of year change soil moisture?
4. How does the moisture level of the wetland soil compare to the moisture level of the woodland soil?

SITE 3. MYSTERY SOIL

At this site your job is to use your soil analysis techniques and skills to determine the type of soil that is present at this site. You will compare this soil to the woodland and wetland soils you analyzed earlier. Is the soil the same or different from a woodland or wetland soil? What would explain why the soil is the same or different from the other sites?

Soil Texture

Use the sample tube; take a soil sample by twisting or pushing the tube all the way into the ground and pulling the tube out, analyze the soil sample at a depth of 1, 3, and 6 inches. Remove between 25-50 grams of soil from each depth for analysis. Follow the procedures on the *Soil Texture Chart* to determine the type of soil and then use the *Soil Triangle* to estimate the percentage (range) of sand, silt, and clay found in the soil sample.

Think about it

1. Based on the soil triangle, what type of soil is found at this site?
2. How might the soil texture influence how much moisture this soil type can hold.
3. Does the soil texture change with depth?
4. How does the texture of the soil compare to the texture of the woodland and wetland soils?

Soil Temperature

Using the soil thermometer, measure the soil temperature about 1 inch deep. Be careful when pushing the thermometer into the soil. Using the garden trowel, remove about 3 inches of soil and measure the soil temperature. Now remove 3 more inches of soil (a total of 6 inches) and measure the soil temperature. When finished, carefully replace the soil.

Depth	1 inch	3 inches	6 inches
Temperature			

Think about it

1. What is the relationship between soil temperature and depth?
2. Which surrounding environmental factors might affect the soil's temperature?
3. How does the temperature of the soil compare to the temperature of the woodland and wetland soil?

Soil Color

The darker the surface soil, the more organic matter (dead and decaying matter) is present. Reddish and brownish colors indicate good aeration and percolation (little water logging). Grayish and olive colors suggest much water logging. Mottled or splotchy soils indicate fluctuating wet and dry periods.

Use the sample tube; take a soil sample by twisting or pushing the tube all the way into the ground and pulling the tube out. Use the *Globe Color Guide* and analyze the color of the soil sample at different depths—1, 3, and 6 inches.

Depth	1 inch	3 inches	6 inches
Color			

Think about it

1. What color is the surface soil?
2. Does the color change by depth?
3. Based on color, is the soil mostly waterlogged or well drained?
4. How does the color of the soil compare to the color of the woodland and wetland soils?

Soil pH

Use the pH meter (probe) to determine the pH of your soil sample at 1, 3, and 6 inches.

Depth	1 inch	3 inches	6 inches
pH			

Think about it

1. Does soil pH change with depth?
2. How might you explain why the pH changed, or did not change, with depth?
3. How does the pH of the soil compare to the pH of the woodland and wetland soils?

Soil Moisture

Use the soil moisture meter (probe) to determine the moisture level of your soil sample at 1, 3, and 6 inches.

Depth	1 inch	3 inches	6 inches
Moisture			

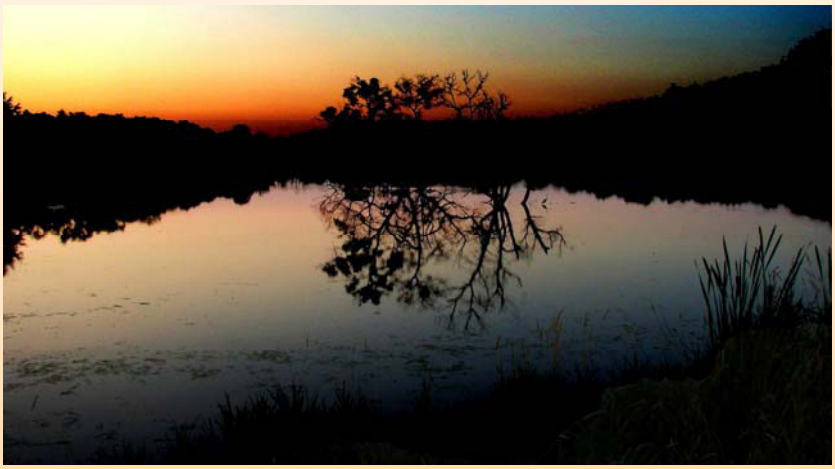
Think about it

1. How might you explain why the soil moisture changed or did not change with depth?
2. How might the time of year change soil moisture?
3. How does the moisture level of the soil compare to the moisture level of the woodland and wetland soils?

Now that you have completed all of the soil tests and compared the results from all three sites. Is the soil at Site Three the same or different from a woodland or wetland soil? How would you explain the similarity or difference in the soil at Site Three?

History of Celery Bog Nature Area

More than16,000 years ago retreating glaciers created the basin which led to the formation of Celery Bog. Over the course of thousands of years, this area has experienced many transitions through various ecological communities, including once functioning as a type of wetland called a bog.



Celery Bog was converted to farmland in the 20th century (1900s). Celery as well as other crops were grown in the rich peat of the drained wetland. In order to farm the wetland, the water had to be drained using tile drains. Tile drains are porous pipes that allow water within the soil to enter and flow out through the pipes. This prevents the soil from becoming waterlogged. This agricultural drainage system, however, constantly failed and resulted in the termination of farming in the wetland. Over time, the farmland gradually reverted back to wetland conditions, and now closely resembles a marsh ecosystem.

The wetland and surrounding area are now preserved as the Celery Bog Nature Area. As a wetland, it serves several important functions. First, it acts as a sponge to soak up water, reducing floods and recharging the ground water. Secondly, it filters pollutants and traps sediments, improving water quality; and thirdly it provides habitat for countless wildlife species.

History of Celery Bog Nature Area (continued)

Celery Bog Nature Area offers year round opportunities for families to experience the local ecological communities that are being restored and managed within the park. Nature trails wind through the area, providing for close observation and appreciation of the trees and wildlife of the Midwest.

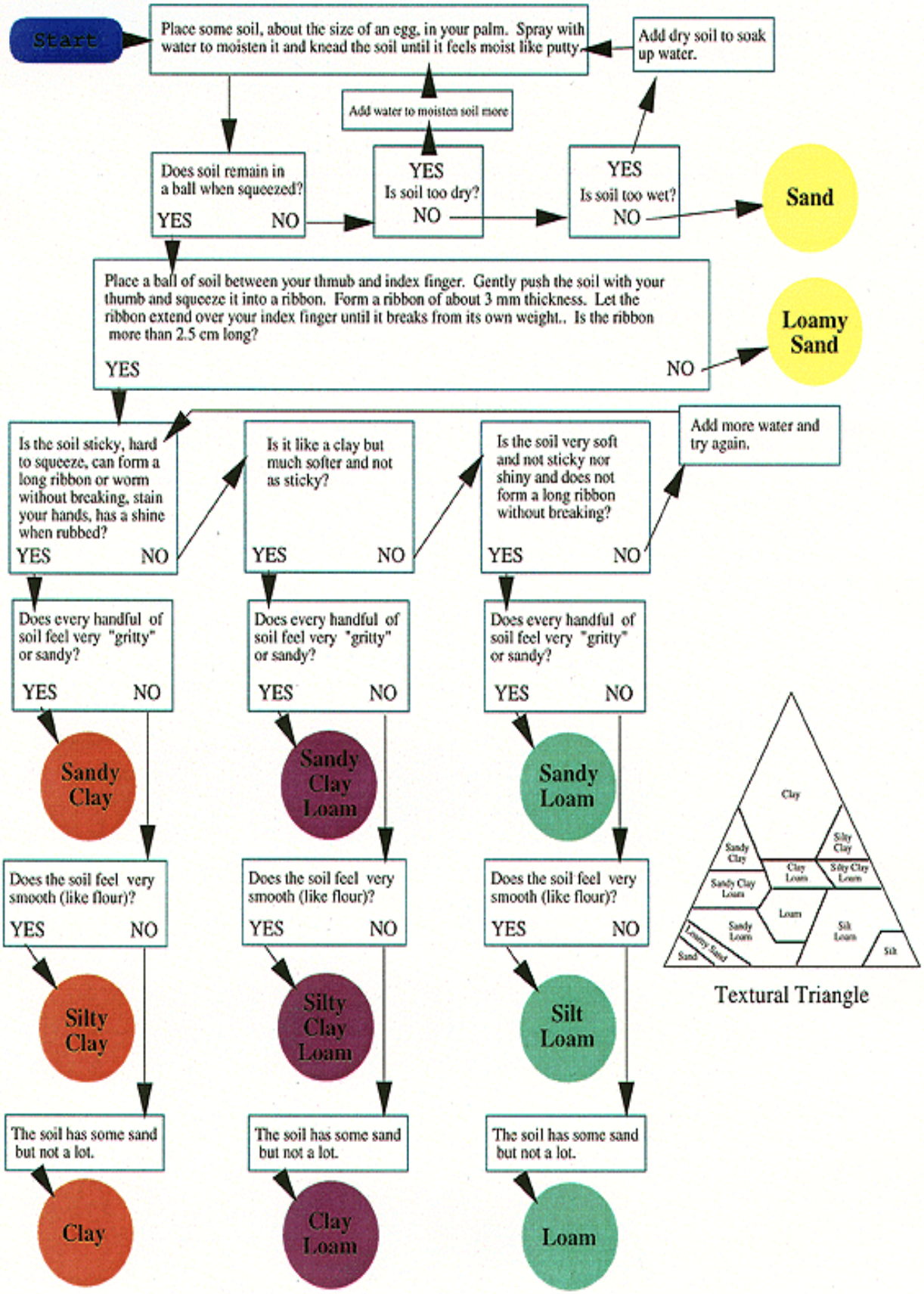
Additional information about Celery Bog Nature Area
and West Lafayette Parks and Recreation
may be found at the following websites:

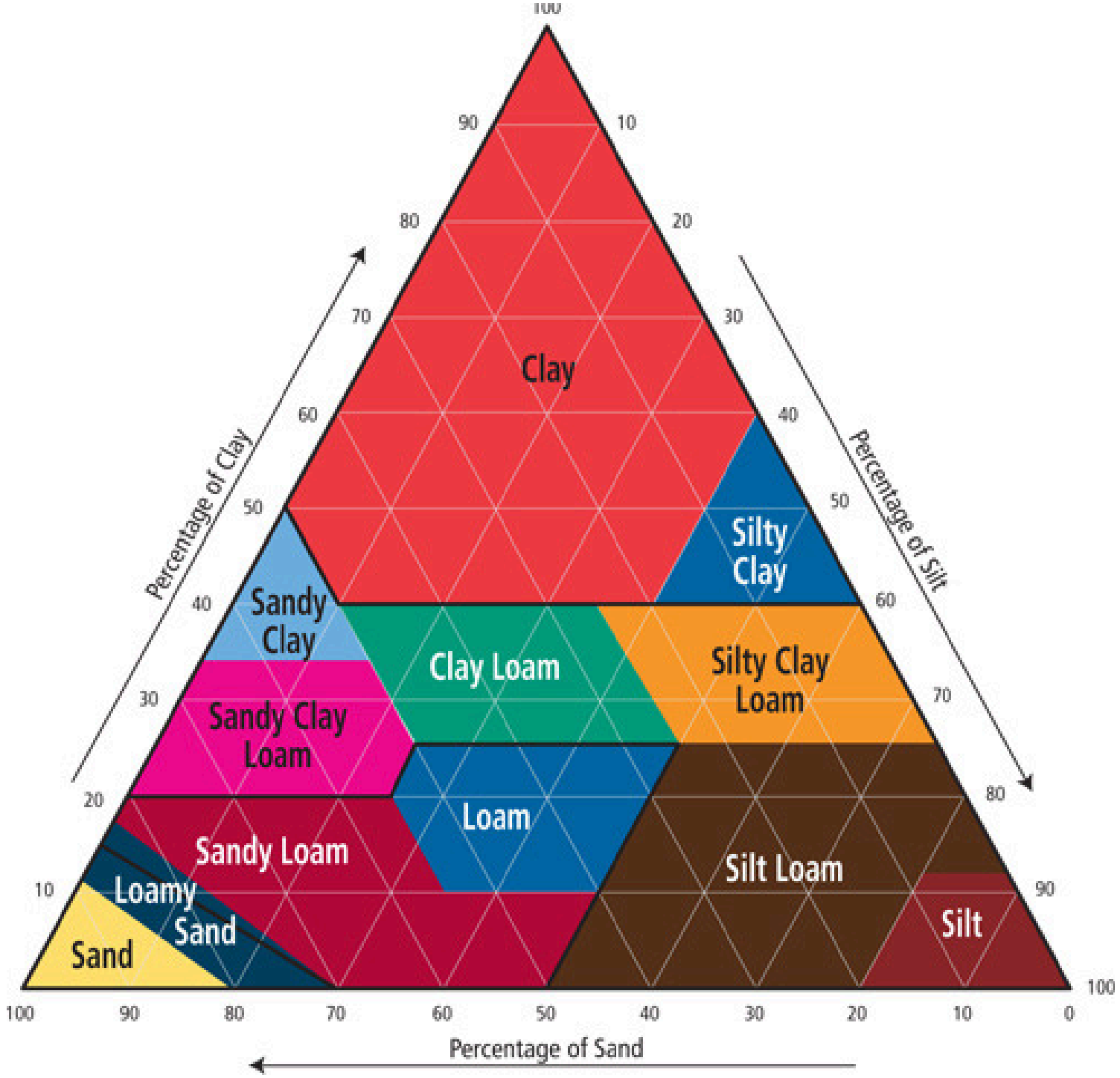
www.purdue.edu/eas/geomorph/research/celeryboghomepage.html

www.westlafayette.in.gov/parks

Guide to Texture by Feel

Begin at the place marked "Start" and following the chart by answering the questions until you determine your soil's texture.




Clay
Silty Clay
Sandy Clay
Clay Loam
Silty Clay Loam
Sandy Clay Loam
Loam
Sandy Loam
Silt Loam
Loamy Sand
Silt
Sand
Percentage of Clay
Percentage of Silt
Percentage of Sand
100
90
80
70
60
50
40
30
20
10
0

Record Sheet

Soil Texture

Depth	1 inch	3 inches	6 inches
Woodland Soil			
Wetland Soil			
Mystery Soil			

Soil Temperature

Depth	1 inch	3 inches	6 inches
Woodland Soil			
Wetland Soil			
Mystery Soil			

Soil Color

Depth	1 inch	3 inches	6 inches
Woodland Soil			
Wetland Soil			
Mystery Soil			

Soil pH

Depth	1 inch	3 inches	6 inches
Woodland Soil			
Wetland Soil			
Mystery Soil			

Soil Moisture

Depth	1 inch	3 inches	6 inches
Woodland Soil			
Wetland Soil			
Mystery Soil			