Soil Percolation Teacher's Guide

Subject: Integrated Science (Life; Earth-Space; Physical)

Topic: Characteristics of Wetland Soil and soil percolation rates

Summary: Students will examine the percolation rates of surface soil at various locations along a transect line. Percolation will be related to soil particle size, and recharge and runoff rates.

Objective(s): After completing the field lab, students will be able to:

1. Identify characteristics of wetland soil
2. Use a Munsell color chart to identify specific soil classifications
3. Calculate percolation rates

Ecosystem(s): Hammocks; Pinelands; Freshwater Wetlands

Equipment:

- Coffee Can (aluminum)
- 6 large water jugs (1 gallon)
- 1 liter container (graduated)
- GPS
- Data Sheet & clipboard
- Tape measure
- Stopwatch
- 3 x Spray bottles
- Towel

Background (Pre-field Classroom Activity):

- **Equipment Training**: Sedimentation tube: Sand-Silt-Clay
- **Vocabulary**: Percolation, Infiltration Permeable, Porous, Transect line, Recharge rate, Runoff rate
- **Reference material**: Project WET: Get the Groundwater Picture (warm-up)

Procedures (Engage; Explore; Explain; Elaborate; Evaluate):

1. Engage students by asking them what would happen if there was no soil no Earth and only non-porous rock at the surface; where would all of the water go? Would plants and animals be able to survive without soil? Is soil porous? Why or why not?
2. Identify field sites where percolation rates will be measured. Identify main categories of habitat/surface soil types. Identify a location within the identified habitat using the GPS unit and place marker at spot within 3 meters of where the GPS reading is made. Select three other spots within the same "central location."
3. Divide students into three groups; assign each group to a different site.
4. Within each site, divide students into groups of three with the following assignments: 1) percolation can placer & water pourer; 2) timer; 3) GPS locator & soil examiner; & 4) measurement recorder.
5. Clear loose leaf-litter to expose soil surface; try not to disturb the soil surface.
6. Insert one end of coffee can approximately 5 cm into the soil.
7. Pour 500 ml of water into can & begin stopwatch. Stop stopwatch when the standing water is no longer visible & only the soil surface is visible. Record the time. This is the Dry Percolation Measurement.
8. Repeat measurement a second time - now that the ground is saturated. This is the Wet (saturated) Percolation Measurement. While waiting for the water to drain, examine and describe the surrounding leaf litter. Take a minimum of three measurements in one of the habitat areas.
9. After each measurement, collected a small amount of soil by hand from an area within one can length from the measurement (an area not affected by water from the activity) & record dampness/moisture (Wet = if water squeezed out; Damp = if soil holds its shape; Dry = if sample will not hold its shape when squeezed).
10. After conducting the percolation test, collect a small handful of soil and rub it between the fingers & record texture/content (Gritty = sand; Slippery = silt; Sticky = clay; or some combination sandy-silt). Note the soil consistence (loose; friable; firm; extremely firm); Note other observations such as smell, roots, insects, shells or trash found in the soil in your area.

Sunshine State Standards:

Science: SC.D.1.3.1; SC.G.2.3.4; SC.G.2.4.4; SC.H.1.3.6; SC.H.2.3.1; **Mathematics:** MA.A.1.3.1; MA.B.3.3.1; MA.B.4.3.1; MA.E.2.3.1; MA.E.3.3.1; **Language Arts:** LA.A.1.3.3; LA.C.1.3.1; LA.C.1.3.4; **Social Studies:** SS.A.6.3.2; SS.B.2.3.9

Soil Percolation Student Data Sheet

General Information

Full Name:		Date:	
School (teacher):		Time:	

Student Hypothesis and Rationale

If dry soil has more available air space between the particles, then the dry percolation rate will be (choose one: faster/ slower) than the wet percolation rate because… _____

_____.

Field Observations/Measurements

	Location 1: _____	**Location 2:** _____	**Location 3:** _____
Latitude			
Longitude			
Dry Percolation Time (seconds)			
Wet Percolation Time (seconds)			
Dry Percolation Rate (ml/sec)			
Wet Percolation Rate (ml/sec)			
Soil Texture			
Soil Consistence			
Soil Moisture			

- **Soil Moisture**: Wet = if water squeezed out; Damp = if soil holds its shape; Dry = if sample will not hold its shape when squeezed
- **Soil Consistence**: Loose; Friable; Firm; Extremely Firm
- **Soil Texture**: Gravel; Sand; Silt; Clay; Loam
- **Note:** If the time extends beyond 6 minutes record as 360 sec.+
- **Note:** percolation rate = 500 ml / percolation time in seconds

Soil Percolation Assessment

1. Which location had the fastest percolation rate? Which location had the slowest percolation rate?

2. For each of your three locations, what was the difference between the wet and dry percolation rates?

Location 1: wet percolation rate – dry percolation rate =
Location 2: wet percolation rate – dry percolation rate =
Location 3: wet percolation rate – dry percolation rate =

3. Was your hypothesis supported by your data? Explain your results and what you can infer from your observations, measurements, and results.

4. Under what conditions would the dry and wet percolation tests be very similar? Under what conditions would they be very different?

5. What explains the difference in percolation rates between the location along the path, the dock, and the shore?

6. Think about the observations you have just made. Did the activity raise new questions? Write a short question (start with "What, Why, Where, When, or How") about something you want to learn more about.

Soil Percolation Portfolio Journal Prompt

The downward percolation of water through limestone rock is what forms many Karst features. Before you begin writing, think about the role that gravity plays in the way water comes into contact with sediment and rocks. Now, explain what you think Karst features would look like if the force of gravity was non-existent on Earth.

Soil Texture

Step 1 ***(Get and moisten sample)***

Use the triangle to determine the soil texture of your horizon.

Place some soil from a horizon (about the size of a small egg) in your hand, and, using the spray mist bottle, moisten the soil. Let the water soak in and then work the soil between your fingers until it is the same moisture throughout. Once the soil is moist, try to form a ball. If the soil forms a ball, go on to Step 2. If the soil does not form a ball, go to Step 5.

Step 2 ***(Test for Clay)***

A. If the soil:
- Is really sticky
- Hard to squeeze
- Stains your hands
- Has a shine when rubbed
- Forms a long ribbon (5+ cm) without breaking,

Call it a **clay** and go to Step 3.
Otherwise, go to B.

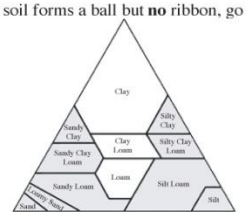
B. If the soil:
- Is somewhat sticky
- Is somewhat hard to squeeze
- Forms a medium ribbon (between 2-5 cm)

Call it a **clay loam** and go to Step 3.
Otherwise, go to C.

C. If the soil is:
- Soft
- Smooth
- Easy to squeeze,
- At most slightly sticky,
- Forms a short ribbon (less than 2 cm)

Call it a **loam** and go to Step 3.
Otherwise, go to **D**.

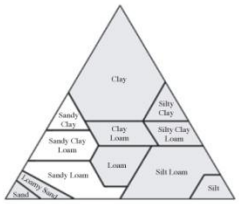
D. If the soil forms a ball but **no** ribbon, go to Step 4.



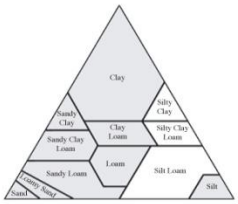
Step 3 ***(Refine initial soil texture classification from Step 2 for relative amounts of sand and silt)***

Wet a small pinch of the soil in your palm and rub it with a forefinger.
If the soil:
- Feels very gritty, go to **E**
- Feels very smooth, with no gritty feeling, go to **F**
- Feels only a little gritty, go to **G**

E. Add the word **sandy** to the initial classification.
Soil texture is (check one): ❑ sandy clay, ❑ sandy clay loam, ❑ sandy loam
Soil Texture is complete.



F. Add the word **silt** or **silty** to the initial classification.
Soil texture is (check one): ❑ silty clay, ❑ silty clay loam, ❑ silt loam
Soil Texture is complete.



G. Leave the original classification of (check one): ❑ clay, ❑ clay loam, ❑ loam
Soil Texture is complete.

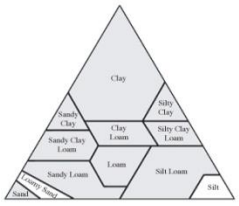
Step 4 ***(Test for loamy sand or silt)***

If the soil:
- Forms a ball
- Forms **no** ribbon
- And is

H. Very gritty
Soil texture is: ❑ loamy sand
Soil Texture is complete.

Or

I. Very soft and smooth with **no** gritty feeling,
Soil texture is: ❑ silt
Soil Texture is complete.



Step 5 ***(Test for sand)***

If the soil:
Forms no ball and falls apart in your hand,
Soil texture is: ❑ sand
Soil Texture is complete.

Soil Consistence

Take a **ped** from the top soil horizon. If the soil is very dry, moisten the face of the profile using a water bottle with a squirt top and then remove a **ped** to determine consistence.

Holding it between your thumb and forefinger, gently squeeze the **ped** until it "pops" or falls apart. Record one of the following categories of soil consistence on the data sheet. (Repeat this procedure for each horizon in your profile.)

Loose

Friable

Firm

Extremely Firm