Program Name: Dirt Experts: Soil Scientists Know All the Dirt!

Grade Level(s):11-12

Recommended Group Size: 2-3 people per group

Curriculum Connections:

- Science 20: Changes to Environmental Landscapes
- Science 30: How Natural Plant Species React to Their Environment
- Biology 20: Energy Flow Through Systems
- Biology 30: The effects of invasive species on biodiversity of an ecosystem

Approximate Time Required: 1 day

Student Learning Objectives:

- Develop team building/social skills in a group atmosphere.
- Identify soil types and their implications.
- Assess impacts or recreational usage.
- Formulate insightful responses to learned material through artistic expression.
- Develop observational skills and question their relevance.
- Recognize that energy cycled through a food chain is dependent on decomposers and producers (plants).

Brief Program Description:

In this program, students will observe soils in two different locations in Miquelon Lake Provincial Park. Through interactive learning and co-operation, they will determine the compositions and properties of the soils, and infer the implications of these soil properties. They will gain skills related to science by drawing sketches of soil samples using a microscope and skills in researching related topics. Students will then present their findings by creating a poster that will visually display and explain what they discovered throughout the day.

Program:

Activity 1: Soil Composition, Soil Compaction, and Dirt Thriving Organisms:

Students will choose two areas, one area should be near a used pathway and the other area should be a generally undisturbed location (not a path). Make a brief description of the surroundings (i.e. By a road, by a water body, middle of path etc.) and mark your areas with a piece of reflective tape on a nearby branch. Pick one of the two sites and take a sample of soil using a soil sampler. It is preferable if a sample is not take in the middle of a pathway but on the side is acceptable. Place the sampled dirt on a flat plastic bag. Make note of how difficult or easy it was get the sample of dirt. Record this observation. Next, observe the up tilled dirt and hole for bugs. The following site can be used to aid in identifying the types of bugs observed. http://www.insectidentification.org/insect-key.asp. Bugs can include worms, beetles, centipedes, spiders etc. Observe for a minimum 5 minutes while gently moving the soil around. Record how many of bugs are found and the types. Discuss what the presence of these organism's means and why they are important for energy cycles. Discuss which organism is most important for soils. Repeat these steps at the other location. Next, label two jars with your team names and area designations. Fill each jar about 2/3 full with soil from each corresponding location. Bring

the jars back to the research station and fill them to the top with water and close tightly. Vigorously shake the jars and then set them down in an area that will remain undisturbed for the remainder of the day. Students will come back to these jars at the end of the day to collect data.

Activity 2: Soil Tilth and pH:

Observe the soils from each area. Is it wet, dry, clumpy or soft? Record your observations. Next, grab a clump of soil and squeeze it in between your palms. Observe if the soil holds its shape when released. Now gently poke it with a finger and see if the soil still retains its shape or breaks apart. Record your findings. Then use the soil pH tester, measure and record the pH of the soil.

Activity 3: Drainage and roots:

Bring a bucket of water to each location. Fill the hole(s) with water and time how long it takes for the water to completely drain. Record the time. Fill the hole(s) one more time and record how long it takes to drain completely. Next, find a plant nearby and pull it out of the soil, preferably a weed with its roots. Observe the length and size of the roots, and the main features of the root (long strands, single strand etc.). A ruler may be used to determine the length of the root and the lengths of its strands. Record your observations. Make a small sketch of the roots.
Note: The drainage step can take up to several hours depending on the soil. Students may return to the research station but continue to frequently check the hole(s) to see if all has drained.

Activity 4: Under the microscope:

Take a small sample of soil into a sample jar and bring it back to the research station. Observe the soil samples through a microscope and make a small sketch of what is observed in the microscope at each magnification. Record any other observations.

Activity 5: Composition Analysis

Using the jars of soil from activity 1, observe them. Are there different layers? If so, identify what type of soil is in each layer. Refer to Appendix A. Approximately measure the width of each layer using a ruler.
Note: If no visible layers have been separated out, the jars may need to be observed the day after.

Activity 7: Creative Posters:

Have the teams build posters. Laptops may be required for research. The posters should include all their findings from the day and should display some information regarding the importance energy transfer, species diversity, and effects on vegetation in respect to soil types. Include the sketches from the microscope observations and a quick sketch of the composition analysis and approximate percentages of each soil layer.
Note: Depending on time, these may need to be built as a homework assignment.

Closing:

Return to the sampling areas and return the soil samples to the ground. Remove the reflective tape at both locations and dispose of plastic bags and tape properly. Return to the station for clean up. Properly clean the microscopes, and dispose all soil samples and jar samples. Clean and dry sample jars and put away.

Equipment and Resources Provided:

Laptops for research
Microscopes
Soil Sampler
Soil pH meter
Bucket
Water

Equipment and Resources Required:

Individual lunches for each student
Note taking materials such as notebooks and writing utensils.
250-500mL Jars
Art supplies (posters, felt markers, scissors/glue)
Rulers
Garbage Bags
Reflective tape

Ensure Participants Bring:

Bookbags
Appropriate clothing for the weather (including extra layers and an extra pair of socks)
Reuseable water bottles
Activities for the bus ride.
Note: Do not bring valuables along as there is the potential for these items to get damaged or lost.

Contact the Station Manager at gth@ualberta.ca for pricing and more details.

Appendix A:

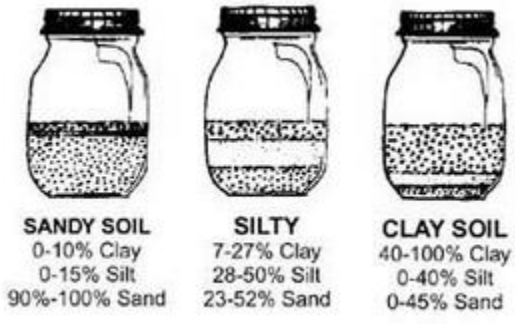
Reference sites:

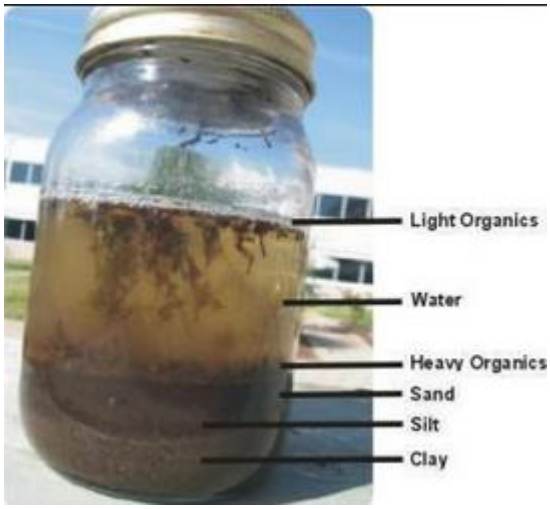
http://organicgardening.about.com/od/soil/a/easysoiltests.htm

http://www.rodalesorganiclife.com/garden/10-easy-soil-tests

http://www.ipm.iastate.edu/ipm/icm/node/1885/print

Reference Pictures:





Appendix B: Student Form

Name: _____ Date: _____ Partner(s): _____

Activity 1:

Description of Area 1: _____

_____

_____

_____

_____

Description of Area 2: _____

_____

_____

_____

_____

On a scale from 1 to 5, where 1 is easy, and 5 is difficult, how easy was it to obtain your soil sample in:

Area 1:

1 2 3 4 5

Area 2:

1 2 3 4 5

Other Observations: _____

_____

_____

_____

Dirt Thriving Organisms:

Bug #	Type of Bug found and/or description of bug
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

13	
14	
15	
16	
17	
18	
19	
20	

Activity 2:

Area 1:

Soil description: _____

_____

_____

Squeeze test (circle which applies):

Holds shape or Breaks apart

Poke test (circle which applies):

Retains shape or Breaks apart

Other observations: _____

_____

_____

Measured soil pH: _____

Area 2:

Soil description: _____

_____

_____

Squeeze test (circle which applies):

Holds shape or Breaks apart

Poke test (circle which applies):

Retains shape or Breaks apart

Other observations: _____

_____

_____

Measured soil pH: _____

Activity 3:

Area 1 drainage:

	First Fill	Second Fill
Start Time:		
End Time:		

Area 2 drainage:

	First Fill	Second Fill
Start Time:		
End Time:		

Area 1: Root observation:

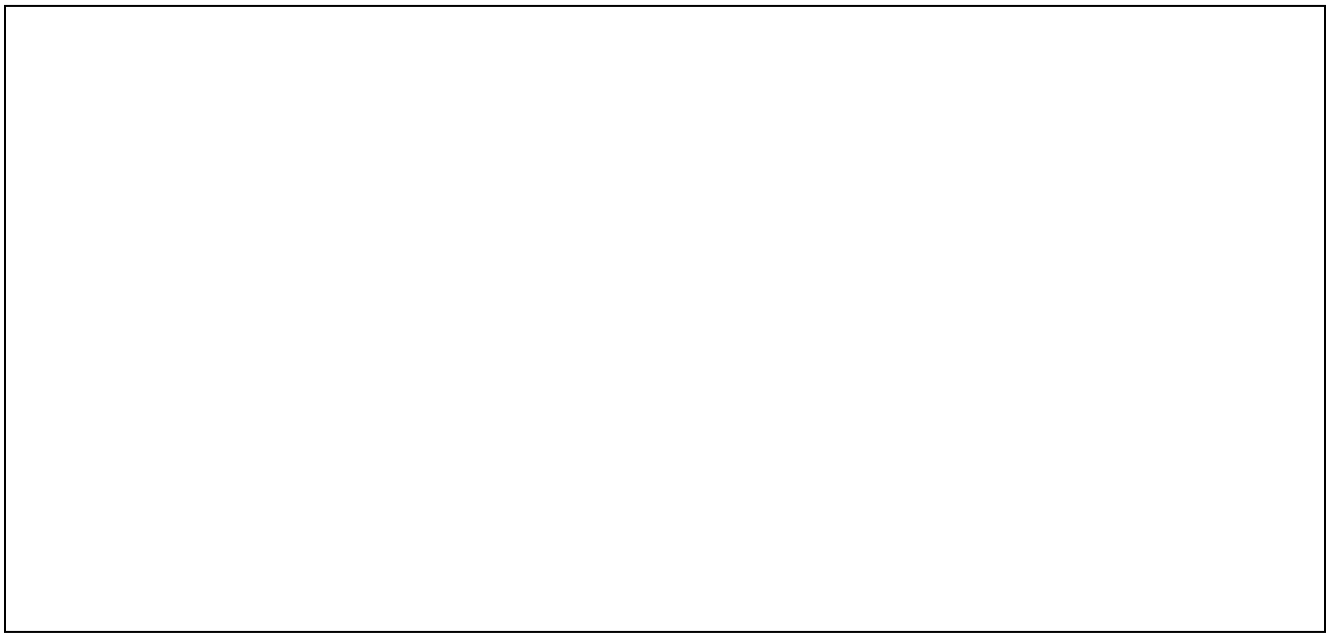
Length of root: _____
Approximate length of strands stemming from root: _____

Root Sketch:

Area 2: Root observation:

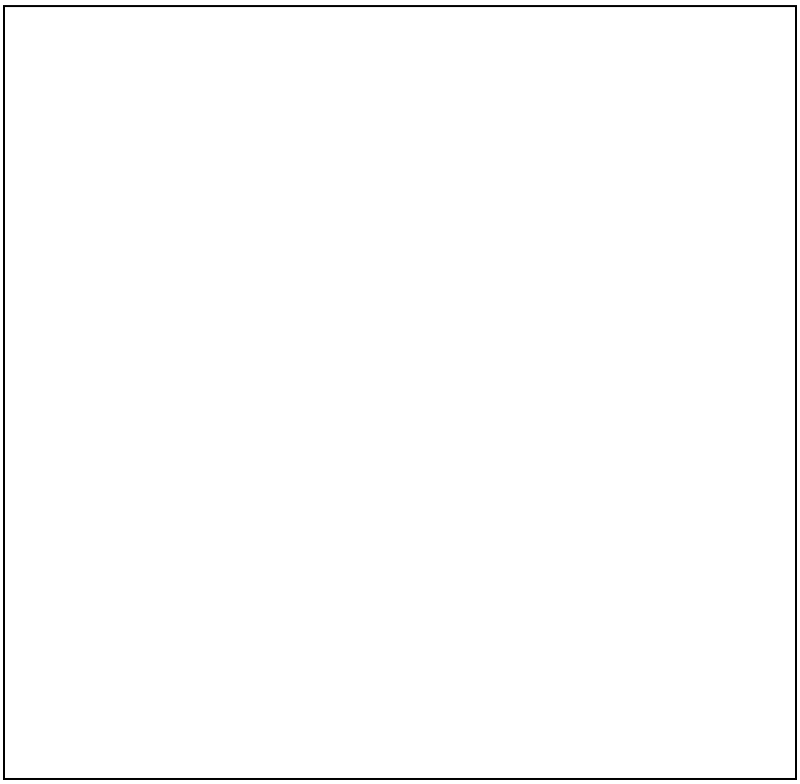
Length of root: _____
Approximate length of strands stemming from root: _____

Root Sketch:

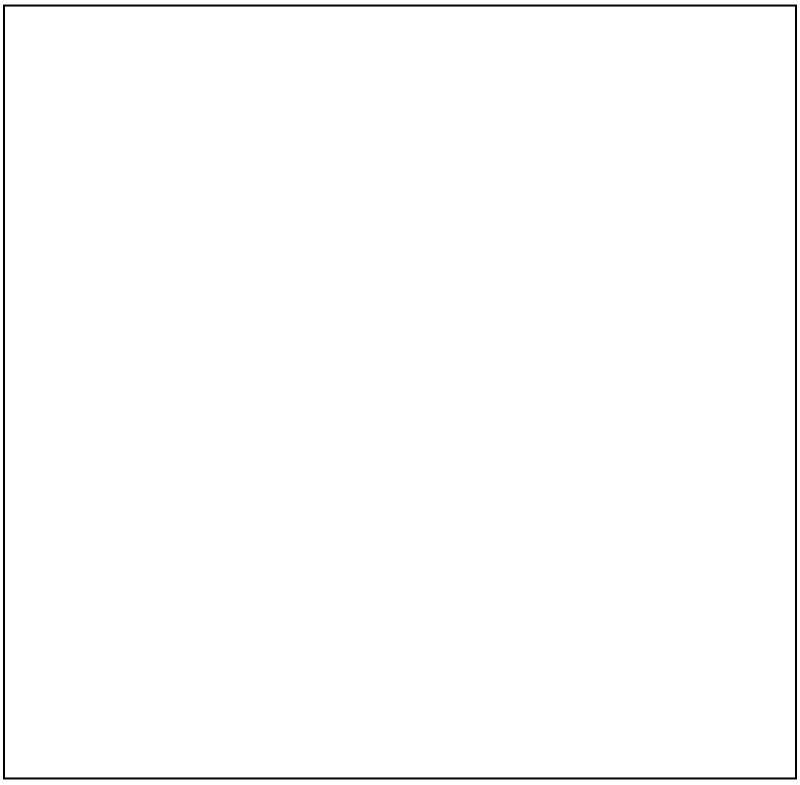


Activity 4:

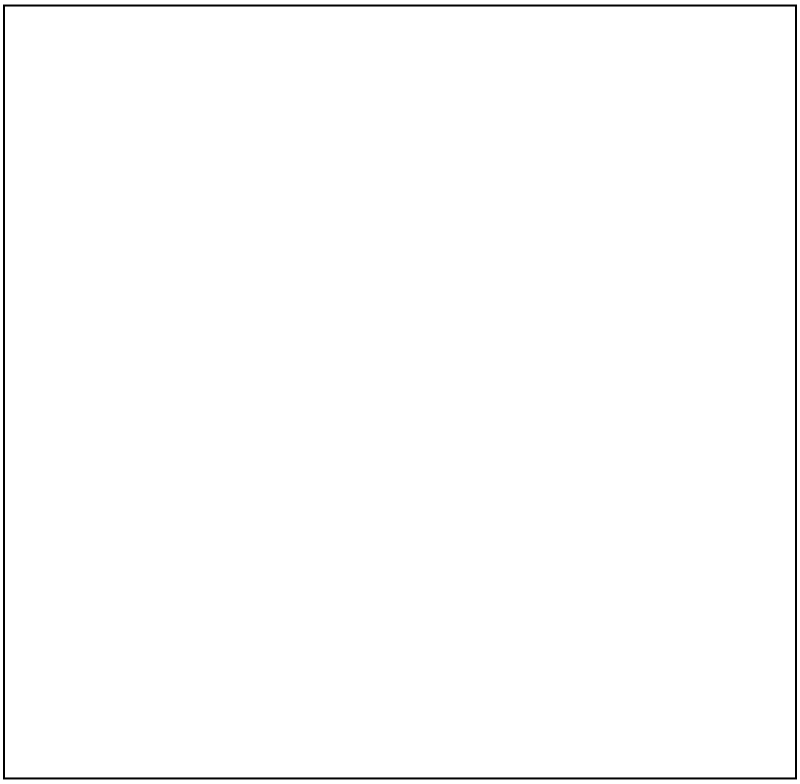
First Magnification: _____
Sketch:



Second Magnification: _____
Sketch:



Third Magnification: _____
Sketch:

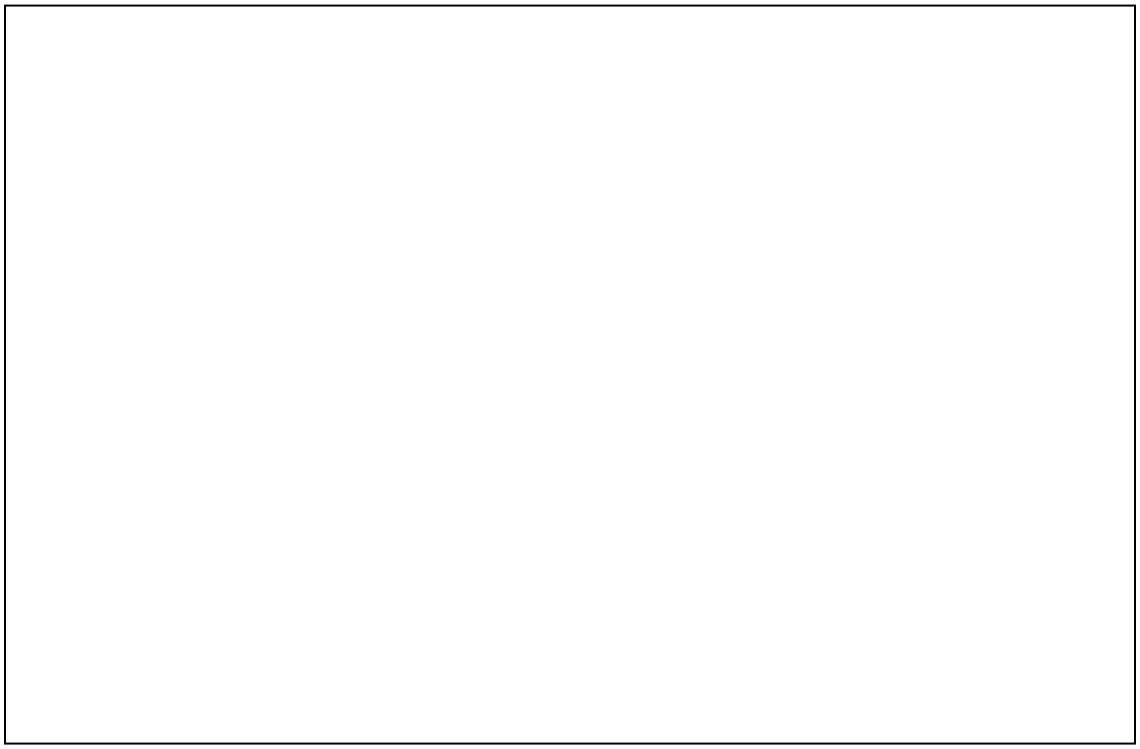


Activity 5:

Layer Widths (cm):

Bottom Layer: _____
Second Layer:_____
Third Layer:_____
Fourth Layer:_____
Fifth Layer:_____
Top Layer:_____

Observational sketch:



Appendix C:

Sample Questions

Science 20: Changes to Environmental Landscape

1. How does soil compaction affect the vegetative growth of a landscape?
2. How would the tilth, composition, and drainage of a soil affect the side of a mountain?
3. How might a man made path disrupt migration patterns of animals?

Science 30: How Natural Plant Species React to Their Environment

1. How does the creation of a walking pathway affect natural plant species?
2. How does the soil pH affect the presence of native plant species? What are some causes of soil acidity?
3. How does the introduction of agriculture processes (crops and farm animals) affect natural plant species?

Biology 20: Energy Flow Through Systems

1. How do dirt thriving organisms aid in the energy and nutrient cycles (including any that are visible under the microscope)?
2. How does soil composition and drainage affect energy cycles?
3. How might poor soils affect grazing animals such as bison?

Biology 30: The Effects of Invasive Species on Biodiversity

1. List one advantage and one disadvantage on the effect of soil erosion of an invasive plant species.
2. How does a long root system affect other plant species? How does compaction affect biodiversity of insects?
3. How would an invasive plant species affect the biodiversity of animals in an ecosystem?

Evaluation Form For Students:

1. On a scale of 1-10, how much fun was the course (1 being no fun, 10 being very fun)?

1 2 3 4 5 6 7 8 9 10

2. On a scale of 1-10 how relevant was the course related to what you are currently learning in your high school science course (1 being not relevant and 10 being the very relevant)?

1 2 3 4 5 6 7 8 9 10

3. Did you learn anything new in the duration of this course? If so, please state what you learned.

4. Was this course organized in a way that helped you learn?

5. Did this course help your ability to apply theory to the practise?

6. Is there anything about the course you would change?

7. How would you rate the overall effectiveness of this course (1 being bad, 10 being good)?

1 2 3 4 5 6 7 8 9 10

8. Any further comments?