“Green for Life”

4-H LANDSCAPE HORTICULTURE PROJECT

Soils – Activity Guide

Learn to do by doing

4-H Pledge

I pledge:

My HEAD to clearer thinking,

My HEART to greater loyalty,

My HANDS to larger service,

My HEALTH to better living,

For my club, my community and my country

4-H Grace

(Tune of Auld Lang Syne)

We thank thee Lord, for blessings great

On this, our own fair land.

Teach us to serve thee joyfully,

With head, heart, health and hands.

INTRODUCTION

The 4-H Soil Activity Guide has been designed with two age groups in mind:

- Junior: 8 to 10 years of age
- Intermediate: 11 to 14 years of age

Each activity has been designed for both age groups. These activities are meant for members to have an opportunity to learn, evaluate, make decisions, communicate and develop confidence.

Each activity has the following format:

Title

Topic

Learning Outcomes

Time

Materials/Resources

Instructions

Suggestions

Discussion/Comments

Processing Prompts

Each activity in the 4-H Soil Activity Project has learning outcomes identified at the beginning of the activity, and processing prompts at the end. To gain a better understanding of why these were added to every activity, we have included the following section about experiential learning.

Experiential Learning

Experiential learning is a model that, simply put, consists of action and reflection. Research show that learning is often best achieved when it is fun, active, interesting and easy to understand. Participating in fun activities creates a sense of togetherness within a group, helping members relate to one another as well as allowing the group to relax, feel safe and at ease. Through guided reflection and discussion, activities with meaning often help individuals understand concepts and skills more than if the same meaning was presented in a lecture format.

A leader can help 4-H members and groups learn by leading activities with meaning. These activities can then be processed to help the group find the meaning. These lessons can then be applied to other areas of the members' lives – helping them to transfer the meaning from the activity to the real world and every day life.

The following 4-H Soil Activity Guide includes learning outcomes at the beginning of each activity. Members will discuss and explore the meaning behind the activities and transfer these insights, through the help of the 4-H leader, into their everyday lives, whether it be in sports teams, school groups, community groups or at home with family. The 4-H leader can facilitate this by using the processing prompts listed at the end of each activity.

What is Processing?

Processing is when individuals reflect, describe, analyze and communicate what they have or will be experiencing in an activity.

Each activity has processing prompts. There will be a list of questions to ask regarding concept to focus on a group discussion. Some or all of the questions can be used to process the activity. Feel free to add your own processing prompts if you feel there is a specific topic that you would like to discuss.

When using the Activity Guide, processing is most easily done with the group when sitting or standing in a circle, and when the group is attentive and focused on the discussion.

When questions are designed properly and used thoughtfully, discussion questions can be an effective learning tool that promotes creativity as well as generated meaningful interaction and understanding for the member. Processing can be fast or slow depending on the group and the activity.

A Note on Health & Safety

It is important to practice good hygiene. Most of the exercises will involve touching soil. Remind children not to touch their eyes and mouth after handling soil and other materials.

Handwashing should be encouraged after each exercise. Soap and lather hands for at least 15 seconds before rinsing.

It is not necessary to wear gloves to touch soil. Using gloves helps protects hands but is not a replacement for handwashing.

Dry soil can be dusty and could create respiratory as well as eye irritations. Be mindful of and anticipate this potential, particularly for those with pre-existing conditions.

Once the experiment is done, sanitizing the area post clean-up is recommended.

Review digging procedures in advance of any related activity. Gloves as well as appropriate footwear should be considered.

Plastic instead of glass containers should be used in any field work and travels.

Content

Soil is the basis of life on our planet. It is where we get our food, gather the materials that create the products that we use and benefit from its work to clean and filter water.

Created and differentiated through impacts of weather, time, parent material, topography and organisms, the formation of soil is a long process, involving thousands and thousands of years as the pre-existing parent rock material erodes and organic matter decays. It is estimated that it takes at least five hundred years to create a couple of centimetres of new soil.

Soil is Earth's living skin, made up of several components: minerals (rock, sand, clay, silt), organic matter (material from once living plants and animals), air and water. It is their combination and relative proportion that creates the many variations of soil across our planet and influences the type and quality of life which can exist in specific areas.

Sidebar

The Influences on Soil Formation

The creation of soil is influenced by the following factors:

i. **Weather or Climate** – the combination of wind, rain, snow and frost as well as temperature influences the land and plants or vegetation which it can contain.
ii. **Parent Material** – the existing mineral and organic composition of the area are the “raw ingredients” from which the area's soil is formed.
iii. **Topography** or the surface shape of the area, including its slope, elevation and other physical features influence soil erosion and deposition.
iv. **Organisms** – the presence of both plants and animals impacts the nutrient content and physical characteristics of the soil.
v. **Time** – the above elements effect their change over time. Soil formation is generally influenced slowly through the above factors and often more dramatically through human influences.

Soil as a Finite Resource

Topic

The importance of soil preservation

Learning Outcomes

Gain an appreciation of the limited amount of land on Earth that is available for growing food

Time

15 minutes

Materials / Resources

Per Team or Individual
- 32 Cheerios or equivalent food item
- 1 cup to contain Cheerios
- serviette

Overall
- world map or globe
- apple or orange
- knife

Instructions

Upfront Group Discussion

1. Begin by examining the map, noting the amount and proportion of water and land in the world. Further subset discussions can be made about water (fresh versus salt; rivers versus lakes; location) as well as land (populated areas; mountains, urban centres, etc.).

Individual Activity

1. Take 32 Cheerios and place on the serviette.
2. Seek input on the estimate of how much land exists compared to water. Explain that about ¾ of the world is comprised of bodies of waters: oceans, lakes, rivers and seas with the remaining ¼ being land. Split the number of

Cheerios according to this proportion (24 for water; 8 for land). Place the 24 Cheerios into the cup.

3. Of the 8 remaining Cheerios, estimate how much of the land is suitable to live and produce food on and what is not. The split is about 50:50. Put 4 Cheerios back into the cup, representing the land that is not suitable for human habitation.
4. Focusing on the remaining 4 Cheerios, one represents the land that is not suitable for food production as it is too rocky or of poor soil quality; another is for the area that is too wet for food production; with another representing the area where humans live and have developed homes, cities, malls, roads and other living places. Place 3 Cheerios back into the cup.
5. The remaining and last Cheerio represents all the area on Earth that is suitable for food production.

Group Follow-up Discussion

1. Using an apple or orange, explain that this represents all the land suitable for food production.
2. Peel the skin (aiming for one continuous peel) from the fruit. The peel represents the soil in the world from which all our food can be grown.
3. A discussion can occur about facts about soil (Exhibit I) as well as soil conservation and land development pressures.

Discussion / Comments

- Do we live in a region with relatively plentiful land for food production, or relatively little?

- With ever greater population on the Earth, what ways are there to save land?

- Is there anything that can be done in towns and cities to preserve land that remains for food production? What else can be done to “gain” urban space for food production?

- What sorts of things can be done (or are being done) in rural areas to make the best use of land?

Processing Prompts

- Is the proportion of land suitable for food production surprisingly low or high?

The Soil Connection

Topic

Linking the importance of soil with our life

Learning Outcomes

Become aware of how connected our life is to the soil

Time

60 minutes

Materials / Resources

- Paper
- Pencil or pen
- Soil Connections Chart
- Ranking the Importance of Soil Chart
- Chalkboard or Display Paper and accompanying chalk or markers

Instructions

Soil Connections Activity

1. Using the "Soil Connections Chart", select 5 – 10 of the items and discuss how each can be connected back to the soil. Use the chalkboard or display paper to create a flow diagram of the linkages between the item and the connection back to the soil.
2. Following this group discussion, ask for suggestions for another list of everyday items. From this list, have the students pick 3 of them and do their own flow diagram for the connection back to the soil.
3. Have each present one of their connections.

The Importance of Soil Activity

1. Review the list of statements about soil's importance.
2. Either individually or in smaller groups, rank the statements.
3. As a group, discuss the rankings, providing back-up rationale.
4. Complete the discussion with an overall summary of the importance of soil to our lives.

Discussion / Comments

- Why is soil important to life on earth? What does soil provide?
- Can you think of anything that doesn't link back to the soil?
- How many steps on average do your flow charts have?
- What does this say about the importance of the soil to our lives?

Processing Prompts

- Which items tend to have the shortest flow charts? Which the longest?
- Do some of the items have multiple flow charts that you could make?

Soil Connections Chart

A list of everyday items		
newspaper	**pencil**	**cotton pants**
milk	**glass jar**	**toothbrush**
leather shoes	**banana**	**metal fork**
bread	**plastic bottle**	**television**
telephone	**apple juice**	**sandwich**
money	**cookie**	**notebook**
can opener	**traffic light**	**broom**
cheese	**sidewalk**	**gasoline**

Flow Chart Examples

i. Wooden Sign → Trees → Grown in Soil

ii. Plastic Bucket → Extracted from Oil → Created from Generations of Plant & Animal Decay → Found underneath layers of Rock & Soil

iii. Cotton Shirt → Cotton → Grown in Soil

iv. Ice cream → Made from milk → Produced from cows → Fed by plants → Grown in Soil

Ranking the Importance of Soil

Create a list of reasons why soil is important to everyday and ongoing life on Earth.

Some reasons may include the following:

- to walk on
- to provide habitat
- to support plant life, providing food and oxygen
- to grow food
- helps conserve history (has formed a protective layer over archeological sites)
- provides a source of minerals for building, heating and manufacturing (ie. sand, gravel, oil, coal, ore, etc.)
- helps store and purify water
- to make money
- etc.

The Importance of Soil to ….

List the importance of soil to …..

An Apple Tree …

A Blue Jay …

An Earthworm …

A Gardener …

A Horse …

A Farmer …

An Apartment Building …

A Miner …

You …

The Texture of Soil

Soils contain a mixture of different sized particles of minerals and rocks as well as organic matter with the spaces between the particles containing air or water.

The texture and physical properties of a soil are impacted by the size of the particles. Larger particles allow for bigger spaces between each particle, resulting in a more porous soil. Less porous soil is comprised of smaller sized particles, creating smaller spaces between each particle, making it harder for air to penetrate and water to drain away.

Soil is described based on the most abundant sized particles present.

Sandy soil is composed of large particles which allow for lots of space between each particle. Water drains very quickly through sandy soils, often taking valuable nutrients with it.

Clay soil is composed of very small particles with very small spaces between each particle. Clay has the ability to hold water and nutrients but air cannot penetrate between these spaces, especially when the spaces are filled with water. Poor drainage and aeration are characteristics of clay soils. Wet clay soil is difficult to work while dry clay is very hard.

Silt is composed of particles sized between those found in sand and clay. Silt particles are small enough that they can cause drainage problems. Wet silt is difficult to work. Unlike clay soil, silt tends to be dusty and powdery when dry.

Loam is the ideal blend of particle sizes. It is a balance of sand, clay and silt. Loam has the ability to hold water. Excess water, though, can drain away enabling air into the soil, providing the necessary oxygen to the plant's roots and the organisms found in the soil. It is easy to work, holds nutrients, has good aeration and good water-retention (also referred to as water-holding) capacity.

The Structure of Soil

A soil's structure reflects how its particles hold together. Soil structure is described by words such as crumbly, clumpy and loose.

Good soil structure means that the soil has a loose, crumbly appearance. The spaces between the clumps allow water to be absorbed into the soil and any excess to drain away. Water and nutrients are retained and there is good aeration. Roots and soil organisms are able to move through the soil easily, improving aeration and allowing roots access to nutrients.

The Scoop on Soil

Topic

Learning about the composition of soil

Learning Outcomes

To understand that soil is comprised of different components including air and water

Time

60 minutes (the Soil Texture Triangle activity will extend over 2 - 3 days to allow for the settling of the sand, silt and clay)

Materials / Resources

Upfront Discussion

- 3 different sized rounded materials (eg. marbles, golf balls, ping pong balls, beads, pebbles)
- large clear jar
- water

Additional Activities

- samples of soil taken from different nearby areas (scoop about 1 cup from each area, digging deep (about 10 cms) into the soil; label according to area; keep separate from each other)
- newspaper or plastic sheet
- magnifying glasses
- tissue paper or paper towel
- water
- 1 litre containers (one per team)
- empty glass jar (1 litre) with lid
- Soil Texture Triangle Composition Chart
- *Getting Settled* observation sheet

Instructions

Upfront Discussion

1. Each of the 3 selected materials should be used to illustrate the comparative size difference between the soil components eg. golf balls can represent sand particles, the largest of the soil particles. Marbles represent silt, the middle-sized particle with the beads representing clay, the smallest particle.

2. Fill the glass jar with a combination of the 3 materials.
3. Pour water into the jar, explaining the presence of water in soil.
4. Talk about what else is in the soil but not visible (air); note any bubbles that surface as the water is poured and becomes settled (this would show the presence of air).

Additional Activities

1. Each team (1 – 3 people) is given one of the soil samples.
2. Pour the soil sample on newspaper or plastic sheet.
3. Examine and describe the soil from an overall touch, smell and sight perspective. Record observations.
4. More closely examine the soil, gently spreading out the soil and breaking any clumps into small pieces. Record observations.

Soil Texture

i. The feel of soil

1. Pick up a small sample of moistened soil (about 1 tablespoon).
2. Rub the soil between your thumb and finger or in the palm of your hand.
3. Note any differences in feel among the particles: sand feels gritty to the touch; silt is smooth, feels somewhat like flour; clay is sticky.

Try to roll the soil into a ball and give it a squeeze …

i. If it is sandy soil, it will be crumbly and won't hold its shape in your hand.
ii. If it is clay soil, it will form a lump when it is squeezed; is sticky when wet and turns very hard when dry.
iii. If it is loam (the ideal garden soil), it will form into a ball when it is squeezed but will break apart easily.

ii. The textural composition of soil

1. Place one cup of soil into a one-litre glass jar with a covered lid.
2. Fill jar with water and thoroughly shake contents, leaving it settle for 2 -3 days (Note: the soil will begin to settle in layers within a couple of minutes post shaking, with the first noticeable layer settling at the bottom of the jar being sand. The silt layer will be the next to settle with the clay staying in suspension for quite a while. The organic matter in the soil sample will float on top).
3. Record the soil layers over time on the *Getting Settled* observation sheet.
4. Estimate the percentage of sand, silt and clay to the total jar size.
5. Use the Soil Texture Triangle to determine soil classification.

To observe the soil's moisture

1. Place one of the soil samples on tissue paper (select a soil sample that is moist to the touch)
2. Leave the soil on the tissue paper for at least 5 minutes.

3. Remove the soil and examine the tissue paper, noting any moisture presence on the tissue.

As an added illustration, different soil samples may be used for comparison purposes.

Additional Soil Moisture Activity

1. Weigh the soil sample, recording weight.
2. Re-weigh soil post 3 – 4 days (or longer). Record weight as well as observations pertaining to touch and colour. The difference in weight between the two measurements reflects the original moisture content.

Alternatively and ONLY WITH CONSTANT ADULT SUPERVISION, the sample can be microwaved for a couple of minutes. Allow sufficient time for the sample to cool down prior to touching.

To observe the soil's air content

1. Place one cup of dry soil into a 1 litre (preferably see-through) container.
2. Slowly pour up to 1 cup of water into the soil container, observing any air bubbles that rise to the surface, a sign of air being displaced from the sample.

Suggestions

With the soil samples being taken from different locations, the specific characteristics will vary but each soil sample will be comprised of a combination of solids (soil particles and organic matter), liquid (water) and gas (air). Possibly the samples will also contain insects or worms.

Discussion / Comments

- Are all soils alike?

- What are the different components of soil?

- How does the proportion of those different components influence what that soil can or should be used for?

- For agriculture, what activities take place to change those proportions in order to grow crops?

Processing Prompts

- What do you notice about the soil? (the description will vary according to the specific sample; components that should be noted include: mineral particles, organic matter such as sticks, leaf debris. The moistness of the soil could also be noted.)

- How can you tell that there is moisture in the soil? Is there any difference in the soil when it is dry?

- What happens to the weight of the sample when it dries out? What might this mean for a farmer's field? For the bank of a creek or river?

- Why do you see earthworms after it rains?

Getting Settled Observation Sheet

Draw the layers as seen in your jar, noting time of observation:

Time:

eg. 10 minutes

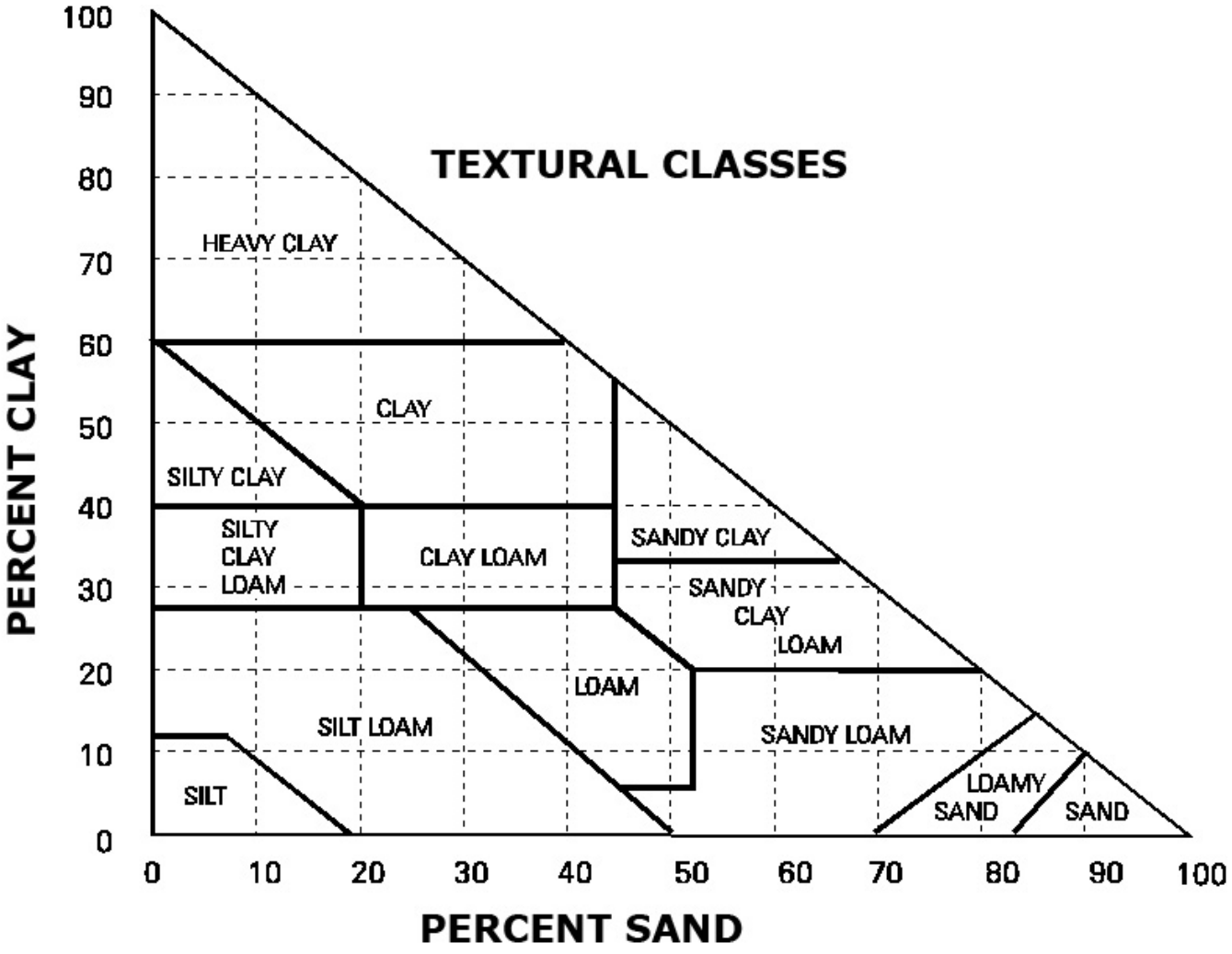
30 minutes

2 Hours

1 Day

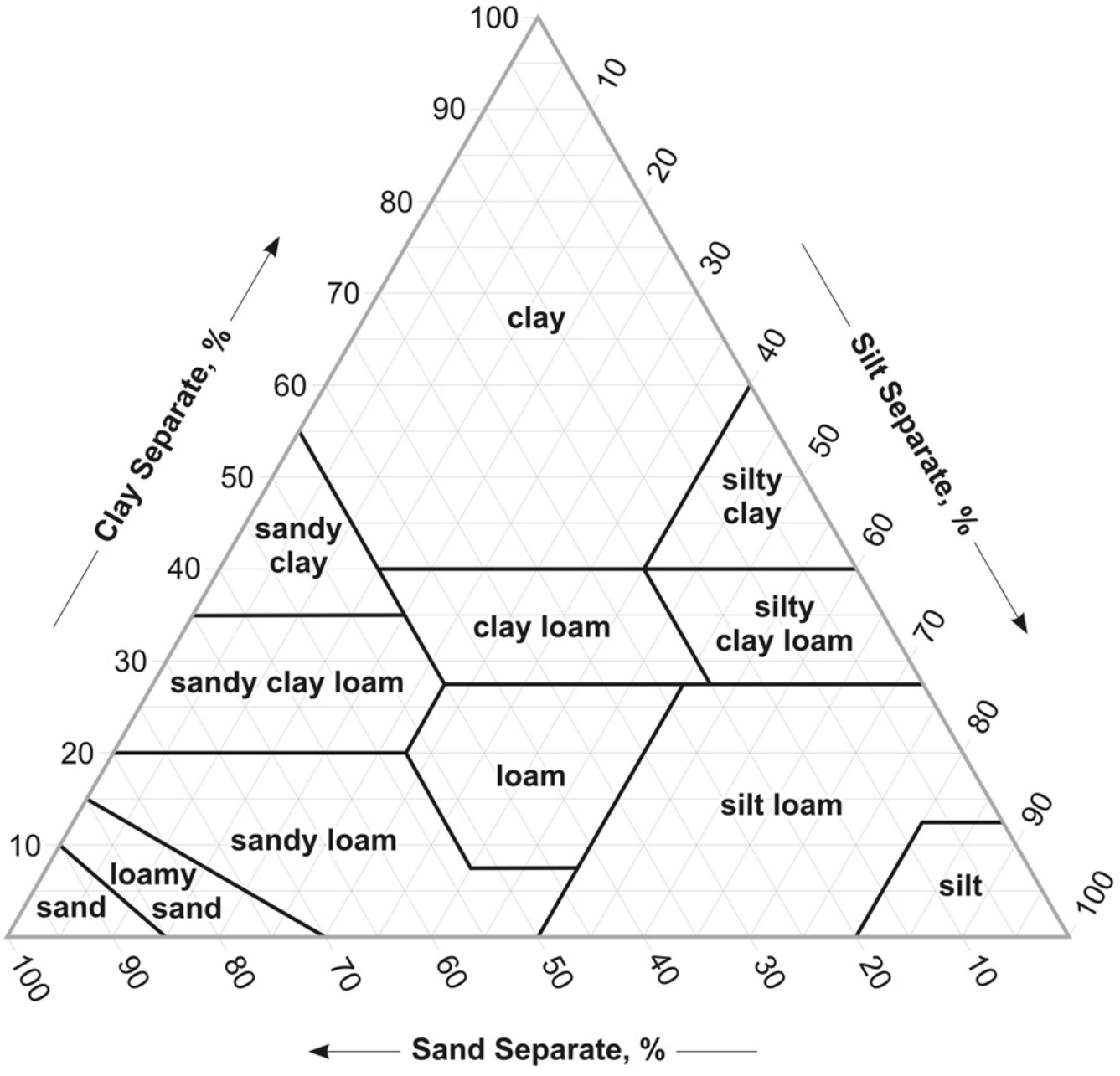
Soil Texture Composition Chart

I. Canadian Soil Texture Triangle



Source: Agriculture and Agri-Food Canada
http://sis.agr.gc.ca/cansis/nsdb/ecostrat/1999report/texture.html

II. American Soil Texture Triangle



Source: NRCS: Natural Resources Conservation Service, US Department of Agriculture

Soil Profile and its horizons

Soil is made up of different layers known as “horizons”, each varying in depth and composition. Influenced by weathering and the presence (or absence) of organic matter, the summation of the layers or horizons is referred to as the soil profile. If cross-sectioned, the soil profile would display the horizons from the soil surface and below to the parent rock material.

The five main horizons are referred to by capital letters: O, A, E, B and C. Not each is present in every soil profile. The horizons may be distinguished through colour, texture and material composition.

O The O horizon is found at the surface, comprised of decomposing organic matter. The layer of fallen leaves found in a forested area, for example, would be considered the O horizon.

A The A horizon is a surface layer containing minerals (sand, silt and clay) with organic matter. This horizon would be what is most readily referred to as “earth” or topsoil.

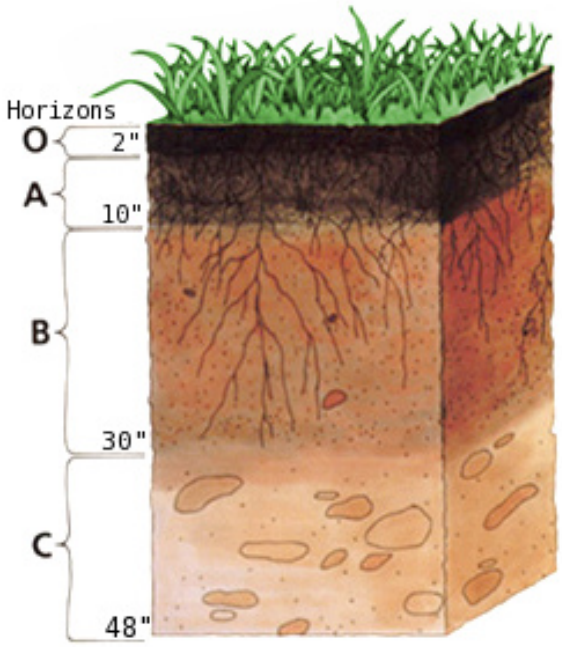
E The E horizon is subsurface to the O and A horizons, much lighter in colour than either with substantially less organic matter content. The “E” refers to *eluviation*, the leaching of materials through the percolation of water or rainfall through the medium.

B Another subsurface horizon, the B horizon accumulates deposits of leached materials from the “higher surface” horizons. This layer is sometimes referred to as subsoil, known as the “zone of accumulation” or zone of *illuviation*.

C The C horizon is comprised of the parent rock material, the least weathered horizon above bedrock.

R Not considered as soil, the bedrock layer is referred to as the R layer.

Soil Profile



Most soils have three major horizons --
the surface horizon (A)
the subsoil (B),
and the substratum (C)

Some soils have an organic horizon (O)
on the surface, but this horizon can also be buried.

The master horizon, E, is used for horizons that have a significant loss of minerals (eluviation).

Hard bedrock, which is not soil, uses the letter R.

Source:
http://www.wpclipart.com/geography/features/soil/Soil_profile_horizons.jpg

Different Horizons – The Layers of Soil

Topic

Understanding the layers of soil

Learning Outcomes

Identify soil layers or horizons, explaining how they are formed and acknowledging the many variations across regions

Time

60 minutes; longer if a field trip is done to sample a variety of local soils

Materials / Resources

Information

- soil map of Canada (*contact* Canadian Soil Information Service: http://sis.agr.gc.ca/cansis/intro.html)
- series of photos of Soil Landscapes across Canada/by region http://sis.agr.gc.ca/cansis/images/index.html

  i. Atlantic Canada: http://sis.agr.gc.ca/cansis/taxa/landscape/slc_atlantic.html
  ii. Southern Ontario & Quebec: http://sis.agr.gc.ca/cansis/taxa/landscape/slc_ontario.html
  iii. Prairie Provinces http://sis.agr.gc.ca/cansis/taxa/landscape/slc_prairie.html
  iv. British Columbia http://sis.agr.gc.ca/cansis/taxa/landscape/slc_bcsouth.html http://sis.agr.gc.ca/cansis/taxa/landscape/slc_bcnorth.html
  v. Yukon Territory http://sis.agr.gc.ca/cansis/taxa/landscape/slc_yukon.html
  vi. Northwest Territory http://sis.agr.gc.ca/cansis/taxa/landscape/slc_nwt.html

- powerpoint presentation on
  i. *Soil Formation & Landscape Stability* http://gomyclass.com/geology10/files/Lecture14.pdf
  ii. *How Soil is Formed* http://www.landfood.ubc.ca/soil200/classification/soil_profile_nov22.html

- Interactive Lesson linking photos with Soil Horizons Smithsonian: National Museum of Natural History http://forces.si.edu/soils/swf/hiddenhorizons.html

- Soil Layers Song - A different way to learn through a song that reviews the different soil horizons: http://www.youtube.com/watch?v=gx2wVHeiTKE

Dig In!

- shovel and/or trowel (auger may also be used if available)
- paper
- pen, pencils (possibly of different colours to record variations)
- optional: digital camera

Instructions

Information

1. Consider using one (or part) of the soil powerpoint presentations (links provided) to discuss soil formation and different soil horizons.
2. Incorporate the information from Agriculture & Agri-Food Canada's *Canadian Soil Information Service* to review Canada's soils as well the ones in your region/area

Dig In!

1. Dig into different soil areas (eg. garden, forested area, grassland) to view the soil layers. Observe any differences in soil (colour, texture, type) relative to depth of digging. If possible, digging to a depth of 1 metre should provide a good variation.
2. Take photos of different soil sections and/or draw the variations.

Discussion/Comments

- How do the soil horizons in your region differ from others in your province and across Canada? What is similar?

- What factors could change the current layering of the soil?

- What soil horizon is usable for plant growth?

- Are there any differences in soil horizons from one sample to another from your same area? What are the similarities?

Processing Prompts

- Can you identify different layers of soil? If so, what differences do you see? feel? smell?

- Which layers are darkest in colour? Why would this be?

Recording the Time to Create an Inch / 2.5 Centimeters of Soil

It can take over 500 years to create an inch of soil.
Record some of the events of history that have taken place while the most recent inch of soil has been created.

Year	Milestone events in Human History
2000s	
1900s	
1800s	
1700s	
1600s	
1500s	
1400s	

Soil's Organic Matter

The organic matter of the soil consists of plant and animal materials that are in various stages of decomposition. Organic matter is both the soil's conditioner as well as its' food supply. Comprised of both material that is decomposing as well as matter that is fully decomposed (referred to as humus or compost), it is the source of nutrients for plant growth, helps retain moisture through its' sponge-like capability, helps soil particles to aggregate or bind together to improve soil structure and reduce soil erosion.

The amount of organic matter in a soil varies, dependent on vegetation, tillage, soil texture and climate. Generally, an organic matter content of 5% is considered optimum.

The addition of compost to the soil helps build organic matter, providing a source of both macro- and micronutrients.

The macronutrients include nitrogen (N), phosphorous (P), potassium (K), calcium (Ca), magnesium (Mg) and sulfur (S). They provide the main nutrients for plants. The first three - N, P, K - are used in the largest amounts by plants, each providing specific benefits including leaf and stem growth (N), root growth (P and K), flower and fruit development (P) and overall vitality (K).

Plants need micronutrients, also called trace elements, such as iron (Fe), manganese (Mn), copper (Cu) and zinc (Zn). Their presence in very small quantities is essential for plant life. The balance and level of these micronutrients is critical as excesses are harmful to plants. Compost provides an available, balanced supply of these micronutrients.

Organic Matter and Water-Holding Capacity

Topic

How Soil holds Water

Learning Outcomes

Understand how soil retains water

Time

45 minutes

Materials/Resources

- 3 2-litre pop plastic bottles
- coffee filters
- 2 cups each of dry sand, gravel/pebble rocks, clay container(s) for mixing
- 3 cups of compost
- water
- measuring cups
- stopwatch
- comparison chart

Instructions

This activity is best done in groups of 2 or more, depending on the amount of soil samples available.

1. Cut each of the plastic bottles about 12 cms from the bottle's base. Invert the top in the base as per illustration.
2. Place coffee filter in the bottom of the inverted top (as per illustration).
3. Place one cup of one of the mediums (sand, gravel/pebble rocks, clay) in one of the plastic bottles.
4. Assign one person to record the time and another to pour the water into the bottle.
5. Pour 2 cups of water into the bottle, starting to record time as soon as the water is begun to be poured.
6. Record the time once the water has gone through the medium as well as measuring the amount of water that has filtered through, noting the differences between the various mediums.

To note the impact of organic matter on soil's water retention

1. Mix one cup of compost with each of medium (sand, gravel/pebble rocks, clay).
2. After removing the medium, coffee filter and water from the previous activity, place a fresh coffee filter at the base of the inverted bottle, adding the medium which has now been mixed with compost.
3. Similar to the previous activity, pour 2 cups of water through the filter, recording time and water that has filtered through.
4. Record results on comparison chart and discuss findings.

Discussion / Comments

- What is the impact of organic matter on the water-holding capacity of the medium?

- Why would there be differences in the amount of time for the water to filter through between the various mediums?

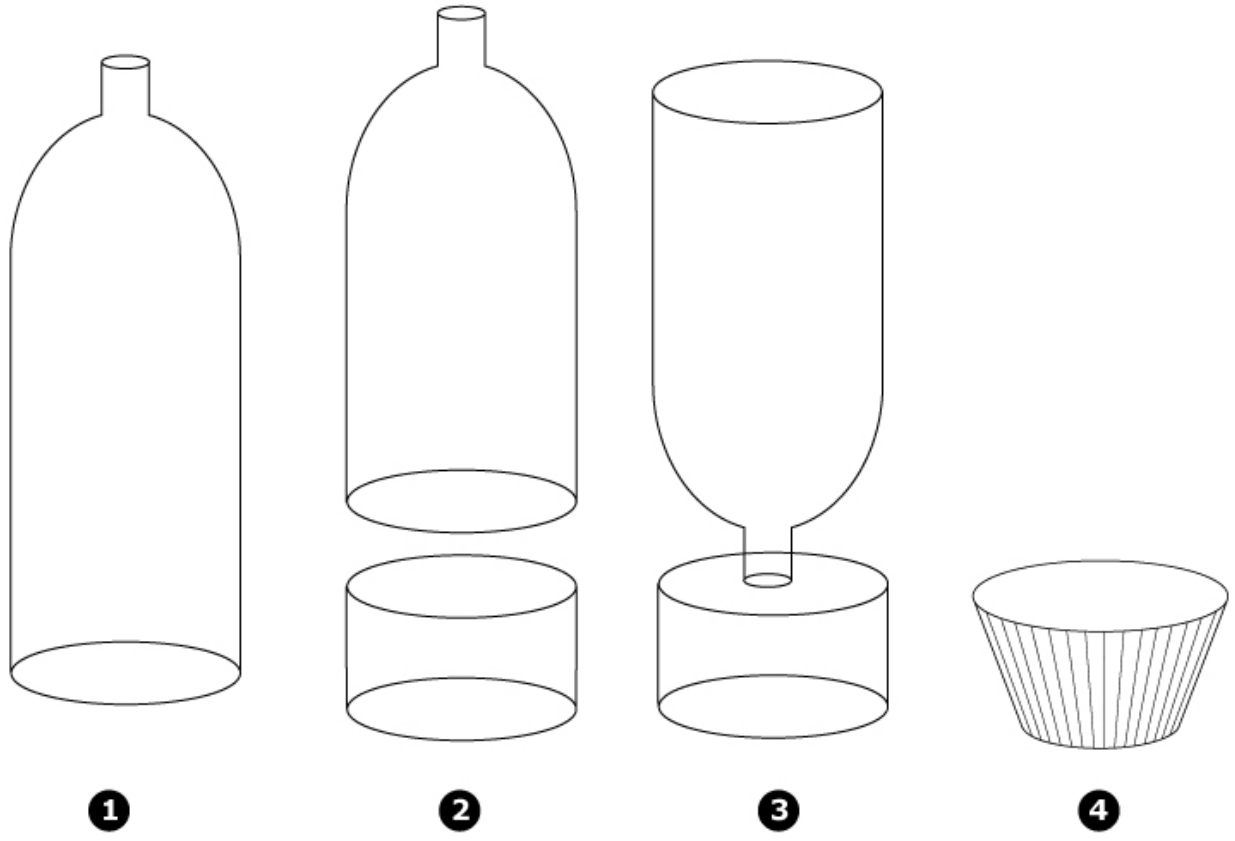
- How would those differences affect what could be done with those soil types?

Processing Prompts

- How would the size of the particles in the medium influence the amount of air space between the particles?

- Do greater air spaces increase the water-holding capacity of the soil, or reduce it, or both?

Organic Matter and Water-Holding Capacity **Activity**



1. 2-litre plastic pop bottle
2. Cut about 12 cms from bottle base
3. Invert top into base
4. Place coffee filter in the bottom of the inverted top

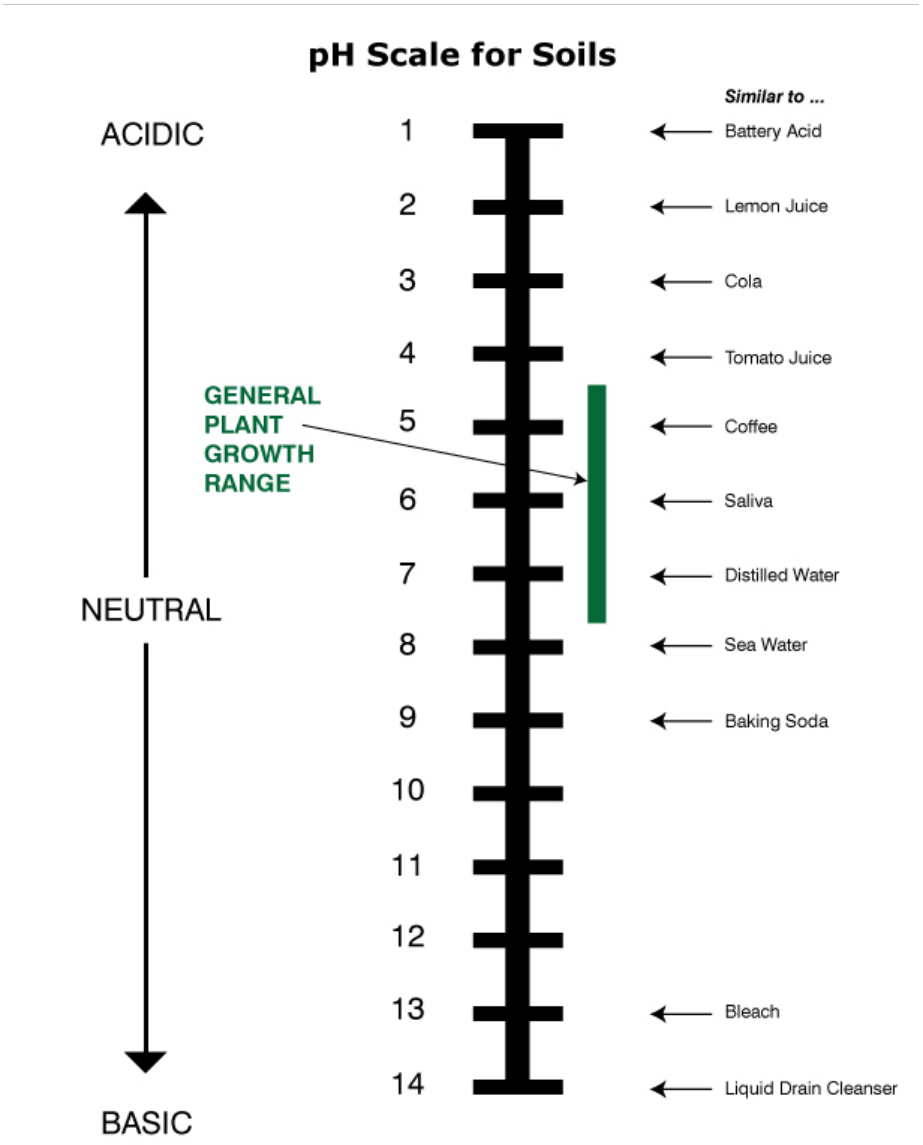
Comparison Chart

Medium	Time (minutes(s))	Amount of Water after Filtering (cup(s))
i. Sand		
Sand with Compost		
Difference		
ii. Pebbles/Rocks		
Pebbles/Rocks with Compost		
Difference		
iii. Clay		
Clay with Compost		
Difference		

Soil pH and Nutrients

A soil's value to plant growth is affected by its pH and nutrient content.

The pH of a soil relates to its alkalinity or acidity. Measured in units, the pH scale ranges from 0 (acidic) to 14 (alkaline or basic), with neutrality being 7. The pH level of a soil can impact the availability of nutrients for plant growth, with specific nutrients being "tied up" or not available at different pH levels. Some plants respond or grow better in different pH levels with the pH range preferred by most plants being slightly acid to neutral, that is a pH between 6.0 and 7.0.



Soil Testing

Topic

To measure the pH and other properties of soil

Learning Outcomes

To understand how to conduct a soil test and what the test results mean

Time

30 – 60 minutes

Materials / Resources

To Take a Soil Sample
- clean spade or trowel
- clean container
- visually divide selected area where soil is to be tested into 6 – 8 equal parts. The area selected should be relatively uniform and consistent, with soil of the same texture and colour. (If there is a considerable difference in the area, separate samples should be taken.)

I. pH Test
i. "simple; directional"
- vinegar
- baking soda
- water
- 2 containers (preferably clear)
- soil sample (1 – 2 cups)

ii. "more precise"
- soil test, available for purchase from local garden centre or local soil testing laboratory
- soil sample

II. NPK Test
- may be done in concert with pH test, utilizing the soil test purchased from local garden centre of local soil testing laboratory
- soil sample

Instructions

To Take a Soil Sample
1. Using a spade or trowel, take a small sample of soil from each of the 6 areas. Dig about 10 to 12 cms into the soil.
2. Combine all samples in the container, mixing together.
3. Scoop a soil sample from the “batch”, sized according to sampling requirements.

I. pH Test
i. “simple; directional”
- Place some soil into one of the containers.
- Add ½ cup of vinegar, watching for any sign of bubbling or fizzing from the soil. If this occurs, it indicates that the soil is basic.
- Alternatively, place some soil into the other container, mixing the soil with water.
- Add ½ cup of baking soda to the mix. If the mixture fizzes, it indicates that the soil is acidic.

ii. “more precise”
- Follow directions on kit or from soil testing lab.
- Obtain representative sample for area.
- Use clean equipment to gather and mix sample.

II. N-P-K Test
- Follow directions on kit or from soil testing lab
- Obtain representative sample for area.
- Use clean equipment to gather and mix sample.

Discussion / Comments

- What do differences in soil (i) pH (ii) N-P-K mean?
- What could cause differences in soil (i) pH (ii) N-P-K? What can be done to change the soil (i) pH (ii) N-P-K?
- How do differences in soil pH and N-P-K affect a plant’s ability to grow?

Processing Prompts

Why would you want to have the soil samples to be representative of the same area?

Soil as a Filter

Topic

See the value of soil to filter and clean water

Learning Outcomes

To understand that soil can filter as well as store water

Time

45 minutes

Materials / Resources

Per Team

- 2 funnels (cone-shaped paper cups could be used)
- coffee filter paper (from this material, cut two 5cm squares of “fabric”)
- ½ cup each of dry, clean sand and dry soil (not potting soil)
- 4 cups in which the funnels will be placed
- 3 cups of water
- 3 cups of Grape Kool-Aid drink
- worksheet

Instructions

Step I – Creating the filter system

i. Place the filter paper in the base of the funnel (if using cone-shaped paper cups, cut the tip off the cup), twist the paper through the funnel opening and having the paper also extend below the funnel (will help block the sand/soil).
ii. Place the funnel in the cup (the cup will collect the liquid once poured)
iii. Place ¼ cup of sand in one of the funnels and ¼ cup of soil in the other.

Step II – Plain Water Filter

i. Using the worksheet, record assumptions as to what will happen when the water is poured through each filter.
ii. Measure two ½ cups of water.
iii. At the same time, pour the water into each of the funnels.
iv. Observe the speed of infiltration, noting any differences between the sand and the soil.
v. Once the water has seeped through the funnel, measure how much has been collected, noting any differences between the sand and the soil.
vi. Update observations on worksheet.

Step III – Filtering Contaminants

i. Use the same materials (funnels/cups), removing the water from the cups.
ii. Record assumptions as to what will happen when the grape drink is poured through each filter.
iii. Measure two ½ cups of grape Kool-Aid drink mix.
iv. At the same time, pour the grape drink mix into each of the funnels.
v. Note any differences in the colour of the liquid in the cup as well as filter time.

Discussion / Comments

- Based on what you observed, can you think of some situations where a sandy soil would be ideal? Why is it not always ideal?

- What happens when the water is poured too quickly? What does this mean for a field? For a slope?

Processing Prompts

- Re: Plain Water Filter → As you pour the water, which medium is faster?

- What is happening to the water initially when poured on the dry soil/sand?

- Are there any differences in the amount of water that is collected? (The sand should have more water seep through.)

- How can you tell that there is moisture in the soil? Is there any difference in the soil when it is dry?

Adapted from: Oregon Agriculture in the Classroom Foundation, *Water Filtering & Soil.* www.aitc.oregonstate.edu

Soil Compaction

Topic

The Impact of Compaction on Soil Function

Learning Outcomes

To understand the difficulty of soil to act as a medium for water and air movement, plant & root growth and other functions when compacted

Time

15 minutes (the activity with the compacted soil example may take significantly longer to drain)

Materials / Resources

- minimum of two cylindrical containers, open at both ends (eg. plastic pop bottles, evenly cut at both ends; apple juice can, open at both ends)
- water
- stopwatch

Instructions

1. Locate a compacted soil location (eg. on a walking path) as well as other nearby soils that are not compacted (eg. flower bedding or vegetable garden soil).
2. Place the cylindrical containers on the soils, inserting them to be able to stay upright.
3. Pour equal amounts of water into both containers/soils, recording the time it takes for the water to drain into each soil.
4. This activity can be repeated with different locations to further illustrate the impact of compaction on soil's ability to absorb water.

Discussion / Comments

Soil can become compacted through any number of ways such as foot traffic, vehicles and construction. The soil particles are squeezed together, reducing airspace and decreasing the ability for roots, water, air, earthworms and other living creatures to "move" and function properly, negatively impacting soil health and plant growth.

Processing Prompts

- What was it that caused compaction on that area of soil? What other factors can cause compaction of soil?

- For the area that was not compacted, was that its' natural state, or was the area maintained that way? (such as a garden of some kind)

- What are some reasons that gardens are maintained in a very loose (non-compacted) state?

Soil Erosion through the Forces of Water and Wind

Topic

Factors influencing Soil Erosion

Learning Outcomes

Understand erosion and its impact on soil

Time

30 – 60 minutes

Materials / Resources

Raindrop Activity
- Raindrop-Soil Erosion chart
- 2 tablespoons of dry soil
- eye dropper
- water

Land Changes Activity
i. Water Erosion
- large pan(s) (eg. aluminum roasting pan)
- moistened sand, silt, other soil mixes
- water
- indoor watering can or other water container
- coloured aquarium gravel
- small items to simulate physical barriers

ii. Wind Erosion
- portable blow dryer
- large cardboard box (.5m x .3m x .3m; similar to a box for reams of paper); hole in one end to fit the nozzle of the blowdryer (hole should be cut about 5 cm from base)
- clear plastic film to serve as a see-through box top
- samples of different soil types, varying by moisture content (dry, moist)
- damp paper towels to hang one end and both sides of the inside of the box
- chart to record dispersion results

iii. The Importance of Vegetation to Reduce Erosion
- 2 cardboard boxes or aluminum pans (about 7 x 7 cm in width/length and at least 4 cm in depth); a V-shaped notch must be made on one end of each box
- top soil or other soil mix
- grass (either piece of sod or grass seeds) or various plants such as ivy
- water
- pan to catch water

Instructions

Raindrop Activity
1. Place about 1 teaspoon of dry soil in the centre of the Raindrop-Soil Erosion chart.
2. Fill eye dropper with water.
3. Holding the eye dropper about ½ metre above the chart, allow about 5 drops of water to hit the soil.
4. Record all the water splashes which contain soil.
5. Repeat the activity at different water drop heights as well as with water-saturated soil.

Land Changes Activity
i. Water Erosion
1. Fill the pan with the sand or other medium, having punched holes in one end of the pan to permit water to drain.
2. Create a slope by raising the pan at one end (the opposite to where the drainage has been created)
3. Trace a large wavy line on the soil medium from the top to bottom (drain location)
4. With the watering can, pour a constant stream of water from the top of the wavy line, observing the water flow and the impact on the soil, noting erosion as well as soil deposition.
5. Having smoothed the surface and created another wavy line, place small items at different angles along the "stream" path to observe the impact of barriers on erosion and deposition. Altering the slope as well as the rate of water flow can also be varied to observe impact. Adding some coloured aquarium gravel in the area at the top of the stream may be done to see how its' travel might vary relative to the soil.

ii. Wind Erosion
1. Place about 3 cm layer of one of the soil mediums at the base of the box.
2. Tape the damp paper towels to the inside of 3 sides of the box (not the one with the hole for the blow dryer).
3. Tape the clear plastic film to the top of the box (serves as a cover).
4. Insert blow dryer nozzle in the hole.
5. Start with the lowest air setting, turning on the dryer.
6. After 30 seconds, turn off the dryer and check the towels to see whether there has been any soil medium dispersion. Record findings on chart.
7. Replace soil medium with another type. Repeat process.
8. Continue analysis with each available soil medium and moisture level.
9. Continue to record findings for each soil sample.

iii. The Importance of Vegetation to reduce Erosion

1. Make a V-Shape notch at the end of each box.
2. Place the boxes on an angle so that the V-Shaped end is lower than the other. Place the pans to catch any run-off water below the V-Shaped end.
2. Put equal amounts of soil in each box.
3. Prepare one box with plants or grass (if using grass seed, this must be prepared at least a week in advance of the activity).
4. Pour equal amounts of water at the top end of the boxes.
5. Note any differences in the amount of water and soil run-off from each box.

Discussion / Comments

Raindrop Activity

- What happened when the raindrops hit the soil?
- How did that change when you tried different heights?
- What changed when the soil became or was water-saturated?

Water Erosion Activity

- Were there any changes in erosion rate when the slope changed?
- Were you able to reduce the erosion rate by using barricades? Did the barricade(s) make the water flow faster or slower?
- How can you protect soil from water erosion?

Wind Erosion Activity

- Were there differences in erosion rate among different soil types?
- Were there further differences with moisture level increases?
- How can you protect soil from wind erosion?

Vegetation & Erosion Activity

- What were the differences in run-off between the non-vegetated and vegetated boxes?
- What impact does vegetation have on erosion and water retention?

Processing Prompts

Raindrop Activity

What do you notice about the amount and distance of soil movement when the soil is dry? wet?

Water Erosion Activity

Where is the water going? Where is the soil being deposited?

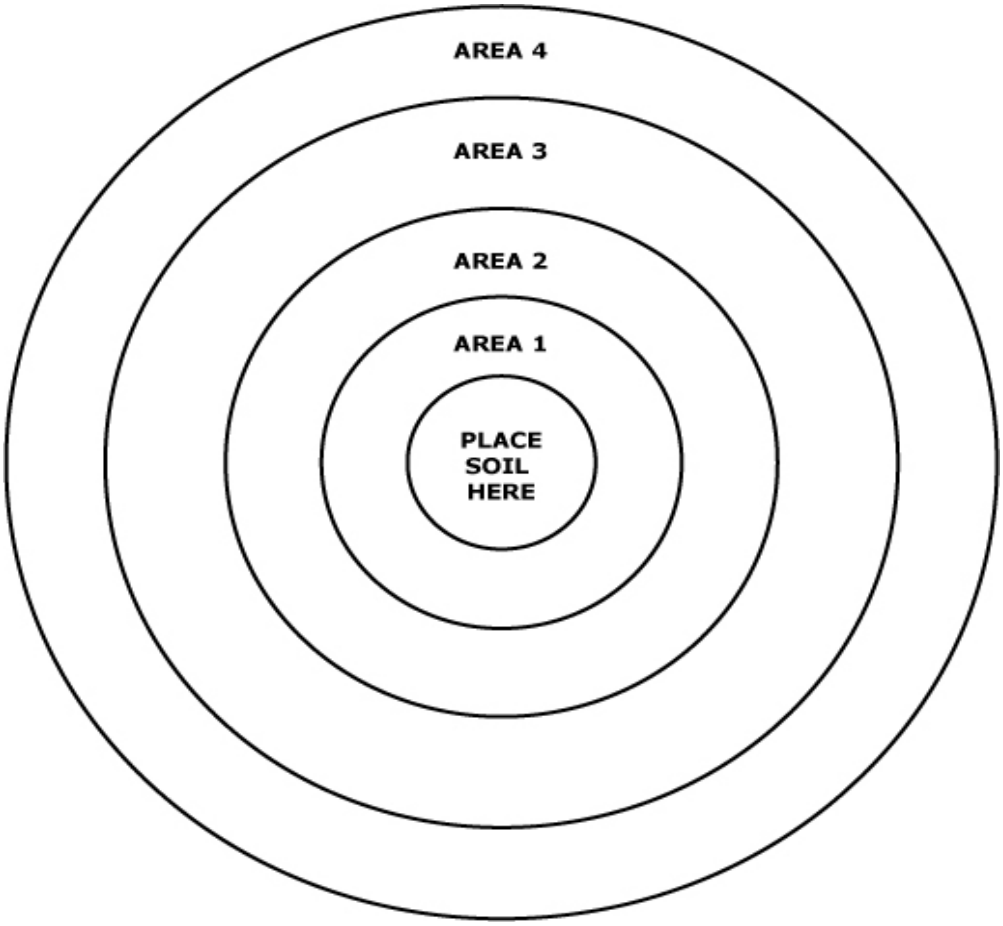
Wind Erosion Activity

Did each soil sample get dispersed onto the paper towels?

Vegetation & Erosion Activity

Is there a difference in water retention and soil run-off when there is no vegetation? With vegetation?

Raindrop-Soil Erosion Chart



SPLASH DROP CHART

	# of Splash Drops
Area 1	
Area 2	
Area 3	
Area 4	

Roots & Water

Topic

Water Uptake in Plants

Learning Outcomes

To understand how water is absorbed and travels through plants

Time

Preparation: 30 minutes

Observation: 1 day

Materials / Resources

- at least 3 – 4 celery stalks with leaves per person
- 3 – 4 clear containers (could be empty plastic pop bottles (1 litre), glass jar or drinking glass)
- water to fill containers halfway
- 3 – 4 different colours of food colouring (blue, red, green, purple)
- knife
- chart to record observations

Instructions

1. Prepare each container with water and food colouring, selecting one food colouring per container
2. Place one celery stalk per container, cutting each to different lengths. Make sure at least one stalk does not get cut and retains its leaves.
3. Check the stalks according to the following intervals (or your choice of timeframes): 30 minutes; 2 hours; 4 hours; 1 day
4. Observe and record any changes to the colour of the celery stalk at each interval
5. After completion of the decided timeframe, cut the stalk both widthwise and lengthwise, observing how the colour has traveled through the plant. Record observations.

To add to this activity, also include a white carnation and observe colour changes over time to the flower.

Discussion / Comments

How does water travel through a plant? Does it serve as a medium for plant nutrients?

Does the water uptake happen quickly? What happens when there is no water available? How would you notice that there is not enough water?

How is water taken up by the plant when it is in the soil?

Processing Prompts

What do you think you will see? and when?

How far did the colour travel for each time interval?

What part of the celery stalk is transporting the water?

Celery Stalk & Water Observations

Time Interval				
Celery Stalk	**30 minutes**	**2 hours**	**4 hours**	**1 day**
I				
II				
III				
IV				

The Roots of the Matter

Topic

Soil as a Good, Growing Environment

Learning Outcomes

To understand the importance of soil for plant growth

Time

Preparation: 15 – 30 minutes

Observation: minimum of 5 – 10 days

Materials / Resources

- bean seeds
- container mix soil (good for seedlings)
- clear container
- water

Additionally, to further illustrate and discuss root growth, select a variety of plants (eg. ivy, various plant bulbs such as tulips, daffodils, dig up a clump of grass (with permission) and examine the extensiveness/dynamics of their root structure.

Instructions

1. Fill clear container with good quality container mix.
2. Place 1 seed about 4 cm in depth (check planting instructions on seed package). Place the seed close to the side of the container so that it can be seen.
3. Establish a watering as well as “watch” schedule to follow the growth of the seed/emergence of the plant.
4. Record the growth of the plant, noting how long it takes to “surface” and the happenings underground between planting & surface emergence.

Discussion / Comments

What is the importance of quality soil for the growth of seeds, seedlings & plants?

How long did it take for the plant to emerge at the surface? What was happening underground in the meantime?

What is the importance of roots for the plant?

Processing Prompts

What do you think you will see? and when?

Why is it important to space seeds apart from each other?

Soil Makes a Growing Difference

Topic

Soil type and its impact on plant growth

Learning Outcomes

To understand the impact of soil type on a plant's ability to grow

Time

Preparation: 15 – 30 minutes

Observation: minimum of 10 – 14 days, extended to sufficient time to note differences in growth

Materials

- minimum of 5 different soil samples/types: sand, clay, silt, loam, potting soil
- minimum of 5 containers for planting
- one bean seed per container
- labels
- water
- recording observation sheet

Instructions

1. Fill container with one of the soil samples. Moisten soil. Label accordingly.
2. Plant a bean seed in each of the container, placing at a depth of about 4 cm.
3. Establish watering schedule to ensure soil does not dry out.
4. Record growth observations on a daily/regular basis, noting any difference/similarities amongst soil samples.

Alternative Activity

In addition to samples of sand, clay and silt, also include a sample of compost which will be used to create loam, mixing equal parts of clay, sand & silt. Add different portions of compost to the mixture, proceeding with the growth experiment as per above.

Discussion/Comments

Why would one soil type be better than another for plant growth?

What determines the growth success of a seed/plant?

Processing Prompts

In what soil type will the seed/planting grow best? Why?

What is happening to the growth of the seeds in each container type?

Growth Observations

Soil Type

	Sand	Clay	Silt	Loam	Potting Soil
Day 1	Record plant height and any other growth comparisons on a daily basis				
Day 2					
Day 3					
Day 4					
Day 5					
Day 6					
Day 7					
Day 8					
Day 9					
Day 10					
Day 11					
Day 12					
Day 13					
Day 14					

Feed the Soil

Topic

Learn about plant nutrition through soil quality

Learning Outcomes

To gain a perspective on the impact of different amounts of nutrients and soil conditioners on plant growth performance

Time

Preparation: 30 – 60 minutes

Ongoing Management & Observations: 1 – 4 weeks

Materials/Resources

Per Group/Individual

- plastic drop sheet
- at least 5 plant pots (clean); ensure pot has drainage
- container mix potting soil
- compost
- commercial fertilizer in pellet form
- pot labels
- pen
- water
- watering can or water spray bottle
- fast-growing seed (select one type eg. bean, radish, sunflower)
- sunny windowsill
- chart to record observations

Instructions

Preparation

1. On plastic drop sheet, the 5 plant pots should be filled as follows:
   i. Control: ¾ full of container mix potting soil
   ii. Compost Only: ¾ full of compost
   iii. Compost Mix: 25% compost and remainder potting soil to ¾ full
   iv. One Pellet Fertilizer: add 1 fertilizer pellet to ¾ full container mix
   v. Five Pellet Fertilizer: add 5 fertilizer pellets to ¾ full container mix
2. Label each pot according to material content.
3. Plant 2 seeds per pot, spacing apart but close to the pot's centre. Following seed package instructions for depth of planting.
4. Place all pots in sunny location; ensure there is a tray to catch any excess water.
5. Water according to seed package instructions.

Ongoing Management & Observations
1. Assign responsibility for ongoing watering, recording of growth and other observations.
2. Utilize chart to record observations, noting similarities and differences among the different soil treatments and control.
3. If both seeds sprout in the pot and become crowded, prune/remove the weakest seedling before it reaches 4 cm.

This activity could extend well beyond the 4 week timeframe, depending on available space, growth and interest.

Discussion / Questions

What growth is happening and when? Are there any differences among the soil mediums? What do you think is causing these differences/ similarities?

Beyond the 4 weeks of growth that is observed, what future growth and differences do you anticipate among the soil mediums?

Processing Prompts

What differences in plant growth and development do you anticipate seeing among the 5 soil mediums? Why?

When do you think you will start seeing the first signs of growth?

How does the water help support growth? Would the answer be different for different stages of growth?

Observations

	Growth	Colour	Leaf Structure
State Timeframe:			
I. Control			
II Compost Only			
III Compost Mix			
IV One Pellet Fertilizer			
V Five Pellet Fertilizer			
State Timeframe:			
I. Control			
II Compost Only			
III Compost Mix			
IV One Pellet Fertilizer			
V Five Pellet Fertilizer			
State Timeframe:			
I. Control			
II Compost Only			
III Compost Mix			
IV One Pellet Fertilizer			
V Five Pellet Fertilizer			

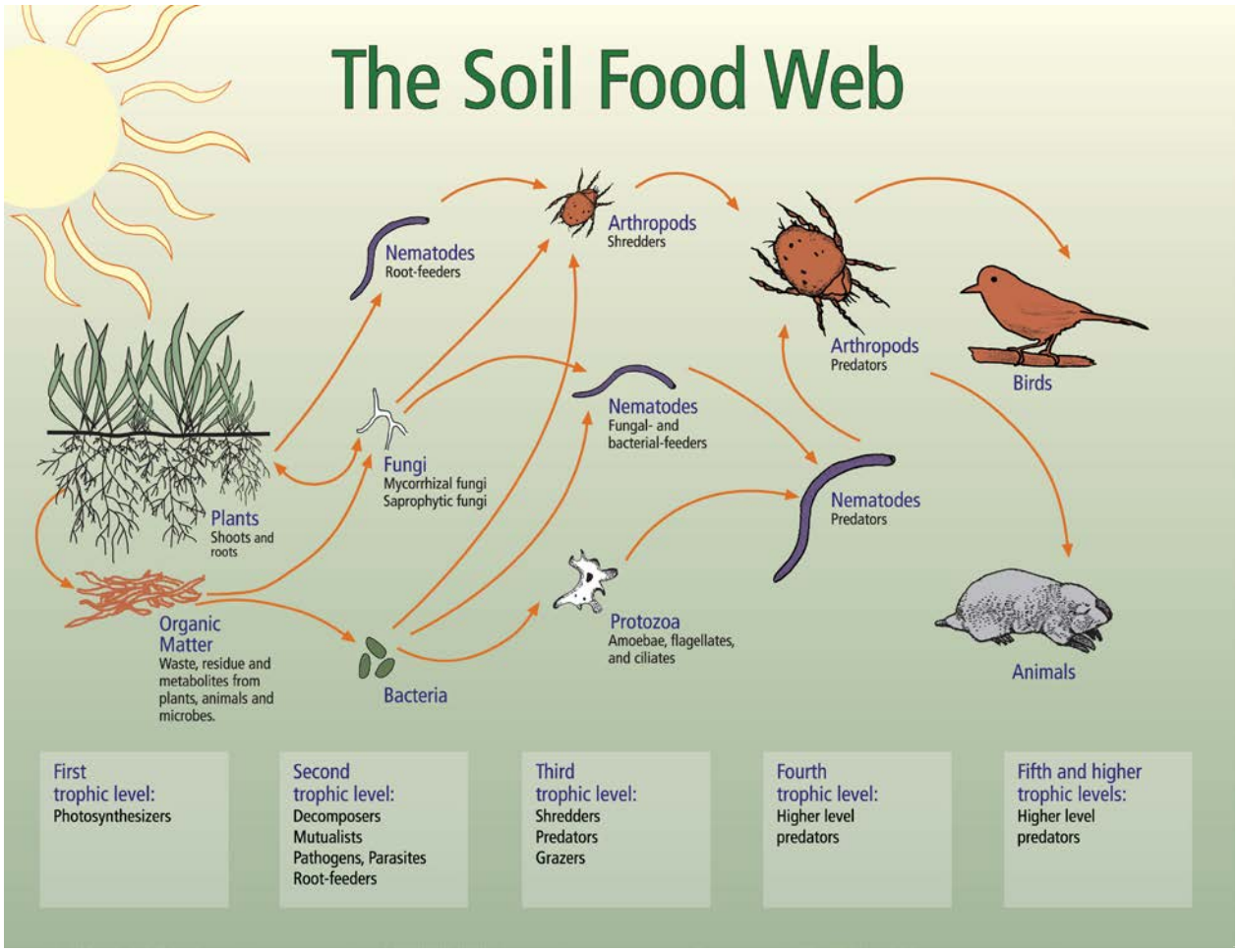
etc…..

Soil as an EcoSystem

Soil contains a great diversity of life, alive with micro- and macro-organisms which can be abundant in both their diversity and complex in their interactions. Like us, they depend on food, air and water to survive and contribute to the circle of Life.

Micro-organisms such as bacteria, fungi, algae and actinomycetes are the “invisibles” but make up the vast majority of living entities in the soil. They are decomposers, responsible for breaking down organic matter, enabling its nutrient content to be released and become available for plant and root growth. Billions of these entities may be found in one tablespoon of soil.

Generally visible, macro-organisms include earthworms and arthropods such as insects, mites, spiders, springtails and millipedes. Their many activities of burrowing, eating and traveling through the soil are important in the soil’s nutrient cycle and structure.



Source: Soil Biology Primer
Natural Resources Conservation Service
United States Dept of Agriculture
http://soils.usda.gov/sqi/concepts/soil_biology/soil_food_web.html

A Soil Food Web Glossary

Arthropods	Invertebrate animals with jointed legs. They include insects, crustaceans, sowbugs, arachnids (spiders), and others.
Bacteria	Microscopic, single-celled organisms that are mostly non-photosynthetic. They include the photosynthetic cyanobacteria (formerly called blue-green algae) and actinomycetes (filamentous bacteria that give healthy soil its characteristic smell).
Fungi	Multi-celled, non-photosynthetic organisms that are neither plants nor animals. Fungal cells form long chains called hyphae and may form fruiting bodies such as mold or mushrooms to disperse spores. Some fungi, such as yeast, are single-celled. **Saprophytic fungi:** Fungi that decompose dead organic matter. **Mycorrhizal fungi:** Fungi that form associations with plant roots. These fungi get energy from the plant and help supply nutrients to the plant.
Grazers	Organisms, such as protozoa, nematodes, and microarthropods, that feed on bacteria and fungi.
Microbes	An imprecise term referring to any microscopic organism. Generally, "microbes" includes bacteria, fungi, and sometimes protozoa.
Mutualists	Two organisms living in an association that is beneficial to both, such as the association of roots with mycorrhizal fungi or with nitrogen-fixing bacteria.
Nematodes	Tiny, usually microscopic, unsegmented worms. Most live free in the soil. Some are parasites of animals or plants.
Protozoa	Tiny, single-celled animals, including amoebas, ciliates, and flagellates.
Trophic levels	Levels of the food chain. The first trophic level includes photosynthesizers that get energy from the sun. Organisms that eat photosynthesizers make up the second trophic level. Third trophic level organisms eat those in the second level, and so on. It is a simplified way of thinking about the food web. In reality, some organisms eat members of several trophic levels.

Source: Soil Biology Primer
Natural Resources Conservation Service
United States Dept of Agriculture
http://soils.usda.gov/sqi/concepts/soil_biology/soil_food_web.html

Functions of Soil Organisms

Type of Soil Organism		Major Functions
Photosynthesizers	• Plants • Algae • Bacteria	**Capture energy** • Use solar energy to fix CO_2. • Add organic matter to soil (biomass such as dead cells, plant litter, and secondary metabolites).
Decomposers	• Bacteria • Fungi	**Break down residue** • Immobilize (retain) nutrients in their biomass. • Create new organic compounds (cell constituents, waste products) that are sources of energy and nutrients for other organisms. • Produce compounds that help bind soil into aggregates. • Bind soil aggregates with fungal hyphae. • Nitrifying and denitrifying bacteria convert forms of nitrogen. • Compete with or inhibit disease-causing organisms.
Mutualists	• Bacteria • Fungi	**Enhance plant growth** • Protect plant roots from disease-causing organisms. • Some bacteria fix N_2. • Some fungi form mycorrhizal associations with roots and deliver nutrients (such as P) and water to the plant.
Pathogens **Parasites**	• Bacteria • Fungi • Nematodes • Microarthropods	**Promote disease** • Consume roots and other plant parts, causing disease. • Parasitize nematodes or insects, including disease-causing organisms.
Root-feeders	• Nematodes • Macroarthropods (e.g., cutworm, weevil larvae, & symphylans)	**Consume plant roots** • Potentially cause significant crop yield losses.
Bacterial-feeders	• Protozoa • Nematodes	**Graze** • Release plant available nitrogen (NH_4^+) and other nutrients when feeding on bacteria. • Control many root-feeding or disease-causing pests. • Stimulate and control the activity of bacterial populations.
Fungal-feeders	• Nematodes • Microarthropods	**Graze** • Release plant available nitrogen (NH_4^+) and other nutrients when feeding on fungi. • Control many root-feeding or disease-causing pests. • Stimulate and control the activity of fungal populations.
Shredders	• Earthworms • Macroarthropods	**Break down residue and enhance soil structure** • Shred plant litter as they feed on bacteria and fungi. • Provide habitat for bacteria in their guts and fecal pellets. • Enhance soil structure as they produce fecal pellets and burrow through soil.
Higher-level predators	• Nematode-feeding nematodes • Larger arthropods, mice, voles, shrews, birds, other above-ground animals	**Control populations** • Control the populations of lower trophic-level predators. • Larger organisms improve soil structure by burrowing and by passing soil through their guts. • Larger organisms carry smaller organisms long distances.

Source: Soil Biology Primer
Natural Resources Conservation Service
United States Dept of Agriculture
http://soils.usda.gov/sqi/concepts/soil_biology/soil_food_web.html

Soil as an EcoSystem

Topic

Soil Life

Learning Outcomes

To gain an understanding of the soil as a living environment and the interrelating life cycles contained therein

Time

60 minutes

Materials / Resources

- charts that describe the *Soil Food Web* with back-up charts on the functions of soil organisms and glossary of terms

Instructions

1. Through drawing, charts and written descriptions, encourage students to create and describe the *Soil Food Web* and the many interconnections.
2. As a variable, suggest potential changes that could appear and describe their impact on the sustainability of the *Soil Food Web*.

Eg. topsoil is removed for new building construction; trees are cut down; drought; pesticide use

Discussion / Questions

What are some of the factors that could upset the balance of the soil's ecosystem?

How can a soil's ecosystem be improved?

Can you describe what differences there might be in a soil's ecosystem as found in a forest? a desert? in a city? on a farm?

What is the impact of climate change on a soil's ecosystem?

RESOURCES

Websites

Faculty of Land and Food Systems
University of British Columbia
http://www.landfood.ubc.ca/soil200/index.htm

Dig It! The Secrets of Soil
Smithsonian: National Museum of Natural History
http://forces.si.edu/soils/index.html

Series of Information Pages, created as part of SOILS *exhibit*
→ an useful backgrounder as well as overview introduction
Smithsonian: National Museum of Natural History
http://forces.si.edu/soils/02_00_00.html

Videos

A Great Introduction!

Soil: The Secret Ingredient
Smithsonian: National Museum of Natural History
http://forces.si.edu/soils/video/secret_ingredient.html

Get Soil Savvy
Smithsonian: National Museum of Natural History
http://forces.si.edu/soils/video/soil_savvy.html

Soil
National Geographic Digital Motion Video
http://www.natgeoeducationvideo.com/film/1224/soil

About Soil

Different Soil Types
ThingsGreen.com
http://www.thingsgreen.com/things-green-tv/viewvideo/78/different-soil-types

Soil in the Garden
ThingsGreen.com
http://www.youtube.com/watch?v=e6n0LqHHlBU

How Water Moves through Soil
ThingsGreen.com
http://www.youtube.com/watch?v=QEj6VOXPGd8

Soil and Erosion

Weathering & Erosion
WatchKnowLearn.org
http://www.watchknowlearn.org/Video.aspx?VideoID=13256&CategoryID=2443

Causing the Erosion
Bill Nye the Science Guy Song – Erosion
http://www.youtube.com/watch?v=09OvdYCcEEw&feature=player_embedded

Weathering, Erosion and Deposition
Bilingual Science
http://www.youtube.com/watch?v=R48zYr-S7v0

Decomposition

Matters of Life and Death
Smithsonian: National Museum of Natural History
http://forces.si.edu/soils/video/mold.html

Soil Horizons

The 4 Horizons
4-H USA, Montana State University & terraPOD
www.vimeo.com/3427895

Organizations

Soil Conservation Council of Canada

www.soilcc.ca

Box 998
Indian Head, SK S0G 2K0

Ph: 306 972 7293

The Compost Council of Canada

www.compost.org

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New Brunswick Soil and Crop Improvement Association (NBSCIA)

www.nbscia.ca

Nova Scotia Soil and Crop Improvement Association (SCIANS)

www.scians.org

Ontario Soil and Crop Improvement Association (OSCIA)

www.ontariosoilcrop.org

Prince Edward Island Soil and Crop Improvement Association (PEISCIA)

www.peiscia.ca