*Growing Up Organic operates on traditional and unceded territory of the Algonquins: now known to many as Ottawa, and now home to many from across Turtle Island and beyond.*

Grades 6-8

# Pop Bottle Composting Workshop

Mindfulness minute: If it speaks to you, take two minutes with your students before this workshop to slow down and root down with this mindfulness minute.

## *LESSON FOCUS AND GOALS*

*In this workshop, students work in groups to explore the soil. They learn to distinguish what makes healthy soil and get to identify whether it is healthy or not. They get to understand why having healthy soil is so essential and how to keep it that way.*

## *LEARNING OBJECTIVES*

**Grade 6**

**Science and Technology: Understanding Earth and Space Systems**

**SPECIFIC EXPECTATIONS:**

2.1 - Follow established safety procedures for outdoor activities and field work;
2.4 - Use appropriate science and technology vocabulary, including classification, biodiversity, natural community, interrelationships, vertebrate, invertebrate, stability, characteristics, and organism, in oral and written communication

**Mathematics: Operations**

**SPECIFIC EXPECTATIONS:**

B2 - Use knowledge of numbers and operations to solve mathematical problems encountered in everyday life

**SPECIFIC EXPECTATIONS:**

B2.1 - Use the properties of operations, and the relationships between operations, to solve problems involving whole numbers, decimal numbers, fractions, ratios, rates, and whole number percents, including those requiring multiple steps or multiple operations

***Grade 7***

**Science and Technology: Understanding Life Systems**

**OVERALL EXPECTATIONS:**

1-Assess the impacts of human activities and technologies on the environment, and evaluate ways of controlling these impacts
2-Investigate interactions within the environment, and identify factors that affect the balance between different components of an ecosystem

**SPECIFIC EXPECTATIONS:**

2.2 - Design and construct a model ecosystem and use it to investigate interactions between the biotic and abiotic components in an ecosystem
3.1 - Demonstrate an understanding of an ecosystem as a system of interactions between living organisms and their environment
3.2 - Identify biotic and abiotic elements in an ecosystem, and describe the interactions between them
3.3 - Describe the roles and interactions of producers, consumers, and decomposers within an ecosystem
3.5 - Describe how matter is cycled within the environment and explain how it promotes sustainability

**Grade 8**

**Science and Technology: Understanding Structures and Mechanisms**

**OVERALL EXPECTATIONS:**

1-Assess the personal, social, and/or environmental impacts of a system, and evaluate improvements to a system and/or alternative ways of meeting the same needs
2-Investigate a working system and the ways in which components of the system contribute to its desired function
3-Demonstrate an understanding of different types of systems and the factors that contribute to their safe and efficient operation

**SPECIFIC EXPECTATIONS:**

3.2 - Identify the purpose, inputs, and outputs of various systems

**Geography: Global Settlement**

**SPECIFIC EXPECTATIONS:**

A1.3 - Describe possible features of a sustainable community in the future, and analyse some challenges associated with creating such a community
A3.5 - Describe various ways in which human settlement has affected the environment
A3.6 - Describe some practices that individuals and communities have adopted to help make human settlements more sustainable (e.g., reducing water use, increasing recycling and composting, limiting the construction of housing on land that could be used for agriculture, using public transit, planting and maintaining trees).

## *MATERIALS NEEDED*

2 plastic pop bottles for every 3-4 students
Clear packing Tape
Elastic bands
Cheesecloth
Scissors, exacto blades
Pop bottle labels
Spray bottle with water
Browns (dried grass or leaves, wood chips, etc.)
Greens (grass clippings, fruit and vegetable peelings, coffee grinds etc.)
Garden soil
Shredded newspaper
Waterproof markers

## *STRUCTURE / ACTIVITY*

**Part One: What is compost?**

The purpose of today's activity is to build an ecosystem: can anybody tell me what an ecosystem is?

Ecosystem: A complex system that comprises living organisms and their environment, which interact as a unit.

The ecosystem we are going to build today is in the form of a composter. A lot of the time we don't realize that the process of decomposing and building compost involves many different players acting as a unit. What is it that allows organic materials to decompose?

**Microorganisms:** bacteria, fungi and a host of other miniature creatures that break down organic matter and recycle its nutrients. Almost everything around us that was once alive can be composted. Some things take a short amount of time, like our lunch scraps, and other things, like a pair of leather shoes, take a lot of time.

**Part two: Decomposing (if time permits)**

With the help of the Powerpoint Presentation, query students on how long they think it will take the following items to decompose in a landfill. This game can be structured as a competition by dividing the class into two teams and assigning points to correct answers.

- Banana peel 2 – 10 days
- Cotton rags 1 – 5 months
- Paper 2 – 5 months
- Rope 3 – 14 months
- Orange peels 6 months
- Wool socks 1 – 5 years
- Cigarette filters 1 – 12 years
- Tetra packs 5 years
- Plastic bags 10 – 20 years
- Leather shoes 25 – 40 years
- Nylon fabric 30 – 40 years
- Diapers 500 – 800 years
- Tin cans 50 - 100 years
- Aluminum cans 80 - 100 years
- Styrofoam cup non-biodegradable

*(Source: Learning for a Sustainable Future, 2008)*

What is essential to building a good composter ecosystem, especially if we want the outcome to be nutrient-rich compost for the garden, is providing these microorganisms with the right proportions of essential ingredients.

Microorganisms need an energy source, a protein source, water and oxygen.

1. Energy Source Carbon (Browns)
2. Protein Source Nitrogen (Greens)
3. Water  Moisture
4. Oxygen  Aeration

All organic matter is made up of large amounts of carbon and lesser amounts of nitrogen. Generally, we call materials that are especially high in Carbon 'Browns'; these are things like dry leaves, shredded paper, ash, woodchips, sawdust, pine needles, etc. Things that are high in Nitrogen, although still proportionately higher in Carbon, we call 'Greens'; these are things like food waste, coffee ground, weeds from the garden and grass clippings.

Ideally in the composter, we're looking for a ratio of 30 parts carbon to 1-part nitrogen. This is a microorganism's balanced diet. This ratio describes the chemical ratio and does not mean that you need a volume of brown materials that is thirty times greater than the amount of green matter! Remember, all compostable materials contain carbon and nitrogen; however, they generally do not fit the 30 to 1 ratio. Anything that has a Carbon (C) to Nitrogen (N) ratio smaller than 30 to 1 is generally considered a 'Green', while anything that has a C to N ratio larger than 30 to 1 is generally considered a 'Brown'.

Grass clippings have a C to N ratio of 20 to 1 (too much nitrogen), whereas dry tree leaves have a C to N ratio of 40 to 1 (too much carbon). We try to mix browns and greens to get the right ratio. If the carbon content is too high (too many browns) decomposition slows down, but if there is too much nitrogen, the microorganisms can't ingest it all and it evaporates as strong smelling ammonia gas and is lost in the air. This is why often times our kitchen green bins are smelly because there are too many 'Greens' (kitchen scraps) and not enough 'Browns' (leaves, etc.).

Generally speaking, to get the 30 to 1 magic ratio we want to mix 2 parts 'Greens' to 1 part 'Browns'. Keep this in mind when constructing your composter today.

| | |
|---|---|
| Vegetable Scraps 17:1 | Leaves 60-80:1 |
| Coffee Grounds 25:1 | Straw 90:1 |
| Fresh Grass Clippings 17:1 | Sawdust 500:1 (use sparingly) |
| Fresh Weeds 20:1 | Twigs 700:1 (use sparingly) |
| Fruit Wastes 25-40:1 | Shredded Newspaper 175:1 (Has no nutrient content) |
| Humus (Rich Soil) 10:1 (use to seal the pile by putting 1-2 inches on top) | Pine Needles 80:1 (Very acidic, breaks down slowly) |

Source: www.homecompostingmadeeasy.com/carbonnitrogenratio.html

## Part Three: Building a composter

1.Label your two bottles A and B. Draw a loop half way around bottle A and using scissors or an exacto knife, carefully cut the bottle in half by following the line. Make sure both halves are labeled A.
2.Draw a loop close to the bottom of bottle B. Using scissors or an exacto, carefully cut the bottle by following the line.
3.Take the cap off bottle B and place a piece of cheesecloth around the top with an elastic band.
4.Turn bottle B upside down and fit it into the bottom of bottle A. Take some tape and secure the seams.
5.Using a push pin, poke some holes up and down the bottles to let air come in.
6.Decide on your organic materials, trying to stick to a ratio of two parts 'Green' to one part 'Brown.' Estimate your volumes.
7.Fill your upside-down Bottle B with layers of composting materials; put a layer of soil in the bottom. Add a layer of 'Greens'. Continue this layering, incorporating 'Brown' materials as well. Record the contents you included on your label.
8.Take the spray bottle and spray a bit of water onto the mixture. No additional water should drain from the column at the onset.
9. Now you are ready to watch the composting process at work! Record the level of volume in your bottle over the next four weeks on your data sheet along with any other observations on texture, smell, etc.
10.Use one of the pop-bottle composters to observe temperature change by punching a small hole in the sides of the column with a large, hot nail and putting a meat thermometer into the decaying matter. Record the temperature change over the next four weeks on your data sheet.