

Program Title: What makes up soil? Part 2: Compost and Worms

Duration: 50 minutes

Grade level: Kindergarten

Theme(s): Compost feeds the soil, the worms, and our plants!

Goal(s):

Students will learn that compost is a way to feed soil, providing both food and shelter for worms and eventually nutrients for plants.

Objective(s):

<u>Students Will Be Able To:</u>	<u>Educator verification method</u>
1. Review their understanding of soil, what it is made from and where it can be found.	Drawing from their previous lesson, students will share what they can find in the soil, including reviewing some of the creatures, and the plant parts (roots) that live in the soil.
2. Describe the anatomy of a worm and discuss what worms need in order to survive.	Through a puppet show, students will get an introduction to worm anatomy and will be asked to help describe what worms eat. Through building a worm home, they will play a role in providing a worm the food and materials it needs.
3. Compare the materials that make up a compost pile and identify the compost pile as a worm home.	Students interact with and learn the important roles of different “green” and “brown” materials in a compost pile, adding a balance of both to their worm homes/compost chambers.
4. Examine the steps and components of decomposition and composting.	Drawing from their previous experiences (watching a pumpkin, or other veggies and fruits “rot”) through the Squirmy puppet show, and through acting it out, students will be able to explain that decomposition is the process of breaking down old plant parts to make new soil.
5. Describe the value of worms on the farm and their role as decomposers, making food for plants.	Students can explain how worms help decompose old plant parts & release nutrients back into the soil (eating & pooping), as well as digging tunnels, improving water & air flow in the soil. Drawing from their knowledge, students will predict what will happen in the compost chambers with and without worms.

Teacher Background:

As organic farmers, the health of our soil is a top priority. Worms and other decomposers like fungus, bacteria, and other invertebrates play an important role breaking down old plant parts to release nutrients back into the soil to continue feeding our crops. It is helpful to read the book *Compost Stew* prior to this lesson.

Decomposition simple description:

Bacteria, worms, fungi and other creatures eat materials such as food scraps and plant parts, breaking them down into soil-like material, becoming food for plants.

Compost simple description:

Compost is like recycling for plant nutrients. Composting is working with nature's nutrient cycles to decompose organic matter (living or once-living materials) under controlled conditions, to produce natural fertilizer or plant food to build garden soil. Composting is one way to reduce the waste going to landfills. Within a healthy compost system, there is a maintained ratio of carbon-rich materials known as "browns," and nitrogen-rich materials known as "greens."

Decomposers:

Organisms that eat or consume plant parts and decomposing materials: Fungi, bacteria, snails, slugs, flies, pillbugs (rollie pollies), worms, millipedes.

Predators in the compost pile: centipedes, predatory mites, pseudoscorpions, ground beetles.

Materials/Preparation:

- Squirmy the Worm Puppet
- Squirmy introduction skit script (attached)
- Hand lenses (1 per student)
- Four compost chambers per class: 2-liter bottle or clear, medium size plastic tub prepared for composting (see attached design)
- Tablecloths (1 per student table)
- Plastic trays on "browns" tables for containing the mess.
- Two containers each of the following ingredients for building the compost chamber:
 - Chopped green material
 - Shredded brown material
 - Soil (potting or from farm)
 - Extra worms (one handful per class)
- Large poster and coloring materials for each sensory table (four posters, two "browns," two "greens")
- Chamber labels (2 sets included) with "worms" and "no worms" labels.
- Four permanent markers for marking volume of materials in compost chambers
- Compost Layers Visual (attached)
- Food scrap props (extra smelly/slimy ones can be in plastic bags)

“Greens”- nitrogen	“Browns”- carbon
<ul style="list-style-type: none"> ○ Rotting Pumpkin ○ Banana peel ○ Apple core ○ Carrot tops ○ Coffee grounds ○ Egg shells ○ Lettuce or leafy greens ○ Grass clippings 	<ul style="list-style-type: none"> ○ Dry leaves ○ Cardboard scraps ○ Wood chips ○ Small sticks ○ Straw/hay ○ Corn stalks ○ Newspaper shreds ○ Paper towels

Introduction: (10 min) Entire class seated on carpet.

Background Information (5 mins): With this activity students will revisit that soil is a place where both plant roots grow and where underground creatures live. They will identify what living things in the soil eat and how to feed them. On farms, we feed them by composting! Because of that compost, our soil is alive.

Educator: *Remember the last time Oxbow Farmers visited your classroom? We learned about a very important part of our world: the soil! What did we find in the soil? [Allow time for students to share.] There are so many things that make up soil but my very favorite things are all the living creatures that call the soil their home. We brought one of our very special underground friends to class today to share with you why the soil is the perfect habitat for them!*

Use the worm puppet (Squirmy) for the remainder of the introduction. [See attached script.]

Transition into Compost Building Activity: Let’s spend some time looking a little closer at all the food that worms eat and see if we can build them a perfect habitat out of the materials we brought today.

[Introduce activity rules, teacher helps set expectations].

Sensory Tables Activity: (25 min)

Background Information: With this activity students will understand what makes up compost and how compost can provide a healthy habitat for living things. These living things help to break down the compostable material and create healthy soil.

Intro to Activity: (5 min)

Educator and students recall that there are many types of materials worms need in their home. Explain that while you have looked closely at soil together, you’ll now be looking at two new kinds of things worms need: green materials and brown materials. Together, you’ll find out how each one of those ingredients helps to build the perfect home for the creatures that live in our soil.

Sensory Tables (16 minutes total, 8 minutes at each table)

For a group of about 24-30, set up four Stations (2 green stations and 2 brown stations.) Divide group into four groups of approximately 6 students so that each group can visit both materials at different labeled stations. Each group of students will visit one green and one brown station. Students will have

the opportunity to make hands-on observations of different materials and record their observations (written and illustrated) on group posters.

Educators, with help from classroom teachers, will facilitate movement of stations and the exploration of materials at each location.

Greens Station (Nitrogen- vitamins/moisture):



Students explore green materials with senses and hand lenses. Use the following guiding questions:

- What are all of these things? What do you notice about them? Do they have anything in common? [wet, slimy, not 100% dead, plant parts]
- How does this part of the compost help a worm home? [this keeps their home wet]
- The green materials are the worms' favorite part of their home. Eating this material helps the worms **build their bodies**, getting strong and growing big, just like drinking milk and taking vitamins.
- Ask students to recall the white buckets at Oxbow. What was put in those buckets? The food scraps that they added is the "green material" that can be worm food.
- Can there be too much of the green materials? What would happen? [their habitat will be too wet, too smelly, not enough air]
- What would happen if we only ate vitamins for dinner? We would still be hungry. If worms only ate green material, they would still be hungry too and they might get sick.
- Why are they called "green materials"—are they all green? They call them green materials because they are fresh or raw materials, not dried out and dead. Many fresh plant materials are green.

[After 8 minutes, student groups rotate once, clockwise or counterclockwise, to the next table station. (Rotating to two stations total: the Brown and the Greens stations)]

Browns Station (Carbon- food/bedding):



Educators help facilitate the breakdown of brown materials. Have students tear up straw into fine pieces and tear up newspaper/cardboard to start the decomposition process.

- What do you notice about all of these materials? What do they have in common? [Dry, brittle, “dead.”]
- How do you think this helps a worm home? [It helps to keep air in it, it gives them something chewy to eat, it can help dry out their home when it rains too much, etc.]
- This brown material is really important for a worm home. It is a great bedroom for all the critters, and if they get hungry in the middle of the night, worms can eat right from their beds! **The “browns” give them energy** like eating bread or a spaghetti dinner.
- Can there be too much of the brown materials? If worms have too much brown material in their home, they won’t have any room in their tummies for their vitamins (the green material.) Just like you and me, worms need both food and vitamins to grow big and strong.
- Don’t give them too much food/bedding (brown materials) their homes will be a little too dry for their liking— remember that worms like their homes to be a little soggy.
- By tearing the brown material into smaller pieces, the worms and other organisms have a head start on breaking them down.

Transition Students to the Worm Home Building Stations: Remind students that the brown materials, the green materials, and the soil they explored with Oxbow during the last visit are three very important parts of a worm home. Have students list off the parts to build a worm home together: 1. Soil, 2. Green materials, and 3. Brown materials. Tell students that together you’re going to build a worm home layer by layer in a pattern, so it looks like a green and brown tower!

[Staying at their same table, instructors pull out additional materials and diagram to begin building the compost chamber, involving students in adding materials and repeating the pattern. Four chambers are made in total for demonstration.]

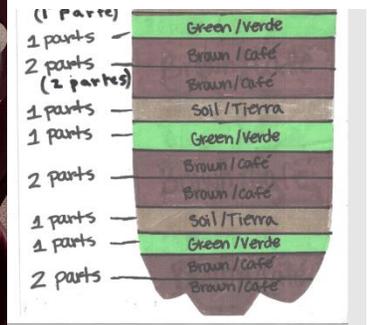
Worm Home Building/ Compost Chamber Construction (8 minutes)

Background Information: In four groups at separate stations, students and educators will build worm homes (one per station) by layering the greens, the browns, and the soil in plastic compost chambers ([see diagram](#)). Make a line with a permanent marker at the top of each layer of the material in the chamber and apply material labels to the side of the chamber so students can make observations about the volume of material over time. In total, the class will build four worm home/compost chambers using

identical amounts and types of ingredients. Note: Two of these four chambers will be kept and used for the experiment. Two are demos to facilitate student participation and will be disassembled.



Blueprint for compost chamber.



Conclusion: (10 min) Back at the carpet

[Instructors bring compost chambers from student table groups to a table, desk or floorspace at the front of the room while students transition to the carpet.]

What a great habitat for our friends who live in the soil. But I have a surprise! We built a worm home, but we also built something else. We built a compost pile. Do you remember reading the book Compost Stew? Composting is what happens when worms, bugs, and tiny creatures turn old food scraps into soil that is healthy for plants to grow in. It is like recycling for plant parts!

But your worm homes will take a LONG time to turn into compost. We are going to have to be so patient and check on our worm homes over time to see what happens. These habitats will live in your classroom and you will get to watch the green and brown materials decompose (recall decomposition action) or be gobbled up and broken into little pieces by the critters living inside. OH! I almost forgot!!! We have to invite some of Squirmy’s friends to stay in one of our homes we built!

[Educators will choose one chamber to place several worms inside, and one chamber will remain without worms. Ask some inquiry/guiding questions from below.]

*We are putting worms in only one of the compost piles, why do you think we are doing this? We’re starting an experiment where we’re asking the question: **“What will happen to the materials in our compost chambers over time, with and without worms?”** We want to know if the worms make a difference in how these materials decompose over time. What difference do you think adding worms will make?*

[Write the research question on the board, giving space for recording student predictions under “with worms” and “without worms.”]

Record predictions and leave them with the teacher to revisit over time.

Inquiry/Guiding Questions:

- What do you think will happen to your worm homes overtime?
- How long will it take for the worm home to change into compost?
- In what ways will the compost without worms added will break down/decompose differently than the compost with worms in it?
- What signs of worm activity can we observe?
- How will we know if decomposition is occurring? (What clues will we find?)
- What will look different between the compost chamber with worms compared to the one without?
- Will the worms themselves go through any changes? In what ways?
- How will we know if the worms are happy and healthy in their home?
- We added ___# of worms, if we count again in a month, do you think we will find the same number of worms? More? Less?
- **If there weren't any bugs and worms around to eat our food scraps, what do you think our world would look like?**

NGSS 3-Dimensions Connections:

Performance Expectation (P.E.) supported:	
K-ESS3-1: Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.	
K-LS1-1: Use observations to describe patterns of what plants and animals (including humans) need to survive.	
Dimensions from Framework	What students are doing
Science and Engineering Practices (SEP)	
Constructing explanations	Based on observations and through group discussion, students explain what contributes to healthy soil. Students can explain the needs of worms and how their bodies compare to humans. Students can explain how compost provides a good habitat for worms and how worms help turn food scraps into nutrient-rich soil for growing plants.
Planning and Carrying Out Investigations	With guidance, students build two compost “trials” and make predictions about what they might observe over time, regularly checking their compost chambers and recording changes they observe, noting differences between the chamber with worms vs. without, and making claims with evidence about why there might be differences between the results of the trials.

Asking Questions	Students ask open-ended questions based on observation. Students are provided time to ask questions to Squirmy and to investigate questions they might have about “greens” vs “browns” through hands-on exploration of the materials. Students will make predictions and contribute to the scientific question, “What will happen to the materials over time in our compost chambers, with and without worms?”
Developing and using models	Students participate in building a model worm home/compost pile. The materials added to the compost chamber will each be defined based on how they are needed by worms. The compost pile model is referred to as a “worm home” to demonstrate the relationship between worms, compost materials, and the process of decomposition.
Disciplinary Core Ideas (DCI)	
ESS3.A: Natural Resources	Students will identify the key resources worms need to survive and will learn that worms cannot live in locations that lack these resources. Students explore how worms and other decomposers help create a very valuable resource for people: fertile, nutrient-rich soil where we can grow food.
LS1: Structures and Function	Students make and share observations about worm habitat needs and how a worm’s body helps it survive. Students compare worm and human bodies (structures) and habitats (needs,) noting similarities and differences.
LS1.C: Organization for Matter and Energy Flow in Organisms	Students will examine from where worms get their energy. They will explore what happens to plant matter after a worm eats the plant and how worm castings play an important role as the food source for plants. This lesson provides an introduction to the concept of nutrient cycling in an ecosystem.
LS2.A: Interdependent Relationships in Ecosystems	Through the composting experiment, students see the impact worms have on decomposition rates. Students explore the relationship between different kinds of organic material and the habitat needs of worms. Students discuss how the basic process of decomposition affects farming and our natural world.
Crosscutting Concepts (CC)	

Patterns	Students recognize patterns between different animals habitat needs and their body structures. They also create a pattern when layering ingredients in their compost chamber, predicting what will come next sequentially.
Scale, Proportion, and Quantity	Students measure each portion of their compost chamber mix, adding specific amounts of each material to ensure the two chambers are built the same.
Energy and Matter: Flows, Cycles, and Conservation	Students explore how composting “recycles” plant nutrients, transferring energy from dead plant parts to animals to the soil, which then helps more plants grow.
Structure and Function	Students learn about worm anatomy and review the plant structure (roots) that live in the soil. Students are introduced to how the structure of these organisms help them survive or perform their functions.
Stability and Change	Observing the compost chambers over time reveals how worms affect the decomposition process, changing organic material into usable compost more quickly than composting without worms. Students make predictions about how the compost towers will change over time.

Five E Learning Model:

Engage: How does the lesson pique the learner’s interest and allow them to express their existing thoughts and opinions on the subject?	Students are invited to share what they know about what makes up soil (explored in Part 1) and share ideas for how to build the best worm habitat. They will revisit using adjectives while doing hands-on observations with rotting materials.
Explore: How does the lesson allow students to interact with each other and observe their surroundings. Does the lesson include problem solving or coming up with an answer to the question?	Students have the opportunity to look at, smell, and touch the ingredients for their compost chambers. The compost chamber activity sets students up to make observations over time to answer the question, “What will happen over time to the material in our compost chambers, with and without worms?”
Explain/Elaborate: How does the lesson help students make a connection between new and former experiences. How does the lesson encourage students to record, reflect, and explain their new understanding to others?	Students recall what they learned about what makes up the soil and learn through hands-on experience about the organic material and living creatures involved in decomposition. They record observations about the different materials put into the chamber and continue to make and share observations about the chambers over time.
Evaluate: How will the students be encouraged to reevaluate their understanding of the phenomena and demonstrate what they have learned?	By revisiting their soil building experiment, students will see decomposition in action over time. They can then apply this knowledge to create a new understanding of how food scrap waste breaks down to build healthy soil, with the help of animals like worms.

Enrichment/Expansion: *(Possible pre & post lesson programming or opportunities to adjust the content for more or less advanced groups).*

Post-Lesson:

- Feed the soil at school; get to know other decomposers
- Diary of a Worm book
<https://www.youtube.com/watch?v=sVSCs8pTJ3M>
- Detailed vermicomposting poster
<https://ecommons.cornell.edu/bitstream/handle/1813/11729/How%20Does%20Composting%20Work%20poster.PDF?sequence=6&isAllowed=y>
- Have students ask the educator and Squirmy any other questions they have for Squirmy.

Resources:

Composting Food and Yard Waste at Home, Natural Yard Care.

<https://snohomishcountywa.gov/DocumentCenter/View/7256>

Backyard Composting, WSU. <http://cru.cahe.wsu.edu/CEPublications/eb1784e/eb1784e.pdf>

Siddals, Mary McKenna. *Compost Stew* <https://www.youtube.com/watch?v=CLYHRPjPclQ>