



School Composting

An Introduction (6-12 Teacher's Guide)

Rationale

Composting is environmentally responsible and allows schools to comply with Vermont's Universal Recycling law. It's good for the earth and the school, and it's a great way for students to learn about food, resource recovery, and closed-loop systems. Composting can also be a great way to bring the school together since it requires participation from the entire learning community.

The practical, hands-on work of collecting food scraps for composting creates opportunities to develop leadership, problem solving and communication skills. Students will see the impact of their actions and better understand the importance of diverting food scraps and organic material from the landfill.

Creating and implementing a composting program is highly interdisciplinary and provides learning opportunities across all subjects. Curriculum can be built around the composting program and individual courses can connect composting to their

relevant content. When students have the opportunity to participate in designing and building the Separation Station, tracking the reduction of the school's carbon footprint, and using compost in the school's garden, they will better understand concepts and demonstrate proficiencies.

It is **essential** that the entire learning community has a basic understanding of composting and their role in the school's program. The success of a school composting program depends on how well the learning community understands the "why" of composting generally, and the "how" of the school's specific system. If individuals in the learning community don't understand what they're being asked to do and why they're being asked to do it, the program will not be successful.

This introductory lesson and accompanying presentation can be used to provide the entire learning community with a basic understanding of composting and how the school program works. It can be used in a large assembly or small classes.



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Duration

This is a self-contained lesson designed for a single class or assembly. It requires a minimum of 40 minutes. Additional information and discussion questions in each of the sections provide opportunities to reinforce learning and extend the lesson.

Learning Objectives

Essential Questions

- What is compost?
- Why should you compost?
- How do you compost?

Enduring Understandings

- Compost is nutrient-rich decomposed organic material
- Composting food scraps creates a healthy closed-loop food system
- School Composting requires the whole learning community to participate

Standards

NGSS - Disciplinary Core Ideas

- **ESS3.C:** Human Impacts on Earth Systems
- **LS2.B:** Cycle of Matter and Energy Transfer in Ecosystems
- **LS2.C:** Ecosystem Dynamics, Functioning, and Resilience

NGSS - Performance Expectations

- **MS-LS2-3** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
- **MS-LS2-5** Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- **MS-ESS3-3** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- **MS-ESS3-4** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
- **HS-LS2-3** Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
- **HS-LS2-7** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **HS-ESS3-2** Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
- **HS-ESS3-4** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Using The Guide

This guide is designed to be used in conjunction with the "School Composting: An Introduction" presentation. The guide follows the presentation and provides the educator with background information, discussion questions, and further learning options.



Learning Plan

Intro

Tell students that their school either has a composting program or is going to be creating one. Explain to students that when they compost their food scraps, they are being environmentally responsible, and actively involved in making their food system healthier and more productive. Tell students that successful school composting programs require the whole learning community to participate, and talk with them about their participation. Explain that the following presentation will give them a basic introduction to composting and what makes it important. Tell them that the presentation will go over what needs to happen in order to compost at their school and emphasize that it's their responsibility to know what to do and why they're doing it.

What Is Compost?

1. Begin by asking students if any of them compost at home. Ask some of the students to describe what "composting" looks like or how they do it at their house.
2. Display the pictures of collected food scraps and ask students if they are compost. Allow students to offer responses, and encourage any students who make the distinction between food scraps and compost to explain further.
3. Explain that food scraps are just one ingredient needed when making compost, and that they need to be combined with other materials such as hay, straw, wood chips, dried leaves, or shredded paper.
4. Explain that composting is a natural process of decomposition that occurs everywhere. When a tree falls in the forest, it will eventually decompose. There is no waste in nature. The dead tree breaks down into soil providing nutrients for new trees and plants to grow.
5. When we make compost we are just speeding up nature in a controlled process. So compost is just:

Organic materials that have decomposed to the point where living plants can reuse the nutrients. It is used to build soil structure and fertility.

HOW DO YOU MAKE IT?

- a. Tell students that making compost is like cooking. You need to have a recipe, the ingredients, a way to cook it, and the time to make it.
- b. Tell students that compost has a very simple recipe, but that it can vary greatly depending on what its being used for and what ingredients are available. Just like when you make something for dinner, you use what is in your refrigerator and cupboards to make meals that have proteins, carbohydrates, and vitamins because that's what your body needs. Compost needs certain types of ingredients, too.
- c. The basic recipe for compost is:

Nitrogen + Carbon + Oxygen + H₂O + Microbes

- d. Explain the three basic steps to making compost:

Step One: Blend (mix) Your Carbon and Nitrogen

Schools produce large amounts of food scraps which are high in nitrogen. To keep compost ingredients in the right proportion, additional ingredients rich in carbon, such as hay, wood chips, or dried leaves will need to be obtained. Sometimes these can be acquired for free, but often must be purchased, which is a significant portion of the operational expense. Conversely, if someone had lots of hay or leaves to compost, they would need ingredients high in nitrogen like food scraps, manure, fresh yard debris, or grass and garden clippings to make a good batch of compost.

Step Two: Add Air- Turn and Aerate the Pile

Turning a compost pile adds oxygen (air), which allows the material to decompose properly. There are several ways to turn a pile depending on the pile's size and the technology available. Home or small-scale bin systems can be turned by hand, using a pitchfork or shovel, while larger commercial compost facilities use a loader or a Windrow Turner (pictured in the presentation) to blend ingredients and add air to the pile. With a technology called Aerated Static Pile, air can even be added without turning by building the compost pile on tubes that force air up through the pile. Mixing or blending the ingredients creates the right consistency, just



like when cooking, and adding air helps the billions of microorganisms in the compost pile do their job decomposing material.

Step Three: Let The Microbes Do Their Job

There are over 1 billion microorganisms in 1 tsp. of compost! 90% of them are bacteria that aerobically (use oxygen) break down the decomposing material, generating heat in the process. Oxygen is essential for aerobic decomposition; while some decomposition can occur anaerobically (without oxygen), it is much slower and releases terrible smells and methane, a harmful greenhouse gas. The heat generated during aerobic decomposition further accelerates the breakdown of organic material. Large, well-aerated piles can get very hot - hot enough that if they maintain temperatures above 131°F for a number of days, it will kill weed seeds and pathogens!

- e. Tell students it usually takes 6-12 months for all the material to completely decompose into nutrient-rich compost that is ready to be used.

WHAT DO YOU USE IT FOR?

- a. Ask students if they have ever used compost. Encourage those who have to explain what they used it for and how they used it.
- b. Ask students if they know some other common ways that compost is used. In general compost is used to organically add nutrients to the soil and eliminates the need for petroleum-based fertilizers, and reduces the need for watering and pesticides.
- c. Compost can be used around the house for potted plants, gardens, landscaping and lawns.
- d. Compost is used by landscapers, grounds crews, and contractors. It's used on golf courses, soccer fields, parks, and commercial developments.
- e. Compost is especially beneficial to farmers and gardeners who depend on the nutrients in their soil to produce agricultural products. Compost is different than chemical fertilizer because it releases nutrients over time, doesn't leach out into our rivers and lakes, and improves the structure and biological composition of the soil while retaining moisture. Compost is essential for farms with organic certification.

- f. Applying compost along eroded riverbanks and shorelines promotes healthy plant growth. The plant roots hold the soil during flooding and filter out harmful substances like phosphorus that cause toxic algae blooms and pollute our rivers and lakes.

Why Compost?

1. Ask students where their food scraps go if they don't separate and compost them. Ask students if they know why putting food scraps in the landfill is a problem. Allow students to offer responses and encourage students who say it's bad for the environment to explain further.
2. Explain that when food scraps are placed in a landfill they decompose slowly and produce methane, a harmful greenhouse gas. The liquid that results from decomposition mixes with trash and creates a toxic sludge called leachate that can pollute ground water.

THE PROBLEM

- a. Explain to students that our current food system is "Linear." Food is grown using fertilizers imported onto farms from far away, while food surplus and scraps are sent to the landfill. The nutrients in the food sent to the landfill are lost and farmers replace nutrients in their soil with artificial fertilizers.
- b. Ask students why they think we have a linear food system and how they think we can recover more nutrients and create a "Closed-Loop" food system.

THE SOLUTION

- a. With the "Closed-Loop" food system slide projected, ask student what is different about this food system. Allow students to respond and encourage them to not just identify the different pictures, but explain how the system changes because of them.
- b. Explain that in a "Closed Loop" system nutrients are recycled back into the soil through composting. Food scraps are collected and turned into nutrient rich organic fertilizer that farmers use to grow more food for us to eat. There is less need for artificial fertilizers, supplemental watering and pesticides because nutrients are recovered, and food is grown as nature intended!



THE LAW

- a. In 2012 the VT Legislature passed the Universal Recycling law. The law covers many different areas of recycling in order to prevent recyclable materials from going into the landfill. Food Scraps are covered under the “Organics Recycling” portion of the law, and after 2020 will no longer be allowed in landfills.
- b. In accordance with the law, many businesses and institutions are starting to keep their food scraps out of the trash. Tell students that soon it will be against the law for their school to throw food scraps in the trash!
- b. The law also adopted the “Food Recovery Hierarchy,” which outlines the preferred uses of food surplus and scraps. Explain to students that reducing food waste and recovering food for people are the first priorities and can go a long way in reducing the amount of food that is wasted or needs to be recycled. Next, wasted food and food scraps should go to feed animals, be composted, or be used to generate energy using digesters.

How Do You Compost?

- 1. The first step to starting or overhauling a school composting program is to form a representative committee of students, administrators, faculty and staff. The committee will develop a plan for the program using the checklist outlined in the “Getting Started With School Composting” resource accompanying this guide.
- 2. Once the committee has decided on a system and made the necessary preparations, the next step is to educate the learning community about why it’s important to compost and what they will need to do. Tell students that it’s their responsibility to know how the compost system works.
- 3. Tell students that designated members from the learning community will serve as the Compost Crew, and oversee implementation of the composting program. The Compost Crew will monitor the Separation Station to ensure that food scraps are separated properly, and they will transport the food scraps to where they will be composted or picked up by a hauler.
- 4. Tell students that the three main components to school composting are Separating, Monitoring and Rotting (decomposing).

SEPARATE

- a. Tell students that collecting food scraps separately from trash and recycling is critical. If the food scraps are contaminated with trash, recyclables, or **anything** that’s not compostable, it reduces the quality of the compost and can cause damage to the equipment used to make it. If your food scraps are being picked up by a hauler they will not take them if they are contaminated!
- b. Tell students that a Separation Station will be built and installed in a central location in the cafeteria (and any other parts of the school where food scraps are generated) to encourage proper separation of food scraps. A separation station consists of separate containers for Food Scraps, Recycling, Dishes, and Trash. Separation stations can be fixed or mobile, and you can build one or use existing buckets or containers.
- c. All containers will be clearly labeled. Signs for each container with common cafeteria items stuck to them are a good way to clearly show what to put in each bucket.
- d. Ask students for examples of things in their cafeteria that can and cannot be composted. Allow them to offer examples and refer to the “School Composting Separation Guide” that accompanies this resource to confirm or correct their responses. Tell students that the “School Composting Separation Guide” (pictured) will be visible when using the separation station. The separation guide should also be posted around the cafeteria and anywhere else food scraps are generated and collected.
- e. Tell students that it is their responsibility to know what can and cannot be composted. Remind them that a successful school composting program requires participation from the entire learning community. Go over the list of common contaminants on the slide with the separation guide.

MONITOR

- a. Tell students that members of the Compost Crew will be assisting with food scrap separation at the Separation Station and if they are unsure of what to put in each of the containers they should ask for help.



- b. Tell students that the Compost Crew is volunteering their time to make the school composting program successful and they will be the ones who have to dig through the compost buckets and remove any contaminants. By separating food scraps properly students can help their fellow students.
- c. The Compost Crew will need to monitor the compost buckets during meals and at the end of the day and remove any contaminants before the food scraps are added to the on-site composting system or stored for the hauler to pick up.

ROT

- a. Tell students that at the end of each day the food scraps that were collected will be transported to the on-site composting system or stored for the hauler to pick up.
- b. The food scraps will be combined with other ingredients and turned periodically to add air. After 6-12 months the food scraps that were collected will be ready to use on a farm, in a garden, or maybe even the school fields or gardens.
- c. If possible, take students to see the on-site composting system, or go on a field trip to the commercial composting facility where the food scraps are composted. This allows students to see active composting and helps them understand the closed-loop system they are creating.

Let's Review

- 1. Play the video "[Composting For Kids](#)."
- 2. When the video is done, ask students if they have any questions about anything that has been covered, or if they have any general questions about school composting.
- 3. Go over the review questions on the final slide and ask students to provide the answers. Confirm or correct answers and allow discussion as time permits.
- 4. After answering all the questions tell student that they now have all the information they need to be school composters. If they have further questions or would like to join the Compost Crew they should contact the Crew Leader.

Extended Learning Activities

- 1. Collect common items from the cafeteria and student lunches and sort them into the appropriate buckets at the "Separation Station."
- 2. Collect common items from the cafeteria and student lunches and create an installation display. Create a compost pile, recycling facility, and a landfill on a large bulletin board or wall and have students attach items in the proper place.
- 3. Have students design a presentation demonstrating a local example of a closed-loop food system.
- 4. Create "Compost Awareness" posters for the school. Research facts about trash, landfills, fertilizers, and composting and have students create posters that encourage their fellow students to compost.
- 5. Build the "Separation Station." Find the materials, assemble the station and label the buckets. Don't forget to post the "School Composting Separation Guide!"
- 6. Volunteer as a class to staff the "Separation Station" at lunch. Educate and assist fellow student with separation of food scraps, recycling and trash.
- 7. Create puppets or make costumes and write a script about composting. Travel to Elementary Schools and perform at lunch or during an assembly. Be creative, the story can be about made-up food scrap characters, or it can feature bacteria, haulers, composters, students, farmers and many others.
- 8. Design, build and manage an "On-Site Composting System."
- 9. Visit your school's on-site compost system or take a field trip to a commercial compost facility or farm that uses compost.
- 10. Use compost from your on-site compost system or the commercial facility you send your food scraps to when planting your school garden.
- 11. Create an installation with a running calculation of how many gallons, pounds or tons of food scraps your school has kept out of the landfill.
- 12. Write letters to a farmer that your school gets food from thanking them for using compost or asking them to use compost.
- 13. Invite a composter, farmer, and/or representative from your solid waste district into the classroom to talk to students and answer questions.

Don't forget to ask students for their ideas!



Photos and Videos

- Highfields Center For Composting

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Content and Design



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Companion Resources:

- School Composting: An Introduction (K-5 Presentation)
- School Composting: An Introduction (6-12 Presentation)
- School Composting: An Introduction (K-5 Teacher's Guide)
- School Composting Manual
- Compost Separation Guide
- On-site Composting For Schools
- Bin System Design Guide
- Bin System Management Guide
- Compost Recipe Guide
- Compost Planning Checklist
- Compost Bin Monitoring Log

