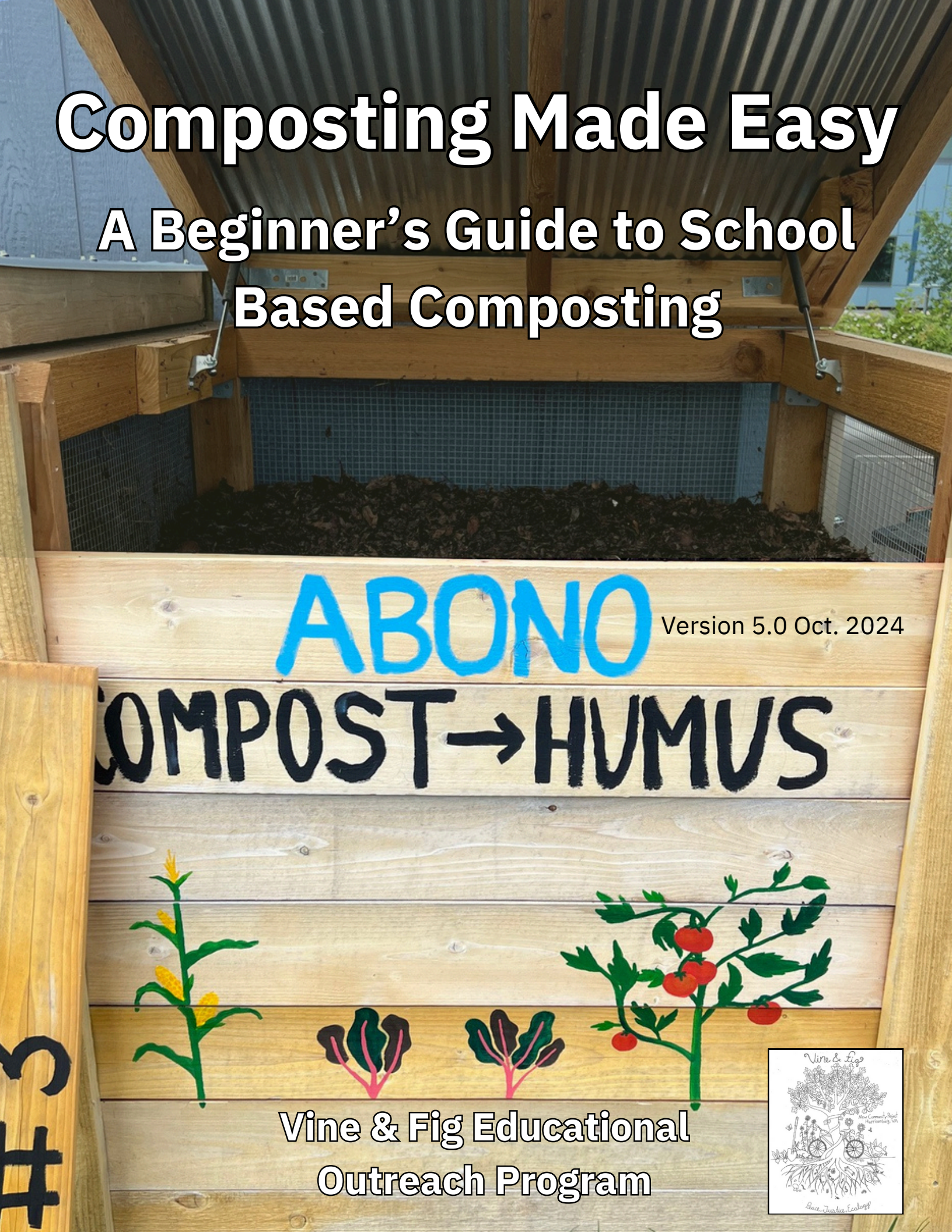
Composting Made Easy

A Beginner's Guide to School Based Composting



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Vine & Fig Educational Outreach Program

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Why Compost?

Did you know it takes a head of lettuce up to **25 years** to decompose in a landfill, but only **2-3 weeks** when composted? (*1*)

We waste a lot of food.

- 30-40% of all food produced in the U.S. is wasted (*10*).
- Schools in the U.S. throw away $5 million of uneaten food each school day (*2*).
- In 2019, the World Wildlife Fund estimated national food waste in schools to be approximately 530,000 tons per year, or 1 billion pounds of food (*28*).

Most of it goes to landfills.

- In 2017, the U.S. generated more than 66 million tons of food waste (*24*). That's about 418 pounds per person!
- Of this food waste, 94% went to landfills and incinerators, while just 6% was composted (*24*).

Composting is better for the planet.

- One ton of dry food waste in a landfill can generate 1/4 ton of the potent greenhouse gas methane (*12*).
- You could save the equivalent of 6 tons of CO2 in emissions by composting.

Composting saves taxpayer dollars.

- On-site composting is not only an educational tool but reduces the amount of waste needing to go to the landfill, thus reducing the cafeteria's operational costs for waste management.
- Purchasing compost as a soil amendment can be expensive. Composting reduces financial costs for a natural fertilizer that is applied to gardens (*25*).

Contents

Introduction

Welcome to Vine & Fig Educational Outreach's School-Based Composting handbook! This manual explains the basics of starting an on-site composting program for schools or community settings. This manual includes the best practices for physical implementation, maintenance, and health and safety. Read on to learn how to bring this exciting practice to your school or community.

Compost Basics

Composting is the process of controlling the decomposition of organic matter and turning it into a useful substance called compost.

Compost can be created out of a wide range of materials, from yard waste to food scraps. After several months or longer, the materials decompose into a rich, dark soil component called humus. This final product can be used in a garden to enhance the growth of plants, by adding nutrients and decreasing compaction (*15*). In this way, composting creates a sustaining cycle that returns organic materials back to the earth to help grow more food.

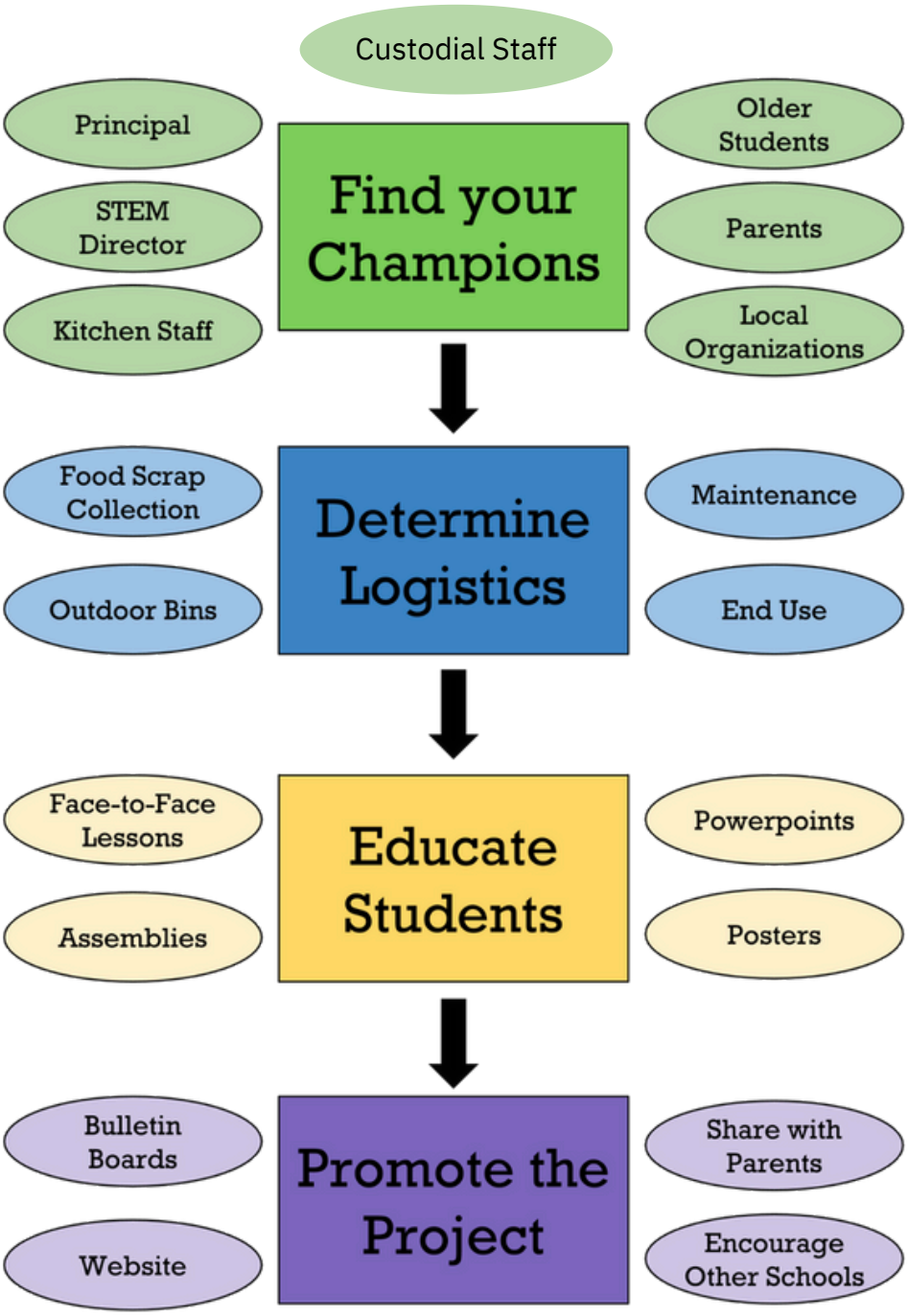
Diverting these materials from landfills also saves space and reduces greenhouse gas emissions. In a tightly packed landfill, organic waste decomposes anaerobically (without oxygen), producing the harmful greenhouse gas methane. However, the same waste decomposes aerobically (with oxygen) in open-air compost systems and does not produce methane (*7*).

Composting can also benefit schools by reducing the cost of waste removal. Some schools and organizations collect compostable materials and have a professional composting operation pick them up to take care of the rest of the process, but the cost savings of an on-site composting system are even greater.

Particularly, composting in a school setting provides numerous educational opportunities. By participating in a composting initiative, students become more aware of environmentally sustainable practices and may encourage their families to start composting at home. Interested students can get more involved with the process by helping to collect scraps, turn the pile, and record totals. Finally, composting can be incorporated into the school curriculum, providing real-life, hands-on activities for a variety of subjects.

Getting Started

Here's a breakdown of steps you might take to get your compost program up and running. See the sections listed to the right for details on each step.



Gather enthusiasm!

Details on pages 6-12

Details in age-specific appendix

Details on page 13-14

Building Blocks

Once you've decided to start a composting system and have a rough plan for how you'll make it happen, it's time to get your hands dirty and begin with the essentials.

Vine & Fig staff collect scraps at HCPS school.

Food Scrap Collection

First, you need a way to collect food scraps. Five-gallon buckets, like those used for drywall, are an easy way to start. **To get students to notice the new option, you can move the trash can a short distance away from its usual spot and replace it with a compost bin.** Clear signage and instructions will help students quickly sort out their waste between garbage and compost. All organic food waste can be composted, but meat and dairy should only be used in a system that takes proper measures to handle them (see the Health and Safety section for details).

To reduce the mess, bin openings should be wide. The school kitchen can also collect food scraps generated while preparing lunch, and these can be combined with the uneaten student food after the lunch period. Thus, having the reward of identifying what foods that are uneaten and lowering cafeteria food costs.

Transferring Scraps

In a school setting at the end of the lunch period, the food scraps must be transferred outside to the compost pile. The scraps should be added to the pile along with carbon-rich materials (see the Maintenance section on page 9 for details), and mixed in to reduce possible pests.

A key component is someone responsible for washing out the collection bins every day after they've been emptied. Kitchen staff could be consulted to see if they are willing to take on the extra task; a bin that can be sent through a commercial dishwasher will make this easier for them.

Food scraps can be transferred on a rolling cart, with a lidded container to deter bees, etc.

Compost Bins

Next, there must be a place to store the compost while it decomposes. This should be in an out-of-the-way location, usually behind the school building or area with level ground where water can drain off (*8*). Ideally, the compost should be kept downhill from a garden, or a barrier can be constructed between the compost and the garden to ensure separation because unfinished compost can drain onto gardens, introducing disease to growing plants (*3*).

Food scraps are collected and put into a compost bin at an elementary school.

A multi-bin system is recommended for schools. It is made up of two or more large wooden holding containers side by side which contain compost in progressively further stages of decomposition (*8*). For example, in a two-bin system, new food scraps are added to one bin. After the bin fills up, its contents are transferred to the second bin (leaving a small amount behind so that some beneficial insects and microorganisms remain), and a new pile is started in the first bin. This allows the large pile to sit and decompose fully without being contaminated by the addition of new materials. In several months, when the compost is dark and soil-like, it can be transferred to the garden, making room for a new pile and continuing the cycle (*8*).

The compost bins should be as close to the ground as possible, to allow beneficial micro- and macro-organisms to move into the pile from the earth beneath. If this isn't a feature of the design you use, some of these organisms can be added intentionally, for example by ordering a batch of red wigglers worms and adding them to the food scraps to aid in decomposition. See page 15 for other organisms that play a role in decomposition.

An example of a three bin system at a city school in Harrisonburg, VA

Detailed plans for the design of this 3-bin composting system can be purchased at the following link urbanfarmplans.com. This system is a high-density, critter-proof compost system that costs Harrisonburg City Public Schools about $4,000 to build using cedar (2022) and with donated labor. Labor would cost approximately $2,000. Holland Elementary School in Vermont built a three-compartment container for less, using cheaper materials to lower the cost, such as wooden pallets from a local business (*13, 23*).

Maintenance

Although food scraps will decompose no matter what you do, there are several steps you can take to make the process safer, faster, and more efficient. If you want to see a multi-bin system in action, Bluestone Elementary in Harrisonburg, VA has one constructed. Please visit when school is not in session.

Temperature

When food scraps decompose, they generate heat, which helps with the most rapid and complete breakdown of materials (*27*). The pile should reach at least 130° F for five days to kill pathogens, and hotter piles decompose faster (*3*). Smaller compost piles lose heat quickly, so make sure yours have enough bulk to maintain high temperatures: about one cubic yard (3' x 3' x 3') is suggested as a minimum (*8*). A drop in temperature indicates that the pile should be turned, or that it's finished with the hot phase of decomposition. A long-stemmed thermometer can be used to take the temperature at the center of the pile (*3*).

Moisture

Compost should be 50-60% water by mass to allow microbes to develop (*27*). Therefore, it requires a mixture of dry ingredients—shredded leaves and sawdust and wet ingredients—fruits and vegetables. A handful of compost squeezed with a fist should feel moist, but not release more than a few drops of liquid (*20*). The challenge is usually getting enough dry ingredients since most food scraps are "wet." To aid with this, it's a good idea to store a supply of bulk dry matter, such as shredded leaves, close to the compost, to be added in conjunction with food.

A long-stemmed thermometer can take the temperature at the center of a compost pile

Vine & Fig staff help transport shredded leaves to a HCPS school and turn compost.

Carbon and Nitrogen

Different organic materials contain different amounts of carbon and nitrogen. If compost is too high in nitrogen, it may become wet and foul-smelling, but if the carbon content is too high, the pile may not heat up and will decompose much more slowly. Materials like sawdust and dry, shredded leaves are high in carbon and are known as “browns,” while food scraps are relatively higher in nitrogen and called“greens” (*15*). The ratio should be roughly twice as many browns as greens (e.g. two handfuls of shredded leaves for every handful of food scraps) (*6*). As with moisture, it’s useful to have a high-carbon material stockpiled to balance out the addition of high-nitrogen foods. However, make sure that these additional materials don’t have any harmful chemicals in them. For example, shredded paper with heavy ink should not be put into the compost, but newspaper is okay (*26*).

Turning the Compost

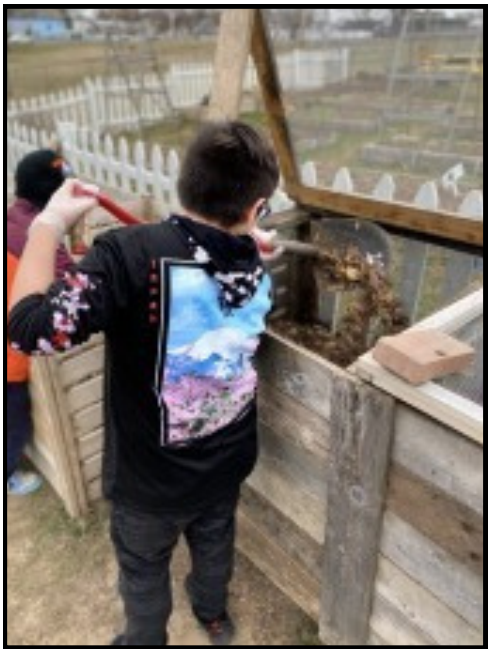
The final step is turning, which simply means re-mixing the pile with a shovel or pitchfork, either in place or by transferring a pile from one bin to another. Turning redistributes the nutrients in the pile, giving micro- and macro-organisms in the center access to less decomposed materials, and it aerates the pile to make sure the decomposition stays aerobic. The pile can be turned when the temperature drops or at regular intervals (*8*).

Health and Safety

With proper precautions, composting is a fun, safe, and healthy activity. However, it's necessary to examine the potential risks associated with it, especially when children are involved.

Student Health

Since some organic materials are allergens, students with allergies should be kept at a safe distance from the compost location. Compost can also release gasses and airborne spores when it is turned, which can cause respiratory problems for sensitive people (*13*). To address this, the pile should only be turned when susceptible people aren't present, wind direction should be monitored, and high-carbon materials should be kept on top since they are less likely to disperse spores. If the pile is dusty, water can be added (*14*).



Students should wear gloves while composting.

Pathogens can be introduced to the pile through plate scrapings, which have a tendency to come into contact with students' mouths. Just as if they were digging through a trash can, anyone who handles the compost should wear gloves and wash their hands thoroughly afterward, and students who have weakened immune systems or are vulnerable to infection should avoid contact with the compost (*13*). If the finished product will be added to a garden, extra precautions should be taken. If a pile remains cool after multiple turnings and looks like soil, it may be finished with the hot phase—but still not done decomposing. At this point, it should sit for another several-month "curing" phase, during which final decomposition occurs (*27*). A"jar test" can be used to determine when this is finished: seal some compost in a jar with a bit of water and let it sit for a week. If the jar smells unpleasant when opened, it's still decomposing and the pile should be left to cure longer. If it smells fresh and earthy, the compost is ready to be used (*27*).

Meat and Dairy

There is some disagreement over whether meat and dairy should be composted, for health reasons. Some sources don't recommend it because of the chance of spreading disease, causing odors, and attracting pests. The EPA advises against composting meat and dairy at home and suggests that they be sent to a larger-scale composting operation.

Others state that in a properly maintained multi-bin system, the large piles will reach high enough temperatures to break down meat and dairy and kill pathogens (*20*). To increase safety, this compost can be left to decompose for at least a year before it is used (*14*). Composting meat and dairy is an efficient use of food waste, but it could take significantly more effort to maintain a safe temperature and deal with the potential increase in pest attraction.

Those wishing to include these items should be ready to invest in proper system design and maintenance.

Students learn which foods can be composted at lunch; they don't compost meet and dairy.

Pest Control

Students learn which foods can be composted at lunch; they don't compost meat and dairy. The last health concern is pests, which understandably tend to visit outdoor compost piles. Insects are not considered a problem with compost and are an important part of natural decay, but rodents and other mammals can be a nuisance and infest or damage the pile (*8*). The best way to deter these guests is to keep the pile covered with non-food items, such as the browns that are used to introduce carbon, and to take special care that odorous items like meats are buried deep (*13*). When the pile is large enough to heat up significantly, food should break down quickly and no longer attract animals.

If mice or raccoons continue to be spotted around the pile, consider adding a latched lid on top and/or wire mesh around the entire container. This can be accomplished by attaching a layer of ¼" hardware cloth around the inside of the wooden bin with a staple gun, ensuring overlap at the corners and joints (*19*).

Community

Starting a composting program is a big project and it's more likely to succeed if you make it a team effort and learn from the many available resources. Ask yourself ... How can we improve our program and make sure it continues to benefit the school and community?

Bringing Others In

To make your composting program robust and sustainable, try to connect it with a network of participants who can each contribute in different ways. In a school setting, full support from your school principal is vital and the composting program coordinator should train cafeteria monitors and others to watch students sort their food waste to limit bin contamination. Kitchen staff may be willing to wash the collection containers each day. Train after-school garden club students to become compost ambassadors for their class or grade level. " Teach the teacher" is important, so one person is not responsible for training everyone.

A bar graph displays the amount composted each month.

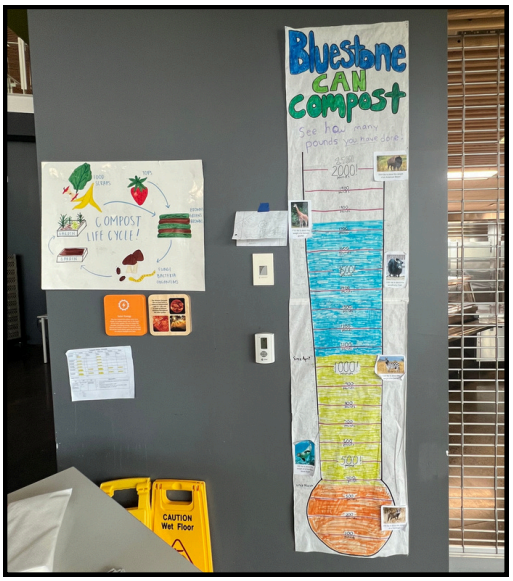

Teacher, custodial staff, and parent coming together to compost.

The appendices contain age-specific supplements for classroom teachers to increase student engagement with environmental stewardship. STEM high school engineering students could construct the 3-bin composter or parents/community members may be able to help or willing to volunteer labor, and local organizations might donate carbon-rich materials to supplement the piles. Local education foundations might also have yearly grants for educators that could support your program.

Promoting the Project

While your compost system is getting underway, and after it's up and running, spread the word! Give updates to parents and teachers and share why it matters. A bulletin board can be a central location for an explanation of the project, pictures, and bar graphs of how much is composted per month. If there are others in your area that are interested in starting to compost, share your experience and advice on what has worked well for your program.

Linked is a School Food Waste Tracking Template, created by Vine & Fig that can be used for data collection of compost over time.



A bar graph displays the amount composted with corresponding animal weights to reference

Additional Resources

This manual is intended as a general guide for starting a composting program in a school setting and is not specific to a grade level. However, since composting in an educational setting can go far beyond just helping the environment, two age-specific supplements (for elementary and middle/high school) have been created with ideas for getting students involved and integrating the program into the school curriculum.

Below are a few comprehensive examples for School-Based Composting:

"A Guide to Composting Onsite at Schools" Linda Bilsens Brolis, Oct. 2018. https://nrcne.org/wp- content/uploads/2019/12/ILSR_Guide_Composting_Onsite_Schools_Oct2018.pdf

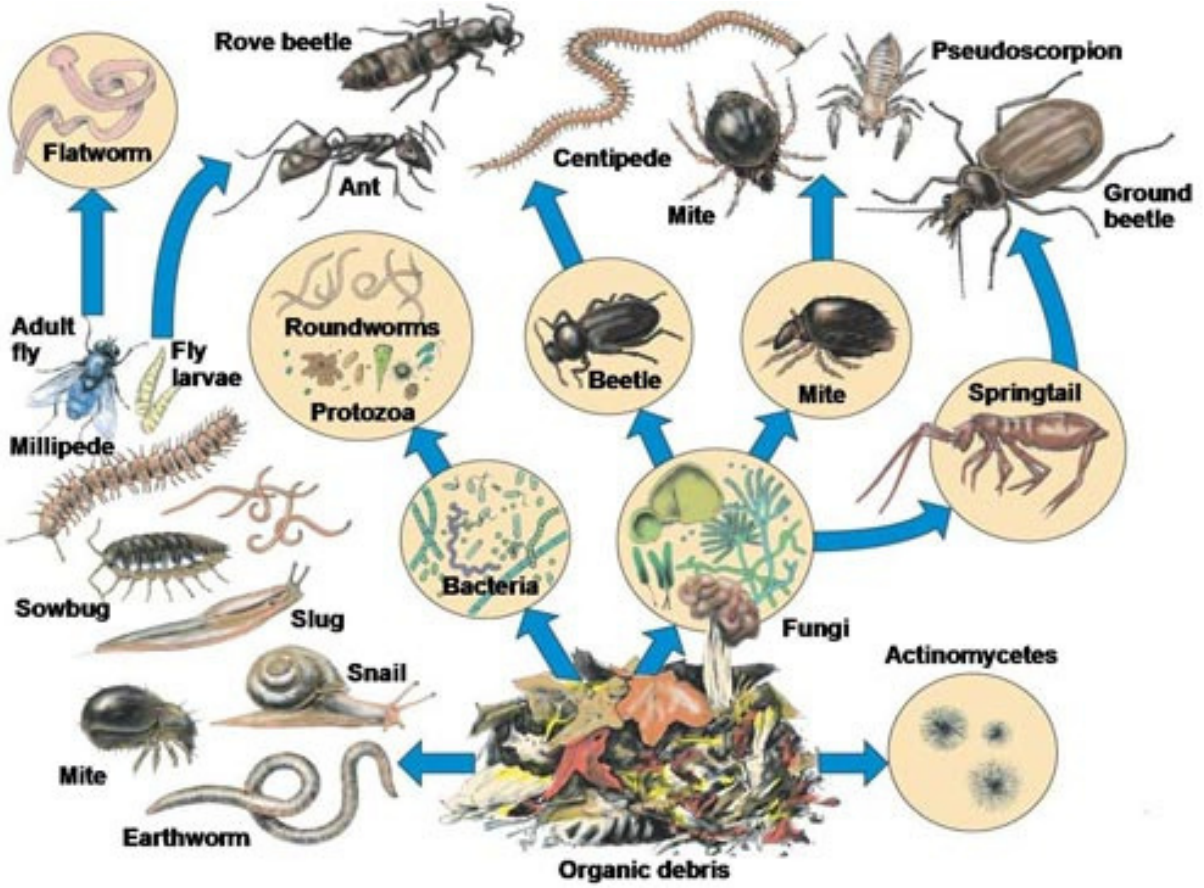
"School Composting: A Manual for Connecticut Schools" Paula Coughlin, 2002. portal.ct.gov/-/media/DEEP/compost/compost_pdf/schmanualpdf.pdf

"A Guide to Starting a Compost Program in Your School" Green Mountain Farm to School, 2010. http://greenmountainfarmtoschool.org/wp-content/uploads/ 2016/01/Guide-to-Staring-a-School-Compost-Program.pdf

"School Composting—Let's Get Growing!" Mary Schwarz and Jean Bonhotal, 2017. compost.css.cornell.edu/SchoolCompostingLetsGetGrowing.pdf

Compost Fun Facts

- The Australian brush turkey builds large piles of decomposing materials and uses the heat from the compost to keep its eggs warm (*4*).
- Increasing the organic matter in an acre of soil by only 1% allows it to hold 16,000 more gallons of water (*5*).
- It takes at least 100 years for one inch of topsoil to form naturally (*16*).
- Red Wiggler worms can eat their own body weight in food scraps in just two days (*11*).
- One teaspoon of compost may contain 400 feet of fungal hyphae, 10,000 protozoa, and a billion bacteria (*19*).



A diagram of some of the micro- and macro-organisms found in a compost pile. Image from www.imbt.org.

Appendix I: Compost Engagement Supplement for

Younger Students

This document is a supplement to *Composting Made Easy: A Beginner's Guide to School-Based Composting*. It describes strategies for engaging elementary school students in a school composting program.

A student adds shredded leaves to the compost pile

Cooperation

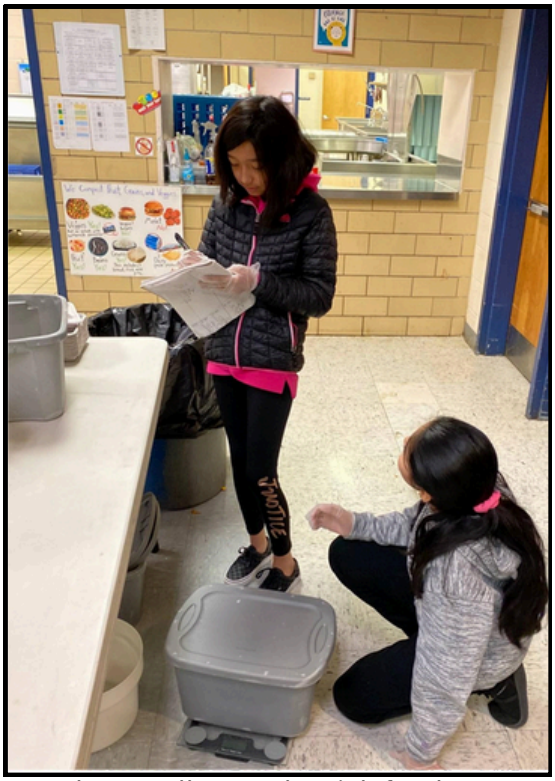
Realistically, students will not immediately buy into the compost system and comply with all the instructions given to them without encouragement. Before you start composting in the cafeteria, it's helpful to give students an idea of what to expect. One school had a "Meet the Renewables" assembly to introduce waste reduction concepts (*17*). At another school, a slideshow was created for teachers to explain the new compost system in their classrooms with visuals and humor (*8*).

The next important component is eye-catching, informative signage: colorful pictures of which foods should be placed in which bins will help students sort their plates. It may make the instructions even clearer to display some actual items, such as paper plates, napkins, and soda cans, above their corresponding bins, although this is harder with perishable food items. Other suggestions include color-coded bins for different types of waste and writing directions on a whiteboard for where to place specific items on that day's lunch menu (*13*).

Beyond signage, students can be encouraged to cooperate through incentive programs, such as giving them raffle tickets when they compost correctly (*13*), or through a "composting tip of the week" announced to the school to bring awareness of a certain item or idea (*8*). To reinforce what can and can't be composted, one idea is to play a "hot potato" game where students toss a ball around a circle and name items that are biodegradable (*11*).

Participation

Some students will want to participate in other parts of the composting process and contribute more to the program. Schools have formed a "Compost Club" or a "Green Team,"(*17*) often made up of older students, which allows them to take an active role in the process.
These students can help by monitoring other students and helping them sort scraps correctly at lunch, weighing the amount collected each day, taking the compost outside, measuring the temperature, mixing in new scraps, turning the piles, and distributing the finished product to gardens. They can meet after lunch or at the end of the school day to complete their tasks (*21*).


Students collect and weigh food scraps

Education

The composting system doesn't have to be restricted to lunch, recess, and after-school clubs. Once students are following the rules and even going above and beyond to participate, compost can be incorporated into the curriculum and used to enhance classroom learning. These opportunities range from fun activities to academic lessons that help students meet other learning goals.

Alameda County Waste Management Authority has suggestions for activities to introduce compost concepts to students. These include learning what it means to be biodegradable (p. 3), exploring how all food came from the earth at some point and writing/drawing about its path (p. 4), and keeping a log of what items are left over from students' lunches and how they can be reused (p. 6).

The same guide has ideas for interactive lessons, like “Decomposition Tag,” where students who are assigned as decomposers “unfreeze” others after have “died” by being tagged by another student (p. 9). Some schools use vermicomposting, a different process that relies on worms in a bin to decompose food scraps, to bring composting inside the classroom at a smaller scale (p. 30) (*11*).

For more rigorous learning, Trautmann and Krasny suggest that a closer look at the many life forms in a compost pile, from worms and fungi to microorganisms, makes for an exciting biology lesson (p. 13). The physical properties of the pile can be examined too, including heat, energy transfer, and the effects of particle size (p. 9). They also offer ideas for experiments and projects related to compost that can be used to practice the scientific method: for example, how do you calculate how much water is in compost (p. 85), or how does adding sugar to the pile affect the behavior of the microorganisms (p. 5)? (*18*). These lessons can be simplified, and even the youngest children can benefit from exploring piles of compost and making observations.

The academic applications don’t stop at science: students can practice math by calculating the volume and weight of the piles with measurements and conversion factors, or by graphing statistics about the amount composted each day (*18*). Transporting food scraps and turning the piles can be part of a physical education program. Students can work on their writing and drawing skills by making a guide to introduce others to composting, or signs to place by the compost bins (*11*).

Check out *Do The Rot Thing* by the Alameda County Waste Management Authority, and *Composting Across the Curriculum* by the Marin County Office of Waste Management for starting points, or see the References section for more.

Lesson Plans

There is a three part compost lesson plan that includes recycling. This lesson plan was created for 3rd a Graders. Enjoy.

1. Lesson 1 - How to help the planet and what is composting?
2. Lesson 2 - Compost Life Cycle
    a. Powerpoint for lesson on compost life cycle
    b. Lesson 3- Organisms in the Compost
        i. CompostingCrittersWorksheet.pdf
        ii. “I have. who has?” game.docx.

Appendix II: Compost Engagement Supplement for

Older Students

This document is a supplement to Composting *Made Easy: A Beginner's Guide to School-Based Composting*. It describes strategies for engaging middle and high school students in a school composting program.

Cooperation

Middle and high school students can catch on quickly to rules for sorting compost from trash but may need to be convinced of why it's important. Before you start composting in the cafeteria, it's helpful to give students an idea of what to expect. Some schools have shared an informational slideshow with teachers to explain the new compost system and its importance to their students (*8*).

The next important component is eye-catching, informative signage: colorful pictures of which foods should be placed in which bins will help students sort their plates. It may help to add reminders of why composting is good for the planet and to include color-coded bins for different types of waste (*13*).

Beyond signage, students can be encouraged to cooperate through incentive programs, such as giving them raffle tickets when they compost correctly (*13*), or through a "composting tip of the week" announced to the school to bring awareness to a certain item or idea (*8*). These suggestions may be more likely to succeed if they come from other students, such as a "Green Team."

Participation

Some students will want to participate in other parts of the composting process and contribute more to the program. Schools have formed a “Compost Club” (*8*) or a “Green Team,” (*17*) which allows them to take an active role in the process. These students can help by monitoring other students as they sort scraps at lunch, weighing the amount collected each day, taking the compost outside, measuring the temperature, mixing in new scraps, turning the piles, and distributing the finished product to gardens. Older students can be given more responsibility and complete some tasks without supervision. At Crawford High School in San Diego, students are paid as interns to work with the compost, and the final product is sold (*22*).

Students with an active role often also spread their enthusiasm for composting to peers and are likely to be more appreciative of the difference the system is making in the world. Waliczek et al. write that “life experiences (such as engaging in the actual process of recycling and composting) are most likely to play a direct role in forming a person’s environmental attitude.”

Education

The composting system doesn’t have to be restricted to lunch and after-school clubs. Once students are following the rules and even going above and beyond to participate, compost can be incorporated into the curriculum and used to enhance classroom learning.

Some applications are immediately apparent; Trautmann and Krasny describe a myriad of ways that studying “the science of compost” can complement students’ learning, especially in higher grade levels. The inputs and outputs, elemental ratios, and oxygen and pH levels can all be included in the study of chemistry (p.5). A closer look at the many life forms in a compost pile, from worms and fungi to microorganisms, makes for an exciting biology lesson (p. 13). And, the physics of a compost system can be examined, including conduction and convection of heat, energy transfer, and the properties of the pile based on particle size (p. 9).

They also offer ideas for experiments and research projects related to compost that can be used to practice the scientific method: for example, how do you calculate the moisture retention of compost (p. 85), or how does adding sugar to the pile affect the behavior of the microorganisms (p. 5)? (*27*).

Students in a STEM Engineering class work on a 3-bin compost system

But the academic applications don't stop at science: students can practice math by calculating the volume and weights of the piles with measurements and conversion factors, graphing statistics about the amount composted each day, or solving equations to determine the best combination of materials to be added to maintain a proper carbon to nitrogen ratio (*27*). Transporting food scraps and turning the piles can be part of a physical education program. A technology education class can take on construction projects to support the system; for example, students from a high school engineering class built a wooden 3-compartment storage container for an elementary school.

Finally, a compost system is a useful tool for fostering job skills; Curry developed a whole set of lesson plans for tying compost into workplace readiness, including creating a press release (p. 60), collecting data (p. 65), drawing plans for a compost bin (p. 69), and developing a budget (p. 77) (*9*). Many starting points, and even full project ideas, are offered in *Composting in the Classroom* by Trautmann and Krasny.

See the References section for further resources.

Additional Resources

- *Composting Across the Curriculum: A Teacher's Guide to Composting.* Marin County Office of Waste Management, 1993. marincounty.org/-/media/files/departments/pw/mcstoppp/education/compostingcurriculum.pdf
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