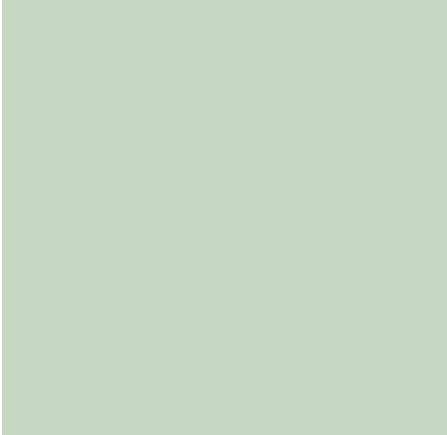


School Composting

A Manual for Connecticut Schools



The Next Step
In Recycling



Untitled

(author unknown)

In the soft warm bosom of a decaying compost heap,
a transformation from life to death and back
again is taking place.

Compost is far more than a healing agent
for the soil's wounds.

Here in a dank and mouldy pile
the wheel of life is turning.

Nature made compost before
the first woman walked the earth,
before the first dinosaur reared its head
above a primeval swamp.

The dead grass of the meadow,
seared by winter's frost,
is being composted by the dampness
of the earth beneath.

The birds, the insects and the animals
all contribute their bodies
to the vast and continuing cycle of rejuvenation.





Acknowledgements

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We were fortunate to have had Paula Coughlin, a former Mansfield Middle School science teacher and environmental educator, author this manual. Throughout the year, she worked with the Steering Committee, After-School Club and in classrooms to help develop the program. This guide benefited greatly from her insights into middle school culture and teaching.

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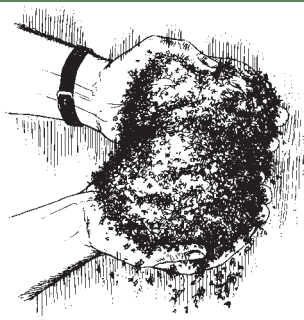
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Introduction

Students throughout the state recycle their paper, cans, and bottles routinely in their schools. Since January 1, 1991, it has been mandatory in Connecticut to recycle eleven different items (see Appendix A, *Recycling in Connecticut*, page 22). Recycling has become part of our culture. Some schools in the state, like Mansfield Middle School, have already taken the next step in recycling— school composting. Is it time for your school to take the next step? School composting can be an exciting way to get the entire school community working together to help the community and the environment.

You probably have some questions. Why compost? Has anyone else in the school attempted to compost? Who would be involved? What are the steps needed to get started? What would we do with the compost? How do we plan well so that the program is sustainable? This manual will help you address these important issues.

Goals of this Manual

- 🌀 To provide a model for initiating and implementing a school composting program
- 🌀 To help schools reduce their waste stream and increase their recycling rate
- 🌀 To teach students, our future community decision-makers, the importance of responsible solid waste disposal and the environmental advantages of composting

You will find strategies for initiating and developing a plan, routine steps of the composting operation, promotional activities, as well as lessons and resources for curriculum connections in this guide.

So if you've been thinking about school composting, you've come to the right place to help your school take the next step in recycling.

Look for the Mansfield Middle School box on the pages of this guide to find practical information about what worked well at the School as it developed its composting program.

Reasons for Composting

Schools can help the environment and their community when they compost food scraps. A school composting program will:

- 🌀 Reduce the school's solid waste stream
- 🌀 Recycle natural resources
- 🌀 Extend the life of a leaching field and septic tank if a garbage disposal system has been in use (or reduce nitrogen loading to the local sewage treatment facility)
- 🌀 Educate the school community about benefits of composting
- 🌀 Create a useful product (finished compost) for landscaping projects

There are additional, far-reaching benefits of a composting program for the school community. Within the classroom, science concepts related to composting are easily integrated into science, math, social studies and language arts curricula. Taking responsibility for the solid waste stream at school empowers students by giving them a specific action to help their community and the earth. Students develop a sense of school pride by taking steps toward becoming a “green school” (a school that practices wise use of natural resources). Students may spread the compost message and be instrumental in starting composting at home or in their neighborhood.

People often have preconceived ideas and fears about composting. For example, they may be concerned about odors that might attract animals or pose safety issues (see Appendix B, *FAQ: Frequently Asked Questions About Composting*, page 23).

A thoughtfully-planned school composting program, from the nuts and bolts of the actual composting process to establishing a culture of composting, can successfully address these issues.



Mansfield Middle School

Mansfield Middle School, in Mansfield, Connecticut, initiated a school-wide composting program in the fall of 2000 with its 650 fifth through eighth graders. 4,168 pounds of food scraps mixed with 3 to 4 cubic yards of wood chips and leaves produced roughly 1.5 cubic yards of compost in the first year of operation.



Getting Started

The idea for school composting may come from teachers, an administrator, parents, a town committee or the students. A program might be started by interested parents bringing the idea to their PTO or the school administration. The town's Recycling Coordinator or a town committee might initiate it as part of a solid waste disposal alternative. A team of teachers could build a composting program into the science, social studies or a character education curriculum. Students, learning about composting in science class, may want to develop a program. A homeroom or environmental club might take on composting as a service learning project, which subsequently is adopted as a school-wide program. A school administrator or Board of Education member may initiate a discussion about school-wide composting.

Regardless of who initiates the program, you want to have the support of the school administration. A Compost Program Steering Committee can benefit from the leadership skills of a school administrator. He or she may advocate for school composting by introducing staff to the program in September or announcing reminders to the student body throughout the year, by finding ways to fit compost tasks into the routine school duties of the staff and by encouraging integration of composting concepts into the curriculum.



Mansfield Middle School

The administrators are experimenting with giving teachers the option of routinely supervising a few student compost-workers in lieu of a regularly assigned lunch, bus, or detention duty.

Developing a Plan and Gathering Support

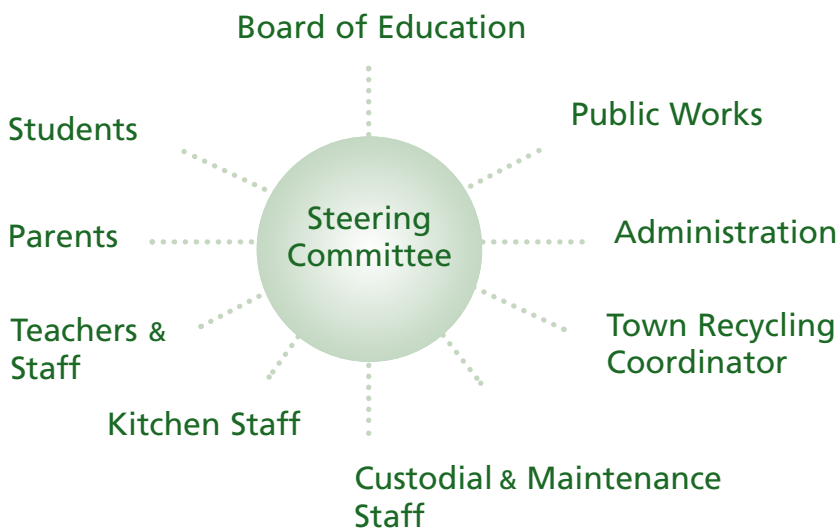
Talk up the topic of composting and you'll probably find other staff members who are supportive of the idea. Learn as much as you can about what is involved in school composting so you can speak knowledgeably about the process and clearly define the scope of your project. It's okay to start with a small pilot program or to develop the program in phases. Schools differ in the way they develop new programs; follow your system's protocol. Follow these steps for developing a successful program:

1. Share your ideas and seek out others who may be supportive of the idea
2. Recruit a core group of people to develop the idea (Steering Committee)
3. Research what is involved in a school-wide composting operation
4. Clearly define the scope of the project (it's okay to start small)
5. Follow the school system protocol for developing new programs
6. Get support from all components of the school community

As with any new program, there will be successes as well as problems with which to deal. It's important for the morale of the Steering Committee to pay attention to small successes; even small changes indicate progress toward your composting goals. It also helps to have realistic expectations. Don't expect 100% compliance by students/staff when it comes to daily sorting of lunch scraps. Don't be surprised if hoards of enthusiastic volunteers are not beating down your door—you will need a plan to actively recruit compost-workers. Although you and your committee will probably not receive the Conservationist of the Year Award, you will, no doubt, deserve a nomination.

Forming a Steering Committee

Effective leadership from a few staff members who are committed to making school composting a reality is critical to the success of the program. An administrator and a few representatives from other parts of the school community should round out the committee to six or seven members. You can always call on additional people for their suggestions and advice.



The Steering Committee is responsible for developing a clear plan of action, promoting the program, coordinating the actual work, and evaluating what's working and what's not. All of this takes time. Identify in committee each member's responsibility. Make sure that

members are willing and able to commit the time. To start up a program will take several hours of planning, which could spill into some weekends or school and summer vacations. Expect to meet once a month, at least, for the first year of the process. As the program matures, quarterly meetings may be all that is necessary.

The Steering Committee will also need to research a compost bin design that best suits the needs and budget of the school and seek financial support from the Board of Education. It may investigate alternative funding from grant sources, local businesses, civic groups, municipal waste disposal funds, and parent/teacher organizations.



When the pilot project began, members of the Steering Committee were the Town Recycling Coordinator, three teachers, and a teacher-consultant (part of the DEP grant program). The school Vice-Principal, Director of Public Works and custodial staff have since attended meetings.



School Community Involvement

A composting program will affect all school personnel, so it's important they know their concerns are being considered. This involves clear communication among members, cooperative problem-solving, and everyone taking responsibility for the success of the project. Taking the time to communicate with individuals and groups about their roles in implementing the program creates allies. People often respond positively if they are asked for their input; it shows their expertise and opinions are valued. It doesn't mean that all the changes they suggest will be implemented, so let them know that the Steering Committee is considering feedback from several sources. In addition, making changes incrementally may ease the school into a full-scale composting program without a lot of resistance.

Getting Teachers On Board

Teachers are important to the successful involvement of the student body in the program. They will be instrumental in introducing the composting program to the students and integrating the ideas and concepts into school curricula. The help of teachers and teacher assistants will be needed to monitor student food-sorting at containers in the cafeteria (lunch duty) and supervise student compost-workers.

If you are asking teachers to do something new, make the job simple and connected to something they already do. Keep a sense of perspective, we're all learning this, we're all busy. It's not the end of the world if a fork ends up in the food barrel. If you try an idea and it doesn't work, ask the teachers for suggestions.

Try these ideas to get teachers involved:

Audio Visual Introduction Make it easy for the teachers to introduce the composting program by providing a video or Powerpoint presentation. This way, the teachers learn along with the students.

Curriculum Materials Display curriculum materials related to composting in the teachers lounge or library.

Service Learning Encourage using the compost project as a service learning project (groups take the responsibility for routine compost operations).



Mansfield Middle School

A Powerpoint presentation introducing the school composting program was shown to Mansfield teachers on the day before the opening of school. A similar Powerpoint presentation, designed for students, was available for teachers to use in their homerooms. The presentations used humor and photos of kids and teachers to explain the operation of the school's composting process. During the first few days of school, the PowerPoint presentation, in tandem with an explanation of cafeteria rules in general, set the tone of expectations for student behavior during lunch.

School Climate Committee Composting could be part of the overall plan to make the school a place where everyone shares responsibilities.

Curriculum Integration Teaching lessons about composting addresses several of the Connecticut State Department of Education Science Curriculum Standards (see Appendix C, *Connecticut Science Teaching Standards*, page 25).

The Role of Students

Students are the target audience for the composting program. All students will be part of the program by sorting their lunch wastes daily in the cafeteria. Some students may want to be a part of the compost team that helps with daily tasks. They will also be your advocates for the program.

It's important to begin educating students about composting at the beginning of the school year. As any teacher knows, new routines are best established by introducing them on the first day of school. Initiating the youngest students into the routines of sorting their lunch wastes means they develop composting habits early; as they get older, they become the role models for younger students.

Recruit a group of ten to twelve students to become the core composting team; they may be work-study students or a group of volunteers. With adult supervision, two students per day can handle the daily tasks of the composting operation (see *Daily Tasks*, page 15). Talk with the leadership of the Student Council about taking on the responsibility of student involvement in the composting program.

Another way to get students involved is to invite them to serve on a committee or attend an after-school club that will design incentives to promote the program among the student body.

It's important to keep the student body motivated. Give special recognition to participants (public address announcements, certificates, prizes), get press coverage, put up signs and posters to show progress.

An after-school club, the Compost Club, was formed to help get the composting message out to students and teachers. It was not surprising that it was fifth graders who became the core of the Compost Club. Fifth graders in Mansfield are used to composting at their elementary schools. New to the Middle School, they were eager to take part in an after-school activity.

We enlisted the group's help in addressing the problems of how to teach their fellow students about food-sorting. One of the first tasks of the Compost Club members was to create posters for the cafeteria to help students know what does not go into the waste barrels: "No meat, no bones, no dairy" was the catch phrase.



Mansfield Middle School

A "Composting Tip of the Week", generated by students, was scrolled on the class televisions as part of the school event postings.

Support from Other School Community Members

Town Recycling Coordinator

A Town Recycling Coordinator brings waste disposal expertise to the composting program. He/she can help with educational resources and facilitate compost bin design selection and operation. The role of the Town Recycling Coordinator as liaison between the Public Works Department, the custodians, the kitchen staff and Steering Committee may be critical in the development of the program. A Recycling Coordinator might also help parent, teacher and student volunteers learn the daily composting routines and monitor the progress of the composting process.

If a town does not have a Recycling Coordinator, other members of the staff must share these tasks. You may find resource people in the community through a garden club, a local conservation organization or town committee (see also *Technical Assistance*, page 89).

Custodial Staff/Public Works Department

The custodial and/or Public Works staff should be consulted when selecting a location for the compost bins, so that practical considerations for machinery and delivery of bulking materials can be addressed. It's easier for the Public Works staff and custodial staff to fit the compost jobs into their schedules if they know what is being asked of them ahead of time. For example, they can plan to deliver a load of fall leaves to the compost bin site rather than transporting them to the town transfer station; they can be asked to empty the Industrial Arts' classroom sawdust barrels at the compost site rather than the school dumpster. If the Public Works Department will be building the composter, ask for their input in the design and put it in as a work order several months in advance.

Appealing to the skills of the custodial staff and being considerate of their time will go a long way in recruiting them as composting advocates. Having students involved is a learning experience for the students and does not put the burden entirely on the custodial staff. Work with the Director of Maintenance to discuss ways to incorporate new expectations into the custodial routines. Ask for suggestions and feedback from custodial staff. An example of a modification to ease the job of the custodian:

Problem The custodian is expected to provide recycling barrels for beverage containers, but students do not always sort correctly.

Solution Waste barrel lids with small cut-outs that will accommodate only one specifically-sized container (square for milk cartons, round for cans).

Problem Students are sloppy when dumping their food wastes, creating a mess on the floor for the custodial staff to clean up.

Solution Be sure food waste barrels have wide openings, are located after the recycling containers, and spatulas are attached to the food barrels for scraping.

During the second year, kitchen prep scraps were averaging about 17–20 pounds per day. Post-consumer wastes (plate scrapings) were about 28 pound per day. The total was 37–48 pounds per day for 650 students.



Mansfield Middle School

It's a good idea for the compost operation to have its own tools, labeled and kept in a separate place so that the custodial staff tools are not borrowed.

Kitchen Staff

Discuss the needs of the kitchen staff with them. The kitchen staff may already be placing food preparation scraps in one barrel, and it may just be a matter of providing a second barrel for packaging wastes such as plastic or foam trays. Make it easy for them with clear signage. Food scraps such as vegetable peelings, coffee grounds and old produce can be easily deposited into a separate barrel. Respect their time and ability to make good decisions; ask for suggestions about what would work best for them.

Parents/PTO

Composting is a positive way to get parents involved in the school. There may be parents who compost at home and would be interested in the project. You could ask them to serve on the Steering Committee or call on them to help supervise student workers one day a week to get the program off the ground.

A presentation about the composting program at the PTO meeting should outline the goals of the program and how parents can help. The parent group may take on the program as a project, help fund the cost of bins or provide incentives for student workers. An information article in the PTO newsletter will help spread the word about the school compost program.

A PTO that does an annual plant sale as a fund raiser may use the compost as a soil amendment for the plants. A student project of bagging, labeling and selling compost might complement their plant sales event (see *Finished Compost*, page 18).

Promotional Activities

In most cases, you will have to win over the minds and hearts of students and staff to the idea of composting. Although the very act of sorting food waste daily will eventually prove to most skeptics that composting is "no big deal," promoting your program can go a long way toward getting voluntary participation and raising awareness.

It is one thing to promote a *new* program, yet it is just as important to do so as the program matures. The fable of the hare and tortoise comes to mind, bearing the message of slow but steady progress. Regular promotion aids that steady progress. Planning any promotional activity requires time. For this reason, it is essential for the long-term success of a school program to have a core group (Steering Committee) that can commit the time to plan and carry out these events.

Compost Awareness Week

This works well in September, after the students have been given some basic instruction and are getting used to the food-sorting system. Students who sort their lunch waste correctly receive a ticket to fill out with their name and home-room. A drawing is held at the end of the day, and a few people from each lunch wave receive a coupon for a free ice cream. Names of winners are announced on the public address system or scrolled on the school television.



America Recycles Week (the week that includes November 15) Connect promotional activities to the national America Recycles Day www.americarecyclesday.org or a local campaign, such as a town Rid Litter Day.

Earth Day (April 22) Celebrate Earth Day with a special emphasis on the school compost program www.earthday.org.

International Compost Awareness Week Celebrated the first week of May, this could be used as a time to unveil finished compost. www.compost.org.

Compost Poster Contest Offer prizes for posters that teach about composting or motivate students to do their part; could be part of an art class on creating posters.

Compost Advertisements Offer prizes or course credit for radio jingles or television commercials; a local radio station may play the winning jingles. This fits in well with language arts lessons.

School Composting Club Give students an opportunity to meet with friends and have fun in an after-school activity that has them take some ownership for what happens in their school (see Appendix D, *Compost Club Activities*, page 30). Get a copy of *Blueprint for a Green School* (see “Resources”, page 86) which outlines ways for schools to become more environmentally conscious.

Student Employment If the school has a work-study program, students can be hired to process the days food scraps. Keep in mind that the work-study hourly rate is typically very low and will probably not motivate students for long. This might be used in the beginning with plans for using other student incentives to get the job done throughout the year.

Community Business Donations Ask businesses to donate items or coupons; students who volunteer to help out receive a ticket for a drawing. Items need to be things that students would think are fun, such as a basketball, movie tickets, an ice cream sundae, or music compact discs.

A Special Trip Students could earn points for volunteering to be part of the compost team. Points are accumulated toward a special trip, such as an amusement park.

Coupons Give out school store coupons for helping with the composting operation. The parents association or Student Council may be a source of funding.

Student Council Get the Student Council to take on the compost project as one of their priorities; they’ll think of fun incentives.

The school homepage features a link to their compost website. The site includes a description of the school compost program, the basics of composting and activities for kids. The Mansfield Middle School compost website is: www.mansfieldct.org/schools/mms/compost/index



Mansfield Middle School

Students who volunteered to help with composting had their names placed in a drawing for a special prize; a basketball signed by the UCONN men’s basketball team.



The Infrastructure

Now that you have rallied the support of the school community, formed a steering committee and developed a clear plan of action, it is time to look at the compost program infrastructure. Being familiar with how the composting process works and the necessary tools required to launch a successful program will aid the steering committee in deciding on compost bin design, location & supplies.

Greens and Browns of Composting

Composting is an acceleration of the decomposition process (see Appendix E, *Inside a Compost Pile*, page 32). In compost jargon, food scraps are referred to as “greens” and bulking materials, such as dry leaves or wood chips, are called “browns.” In a compost pile, a ratio of 30:1 browns to greens gives the decomposers a balanced diet; alternating layers of browns and greens helps maintain this ratio. The drier, bulkier browns help the compost pile stay light and loose, allowing air to circulate more freely. Foods have a high moisture content, and are usually wet enough to keep the pile moist. Regular turning of the pile aerates it and mixes up the browns and greens (see Appendix B, *FAQ: Frequently Asked Questions About Composting*, page 23).

Composting Equipment

All parts of the composting process have to be in place before you can begin daily operation; that will decrease the chances for things to go wrong. When you prepare and plan well, you present the image of a well thought-out program—good public relations for the school composting program. However, recognize that no matter how well you plan, there will be kinks to be ironed out as you proceed.

The tools you will need:

- 🪛 Compost bins
- 🪛 Cloth rags
- 🪛 Shovel

- 🪛 Pitchfork or garden fork
- 🪛 Work gloves
- 🪛 Compost thermometer (*Equipment*, page 89)
- 🪛 Scale that measures in one pound increments (*Equipment*, page 89)
- 🪛 Clip board with record sheets (*Composting Record Sheet*, page 78)
- 🪛 A steady supply of bulking material such as leaves, wood chips, wood shavings
- 🪛 Labeled food waste barrels or receptacles on wheels (see the label *For the Compost Pile*, page 79; & *Equipment*, page 89)
- 🪛 Sifting screen (hardware cloth stretched over wooden frame)

Compost Bins

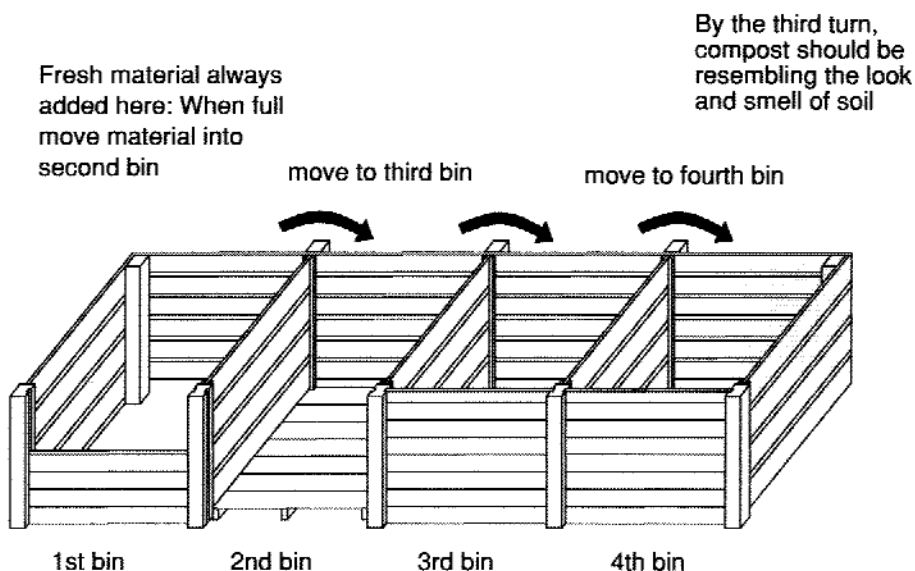
There are several compost bin designs appropriate for a school-wide composting program. Constructing, rather than purchasing a commercially built model, will result in bins suited to the particular needs of your school. Take the necessary time to think about your needs and research various designs. For research guidance, go to *Technical Assistance*, page 89.

Construction costs can range from \$200 to \$2,000, depending on materials and labor (see Appendix F, *Compost Bin Design*, for diagrams of the bins that are used at Mansfield Middle School, page 33).

Constructing the compost bins can be accomplished by various members of the school community. If the Public Works Department or school custodial staff construct the bins, be sure to ask for their input about design and materials. Alternatively, construction of compost bins could be a student project accomplished by an after-school club, industrial arts class, or a technical school project. Student workers, of course, require adequate supervision in building projects, including reading design plans and the safe use of tools. In this case, consult with the teachers involved when selecting a compost bin design.

Location

Think this through carefully; once the compost bins are in place, it is difficult to relocate them. Bins need to be located in a convenient place and should be built on level grass or soil for drainage. The area around the compost bins tends to get muddy from foot traffic. Consider using gravel, wood chips, or another porous material around the perimeter of the bins. The route to the bins should be level for ease of transportation of food barrels.



Always move in one direction. In this illustration, compost is turned from left to right

Bins must be accessible for machinery so that bulking materials can be delivered and deposited beside the bins. Do not place bins directly against the school wall; leave a three foot space behind them for cleaning spillage.

For aesthetics and safety reasons, bins should be located behind the school building or a partition, in a low foot traffic area. If possible, do not locate the bins in the vicinity of a large dumpster; dumpsters often attract animals and the foul odors of the dumpster may be associated with the compost bins (which, of course, if maintained properly, should produce no foul odors).

Bin Size

The minimum recommended bin size for active decomposition is one cubic yard, or 3 feet by 3 feet by 3 feet. This is the size bin a homeowner would typically use. Because a school will generate more food waste than the average household, more and/or larger bins will be required. A series of bins with common removable walls and fronts allows compost to be turned from one bin to the adjacent bin conveniently. Fresh food waste is always deposited into the first bin. When the first bin is full, the contents are turned into the second bin. The first bin is started all over again. When the first bin is full again, the second bin is turned into the third bin, and the first bin is turned into the second bin. The first bin is started all over again, and the sequence continues for however many bins you have.

The number and size of bins you will need depends on the amount of food waste you expect to generate. One way to estimate the amount of food waste is to collect and weigh food scraps from the cafeteria (plate scrapings) and kitchen (prep waste) for two weeks. Four bins, each measuring 4' x 4' x 4' should accommodate a school that generates 50 pounds of food waste per day. Slightly wider bins can be built; however, bins that are taller than 4' make it difficult for student workers to lift the lid easily and reach over the top. Consider adding more bins for storage of bulking materials or curing compost. Ultimately, the dimensions and style of the compost bins may be determined by the space available.

After the first year, it was determined that four 4' x 4' x 4' bins did not accommodate both active composting and storage of bulking materials for a school of 650 students. Three wider, stronger, steel-framed bins measuring 4' x 4' x 6' were built to allow for mechanical turning with a skid-steer loader. Two of the narrower bins are still used for composting and are turned by hand. The other two are used for storage of wood chips and leaves, keeping the area tidy.



original 4' x 4' x 4' bins



with wider bins added

Ease of Use

The easier and safer the bins are to use, the happier everyone will be. Bins should be well constructed and maintained so that workers can easily lift the lid, remove components (such as side slats), dump food wastes and spread bulking material without obstructions. Maintenance is important; loose screening, nails or hinges can be a hazard to workers and will invite unwanted animal guests.

Building Materials

Consider the long-range life of the materials, their cost, availability and ease of construction. Ideally, you want materials that will not rot easily. Pressure-treated wood, which is impregnated with unsafe chemicals, should be used with caution. Woods such as cedar or locust are naturally rot-resistant. Think about building bins from reused or recycled materials.



Mansfield Middle School

When selecting the materials for the compost bin, toxicity of the materials, durability, appearance and support of recycling by purchasing a recycled product were important considerations. Choosing plastic lumber as the primary material best matched all these criteria. It was more expensive than pressure-treated wood, but less than cedar. An arsenic- and chromium-free treated lumber, called ACQ, was used for the support posts.

Wooden shipping pallets, often obtained free from local businesses, are a convenient size for the frame of a compost bin. **Make sure the pallets are all the same size before you start banging them together.** Do not paint or treat the wood in any way. Recycled lumber made from plastic bags and sawdust works well and is easy to work with. It does not rot, splinter or peel and is not subject to damage from insects. Plastic lumber never needs replacing or painting—advantages that offset its initial cost. However, it is not intended for structural support. Regardless of which materials you choose to build with, it should be lined with heavy-gauge, quarter-inch or half-inch hardware cloth and secured with galvanized fence staples.

Ease of Construction

Whoever builds the compost bin must have well drawn design plans and a materials list. Special considerations are needed if students will be constructing the bins. Materials must be in convenient sizes to handle, cut and staple. The builders must have appropriate tools for sawing, cutting and stapling hardware cloth, as well as the usual tools for a building project. A face mask should be used when sawing lumber. Build the bins in place; it is too difficult to transport them, especially a design of multiple bins sharing interior walls.

Costs

The capital expense of the compost bins and tools will vary depending on the materials you select. It will cost something, but it doesn't have to be a budget-buster. Certainly, used materials, such as wooden pallets, are less expensive, but they may not last as long. A local lumber business or manufacturer of the items you are seeking may donate materials or sell them to the school at cost. Materials purchased as part of a large town-wide or school-wide order of building materials may be cheaper than buying them separately. Many times, good garden tools can be bought inexpensively at garage sales and second-hand stores. Work with your grant administrator to research funding possibilities from government programs, foundations, or local civic organizations.

After the initial purchases, realize that composting is a low-cost process. There is very little maintenance and the labor is volunteered. In fact, a compost program can be cost-saving. If food waste is a significant portion of the school's waste stream, you may see a drop in refuse weight, and in turn, lower tip fees.

The first year, the Middle School constructed four 4' x 4' x 4' bins made of recycled plastic lumber, which were lined with quarter-inch mesh hardware cloth. The material was purchased at a local hardware store for \$900. The monies came out of the Public Works budget. For the second year, three wider, steel-framed bins were added at an additional cost of \$1,733. Of that, \$1,000 was covered through a Department of Environmental Protection composting grant. The labor was donated by the Public Works crew.



Mansfield Middle School

If the schools refuse collection fee is based on dumpster size and/or the number of collections per week, its trash bill could be shrunk by reducing the dumpster size or number of times it is emptied per week. It's well worth the effort to review the refuse contract to discover potential savings. As a result of this research, the school may decide to re-negotiate the trash contract to favor waste reduction and recycling.



Mansfield Middle School

The budget for the Mansfield Middle School looked like this:

Supplies

Compost thermometer	\$96.00
Industrial scale	\$71.98
6 compost collection containers	\$100.35
2 pairs work gloves	\$11.68
1 rake	\$25.19
1 garden fork	\$32.36
1 pitchfork	\$23.36
1 wheelbarrow	\$57.56
Video– <i>It's Gotten Rotten</i>	\$97.50
Book– <i>Composting in the Classroom</i>	\$38.85
Cloth rags	\$0.00
Total	\$554.83

Construction materials for four 4' x 4' x 4' compost bins (see Appendix F, *Compost Bin Design, page 33*)

6 pcs	2" x 4" x 8' ACQ treated lumber	\$34.14
21 pcs	5.25" x 6" x 16' plastic lumber	\$598.29
3 pcs	4" x 4" x 16' ACQ treated lumber	\$80.73
3 pcs	1" x 8" x 16' ACQ treated lumber	\$47.22
3 lbs	12D galvanized nails	\$3.57
48 ft	½" mesh 4' wide hardware cloth	\$70.56
5	3" hinges	\$16.95
5	5.5" handles	\$12.95
10	safety gate hooks	\$11.90
Total		\$876.31

Donated time

Labor for construction of bins	72 hours
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Day to Day Composting

Student and staff volunteers will need to be trained in the daily routine of processing the food scraps. Scheduling these tasks depends on the school lunch schedules, the availability of volunteers and what works best for kitchen and custodial staff involved.

Daily Tasks

A team of two or three students, supervised by an adult, can carry out the following daily tasks in about fifteen minutes.

Task 1 Collect Food Scraps

Task 2 Weigh Food Scraps

Task 3 Transport Food Scraps to Bins

Task 4 Take Compost Temperature

Task 5 Spread Food Scraps

Task 6 Layer with Bulking Material

Task 7 Clean-up

Task 1 Collecting Food Scraps

Food scraps are deposited into special containers located in the cafeteria and kitchen. Students retrieve the special food waste containers from the cafeteria and kitchen and consolidate the contents into one barrel that has been lined with a plastic trash bag. In the cafeteria, a labeled food waste barrel should be located alongside the other recycling containers where students normally sort their lunch trays. One or two labeled food waste barrels should be provided in the kitchen for food preparation scraps, leftover food and coffee grounds. Cafeteria and kitchen food scraps should be transported to the compost bin daily.

Other sources of food scraps are the Family and Consumer Science classroom, the teachers' lounge, any classroom or office equipped with kitchen facilities, and areas where students routinely eat after-school snacks.

These areas can be equipped with a small, commercially-produced container fitted with a carbon filter lid or a five-gallon bucket with a cover. These outlying school areas could be added once the cafeteria and kitchen routine is in place. At that point, students will be more inclined to use the compost containers located around the building. This reminds students that composting is now a part of the school culture. It also means that you must plan for regular pickup of these food wastes. If they are not picked up regularly, they may become full or smell unpleasant, resulting in negative publicity for the compost endeavor.

Task 2 Weighing Food Scraps

Students place the bag of food waste in a container on the scale to weigh (subtract the weight of the container) and record the amount of food (see *Composting Record Sheet*, page 78). The best type of scale to use is one where the weight can be viewed easily from the side since a container will probably be covering the entire top of the scale. Or consider purchasing a scale that has a locking feature so that the weight is held still and can be read after the food scraps are removed.

Recording the weight serves several purposes. It can be used to keep track of the total amount of food processed in a given amount of time, which shows the savings in the disposal of solid wastes produced by the cafeteria. The total weight of the food wastes can be compared to the weight of the compost product. Weight records can be used for constructing math problems. Science classes can track and analyze the compost operation, including the amount of food processed.

Task 3 **Transporting Food Scraps to the Compost Bins**

The barrel is wheeled out to the bins. Students need to pick up work gloves, pitchfork and the thermometer on their way if these items are not stored near the bins.

Task 4 **Taking Compost Temperature**

The long probe of the compost thermometer is carefully pushed into the center of the compost pile where it is the hottest. The temperature is read and recorded on the chart. Taking the temperature of the pile is a way to monitor the progress of the compost. A working compost pile will go through stages, getting hotter as the decomposers work and reproduce, and then cooling off. Temperatures can reach 150°F if conditions are favorable. If the compost cools down before most of the decomposition has occurred, it is a sign that the balance of food, moisture, air and bulking materials needs to be adjusted. Usually, a drop in temperature indicates it's time to turn the pile by forking it into the neighboring compost compartment (see Appendix G, *Composting Problems and Solutions*, page 37).

Task 5 **Spreading Food Scraps**

The easiest way to manage the food waste is to line the food waste barrel with a plastic trash bag. Secure the bag around the rim with a bungee cord. Students can then lift the bag out of the barrel into the compost bin. Using a compost bin that has removable front boards makes the lifting easier for students. Food should be spread somewhat, not piled high in the center.

Task 6 **Layering with Bulking Material**

A few inches of wood chips, wood shavings or leaves should be spread with a pitchfork to cover the food completely, making it less attractive to animals. The lid, of course, needs to be latched.

Task 7 **Cleaning-Up**

Students use cloth rags (and water if available) to wipe off the shovel and thermometer, store equipment, and return the barrel to the cafeteria.

Weekly Tasks (or as needed)

Checking and Maintaining Bin

The supervising adult should report any structural problems with the bins to the project director so that they can be remedied quickly to avoid safety issues and animal entry. When it snows, a pathway to the compost bins will have to be maintained.

Turning the Pile

Ideally, the bulking material helps maintain air circulation in the pile. Because of their size and shape, wood chips provide air pockets within the compost pile. However, eventually those pockets of oxygen will be used up by the microbes, causing a decrease in the population of decomposers. The drop in compost temperature is the best indicator of this happening. Turning a pile simply means mixing up the materials. The easiest way to achieve this manually is to use a garden fork or pitchfork to move the pile from one bin to the next. This moves the materials from the cooler edges of the pile into the center. Also, a fresh blast of oxygen is introduced into the pile. The “green” material and “brown” material are remixed. Within a few days, the newly-turned pile's temperature should rise back up to 130–150°F.

Another reason to turn the pile would be that the bin is full. Some students may be physically up to the task of turning the pile, or this job could be taken on by a particular teacher or group. A group of students might be challenged to tackle the job by lining up and everyone moving a shovelful. A more efficient solution (but less hands-on) is to build the bins wide enough for a skid-steer loader or tractor to turn the pile over.

Troubleshooting

Someone (the director, Steering Committee or a student group) needs to take on the responsibility for making sure the composting process is working and address any imbalance in carbon, nitrogen, water or oxygen (see Appendix G, *Composting Problems and Solutions*, page 37).

Acquiring Bulking Material

A system for maintaining a supply of bulking material next to the bins is important. An arrangement with the Public Works Department or the custodial staff can be made for dumping leaves, wood chips or sawdust. Covering them with a plastic tarp will keep out water and decrease the chances of freezing in winter.



Mansfield Middle School

Turning a 4' x 4' x 4' pile into the next bin has been done once a month by a rotation of teachers and a class. It usually takes about an hour.



Finished Compost

You Have Compost

In a school composting system, many pounds of food can be turned into useful finished compost over the course of a school year. Remember, the total amount of material (food wastes plus bulking material) is reduced by as much as two thirds during the composting process.

Testing and Using Your Compost

Realistically, a successful composting process will result in dark, crumbly, sweet-smelling compost in about a year (depending on conditions). The nutrient and salt content of the compost depends on the types of foods that are included. Processed foods are high in salts. Especially for this reason, it is critical that the compost be allowed to cure before it is put into use. Just because the compost looks and smells like soil doesn't necessarily mean that it is chemically stable. Partially-composted material placed directly on garden plants will burn the tender shoots, due to the high unstable nitrogen and salt content. Finished compost should have a **near neutral** pH and be **low** in unstable nitrogen (ammonium nitrogen) and soluble salts. "Curing" is simply letting the pile rest while the composting process finishes. Getting a soil sample analyzed is the best way to determine the compost's usability. The Connecticut Agricultural Experiment Station laboratory will analyze the nutrient levels of the compost free of charge. Ask for the standard soil test plus salts. Send a representative sample of the compost (about two cups) in a sealed plastic bag and puncture-proof packaging to: The Connecticut Agricultural Experiment Station, Soil Testing Lab, 123 Huntington Street, P.O. Box 1106, New Haven, CT 06504-1106. Visit their website at www.caes.state.ct.us/soiloffice/soiltesting.htm for sampling instructions, sample submittal forms and mailing information, or contact them at (203) 974-8521.

There are many uses for finished compost. It will have varying levels of potassium, phosphorus, and nitrogen, all important plant nutrients. But different plants have different nutrient requirements. It is best to use the finished product as either a soil amendment, by mixing it into garden soil prior to planting, or as a top dressing for existing plants.



Mansfield Middle School

In the first year of Mansfield Middle School's project, 4,168 pounds (2.08 tons) of food and approximately 2,000 pounds (1 ton) of leaves and wood chips were composted from Nov. 1 through June 11. This resulted in only 1 to 2 cubic yards of compost. It was ready for use by August.

If the primary bulking material is wood chips, the finished compost will still contain bits of wood chips. This is perfect for mulching around the school's trees, shrubs, and other perennials. If the desired end use of the compost is for potting soil, it will need to be screened. Compost that is high in soluble salts will interfere with plant growth and may even kill seedlings, so particular care needs to be given to the soil analysis. To make potting soil, as long as the compost is within a medium range, it can be mixed with equal amounts of sand (or vermiculite) and peat moss. If the soil analysis indicates that the compost is high in soluble salts, use a lower percentage (25 to 15%) of compost in the mixture.

Uses of Finished Compost

- 🌀 Worked into a school garden
- 🌀 Potting soil component
- 🌀 Mulch (top dressing) around existing plants
- 🌀 Compost tea for watering plants (collect drainage from burlap bags of wet compost)

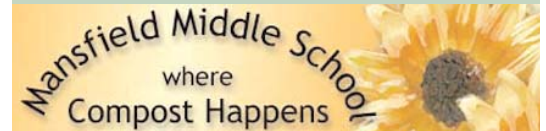
Composting ties in nicely with a school greenhouse operation. A homemade potting soil makes a nutritious growing medium and can eliminate the use of chemical fertilizers. Plants grown in the greenhouse could be used for science lessons, school beautification projects as well as for fund raising events. Used potting soil and unwanted or dead (but disease-free) plants from the greenhouse can be added to the compost pile, thereby closing the loop in organics recycling.

Program Evaluation

The Steering Committee should meet regularly to evaluate the implementation and success of the compost operation. Feedback from various staff members will help address the following questions:

- 🌀 Is the daily processing of food scraps running smoothly?
- 🌀 Are the bins and equipment in good repair?
- 🌀 Are the students and staff volunteer working well?
- 🌀 What is the general attitude of the students and staff about the composting program?
- 🌀 What adjustments can be made to make the process more efficient?
- 🌀 How can we recognize and celebrate our accomplishment thus far?

Plants potted in compost amended soil were presented to teachers on the first day of school as publicity for school composting. The pots were decorated with a label of their own composting logo.



Mansfield Middle School

During September, foraging yellow jackets overtook the compost bin, burrowing beneath the wood chip layers to get at the food. Although they were not aggressive (they were foraging, not nesting), compost-workers were afraid to be around the bins. The solution was to hold the food waste overnight in the maintenance garage and deposit it in the bin first thing in the cool morning, when the insects were less active. Problems were eliminated with the first freeze.

A short annual summary report discussing the success of the program and tallying the tons diverted from disposal could help justify continuing the program.

Taking the Next Step in Recycling

School composting, the next step in recycling, has many benefits for the students, their school and their community. Armed with this guide and enthusiastic leadership, your school can be on the road to composting. All schools are different—see what works for you. You can phase in composting by composting kitchen scraps in the initial stages of the program, followed by student education and cafeteria food scraps. How you begin the program will depend on the goals of the Steering Committee.

Your program will be successful if you plan well and communicate with the members of your school community. Seek out interested members of community groups such as garden clubs, scouting groups and conservation organizations. Be patient; even small steps move you toward the goal of school-wide composting. Get people involved with incentives that thank them for doing their part. Let everyone feel good about the progress of the program—call attention to your successes through newsletters, poster and school announcements. Take the next step in recycling. You can make school composting happen.



Mansfield Middle School

Although there were challenges during the first year of the compost program, the second year went more smoothly. To quote one student, the food-sorting in the cafeteria was “no big deal.”

Transforming Our Compost

from **Touching Peace, Practicing the Art of Mindful Living** by Thich Nhat Hanh



When we look deeply at a flower, we can see that it is made entirely of non-flower elements, like sunshine, rain, soil, compost, air, and time. If we continue to look deeply, we will also notice that the flower is on her way to becoming compost. If we don't notice this, we will be shocked when the flower begins to decompose. When we look deeply at the compost, we see that it is also on its way to becoming flowers, and we realize that flowers and compost "inter-are." They need each other. A good organic gardener does not discriminate against compost, because he knows how to transform it into marigolds, roses, and many other kinds of flowers.

APPENDIX A

Recycling in Connecticut

On average, each one of us produces 4.4 pounds of solid waste each day. This adds up to almost a ton of trash per person, per year. In a state with over 3 million residents, this means we generate close to 3,000,000 tons of municipal solid waste (MSW) each year. Where does all this trash go?

How we handle our solid waste has changed dramatically over the past 25 years. As recently as 1975, 140 of Connecticut's 169 towns disposed of their trash within their own borders. Today, only one municipality operates its own landfill to dispose of residential trash. What happened? In the late 1980s and early 1990s, it became apparent that dozens of municipal landfills would have to close. Many had reached their permitted capacity, while others were unable to meet new Federal regulatory requirements for modern sanitary landfills. Some even posed a contamination threat to drinking water supplies.

An important step was taken toward changing the way we manage our MSW when Connecticut adopted a solid waste management hierarchy which utilizes first source reduction, then recycling, composting, waste-to-energy and finally landfilling as the preferred methods for handling our trash. To implement this hierarchy, the State legislature passed the Mandatory Recycling Act (PA 87-544), which required recycling of 25% of the state's solid waste stream by January 1, 1991. To meet this goal, nine items were designated which could not be disposed of and had to be recycled instead:

glass food and beverage containers, used motor oil, vehicle (lead-acid) batteries, scrap metal, corrugated cardboard, newspaper, metal food & beverage containers, leaves, white office paper (private residences exempt).



On May 1, 1996, **nickel-cadmium batteries** were added to the list of mandatory recyclables. Instead of being recycled curbside, these batteries are recycled through a take-back program sponsored by retailers and battery manufacturers. As of October 1998, **grass clippings** were banned from solid waste disposal facilities. In the 1993 legislative session, Connecticut's General Assembly passed An Act Concerning The State Recycling Goal, PA 93-423. One of the major provisions of this act is to raise the State's recycling/source reduction goal to 40% by the year 2000.

To help achieve this goal, many municipalities have added additional items to their programs, including: plastic resins #1 & #2, magazines and junk mail, and even textiles. Connecticut's recycling/source reduction rate has reached 24% for FY 1999-2000. The rate does not include redeemable deposit containers (CT is a bottle bill state), auto scrap or certain other commercial recyclables.

Taken from *School Recycling Fact Sheets*, State of CT DEP Recycling Program.

APPENDIX B

FAQ: Frequently Asked Questions About Composting

People who have little or no experience with composting often have several questions about the process.

Will the compost pile smell disgusting?

No. A compost pile with the right balance of food wastes and bulking materials, moisture, and oxygen will provide a habitat that will allow the composting organisms to thrive. A working pile typically develops an earthy odor. Food scraps should not be left exposed at the top of the pile. By turning the pile frequently and spreading a layer of bulking material over the fresh food, new deposits are covered, reducing odor. Mature compost has a crumbly, moist texture and looks like dark soil. Foul odors are a sign that the pile is out of balance and requires a remedy such as more frequent turning (aeration), a change in moisture level or food supply.

Will the compost pile look unsightly?

No. The compost bin should be sturdily built of durable materials (see Appendix F, *Compost Bin Design*, page 33). A poorly-constructed or maintained bin begins to fall apart, attracting animals and becoming unsightly. Selecting a site that is behind the school building or is hidden from view by shrubs or a fence will decrease chances of vandalism. Other considerations for placement of the bins are discussed in the section entitled *The Infrastructure*, page 10.

Isn't composting dirty and messy?

No. The composting routine is most pleasant if the area is kept tidy and well maintained. Any spillage of food scraps or bulking material should be cleaned up as part of the daily tasks. Keep garden gloves and composting tools conveniently located, clean and ready to use. Access to water is helpful. Containers for food scraps must be the appropriate size for the amount of wastes expected, easily accessible and have an opening into which food can easily be scraped.

A 20 or 30-gallon trash can that is lined with a trash bag (held in place with a bungee cord around the brim) works well. The container should be on a cart or wheels for transporting to the compost bin. Containers should be emptied and rinsed daily. A covered container is required if it is necessary to hold food scraps overnight.

Can people get diseases from handling composting food wastes?

No, not typically. The heat, ranging from 130–150°F, generated by a thriving colony of decomposers, kills most pathogens. However, staff and students should wear gloves when participating in the compost operation as they may come in contact with food that has not yet decomposed into inert compost. Mature compost can be handled like soil, with or without gloves. (Wearing gloves guards against the drying effects of soil and compost on the skin.) Actively decaying organic matter contains mold spores. Children with asthma or allergies to mold should consult their physician before working with compost.

Don't compost piles attract wild animals?

No, not if managed well. A well-constructed and maintained bin is the best defense against unwanted intruders. The bin should have a latch or lid that raccoons cannot easily pry open. There are numerous designs for bins with mesh wire to eliminate rodents, but these must be maintained for maximum effectiveness. Following proper composting procedures will keep the pile cooking and odors to a minimum, attracting fewer flies and critters. Garbage dumpsters and trash compactors are usually more attractive to vermin than compost bins.

Isn't composting a lot of work?

No. Remember, the decomposers of the pile do most of the work for you. Keep the process simple and convenient. Containers for food scraps must be conveniently located and clearly labeled; students and staff need help learning the best way to separate their lunch wastes. The compost bin should be located conveniently for the efficient transportation of food wastes. (Placement of the bin near a garden may be considered, as well.) Bins must be easily accessible during winter and for delivery of bulking materials (wood chips, wood shavings, saw dust or dry leaves) by large equipment. Bulking materials should be located beside the bin. Keep materials and tools readily available. Turning the pile does take muscle and time, which requires planning ahead. A new task will more likely become routine if the process works well. Take the time to develop a well-trained and responsible compost team.

APPENDIX C

Connecticut Science Teaching Standards

Lessons about the composting process address concepts outlined in the *Science Curriculum Frameworks* established by The Connecticut State Department of Education (March 1998).

<http://www.state.ct.us/sde/dtl/curriculum/cursci.htm>

Content Standard 1: The Nature of Science

Grades K–4

- ☞ Recognize that tools such as thermometers, magnifiers, rulers or balances often give more information than can be obtained by making observations without them

Grades 5–8

- ☞ Conduct scientific investigations which generally involve the collection of relevant evidence, the use of logical reasoning and creativity in devising hypotheses and explanations to make sense of the evidence
- ☞ Identify and control variables in experiments
- ☞ Evaluate the strengths and weaknesses of claims, arguments or data
- ☞ Recognize that a variety of experimental designs and strategies can be developed to answer the same questions
- ☞ Use appropriate technology as a tool in problem solving
- ☞ Use scientific knowledge and way of thinking in personal decision making

Grades 9–12

- ☞ Gather and synthesize information concerning a problem
- ☞ Generate and revise hypotheses based upon empirical data and the requirements of logical reasoning

Content Standard 3: Living Things and Their Environment

Grades K–4

- 🌀 Discuss how organisms depend on other organisms and their environments for basic needs
- 🌀 Describe how a variety of organisms, such as producers, consumers, and decomposers, obtain their basic needs
- 🌀 Explain that some source of energy is needed for all organisms to stay alive and grow

Grades 5–8

- 🌀 Describe the roles of producers, consumers and decomposers in an ecosystem and provide specific examples of each
- 🌀 Explain the need for sunlight and other abiotic factors, such as water and air, in an ecosystem change
- 🌀 Explain that while matter is recycled in an ecosystem, there is a one-way flow of energy in ecosystems
- 🌀 Explain that the number and variety of organisms and populations are dependent on the resources and physical factors of their environment
- 🌀 Explain how both organisms and ecosystems can change if the physical conditions of an ecosystem change

Grades 9–12

- 🌀 Explain chemical bonds and metabolic processes, such as photosynthesis and cellular respiration, as the use of energy by organisms
- 🌀 Explain that the distribution and abundance of organisms and populations in ecosystems are ultimately governed by the availability of matter and energy and the ability of the ecosystem to recycle organic material
- 🌀 Describe the movement of matter and energy through different levels of organizations of living systems and show how matter and energy are transformed and conserved
- 🌀 Explain ways in which humans can minimize their impact on biomes

Content Standard 4: Units of Structure and Function

Grades K–4

- ✎ Discuss basic life functions, such as respiration, movement, elimination, responding to stimuli, taking in food, and reproduction

Grades 5–8

- ✎ Recognize that basic life processes, such as photosynthesis and respiration, occur at the cellular level
- ✎ Understand that cells divide for growth, replacement, repair and reproduction

Grades 9–12

- ✎ Know that cells function in a narrow range of physical conditions, such as temperature and pH, to carry out life functions that help them maintain themselves (homeostasis)
- ✎ Understand that continual solar energy input and the fixing of solar energy by photosynthetic organisms is necessary for most of life
- ✎ Understand that the matter making up living things is the same matter found in the physical world

Content Standard 5: Relationships of Structure and Function

Grades K–4

- ✎ Describe features that help organisms to survive in different environments

Grades 5–8

- ✎ Describe the major distinctions among the kingdoms of living things
- ✎ Describe how different life functions (e.g., digestion, reproduction) are carried out by different organisms

Grades 9–12

- ✎ Given a classification key, classify a given organism
- ✎ Describe how different life functions (e.g., digestion, reproduction) are carried out by different organisms

Content Standard 6: Cycles of Life

Grades K–4

- ☞ Identify external features of organisms that help them survive in different kinds of places
- ☞ Describe the life cycles of familiar organisms

Grades 9–12

- ☞ Explain that preservation of the Earth's biological diversity is critical to the future of human beings and other living things

Content Standard 7: The Earth

Grades K–4

- ☞ List ways that people use the Earth's resources
- ☞ Explain that soil is made partly from weathered rock, partly from plant and animal remains, and also contains living organisms

Grades 5–8

- ☞ Explain how human activities (such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the atmosphere, and waste disposal) have altered the Earth's land, oceans and atmosphere

Grades 9–12

- ☞ Analyze the costs, benefits, alternatives and consequences of natural resource exploration, and consumption

Content Standard 8: Water

Grades K–4

- ☞ Recognize that plants and animals need water to live

Content Standard 11: Structure of Matter

Grades 5–8

- ☞ Show how features such as the temperature and acidity of a solution can influence reaction rates

Grades 9–12

- ☞ Recognize that the ability of a reaction to occur and the extent to which it proceeds depend on the relative stability of the reactants compared to the products and the conditions under which the reaction occurs
- ☞ Show how features such as the temperature and acidity of a solution can influence reaction rates

Content Standard 12: Energy

Grades K–4

- ☞ Recognize forms of energy used every day
- ☞ Recognize that some materials conduct heat better than others, and that poor conductors can reduce heat loss

Grades 5–8

- ☞ Identify energy transformations that occur in various systems (e.g., biological, mechanical, geological) and recognize that heat is a by-product of energy transformations
- ☞ Demonstrate that heat can be transferred by convection, conduction and radiation
- ☞ Recognize that energy exists in many forms (e.g., light, heat, chemical, electrical and mechanical) and that energy can be transformed from one form to another
- ☞ Understand that all physical changes, including changes of state, require energy

Grades 9–12

- ☞ Explain that, although energy changes into different forms within a closed system, the total amount of energy remains unchanged, while the amount of useful energy is decreased

APPENDIX D

Compost Club Activities

Fun activities to get students involved in the composting program:

Videos about Composting

See “[Resources](#)”, page 88, for suggestions.

Decomposition Experiment

Use photography to record decomposition rates. Students predict the decomposition time required for various food items (apple, broccoli, tea bag, pretzel, wrapped fruit bar, cracker, etc.) then place each item in its own labeled mesh bag attached to a string. Each food bag is buried in the compost bin, tying the free end to the top edge of the compost bin so it can be retrieved. The contents of each bag are removed, placed on white paper marked with the date and photographed weekly.

Posters

Students create food composting posters for the cafeteria.

Weekly Menu/Calendar

Students create a weekly calendar poster that lists each day’s menu. Items that can and cannot be composted are marked in contrasting colors. A washable board works well. The poster should be located near the food-sorting barrels for student reference.

National Celebrations

Celebrate America Recycles Day (November 15), International Compost Awareness Week (the week that includes May 1) or Earth Day (April 22). Students help distribute information and publicize the event school-wide by producing posters, school television advertisements and public service announcements.

Worm Bin

Students maintain and monitor a worm bin. See guides about composting with worms listed in “[Resources](#)”, page 87.

Fungus Among Us Party

Students learn about the different roles of fungi in composting and food when they use yeast and mushrooms to build a pizza.

Scavenger Hunt

Take the students outside to find items that relate to natural decomposition and composting. The scavenger hunt included in “[Lessons & Activities](#)”, page 72, requires at least two adults for supervision. Hide a food treat for the students to discover when they follow the last clue.

School Recycling Program

Students take a role in management of the solid waste disposal in the building by inventorying classrooms. Students use an inventory sheet to check which rooms have adequate recycling bins; students distribute labeled bins; students design an informational pamphlet for teachers.

Make Recycled Paper Planters

“Handmade Recycled Paper Planters,” from *The Quest for Less*.

Creepie-Crawlie Snacks

Include gummy worms, insects and “dirt cake” for snack. The dirt cake recipe is included in “[Lessons & Activities](#)”, page 77.

Composting Hint of the Week

Discuss a problem students encounter when sorting lunch wastes and make up a hint of the week to advertise on the school television monitor. Example: “Compost leftover salad even if it has some salad dressing on it.”

Monitor the Compost Pile

Students measure and record the temperature of the compost pile each week. Use this information to determine the success of the pile and troubleshoot problems with the pile.

Public Service Announcements

Students create and read composting hints on the school public address system.

Compost Logo

Students design a school compost logo for use as labels on small bags of compost as a gift to teachers.

Use the Compost

Students pot small plants in compost-based potting soil and give away as gifts; identify with a compost label.

APPENDIX E

Inside a Compost Pile

In nature, decomposition is an ongoing natural process. Dig down into the earth of the forest floor and you will find a rich, dark layer of topsoil up to several inches thick. A major component of topsoil is humus, the result of decomposition of plant and animal material that accumulates on the forest floor. Billions of decomposers convert the nutrients into humus. Fungi, bacteria and actinomycetes break down fibrous plant material. Worms and insects tunnel through the debris, shredding and chewing as they go. Leaves are broken down physically and chemically through digestive processes; the excreted material becomes humus. Without decomposers, critical nutrients would not be recycled for plant growth.

In a compost pile, people provide optimum food, moisture, and oxygen for the decomposers to grow and reproduce continually. Decomposers need nitrogen to build their cells; food scraps, grass clippings and manure are excellent sources of nitrogen. Wood chips, dry leaves and sawdust are rich in carbon, a source of energy for the decomposers. In composting jargon, the nitrogen sources are referred to as the “greens” and the carbon sources are the “browns.”

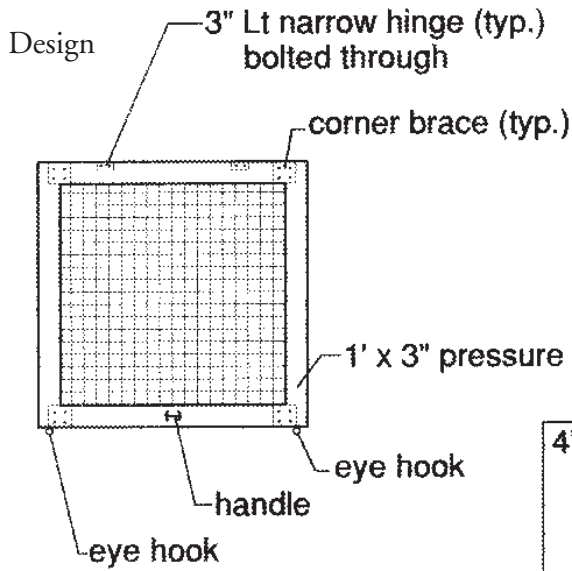
It is beneficial to maintain a ratio of 30 to 1 browns to greens in a compost pile to give the decomposers a balanced diet. Alternating layers of browns and greens helps maintain this balance.

Browns are also referred to as bulking material; the drier, bulkier materials help the compost pile stay light and loose, allowing air to circulate more freely. A compost pile that is too wet and compacted will begin to smell as the result of anaerobic (bacteria that does not require oxygen) bacterial action. A compost pile should be moist, but not soaking wet. Foods have a high moisture content, and are usually wet enough to keep the pile moist. Regular turning aerates the pile and mixes the browns and greens. It is easier to remedy a situation that is too high in carbon than one that is too high in nitrogen and has become wet and smelly.

Besides fungi and bacteria, worms, springtails, mites and beetles are among the typical decomposers in a compost pile. Working decomposers produce metabolic heat as a result of cellular respiration. Smaller food scraps provide more surface area for the decomposers to feed on, thereby increasing the composting rate. In a healthy compost pile, the temperature will gradually rise, as long as there is adequate food for the decomposers.

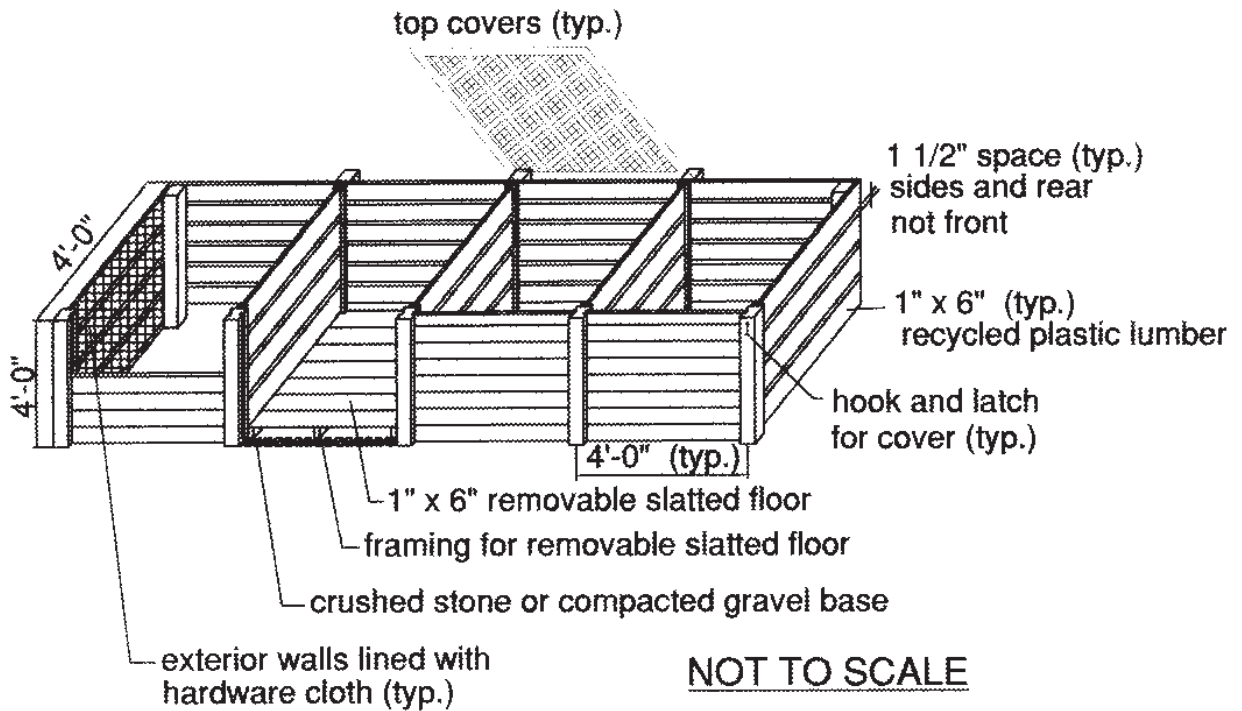
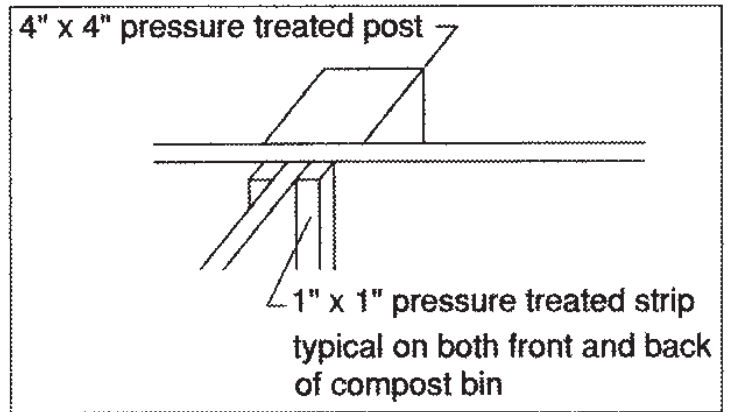
APPENDIX F

Compost Bin Design



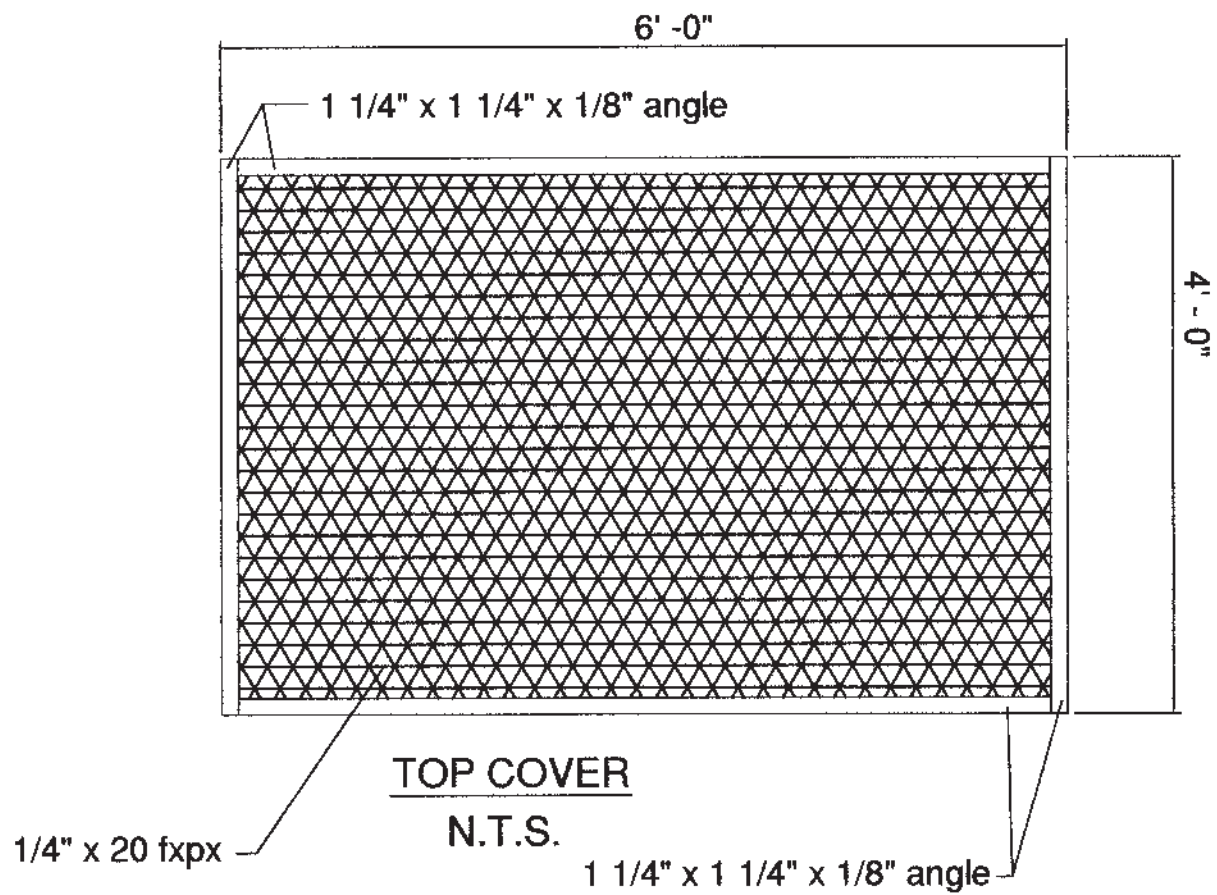
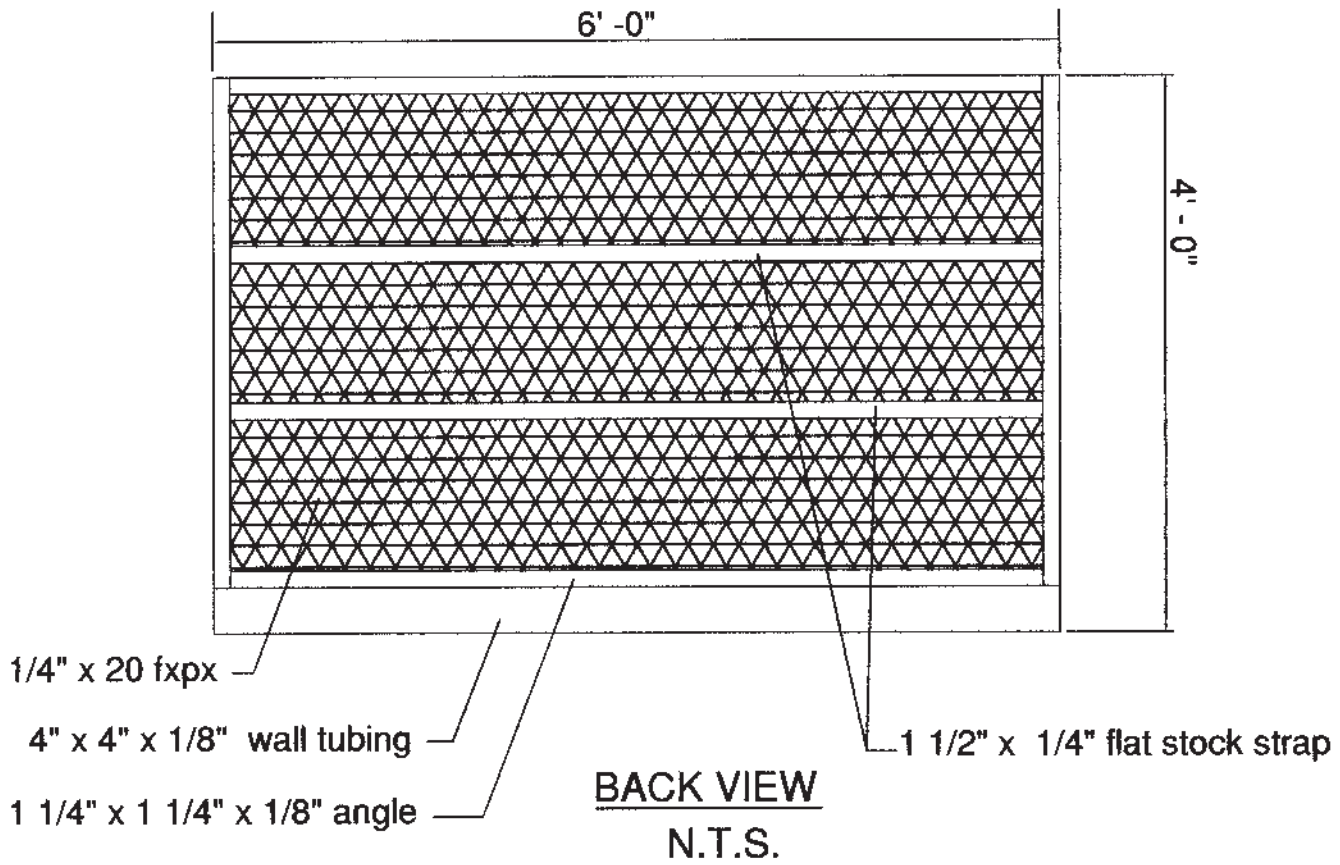
fasten hinges and corner braces with # 8 1 1/2" screws to be bolted through staple 1/2" hardware cloth or chicken wire to frame with 3/8" staples

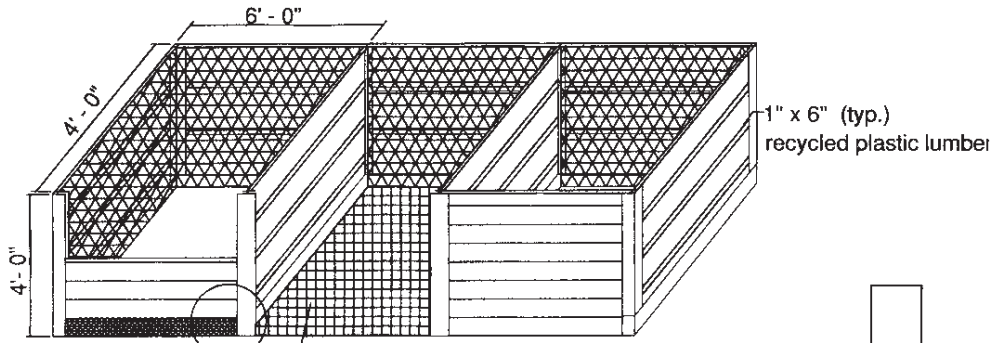
TOP COVERS (TYP.)



NOT TO SCALE

post can be made out of 2-2" x 6" pressure treated lumber with a 1" x 4" pressure treated board between them or a 4" x 4" pressure treated post with a slot routed for the slats

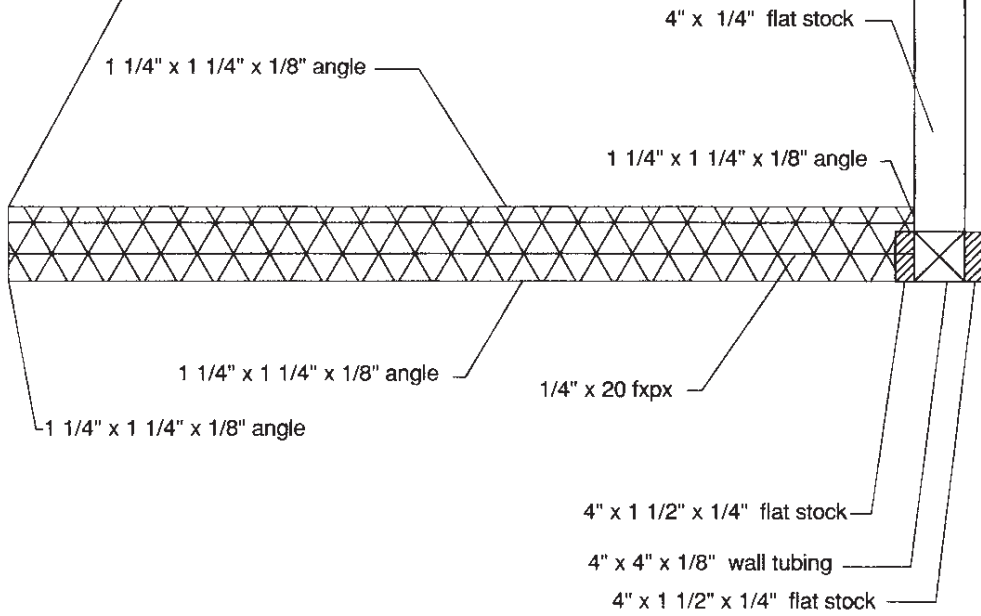


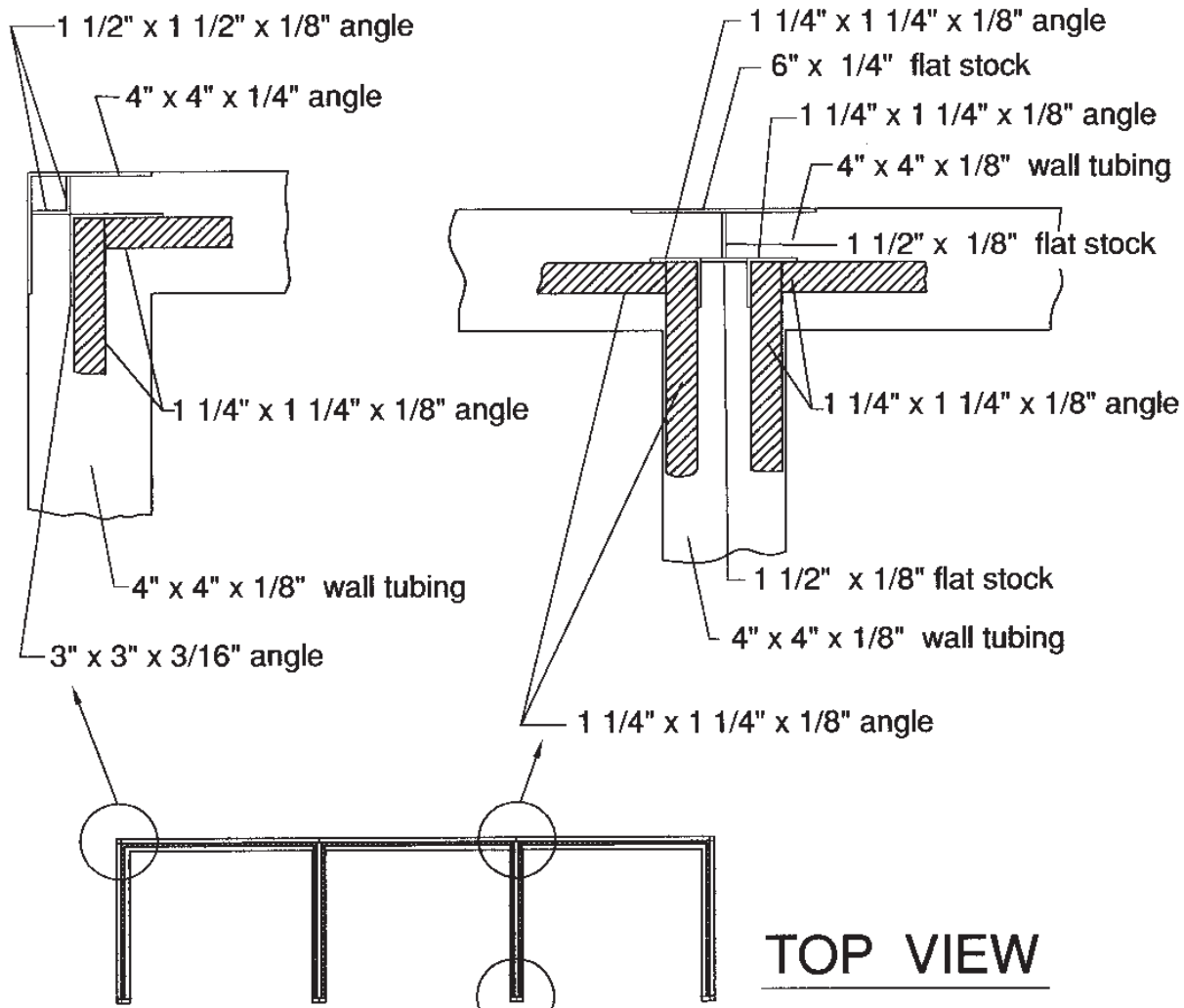


1/2" x 1/2" hardware cloth

PLAN VIEW

N.T.S.





1 1/2" x 1 1/2" x 1/8" angle

4" x 4" x 1/4" angle

1 1/4" x 1 1/4" x 1/8" angle

4" x 4" x 1/8" wall tubing

3" x 3" x 3/16" angle

1 1/4" x 1 1/4" x 1/8" angle

6" x 1/4" flat stock

1 1/4" x 1 1/4" x 1/8" angle

4" x 4" x 1/8" wall tubing

1 1/2" x 1/8" flat stock

1 1/4" x 1 1/4" x 1/8" angle

1 1/2" x 1/8" flat stock

4" x 4" x 1/8" wall tubing

1 1/4" x 1 1/4" x 1/8" angle

TOP VIEW

N.T.S.

1 1/2" x 1 1/2" x 1/8" angle

4" x 4" x 1/8" wall tubing

1 1/4" x 1 1/4" x 1/8" angle

1 1/4" x 1 1/4" x 1/8" angle

1 1/4" x 1 1/4" x 1/8" angle

1 1/2" x 1/8" flat stock

1 1/4" x 1 1/4" x 1/8" angle

4" x 1 1/2" x 1/4" flat stock

4" x 1 1/2" x 1/4" flat stock

4" x 1/4" flat stock

APPENDIX G

Composting Problems and Solutions

PROBLEM	CAUSE	SOLUTIONS
Compost pile contains earwigs, slugs and/or other insects	Pile is composting correctly	Insects are a good sign of a productive compost pile
Compost pile is attracting raccoons, dogs, flies or other pests	Amount or type of greens incorrect	Avoid meats, bones, oils
	Exposed food scraps	Place food scraps in center of pile and cover completely with browns
	Compost bin needs repairs	Keep the bin well maintained
Compost isn't heating up	If it seems damp and sweet-smelling, it may be a lack of nitrogen	Mix in food scraps or other materials high in nitrogen
	Not enough moisture	Add water
	Not enough oxygen	Turn or fluff the pile
	Pile may be too small (less than a cubic yard)	Build the pile up to 3' x 3' x 3'
Temperature levels off	More food scraps needed	Add more greens
	Composting is finished	If it looks dark and crumbly and smells earthy, it is time to remove compost and let it cure Begin a new pile

PROBLEM	CAUSE	SOLUTIONS
Matted, undecomposed layers of leaves or food scraps	Compaction, poor aeration	<p>Break up layers with garden fork, or shred them, then re-layer or turn the pile</p> <p>Avoid adding thick layers of bulking materials</p>
Large, undecomposed materials	Size and composition of materials	<p>Screen out undecomposed items, shred and reuse in new pile</p> <p>Reduce particle size by shredding</p>
Compost pile has a bad odor like a mixture of rancid butter, vinegar and rotten eggs	Not enough oxygen, compaction	Turn the pile and shake material to loosen and aerate
	Not enough oxygen, too wet	Turn the pile and add coarse dry material such as leaves, wood shavings, sawdust, straw or shredded newspaper to soak up excess moisture
Compost pile has a bad odor like ammonia	Pile may have too much nitrogen	<p>Add materials high in carbon such as leaves, wood shavings, sawdust, straw or shredded newspaper</p> <p>Mix in to aerate</p>



Compost Survey

The goal of the Compost Survey is to assess the experience, knowledge, and attitudes of your students as they apply to composting. The overall scores on the two parts are designed to give you a general idea of student knowledge about composting and should be used along with teacher observation to determine your compost education strategies. The items on the survey can also generate an interesting discussion about composting.

The survey can be given shortly after the initiation of a school composting program and again half way through the school year or at the end of the school year. This use is similar to a pre- and post-test; the student responses are a measure of the change in their compost knowledge and attitudes over time.

The first year of a composting project may move along in fits and starts while you are finding ways to make the composting routine work. The survey could be a useful assessment tool at the start of the second year of the project with students who have been in the program for the previous year. This will give you some measure of the progress you are making with the students' grasp of the composting ideas. At that time, the survey could also be administered to students new to the program to help you decide what compost education will be needed with the new group. Students who have done composting at their elementary schools may not require as much initiation to composting concepts.

Part One **The Survey Statements**

A response of "always" is an indication of some knowledge and a positive attitude toward composting. Students can add up the number of responses in each category and multiply times a value to get their score:

never = 1 sometimes/usually = 2 always = 3

Part Two **True or False Statements**

After students complete their responses to Part Two, the teacher should take the opportunity to make this a learning experience. One way to do this is to have the students discuss their answers in groups of three; encourage them to support their answers. If a student wishes to change a response, he/she could write the new response in a different color beside the original answer. (That way, the original responses can still be tallied for the purposes of comparing pre- and post-survey scores.) The large group discussion can follow.

Another way to extend the learning value of Part Two is to use it as a springboard for further research by the students.

Answers:

True statements: # 1, 2, 4, 5, 6, 7, 9, 11, 14, 16, 18, 20

False statements: # 3, 8, 10, 12, 13, 15, 17, 19

Part One **Read each statement and circle your response.**

1. I compost at home.

never sometimes/usually always

2. I understand what composting is.

never sometimes/usually always

3. When I sort my lunch waste, I know what goes into the compost food barrel.

never sometimes/usually always

4. I know what happens to the food in the compost food barrel.

never sometimes/usually always

5. My friends are careful not to throw plastic utensils into the compost food barrel in the cafeteria.

never sometimes/usually always

6. After lunch if I have leftover food, I save it to eat later.

never sometimes/usually always

7. I sort my lunch waste carefully.

never sometimes/usually always

8. Sorting lunch waste is easy.

never sometimes/usually always

9. My friends sort their lunch waste correctly.

never sometimes/usually always

10. I notice when other kids sort their lunch waste correctly.

never sometimes/usually always

11. Sorting lunch waste takes only a few seconds.

never sometimes/usually always

12. After a while, kids get used to the routine of sorting their food waste.

never sometimes/usually always

9. The product of a compost pile is similar to topsoil.
true false
10. The best way to get rid of leaves is to put them in a plastic bag for trash pick-up.
true false
11. When compost gets compacted, it can cause unpleasant odors.
true false
12. The center of a working compost pile is very cool.
true false
13. Compost piles are always very smelly.
true false
14. Nature recycles.
true false
15. People who live in apartments can't compost.
true false
16. Composting is one way to recycle.
true false
17. Decomposers need only food and air to do their work in a compost pile.
true false
18. Yard scraps such as grass clippings and leaves can be composted.
true false
19. Composting works only if it is done in a specially designed compost bin.
true false
20. Usually, animals are not attracted to a compost bin if meat and bones are not put into it.
true false



Compost Introductory Lessons

What Good is Trash?

This is an introductory lesson to composting designed to encourage students to rethink the way we value our trash. The three parts of the lessons can be done in a 90 minute teaching block. Alternatively, Parts One and Two can be taught as one lesson and Part Three, which introduces composting, taught as a separate lesson.

Time 90–120 minutes, depending on age group and extent of discussions.

Class of 20–25 students, divided into groups of four.

Materials

1. Five Grocery Bags, each containing: Cereal box, soda can, another metal food container, plastic food container, old piece of foil, tea bag, a cracker (in a baggie), dry leaves or grass clippings (in a baggie), ribbon or gift bow, piece of junk mail, magazine, peanut or cocoa “can” (made of foil, cardboard and plastic), plastic shopping bag, **empty** container of bug spray, flea and tick powder, fertilizer, or oil-based paint.

Note: some items are in baggies for convenience and should not be removed from the bag. For the purposes of this activity, students should sort the items without regard to the baggie.

2. Five Sets of Index Cards marked: Plastic, Metal, Paper, Household Hazardous Waste, Food, Yard Wastes and Other

3. Sheets of Scrap Paper

4. Transparencies

Make transparencies from the *Documents to Copy* section of this manual. “Soil Diagram”, page 80; “Soil and Decomposition,” page 81; “Discover Compost Animals,” page 82; “The Trash Can Diagram,” page 83.

Items below are needed for Part Three

5. Bag of food scraps

6. Bag of finished compost

7. Sample ingredients for the compost pile (leaf, grass clippings, apple core, orange peel, coffee grounds)

Motivation/Initiation

Begin the lesson by offering to sell a bag of valuable trash; it’s special because it contains packaging from some favorite products. Play up the uniqueness of this trash and entice the students to make offers. Usually no one offers to buy the trash but there may be a student who wants to play along and offers a few cents. A student might see that there is a redeemable can and offer five cents. (Who will offer \$10 for this valuable bag of trash? \$5?) Conclude that basically most of the students are not willing to pay anything for the trash. Ask them why and list their answers on the board. Examples of responses: “The trash is worthless, they can’t use it, they don’t need it.” Solicit words that describe how we feel about trash: “Disgusting, dirty, useless.” Add these words to the list on the board.

Activity

Part One **Sorting for Points**

Divide the students into five groups. Tell them they will be given a quick activity that involves sorting a bag of trash. Each bag contains trash items and a set of category cards. Groups will be given one point for each item correctly sorted by the material it is made of. Tell them that this will probably be easy so they will need only a few minutes to complete the task. The group members must discuss the items and agree on the placement of each item. Give each group of four students a bag of trash and the sorting cards. They will need about ten minutes to sort.

When all the groups have sorted their bags, list the items on the board and review with the class how each item was sorted. For each item, check for general agreement. Students may not agree but a group might be awarded a point if it can make a reasonable justification for its choice. A group member should record the points.

There will be quick agreement for many items so do a quick whip-around to award points. The tea bag will generate discussion because many students do not see the paper as biodegradable. If you use a tea bag with a plastic string or a staple, interesting solutions may arise. Packaging made of a composite of foil, cardboard and plastic (the type for canned nuts), is not easily recycled and, therefore, is trash.

A certain amount of discussion and competition among groups is okay. It will make the points seem more valuable. Tally and list the scores; most groups will have similar scores at this point.

Answers

Paper: cereal box, junk mail, magazine

Plastic: plastic food container, lid of peanut can, plastic shopping bag

Metal: soda can, metal food container, foil,

Food and Yard Wastes: cracker, dry leaves, grass clippings, teabags

Household Hazardous Waste: empty container of bug spray, flea and tick powder, fertilizer, oil-based paint

Other: peanut or cocoa can, ribbon, gift bow

Part Two **What Good is Trash?**

Now challenge the groups to earn more points by using their creativity to brainstorm a list of possible uses for each item they have sorted. Remind them that when brainstorming, all ideas are acceptable. A group member should record their ideas. Give them about 5 minutes to list ideas.

When time is up, each group can tell the class three of their ideas. The group recorder should then count their total number of ideas and add this total to the points from the sorting activity (Part One). Again, different opinions and ideas will increase the value of the items of trash.

Discussion Questions

1. What are some words that describe how we felt about the trash during the activity?
2. Make a list of the words that describe our attitude toward the trash during the activity; compare this list with the first.
3. How did our attitudes compare to the beginning of the lesson when they were offered the bag of trash for sale?
4. What changed our attitudes?

5. Why?
6. What if each point were equal to a dollar, would that affect the activity in any way?
7. What does this activity show us about how we value things?

Lead the Group to these Ideas

- 🌀 We can decide if something has value.
- 🌀 Each culture has objects and materials that it values for various reasons.
- 🌀 Trash is a valuable resource. One person's trash is another person's treasure.

Part Three **What's Composting?**

List the following types of trash on the board: Plastic, paper, food wastes, metal, yard/garden wastes, glass. On a piece of scrap paper, have each student list the types of trash in the order in which he/she thinks Americans produce the most. Have them vote to show some general reactions to the question. Then, compare their list to the figures listed on the transparency showing a diagram of a trash can indicating percentages of types of waste.

Discussion Questions

1. Are the percentages close to what you predicted?
2. What type of trash did you put as the largest percent? The smallest? Why?
3. What surprised you? Why?

Generate a list of what happens to trash after roadside pick-up: Trash is recycled, landfilled, incinerated, composted, reused. (Virtually all Connecticut household trash is incinerated at a resource recovery facility or is sent out-of-state. Items kept separate for recycling are processed at a recycling plant.)

Define biodegradable with the students. Have students circle the items on their list that are biodegradable.

If something is biodegradable, it can be composted. Ask if anyone composts at home; who can explain what composting is?

Discuss decomposition: rotting, decaying, breaking down of organic material (part of living things) by insects, worms, fungi and bacteria (decomposers). If we composted all the biodegradable trash, what percent of the trash we produce could be composted? (Refer to trash can transparency: over 60%.)

Nature Recycles

Discuss how nature recycles nutrients in a food chain. Students can make up examples of food chains. Food chains begin with photosynthesis by plants. Each organism uses the energy it gets to function (grow and repair cells, reproduce, run, eat, etc.)

Discuss the breakdown of leaves in a forest using the transparency that shows how soil is made. What causes the leaves to break down into soil? The rate of decomposition depends on conditions such as the amount of water and oxygen and the types of decomposers. (If this is to be done as a separate lesson, students can go outside and investigate leaf litter and topsoil.)

Explain that we imitate nature when we compost, but we speed up the process by creating the conditions needed for efficient decomposition.

Show the transparency of compost animals. Ask students to name the decomposers they recognize. The discussion about the less familiar ones such as actinomycetes will depend on how much you want to get into the various types of organisms.

It is adequate for them to become aware of the general categories: fungi, bacteria, worms, insects and insect-like organisms (spring-tails, mites) and mollusks (snails). (This fits well into a unit on invertebrates.)

Have students discuss the meaning of the arrows in the diagram. Can they find any food chains?

Explain that decomposers are living organisms. Ask students to list the things all organisms need to survive: food, water, air (oxygen), shelter and space.

Show a baggie full of food scraps and a baggie of finished compost. When we compost food scraps we need to provide the right conditions for the decomposers to live and reproduce so they change food scraps into humus. Allow students to smell and touch the compost and think of words that describe it. Completely composted food results in a crumbly, earthy-smelling product.

Ingredients for Composting

Browns and Greens

Food gives us energy and nutrients (basic elements) for building and repairing cells. Decomposers need carbon for energy; dry leaves and wood chips provide energy for decomposers. They also need nitrogen to build proteins; food scraps and fresh grass clippings are high in nitrogen. A carbon/nitrogen ratio of 30:1 is ideal. The browns are also called bulking agents and are layered between the greens to keep the materials from compacting. A light, loose mixture allows oxygen to circulate and space for decomposers to move around. Water must be provided also; most food has a high water content. If a compost pile gets too wet, it will become compacted and decrease oxygen flow. The compost bin and materials provide shelter (some protection from predators and weather conditions) for the decomposers.

Suggestions

Using samples of the ingredients (or paper or plastic representations), show how to layer the browns and greens. Visit a working compost bin, if possible, to observe contents and measure “living conditions” (temperature).

Hold up a bag of finished compost and ask if any of the students has ever purchased potting soil. How much would this bag cost in a store? Make the point that people will pay money for compost, so it has value. What could you use the compost for?

Have each student write on scrap paper why it would be beneficial to compost our food and yard wastes at home or in the community. Students may think of how they could use the compost in their gardens instead of buying soil or fertilizer.

Community Composting

- ♻️ Reduces the amount of trash (the “solid waste stream”)
- ♻️ Reduces transportation costs (for transporting waste to the incinerator and goods—fertilizer, soil—to market)
- ♻️ Reduces fuel used for trash transportation and shipping goods to market.
- ♻️ Produces humus, a useful product

Closure

Have students write something new that each of them learned about compost or how their attitude about garbage has changed. Students can share their statements.



Lessons for Compost Exhibits

Constructing Traveling Displays

This set of lessons was originally designed for a group of sixth grade teachers to use with their advisor/advisee classes as part of their environmental awareness goal. The students learn about composting by participating in the lesson and designing a compost display. Sixth-graders are old enough to translate the composting concepts into a meaningful exhibit and especially like the idea of teaching other students. Upon completion, the exhibit might be displayed in the school library, cafeteria, or at the school science fair. The exhibit could be made available on a sign-out basis for individual home-rooms or for subject area teachers to display for a week to integrate composting into their curriculum. An extension activity could be for sixth-graders to visit the elementary schools with their exhibit.

Each lesson contains a curriculum resource, lesson concept and summary, and ideas for designing a display board with students. Presented as a traveling exhibit, the display boards get viewers to think about ideas ranging from recycling resources to decomposition. The actual designing and building of the display may be done by the entire class or by a small group of students.

Of course, teachers may choose to do only a few of the lessons, selecting and modifying to suit their needs. The lessons can be adapted for all middle school grades.

The goal is to engage students in creating a series of interactive display boards that help other students learn concepts about composting and recycling.

Concepts

Students do an activity that helps them learn about a composting/recycling concept. Each of the following lessons focuses on one theme about recycling or composting (although several concepts may be discussed); most concepts are probably not new to the students and can be done in a 30–45 minute block.

Resources

Transparencies can be made from the illustrations in the “Documents to Copy” section of this manual. Useful background information from other sources is also listed. Refer to the “Resources” section, page 85.

Display Idea

Students design and build a display about that theme. Using the ideas presented in the lesson, students either design the display together or follow instructions for a teacher-designed display, with student input. The time required for the construction of the display will vary, depending on the group. An idea for building the display board around the compost or recycling themes follows each lesson.

The display board should be instructive, interesting and interactive, focusing on one main concept. The display should have a title or question clearly printed and displayed. Using actual items and three-dimensional depictions whenever possible will make the display more attractive and interesting to viewers. Instructions should be clearly printed to explain how viewers are expected to interact with the display and how the display items should be left for the next user. Other things to consider: materials, simplicity, durability, time for construction.

Lesson One **Rot Time**

How long would it take for various items to decompose if thrown outside onto the ground?

Concepts

The amount of time it takes for an item to break down depends on the material of which it is made; if items are not disposed of properly or recycled, many items will not break down in our lifetime; the consequences would be a more unpleasant and/or dangerous environment, and already limited natural resources would be wasted.

Vocabulary

Decomposition, biodegradable

Resources

“[Enduring Litter](#)” chart, page 84, illustrates estimated years for decomposition of various items.

Lesson Summary

Students estimate decomposition time for items as they put actual items (or pictures, or labels) in the order in which they predict each would decompose; discuss the concepts (decomposition, biodegradable, recycling).

Display Idea

Students bring in actual items and place them in a box. Items are placed on hooks on the display board adjacent to the appropriate years (rot time).

Lesson Two **Trash Statistics**

What are the various types and percentages of wastes we throw away? How much do we recycle?

Concepts

The municipal solid waste stream can be categorized into paper, yard/garden wastes, food, plastic, glass, metal and other; paper is the waste we produce in the greatest percentage; we either burn, bury, compost, reuse or recycle our wastes; most of Connecticut's household trash is incinerated at resource recovery facilities that sell electricity to the power company; bulky waste and incinerator ash are buried in landfills; consequences of burning and burying trash are, water, soil and air pollution; eleven items are mandated by Connecticut state law for recycling – corrugated cardboard, newspaper, white office paper, glass food & beverage containers, metal food & beverage containers, leaves, grass clippings, scrap metal, waste motor oil, nickel-cadmium batteries and lead acid storage (car) batteries; the paper, yard/garden and food waste portions of our garbage can be composted; three benefits of composting are less pollution, recycling plant nutrients, and production of a beneficial product (compost).

Vocabulary

Municipal solid waste stream, composting, resource recovery facility

Resources

“The Trash Can Diagram,” page 83; “Solid Waste,” pages 41–43, from *The Quest for Less*; “Out of Sight, Out of Mind,” pages 65–72, from *Composting Across the Curriculum*.

Lesson Summary

Students examine a trash can's contents, categorize and make predictions (in percentages) for the amount of each type of trash produced in the United States; they can also predict which categories are the highest percentages, lowest, etc. and give their reasons; discuss which items should be recycled; discuss other concepts (above);

a sample of typical daily household waste could be brought in by the teacher; a class room trash can could be examined as a comparison.

Display Idea

Provide a box of items to be sorted by categories into labeled, mini-trash containers, with appropriate label (plastic, metal, paper); the display board could have a recreation of the garbage can diagram with examples of real items; the viewer would hang the appropriate percentage sign on the garbage can.

Lesson Three **Introduction to Composting**

What is composting? Why compost?

Concepts

Decomposition is the process of living organisms digesting and reducing organic material into humus; in nature, soil is created when decomposers digest dead plants and animals, recycling important nutrients (the nutrient cycle); in composting, we create an environment suitable for organisms to flourish and reproduce, causing organic materials to decompose faster; yard trimmings, food waste and paper (a large percentage of our waste stream) can be recycled through the composting process; there are many benefits to composting.

Vocabulary

Composting, compost, biodegradable, waste stream, nutrients

Resources

“Composting,” pages 109–112, from *The Quest for Less*;

“Why Compost?,” pages 1–3, from *Composting Across the Curriculum*

Lesson Summary

Students examine the composition of soil and/or compost material and discuss how nature makes soil; students discuss composting, how it is done, role of decomposers; students make decisions about which parts of our waste stream could be composted (sort trash samples, use diagram, or word cards); discuss the benefits of composting.

Display Idea

Provide informational diagrams and labels which focus on the school composting system; take digital photos of the school process, download and print and use as a sequencing activity; include a sorting activity which has viewers separate out items (real or simulated) that can be composted in the school composting bin.

Lesson Four **Compost Creatures**

What are the important organisms that do the work of decomposition in a compost pile?

Concepts

Decomposers are the organisms that break down foods into their basic nutrients (ie., calcium, potassium, nitrogen, carbon) that can then be reused by plants and continue the nutrient cycle; insects, worms, fungi and bacteria decompose the food by physical activity (chewing, shredding) and chemical activities (digestion).

Vocabulary

Decomposers, decomposition, biodegradable, nutrient cycle

Resources

“[Discover Compost Animals](#),” page 82

Lesson Summary

Students search for organisms in compost material, identify, sketch and read about; discuss above concepts; students may search with the naked eye, a hand lens or by sorting through a sample of compost material with the aid of a dissecting scope.

Display Idea

Diagram or create a compost pile with real and simulated materials; student drawn pictures of decomposers are arranged throughout the pile; decomposer pictures are flipped up to reveal an information card about the organism; display could play on the idea of “most wanted” posters for a compost pile; students may think of their own title.

Lesson Five **Construct a Compost Pile**

What are the parts of a compost pile? What keeps a compost pile cooking?

Concepts

Decomposers are organisms (fungi, worms, insects, bacteria) that digest food/ yard waste, turning it into a rich soil; the decomposers must be given the correct conditions for the composting process to work quickly (water, oxygen, food, and mass); dead leaves, wood shavings, straw or shredded paper (referred to as “browns”) provide carbohydrates for energy and spaces for oxygen to circulate; nutrients such as food scraps or grass clippings (referred to as “greens”) provide the protein necessary for cellular growth and reproduction.

Vocabulary

Decomposers, browns, greens

Resources

“[Discover Compost Animals](#),” page 82; “[Backyard Composting](#),” pages 21–23 from *Composting Across the Curriculum*.

Lesson Summary

Students view video and/or visit the school composting bins; discuss above concepts.

Display Idea

Students construct artificial layers to fit onto a compost bin diagram (browns are represented by 24" x 6" pieces of foam core board covered with paper leaves or dried leaves glued on; greens are foam core board with paper food scraps or magazine pictures of food). Exhibit viewers must read a paragraph about constructing a compost pile, then hook the brown and green layers on the exhibit board.

Situation cards are printed that describe conditions in the compost pile requiring the exhibit viewer to select a remedy card; a reference chart about compost troubleshooting is also displayed. Figure out a clever way to let the viewer know the selected remedy is the correct one.

Lesson Six **Cool Facts about Compost**

What are some interesting facts about composting? What's happening with our school compost? (This lesson is designed for after a school composting project has been started.)

Concepts

Decomposition is the process through which living organisms digest and reduce organic material to humus; in nature, soil is created when decomposers digest dead plants and animals, recycling important nutrients (the nutrient cycle); in composting, we create an environment suitable for organisms to flourish and reproduce, causing organic materials to decompose faster; yard trimmings, food wastes and paper (a large percentage of our waste stream) can be recycled through the composting process; there are many benefits to composting.

Vocabulary

Composting, compost, biodegradable, waste stream, nutrients

Resources

“[The Trash Can Diagram](#),” page 83; copy of the school composting records showing amount of food composted; www.conservatree.com; www.epa.gov/osw

Lesson Summary

Students discuss composting at their school, what is composted, the benefits of composting, tour the school's compost bins, search for interesting facts about composting.

Display Idea

Create a “Cool Facts about Composting” display using foods and decomposers as cartoons characters who ask questions or give hints; viewer must flip up a card or open a lid to read the answer or cool fact.

Lesson Seven **Everything comes from the Earth**

What are the sources of things we use in everyday life? How is everything connected to the earth?

Concepts

The components of all objects can be traced back to the earth; natural resources are used to make the objects we use; natural resources may be abundant, limited, renewable, or non-renewable.

Vocabulary

Natural resource, renewable, non-renewable

Resources

“Everything Comes from the Earth,” page 21–29, from *What a Waste!*;
“Natural Resources,” pages 5–9, “Products,” pages 25–27, and “Source Reduction,” pages 133–136, from *The Quest for Less*.

Lesson Summary

Students list components of everyday items that they have with them (sweater, notebook, pen, food) and web the origin of each part, tracing it back to the earth; discuss availability of the resources and the benefits of recycling, reusing and reducing use of resources.

Display Idea

Group selects a few of the common items that they traced back to the earth in the above lesson, and their webs, to reproduce on the display board; use an example of the actual item, if possible, draw web lines, leaving blanks. The viewer must sort through cards (from an envelope) and place them correctly on the web to show the origin of the parts.

Lesson Eight **Trees to Paper**

How many trees does it take to make paper? What are the benefits of recycling paper?

Concepts

Paper makes up the largest percentage of the solid waste stream we produce; paper is easily recycled and composted; recycling paper saves trees, water and electricity.

Teacher Background Information

Trees are a renewable resource, meaning they can be replaced within a reasonable amount of time (our lifetime) and can be managed and harvested ecologically. However, short-term economic goals often lead to problems: clear cutting large tracts of trees affects the atmosphere, erodes topsoil, pollutes water and disturbs wildlife habitat; repeated replanting and harvesting of trees exhausts the soil, perhaps in 2–3 generations; tree farms of one type of tree (monocultures) fall victim more easily to stressors such as disease and extreme weather events; tree farms typically manage disease with aerial pesticide spraying.

Vocabulary

Solid waste stream, renewable resource

Resources

“The Trash Can Diagram,” page 83; www.conservatree.org; “Recycling Facts,” page 91, from *The Quest for Less*.

Lesson Summary

Show students a stack of newspaper 6 feet tall (or diagram on board) and ask them how many trees it took to make a ton of newspaper (twelve 35 foot tall trees); students examine the trash produced in a classroom and guess the percentage of our solid waste stream that is paper; students discuss how paper is made, how paper-making impacts the environment, the value of trees and the benefits of recycling paper.

Display Idea

Students create a visual about trees and paper that makes a meaningful impact on the viewer (use the example above); students search for facts about paper and trees and recycling and display on illustrated flip cards (viewer reads the question, makes a guess, then flips up card to read the answer). Alternatively, the questions and answers could be shown as a matching activity (example: how many trees does it take to make the Sunday newspaper?)

Lesson Nine **Renewable and Non-Renewable Resources**

Where do the natural resources for our products come from? Which are renewable?

Concepts

Non-renewable natural resources are resources that cannot be replaced because there is a limited supply (coal, minerals), it is economically impractical to extract them (i.e., the gold in ocean water), extraction is harmful to the environment; reducing, reusing and recycling saves supplies of natural resources, reduces pollution and reduces the amount of trash produced (solid waste stream); plant and animal products are usually considered renewable resources (see Teacher Background Information about trees in the previous “Trees to Paper” lesson.)

Vocabulary

Natural resources, renewable, non-renewable, solid waste stream

Resources

“Will We Ever Run Out?,” pages 33–35, from *What A Waste!*; “Natural Resources,” pages 5–9, “Products,” pages 25–27, and “Source Reduction,” pages 133–136, from *The Quest for Less*.

Lesson Summary

Students examine every day items around the room and list the materials each is made from; list all the materials on the board and discuss which might be renewable and non-renewable

Display Idea

Create a matching board where the viewer must match the natural resources cards to the actual items they become a part of in manufacturing; red cards could stand for non-renewable, green for renewable resources.

Lesson Ten **Closing the Loop**

Why should we buy recycled goods? What does closing the loop mean? What types of recycled product items are available?

Concepts

Buying products made from recycled materials makes recycling profitable and keeps the natural resources in the cycle; buying recycled products is “closing the loop” of the three-arrow recycle symbol; post-consumer means the product is made from materials that were previously used by the consumer; pre-consumer means industry scraps created in the manufacture of a product; there must be consumer demand to make more, good quality and affordable recycled products.

Vocabulary

Recycle, natural resources, post-consumer; pre-consumer

Resources

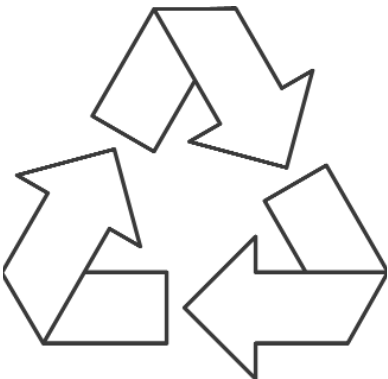
Close the Loop, School Recycling Fact Sheets, CT DEP, <http://dep.state.ct.us/wst/recycle/schoolfact01.pdf>; “Recycled Material Products and Markets,” page 43, from *Project Learning Tree— Exploring Environmental Issues: Municipal Solid Wastes*; Video- *Life After the Curb: Recycling Processes*; recycled products loan kit available through the CRRRA Visitor’s Center at (860) 247-4280; “Recycling,” pages 73– 75, “Buying Recycled,” pages 79– 82, and “Recycling Facts,” page 91, from *The Quest for Less*.

Lesson Summary

Show the three-arrow recycle symbol and solicit explanations of the symbol and explain the third arrow means the resources continue in a cycle, “closing the loop”; distribute several of the recycled products from the loan kit and have students guess what each is made from (example: recycled plastic bottles, newspapers, aluminum cans) and any clues that helped them decide; distribute samples of items that were recycled to make the new products, to match them up; discuss reasons for buying recycled products, their importance and barriers to purchasing recycled products.

Display Idea

Actual objects (or pictures of products) made from recycled materials are displayed; the viewer matches the new product with the item from which it was made.





Compost Labs

Four hands-on compost labs, designed for 5–8 graders, investigate the processes in an active compost bin or worm bin. A lab can be done with a whole class; alternatively, they can be set up as lab stations through which small groups of students rotate (requires about 90 minutes).

Resources

LAB TITLE	DESCRIPTION	CONCEPT	TEACHER PREPARATION	MATERIALS
Lab I Fungi	Examine variety and structure of fungi samples	Fungi are important decomposers	Grow samples of fungi from compost Make copies of "Discover Compost Animals," page 82	Petri dishes Hand lenses or dissecting scopes
Lab II Animal Decomposers	Examine variety of animal decomposers	A variety of animals make up a compost food web	Select samples of compost containing compost animals; keep in small covered containers. Make copies of "Discover Compost Animals," page 82	Compost animals Compost food web diagram Petri dishes Hand lenses or dissecting scopes, probes/ toothpicks
Lab III Red Wigglers	Examine compost worms	Red wigglers decompose food in a worm bin	Start a class worm bin (or have access to an active worm bin)	Red Wigglers Worm bin Petri dishes Hand lenses or dissecting scopes
Lab IV Soil Composition	Examine different types of soils; compare to compost	Organic materials are important ingredients in soils	Collect samples of field and forest soil, unscreened and screened compost	Soil samples Petri dishes Hand lenses or dissecting scopes

Question

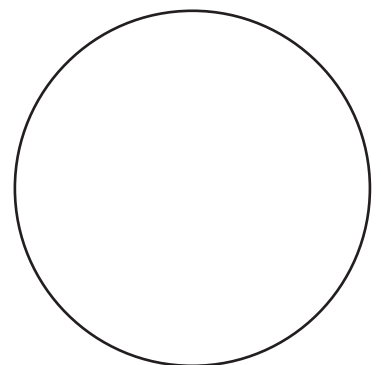
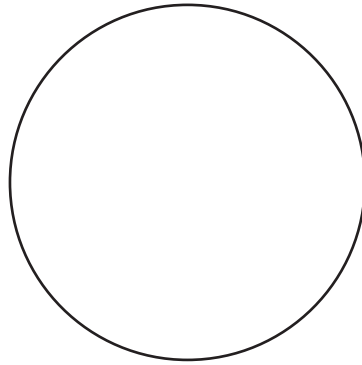
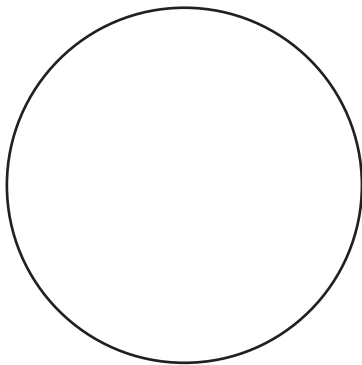
What are some of the first organisms that begin to decompose food scraps in a compost pile?

Hypothesis

What do you think?

Procedure

It takes many types of organisms to decompose food scraps in a compost pile. The food must be physically and chemically broken down. Observe the petri dishes of fungi samples under the dissecting microscope. In the circles below, sketch each type you observe.



Write a Description of the Fungi.

About Fungi

Fungi cannot photosynthesize; instead, they get their energy and nutrients from dead and dying organisms. Many kinds of fungi grow in a compost pile; some are commonly called molds. As a fungus grows, it branches out and burrows through the food scraps, breaking it up into smaller pieces. The fungus releases chemicals that soften the food scraps and make it easier for the fungi to extract the nutrients it needs.

The changes in the food scraps made by the fungus as it grows and feeds, make it easier for other compost organisms to feed. Smaller and softer food scraps are easier for fungi, bacteria and other decomposers to feed on.

Fungi are also part of a food web in a compost pile. Look at the diagram of compost organisms to identify three types of animals that feed on fungi. (The arrows in the diagram indicate the flow of energy and nutrients along the food chain.)

Conclusion

What do you think would happen if all of the fungi in a compost pile died?

Question

What are some of the animal decomposers that work in a compost pile?

Hypothesis

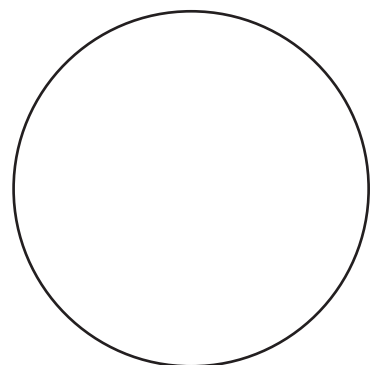
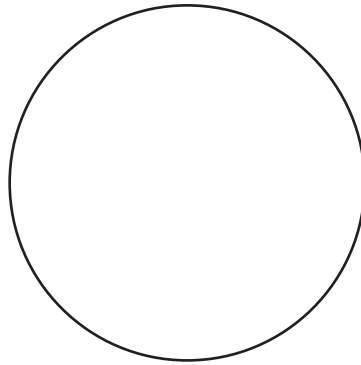
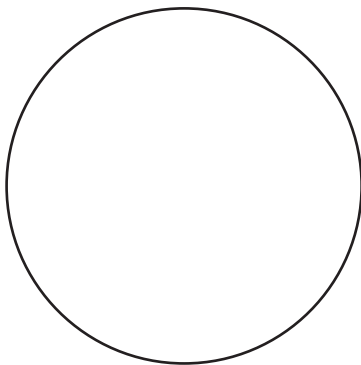
What do you think?

Procedure

Take a small sample of compost material from the tub and place it in a petri dish. Using a toothpick to gently probe through the mixture, look for tiny organisms. Use a hand lens or dissecting microscope to get a closer look.

Observations

Sketch any organisms you find in the circles below.



After you sketch, try to identify the type of organism by referring to the compost food web diagram.

Write where each organism fits into the food web. Does it feed directly on the food scraps or does it feed in the second or third level of the web?

About Decomposers

When animal decomposers burrow into food, they shred the food, pull it apart and chew it. During digestion, food bits are chemically broken down into simpler nutrients by the digestive juices. Each animal takes the nutrients it needs from its food and excretes what it doesn't need. In the compost pile, the dark, nutritious soil made from animal wastes is called compost.

Conclusion

Why do you think it's important to have a variety of decomposers in the compost pile?

Question

How do worms make soil in a worm bin?

Hypothesis

What do you think the worms are doing in the worm bin?

Procedure

Describe what you see in the worm bin.

Carefully remove a small sample of shredded paper and a red wiggler worm from the worm bin and place them in a tray. Take a few minutes to observe the behavior and structure of the worm. You are removing the worm from its home. You may notice some behaviors that indicate that it may be uncomfortable in the tray. Be gentle with the organism; in a few minutes, return it to the worm bin and cover it with some of the paper.

Sketch the Worm.

Write three things you notice about its behavior.

About the Worm Bin

The worms used in a worm bin are red wigglers, a relative of the common earthworm. Red wigglers feed directly on food scraps, which makes them great for composting. Given the right conditions of moisture (they breathe through their skin), oxygen, and food scraps, red wigglers are very efficient decomposers. Their digestive systems break down the food physically and chemically. Their wastes, called worm castings, make soil dark and rich in nutrients.

Conclusion

Why would it be important to have a lot of worms in your garden?

Question

What are the ingredients in soil?

Hypothesis

If you had to write a recipe for soil, what would be the ingredients?

Procedure

Compare the soil samples and write your observations in the chart. (Labeled soil samples: field soil, forest soil, unscreened compost and screened compost.)

Color	Odor	Texture	Ingredients
Field soil			
Forest soil			
Unscreened compost			
Screened compost			

If you had more time, what would be some other ways to compare the soil samples?

About Soil

The formation of soil is the result of three processes, mechanical weathering, chemical weathering and the activities of soil organisms. Mechanical weathering happens when the freezing and thawing of water break down rock material into smaller and smaller pieces. Rainwater dissolving calcium salts from rock material is an example of chemical weathering.

A layer of rich, dark soil, called topsoil or humus, is found in forests and fields. There, dead plant material is decomposed in the digestive system of soil organisms, such as earthworms. Their wastes are the recycled nutrients needed for new plant growth and are the main ingredient in humus. Depending on weather conditions, it could take many years to form one inch of topsoil.

In the forests and fields, nature recycles nutrients all the time. When people compost food scraps, they are copying nature, but we speed up the soil-making process by giving the decomposers the right conditions for them to grow and reproduce quickly. The decomposers need nutrients (to form proteins for cell structures), energy, water, and oxygen. Fresh food scraps supply the nutrients; dry leaves or wood chips supply the energy. Turning the pile regularly provides spaces for oxygen to circulate. The compost pile should be kept moist, but not dripping wet. Given the right conditions, the decomposers can change more food scraps into compost.

Conclusion

How did the soil samples compare? What were some of the surprising or most interesting observations you made?



Compost Tour

Take a Compost Tour

This activity is designed to be used after the school composting program is underway to help students learn more about their school composting process.

Part One **Before the Tour**

Students show what they already know about the school composting program. It is interesting to see what preconceived ideas students have about composting.

Students should respond to questions in Part One individually; if there is time, they may discuss their answers in a small group or as a class. Part One could also be a homework assignment the night before the Compost Tour. Students could be encouraged to get family members responses after they have completed their answers to Part One.

Part Two **Take a Tour of the Compost Bins**

Materials

1. Clipboards and student worksheets: One per student
2. Equipment (used for daily composting operation): Cafeteria food barrels, food scraps in barrel, scale, weight chart, compost thermometer
3. Food Cards (one food written on each card): Salad, cheese, milk, sausage, carrots, chicken, apple, pasta, bread, peanut butter, cookies, vegetable soup, waffles and syrup, cereal
4. Compost Sequence Cards: Each step in the sequence should be printed on large construction paper or an oak tag strip

Compost Sequence Cards

1. Lunch wastes are sorted
2. Food scraps are weighed; weight is recorded on chart
3. Temperature of active bin is measured and recorded
4. Food scraps are placed in the bin
5. Dry leaves, wood shavings or wood chips are spread over the food scraps
6. Fungi, bacteria, worms and insects decompose the food
7. When bin is full, pile is moved over into the next bin

Setting Up the Tour

Talk up the tour as an adventure, perhaps wearing a sign that says “Tour Guide.” Be enthusiastic and ham it up! Get the students involved in the tour. It should be fun, informative and interactive. Students should have their worksheets on a clipboard. For younger kids, you could assign a few students the role of inspectors.

Touring the Group through the Composting Process

Station One

Food Scrap Barrel in the Cafeteria

Student Involvement

Distribute food cards and have students take turns placing cards in front of the correct barrel to show they know how to sort their lunch wastes.

Station Two

Scale (wheel the barrel to the scale to weigh and record, a job for the “inspectors”)

Student Involvement

Students predict weight of food scraps, “inspector” records weight on chart.

Station Three

The School Compost Bins

Explain purpose of the multiple bins and the steps of the composting operation, from food-sorting in the cafeteria to turning the pile into the adjacent bin.

Student Involvement

Measure and record the temperature of the bins. Review the composting operation sequence by using seven students who each hold a sequence card and arrange the composting steps in the correct order. Take turns shoveling (turning over) the contents from bin #1 to bin #2. Compare contents of the bins.

Part Three **After the Tour**

Students return to the classroom to respond to questions on student sheet, based on information gained on the tour.

Class Discussion

Responses on student sheet, the benefits of composting, and how students can volunteer to help out with the daily composting operation.

Part One Before the Tour

Test your knowledge about composting (can be done individually, in pairs or threes)

1. What is composting?
2. Where are the school's composting bins located?
3. What types of foods should be put in our compost pile?
4. Name some cafeteria wastes that do not belong in compost.
5. List two other things you're likely to find in a bin as part of the compost process.
6. List three locations in the school where we could collect food scraps.
7. List the steps for composting food.
8. What actually decomposes the food in a compost pile?
9. What is the end product of the composting process?
10. List any general beliefs or ideas you have about composting.
11. What are the benefits of composting?

Predict

12. The weight of food scraps per day at our school _____ lbs.
13. The total weight of food scraps in the compost pile so far this school year _____ lbs.
14. The temperature of the compost pile _____ °C _____ °F

Part Two **Take a Tour of the Compost Bins**

Answer the following during the tour

15. How many bins are there?
16. Which bin has the oldest contents?
17. Why do we have multiple bins?
18. What are some of the problems we've had with the composting piles?
19. List the items you recognize in bin #1.
20. Which bin is the hottest? Why?
21. Name some of the decomposers.
22. Why are woodchips or dry leaves added to the pile daily?
23. Name two other things needed by the decomposers, besides energy & nutrients.

Part Three **After the Tour**

24. What surprised you about the compost?

25. What is some new information about compost that you learned from this tour?

26. What could be done with the compost produced from the food scraps?

27. Where did our food scraps go before we composted? Are there any problems with that?

For Further Thought

28. We all produce the food scraps in the school. Make some suggestions for sharing the responsibility for the composting operation.

29. Think of a catchy phrase or jingle to get kids to sort their food correctly or get involved in composting.

30. Respond to the following statement: Without decomposers, we could not exist.



Scavenger Hunt

Scavenger Hunt

Team

Members _____

Nature is recycling nutrients all the time. All the items in this scavenger hunt are related to this theme.

Working in pairs, collect the listed items in the containers provided. Each item is worth points. You do not need to hunt for the items in the order they are listed. Your teacher will explain the boundaries for the hunt.

You will have 30 minutes to find as many items as you can. Check off each item as you find it. When you have found everything, or the time is up, return to the starting place.

Points

- 1 A sample of leaf litter
- 2 Two decomposers
- 3 A sowbug
- 1 A fungus
- 3 A sample of three ingredients found in soil
- 1 Something that is decomposing
- 3 A sample of material that could be used as bulking material in a compost pile
- 3 A sample of humus

- 1 An acorn
- 1 A sign of an animal
- 1 A piece of paper litter
- 1 A piece of plastic litter
- 1 A piece of another type of litter (not paper or plastic)
- 1 A pine cone

_____ Sub-total points

Visit the school compost bins to find these items

Points

- 1 A drawing of the compost bins
- 1 A sample of the bulking material
- 3 A list of three food items you recognize in bin #1
- 2 The name of an item that should not be in the compost bin
- 1+ A point for each shovelful of compost you turn over into the next bin

Visit the worm bin to find the next items

Points

- 1 A diagram of the worm bin
- 1 The name of the type of worms
- 1 The name of the bulking material in the worm bin
- 1 A type of food in the worm bin
- 1 A drawing of a worm egg
- 1 An estimate of the number of worms

Locate the food scrap barrel to find the following items

Points

- 1 Find the weight of the food scrap barrel
- 2 Figure the total waste the school produces in one school year (180 days)
- 1 A list of the foods on today's lunch menu that should be composted

Bonus: Ask your teacher for a clue to find the last item, a special treat

_____ Total points

(40–50) compost engineer (30–39) vermiculturist



Composting True or False

Test your compost knowledge. Are these statements true or false? Keep track of your answers by adding up the number you get right.

1. The nutrients in food can be recycled.
true false
2. Paper is biodegradable.
true false
3. Plastic wrap should go into the compost.
true false
4. Changing food into soil takes two weeks and three days.
true false
5. Orange peels cannot be composted.
true false
6. Worms are decomposers.
true false
7. Decomposers in a compost pile need oxygen.
true false
8. It doesn't matter if the compost pile is turned as long as it is wet.
true false
9. The product of a compost pile is similar to topsoil.
true false
10. Nutrients move through the food chain.
true false
11. The best way to get rid of leaves is to put them in a plastic bag for curbside pick-up.
true false
12. When compost gets compacted, it develops a foul odor.
true false
13. The center of a working compost pile is very cool.
true false
14. Compost piles are always very smelly.
true false
15. Nature recycles.
true false
16. People who live in apartments can't compost.
true false
17. Composting is one way to recycle.
true false
18. Decomposers need only food and air to do their work in a compost pile.
true false
19. Yard scraps, such as grass clippings and leaves, can be composted.
true false
20. Composting works only if it is done in a specially designed compost bin.
true false
21. Animals are less attracted to a compost bin if meat and bones are not put into it.
true false

True: #1,2,6,7,9,10,12,15,17,19,21
False: #3,4,5,8,11,13,14,16,18,20



Amazing but True Composting Facts

Composting with worms is called vermicomposting.

Redworms (called red wigglers) can eat over half their weight in food in a day.

About two-thirds of our trash is biodegradable and could be composted—paper, yard and garden wastes, food.

In 1998, each person the United States generated about 4.46 pounds of waste every day.
(Environmental Protection Agency, 1998)

It takes about 200–500 years for an aluminum can to break down.

It takes about 450 years for a plastic six pack cover to decompose.

A compost pile can reach 150°F; it's all body heat given off by the decomposers.

Americans throw away more paper than any other type of trash.

Yes! Hair can be composted.

The decomposers in a compost bin breathe oxygen.

Compost is being used to help clean up land contaminated with hazardous wastes.



Ort Sort (Food Scrap Sort)

Which of these should be put into the school compost bin? Circle your answers.

- | | |
|-------------------------|----------------|
| Vegetable scraps | Orange rinds |
| Meat | Fish |
| Fat | Egg |
| Nut shells | Bones |
| Stalks, stems and vines | Wood ashes |
| Chicken | Leaves |
| Vegetable oils | Dairy products |
| Plastic | Apple core |
| Coffee grounds | Pasta |
| Tea bag | Peanut butter |
| Bread | Beans |

Answers
vegetable scraps, orange rinds, egg, nut shells, stalks, stems, vines, wood ashes, leaves, apple core, coffee grounds, pasta, tea bag, bread, beans



Dirt Cake Recipe

Dirt Cake Recipe

Yields about 24 half cup servings

Materials needed

- 1 three quart plastic flower pot
- 3 large mixing bowls
- 2 measuring cups
- 3 stirring spoons
- 3 artificial flowers

Ingredients

- 1 lb. package chocolate, cream-filled cookies
- Two 8 oz. packages cream cheese
- ¼ cup margarine or butter
- 1 cup powdered sugar
- One 5.9 oz. package of instant chocolate pudding
- 3 cups milk
- One 8 oz. container of non-dairy whipped topping
- One package candy worms

Directions

1. Crush cookies into bowl #1
2. Allow ingredients to warm up to room temperature. Mix together cream cheese, butter, and powdered sugar in bowl #2.
3. Make chocolate pudding with milk in bowl #3. Follow directions on package.
4. Fold whipped cream into pudding in bowl #3.

5. Mix ingredients in bowl #3 with bowl #2. Blend well.
6. In a clean, plastic flower pot, layer the creamed ingredients with the crushed cookies. Start with crushed cookies in the bottom of the pot. End with crushed cookies as the top layer.
7. Decorate your cake with candy worms and artificial flowers. Eat immediately or refrigerate.

Other ideas: Use individual small flower pots instead of one big one. Try making the recipe with other kinds of cookies or cake mixes. Try different puddings.

Permission to reprint “The Dirt Cake Recipe,” page 99, from *Worms Eat Our Garbage*, by M. Appelhof, M.F. Fenton, B.Loss Harris, Flower Press 1995, Kalamazoo, Michigan.



Composting Record Sheet

Fill in the Dates below	List Types of Food	Weight of Food Preparation Waste	Weight of Plate Scrapings	Total Weight
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				

Weekly Total = _____

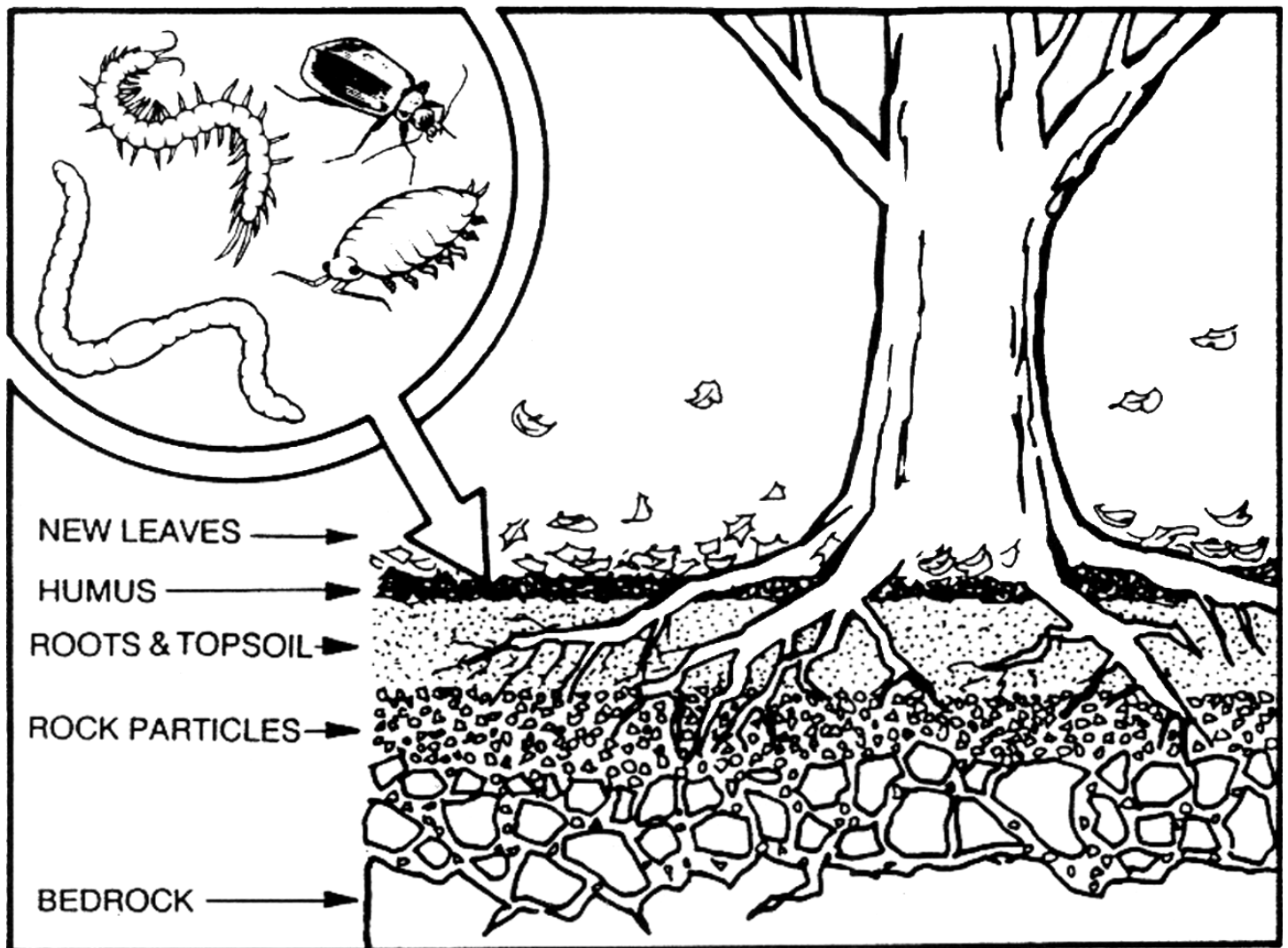
Was anything in the buckets that shouldn't have been? If so what?

For the Compost Pile

- ❖ **Bagels (with cream cheese is OK)**
- ❖ **Bread (with mayonnaise is OK)**
- ❖ **Cereal (with milk is OK)**
- ❖ **Cookies**
- ❖ **Fruit – all parts**
- ❖ **Pasta**
- ❖ **Pizza**
- ❖ **Rolls (with butter is OK)**
- ❖ **Salad (with dressing is OK)**
- ❖ **Soup**
- ❖ **Vegetables – raw or cooked**
- ❖ **Waffles (with syrup is OK)**

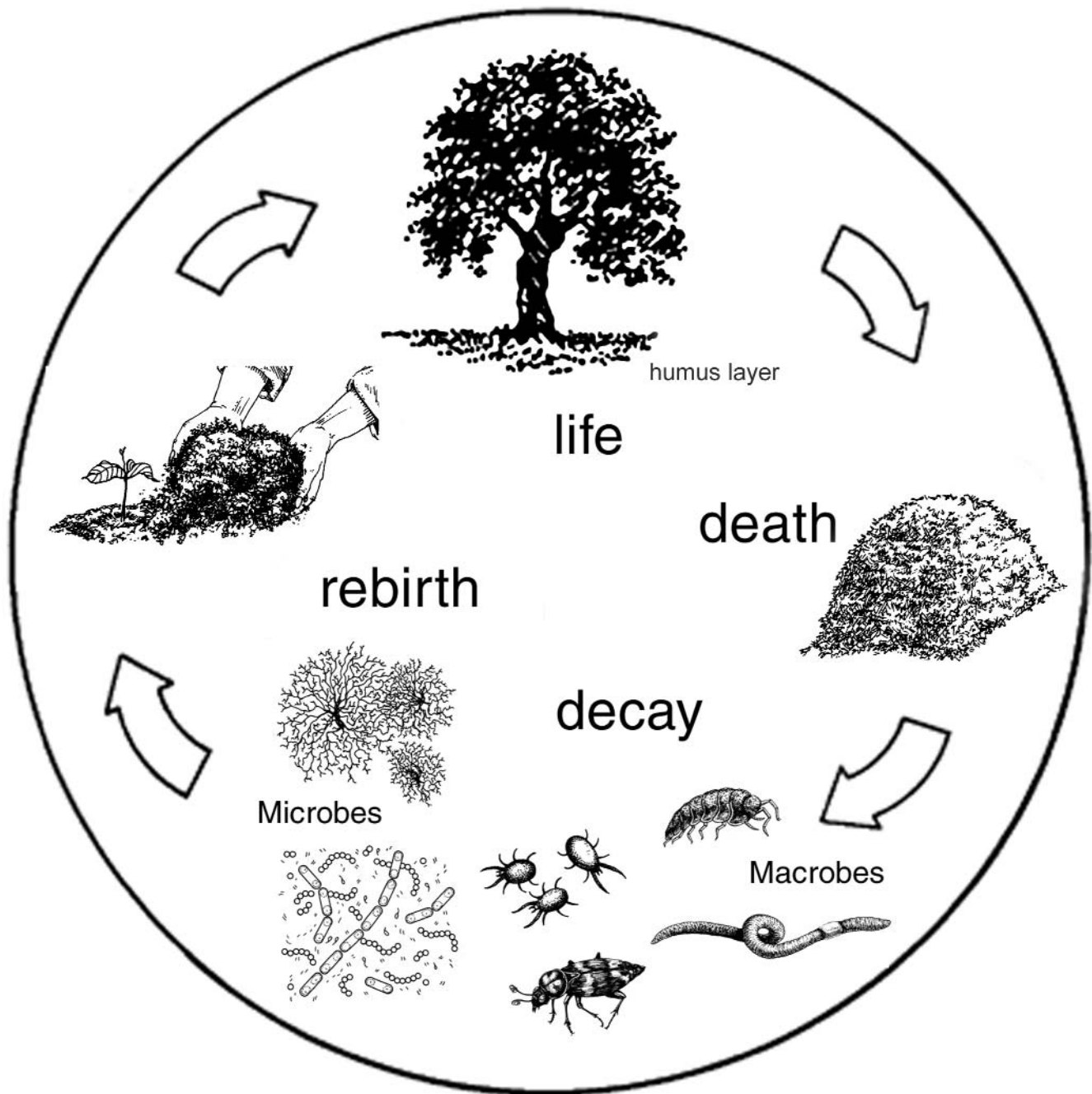


Soil Diagram



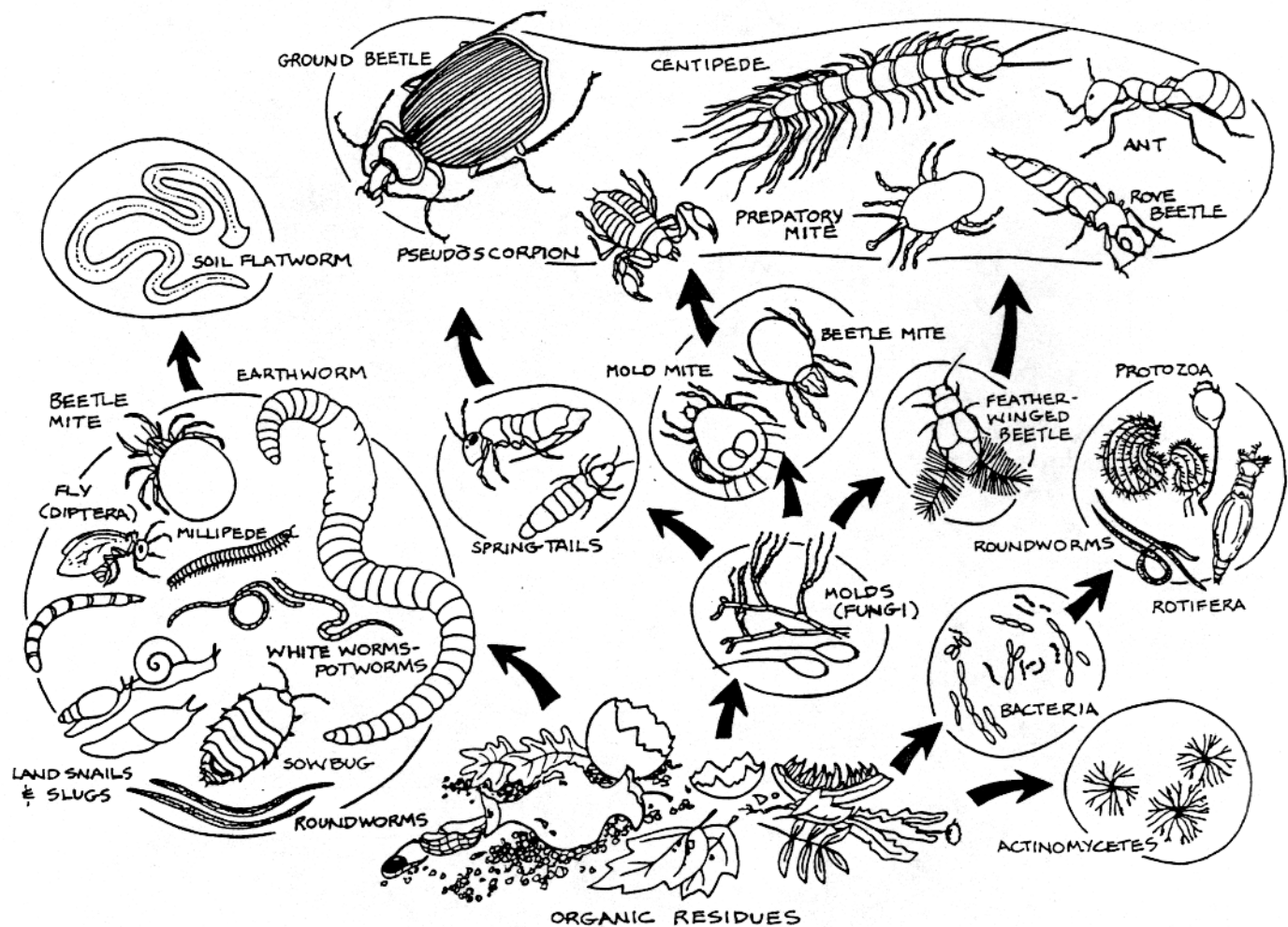
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Soil and Decomposition



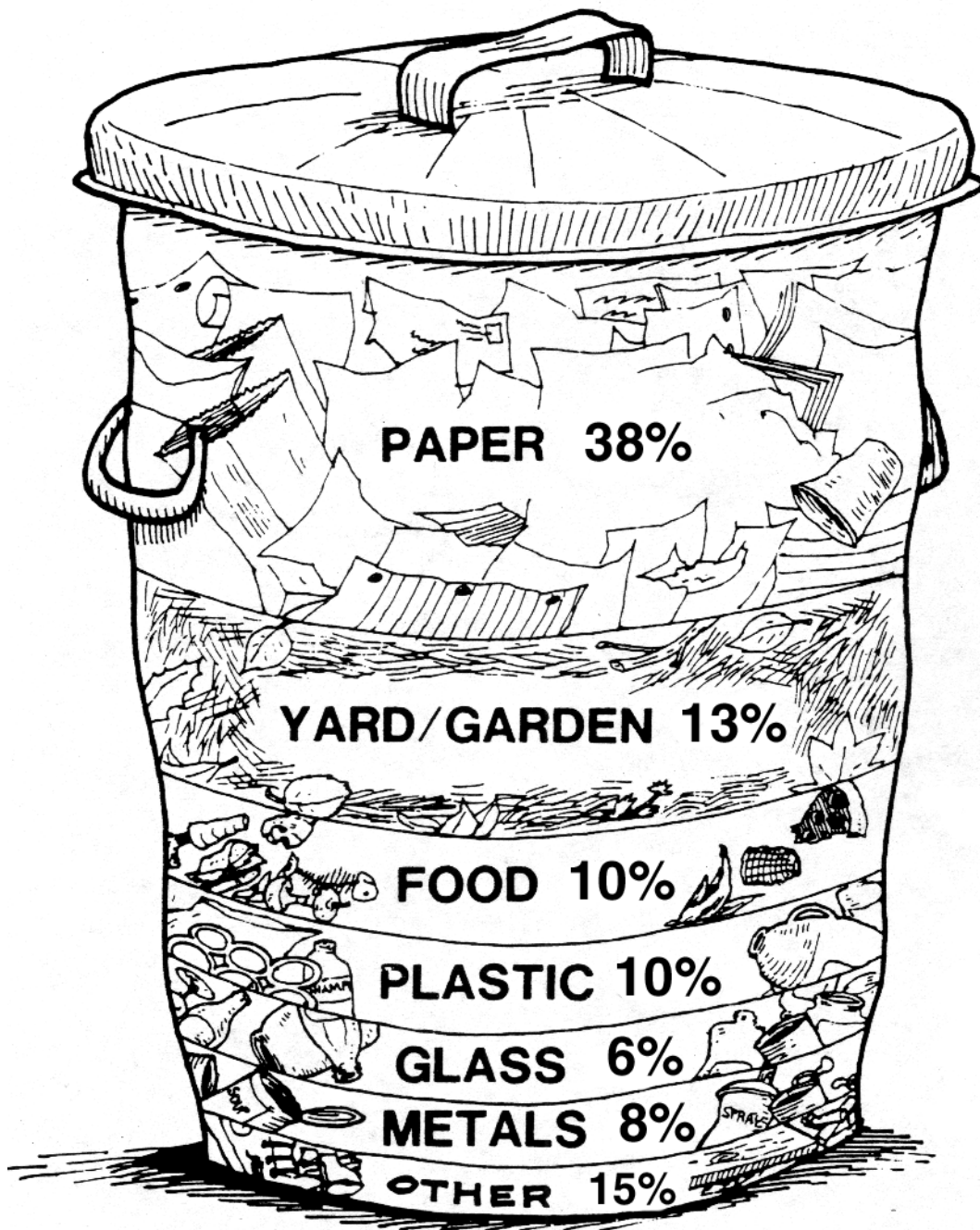
Illustrations courtesy of the U.S. Composting Council, arranged by Rebecca Brine.

Discover Compost Animals



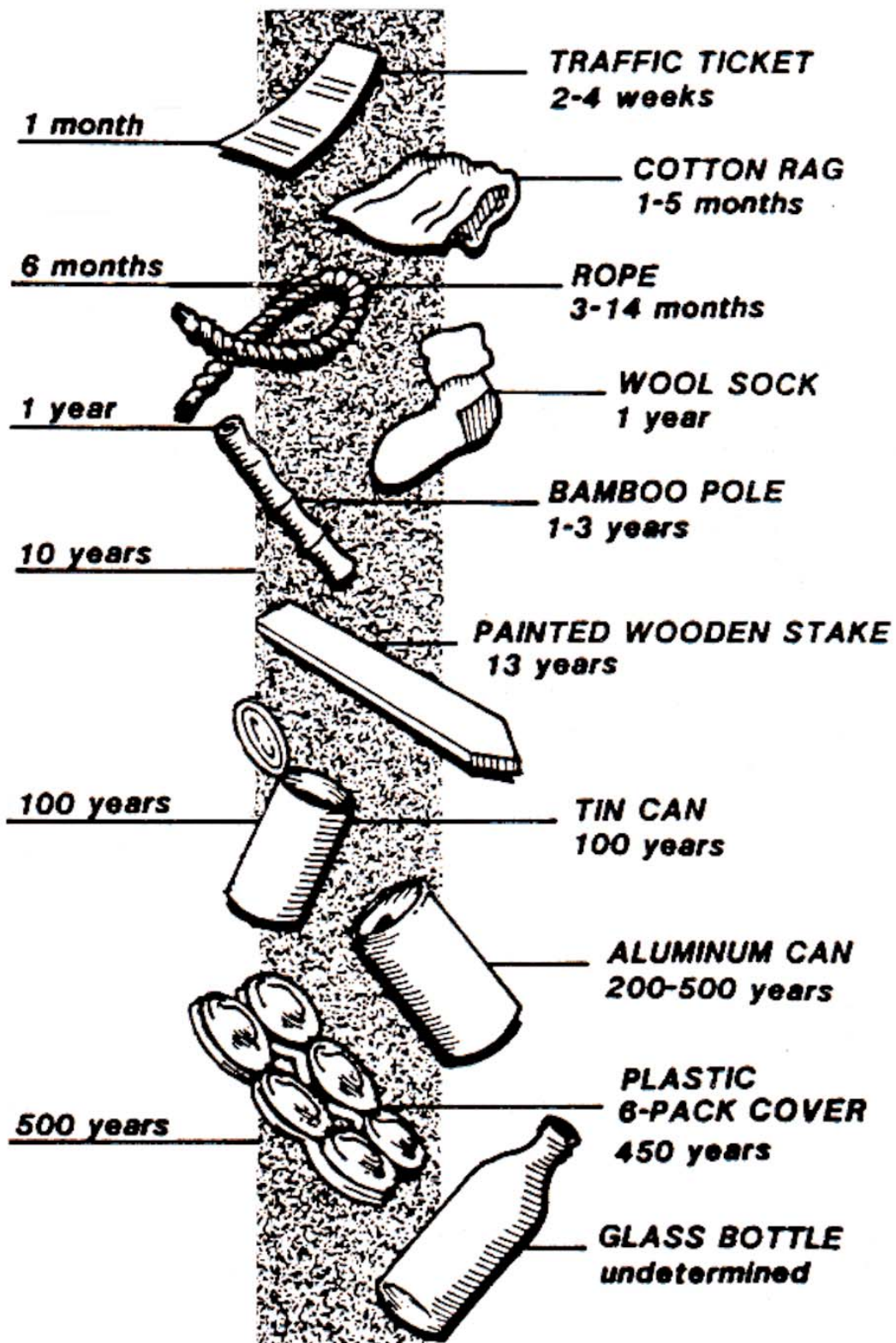
Reprinted from *Composting Wastes to Resources* with permission from the Cornell Waste Management Institute, 101B Rice Hall, Ithaca, NY 14853. Illustration by Tamara Sayre, modified from Dindal, *Ecology of Compost: A Public Involvement Project*.

The Trash Can Diagram



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Enduring Litter



Permission for reprinting was given by Marin County Office of Waste Management, San Rafael, California.



Websites

CT DEP website: <http://dep.state.ct.us/wst/compost/comindex.htm>

Mansfield Middle School composting website: www.mansfieldct.org/schools/mms/compost/

United States Environmental Protection Agency website: www.epa.gov/osw

Cornell University website: www.cfe.cornell.edu/compost

Master Composter: www.mastercomposter.com

The Rot Web: www.a-horizon.com/compost/index2.htm

The Virtual Composter: www.compostinfo.com

Worm Woman: www.wormwoman.com

University of Minnesota Extension Service:
<http://www.extension.umn.edu/distribution/horticulture/DG3296.html>

Backyard Magic, the Composting Handbook, New Brunswick Department of the Environment:
<http://www.gnb.ca/elg%2Degl/0372/0003/0001-e.html>

Composting for Life, Lockwood Webbs:
<http://www.lockwoodwebs.com/composting/link4.html>

Whatcom County Composting, Washington State University:
<http://www.whatcom.wsu.edu/ag/compost/fundamentals/organismis.htm>

Center for Environmental Education, Antioch New England Graduate School: www.SchoolsGoGreen.org

Museums and Education Centers

The Trash Museum
211 Murphy Road, Hartford, CT 06114
(860) 247-4280
www.crra.org

The Garbage Museum
1410 Honeyspot Rd. Extension
Stratford, CT 06615
(203) 381-9571
www.crra.org

Both museums provide tours of their facilities and have a library of teacher resources available on loan (including a vermiculture kit).

SECRRRA Education Center
741 Flanders Rd
Mystic, CT 06355
(860) 536-6765

Books

Backyard Composting, Your Complete Guide to Recycling Yard Clippings
Harmonious Technologies
Ojai, CA 93023
Harmonious Press, 1992

Blueprint for a Green School
Center for Environmental Education
Antioch New England Graduate School
40 Avon Street
Keene, NH 03431-3516
(603) 355-3251
http://search.schoolsgogreen.org/Resources/CEE_Bookstore/%2330000

Compost Critters Note: Excellent photographs of decomposers
Bianca Laires
New York
Dutton Children's Books, 1993

Compost! Growing Gardens from Your Garbage
Linda Glaser, Anca Hariton
Brookfield, CT 06804
The Millbrook Press, 1996

Composting to Reduce the Waste Stream: A Guide to Small Scale Food and Yard Waste Composting
NRAES
152 Riley Robb Hall
Cooperative Extension Service
Ithaca, NY 14853-5701
(607) 255-7654
<http://www.nraes.org/publications/nraes43.html>

Dirty, Rotten, Dead
A Green Patch Book
The Yolla Bolly Press, 1996
Note: Giant-size book with great illustrations of intestines, water, cells, plant decay, infections and body decay

Recycling Matters (booklet)
2000 Casella Waste Systems, Inc.
25 Green Hill Lane
Rutland, VT 05701

The Urban/Suburban Composter
Cullen, M and Johnson, L.
New York
St. Martin's Press, 1992
Note: Chapter 10 has ideas for composting activities for kids

Curriculum Guides

These guides have background material for teachers and students, and lessons along with diagrams and illustrations that can be adapted to a wide range of ages.

*Composting Across the Curriculum,
A Teacher's Guide to Composting*
Marin County Office of Waste Management
Funded by the U.S. EPA
10 N. San Pedro Rd., Suite 1022
San Rafael, CA 94903
(415) 499-6647

*Project Learning Tree
Exploring Environmental Issues: Municipal Solid Waste*
American Forest Foundation with the Council for Environmental
Education, 1997
Kellogg Environmental Center
P.O. Box 435
Derby, CT 06418
(203) 734-2513

*The Quest for Less,
A Teacher's Guide to Reducing, Reusing, and Recycling*
EPA530-R-00-008
United States Environmental Protection Agency
1200 Pennsylvania Ave., NW (5305W)
Washington, DC 20460
November 2000
www.epa.gov/osw Note: download/print all or part of document

The Wonderful World of Wigglers
Julia Hand
Food Works
64 Main Street
Montpelier, VT 05602
A Common Roots Book, 1995
(802) 223-1515

*What a Waste!
A Teacher's Resource for Integrating the
Solid Waste Crisis into the Classroom*
The Garbage Museum
1410 Honeyspot Rd. Extension
Stratford, CT 06615
1992
(203) 381-9571

Worms are a Class Act
Worm curriculum featuring
The Can - O - Worms composter
Cori Kyle
Viscor Distribution Inc.
12165 Cherrywood Dr.
Maple Ridge, BC V2X 0B7
1996

*Worms Eat Our Garbage
Classroom Activities for a
Better Environment*
M. Appelhof, M.F. Fenton, B. Loss Harris
Kalamazoo, MI
Flower Press, 1995
www.wormwoman.com

Other Printed Materials

*Composting at New Hampshire Schools:
A "How To" Guide*

New Hampshire Governor's Recycling
Program. New Hampshire Dept. of
Environmental Services
Concord, NH
1997
(603) 271-3712

*Composting in the Classroom,
Scientific Inquiry for High School Students*
Marianne Krasny and Nancy Trautmann

4050 Westmark Dr.
Dubuque, IA 52002
(800) 228-0810
Kendall/Hunt Publishing Company, 1998
<http://www.cfe.cornell.edu/compost/CIC.html>

School Recycling Fact Sheets

State of Connecticut DEP Recycling Program
79 Elm St.
Hartford, CT 06106
<http://dep.state.ct.us/wst/recycle/schoolfact01.pdf>

Videos

A Crack in the Pavement

A two-part video series on how greening school
grounds improves community
Bullfrog Films
Box 149
Oley, PA 19547
(800) 543-3764

Note: Bullfrog Films will send videos for preview

Garbage into Gold

Produced by Beth Pike and Stephen
Hudnell
The Video Project
5332 College Ave. Suite 101
Oakland, CA 94618
1995
(800) 4-PLANET

*Home Composting: Turning Your Spoils
to Soil*

Produced by Connecticut Department of
Environmental Protection
17 minutes. Available at all Connecticut
libraries or for purchase (\$10) from CT
DEP Recycling Program
(860) 424-3365
[www.dep.state.ct.us/wst/compost/
cresource.htm](http://www.dep.state.ct.us/wst/compost/cresource.htm)

It's Gotten Rotten

A 20 minute video about composting
as a topic for scientific inquiry by high
school students
Bullfrog Films
Box 149
Oley, PA 19547
1997
(800) 543-3764

Recycling with Worms

Bullfrog Films
Box 149
Oley, PA 19547
1996
(800) 543-3764

Wormania!

Flowerfield Enterprises
10332 Shaver Rd.
Kalamazoo, MI 49024
(616)327-0108
fax: (616) 327-7009
www.wormwoman.com

Life After the Curb: Recycling Processes

Cornell University Resource Center
7–8 Business and Technology Park
Ithaca, NY 14850
(607) 255-7660

Technical Assistance

University of Connecticut Cooperative Extension System
1376 Storrs Road
Storrs, CT 06269-4036
(860) 486-1987
Visit their website for a listing of all the county offices
www.canr.uconn.edu/ces/offices.html

Connecticut Agricultural Experiment Station
Soil Testing Laboratory
123 Huntington Street
P.O. Box 1106
New Haven, CT 06504
(203) 974-8521
www.caes.state.ct.us/soiloffice/soiltesting.htm

Connecticut Department of Environmental Protection
Recycling Program
79 Elm Street
Hartford, CT 06106-5127
(860) 424-3365
www.dep.state.ct.us/wst/recycle/ctrecycles.htm

UConn Home and Garden Education Center
1380 Storrs Road
Storrs, CT 06269
(860) 486-6271
www.canr.uconn.edu/garden/

Equipment*

Long Stem Compost Thermometer

Reotemp Instrument Corp.
10656 Roselle Street
San Diego, CA 92121
(800) 648-7737
Request model A-36PF
www.reotemp.com

Industrial Scale

Quill Corp.
P.O. Box 94080
Palatine, IL 60094-4080
(800) 634-0321
www.quill.com

Collection Barrels

Consolidated Plastics Company, Inc.
8181 Darrow Road
Twinsburg, OH 44087
(800) 362-1000
www.consolidatedplastics.com

Rubbermaid Round Brute containers,
available in 20, 32, 44 and 55 gallon sizes
with dollies and snap on lids

Countertop Compost Collection Containers

Busch Systems International, Inc.
130 Saunders Road, Suite #7
Barrie, ON, Canada L4N 9A8
(800) 565-9931
www.buschsystems.com
KC-2000 Kitchen Compost Carrier

*Suppliers used by Mansfield Middle School.

This partial listing does not constitute an endorsement of any product or company.



Glossary

Actinomycetes—a filamentous bacteria that resembles fungi.

Aerobic—a biochemical process occurring in the presence of oxygen.

Anaerobic—a biochemical process occurring in the absence of oxygen. Marked by a foul odor.

Bacteria—microscopic single-celled organisms lacking a nucleus. They are structured as either rod-shaped, sphere-shaped or spiral-shaped.

Carbohydrate—a compound of carbon, hydrogen and oxygen, most of which is formed by green plants and which constitute a major class of animal foods. Three categories of carbohydrates are sugars, starches, and cellulose.

Carbon (C)—an element necessary for the construction of carbohydrates, necessary for the support of life. Examples of carbon-rich materials used in a compost pile are leaves, sawdust, wood chips, straw.

Carbon:nitrogen ratio—the proportion of carbon to nitrogen which affects how quickly microorganisms work. The ideal “C:N” ratio is in the range of 25:1 to 35:1.

Compost—the end result of composting; a dark, rich, humus-like material that can be used as a soil conditioner.

Composting—the natural process of decomposition and recycling of organic material into a rich soil amendment known as compost.

Decomposer—an organism that feeds on and breaks down organic materials into simpler chemical compounds.

Decomposition—the process by which organic materials chemically break down into simpler compounds.

Earthworms—any of a family of numerous hermaphroditic worms that move through the soil.

Food web—the totality of interacting food chains in an ecological community.

Fungi—saprophytic and parasitic plants that lack chlorophyll and include molds, rusts, mildews, smuts and mushrooms.

Humus—a brown or black material resulting from the decomposition of plant and animal matter and forming the organic component of soil.

Inorganic matter – derived from a non-living source such as rocks, sand, plastic.

Invertebrate – an organism lacking a spinal column.

Mesophilic – describes bacteria that exist in a temperature range between 50–100 degrees Fahrenheit.

Microbes – a synonym for microorganisms.

Microorganisms – microscopically small living things that digest organic material through metabolic activity.

Mites – very minute arachnids that have eight leg-like jointed appendages.

Nematodes – elongated cylindrical worms parasitic in animals or plants or free-living in soil or water.

Nitrogen (N) – an element necessary for the construction of all living tissue. Examples of nitrogen-rich materials used in a compost pile are food scraps, grass clippings, animal manures.

Nutrients – a substance that provides nourishment.

Organic matter – derived from or produced through the biological activity of a living thing.

Pathogen – any organism capable of producing disease or infection. Found in animal waste material, pathogens are killed by the high temperatures (131 degrees Fahrenheit or higher for 3 consecutive days) of the composting process.

Primary consumers – herbivores. Feeding on plant matter.

Protozoa – unicellular animals which have varied morphology and physiology, and often complex life cycles. Represented in almost every kind of habitat.

Secondary consumers – carnivores. Organisms that eat primary consumers.

Sow bugs – a crustacean with a flattened elliptical body often capable of being rolled into a ball. Called also pill bugs.

Springtails – also known as collembolan. A small primitive wingless arthropod.

Thermophilic – describes heat-loving bacteria that exist in a temperature range between 104–200 degrees Fahrenheit. Their ideal range is 121–131 degrees Fahrenheit.



Works Consulted

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Hand, Julie. *The Wonderful World of Wigglers: A Common Roots Book*. Montpelier, Vermont: Food Works. 1995.

Harmonious Technologies. *Backyard Composting: Your Complete Guide to Recycling Yard Clippings*. Ojai, California: Harmonious Press, 1992.

Horosko, Millie, Editor. *What a Waste!: A Teacher's Resource for Integrating the Solid Waste Crisis into the Classroom*. Southwest Connecticut Regional Recycling Operating Committee Norwalk, CT. 1992.

Kyle, Cori. *Worms are a Class Act*. Maple Ridge, British Columbia: Viscor Distribution, Inc. 1996.

Laires, Bianca. *Compost Critters*. New York: Dutton Children's Books, 1993.

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United States Environmental Protection Agency. *The Quest for Less: A Teacher's Guide to Reducing, Reusing, and Recycling*. EPA530-R-00-008. Washington, DC: November 2000.

Washington State Department of Ecology. *A-Way with Waste*. 3rd Edition. Waste Reduction, Recycling and Litter Control Program, 1990.

Websites

Cornell University website: www.cfe.cornell.edu/compost

CT Department of Environmental Protection website: <http://dep.state.ct.us/wst/compost/comindex.htm>

United States Environmental Protection Agency website: www.epa.gov/osw