School Composting Options

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Disclaimer

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How to Use this Presentation

This presentation provides detailed information about how to establish a food waste diversion & composting program in schools. There are notes with substantive information associated with many of the slides.

Be sure to look at this presentation in “notes view” mode.

Background
This presentation is designed as a supplement to a companion document—NERC’s *School Composting Options* http://www.nerc.org/documents/composting_school_food_paper.pdf

Several school waste reduction, recycling, & composting documents were developed by NERC as a result of this project.

Presentations & Tip Sheets are available for download at http://www.nerc.org/documents/index.html#SchoolWaste.

**These documents include detailed information & resources to support school source reduction, reuse, recycling, & composting efforts.**
Why Compost?

- Each student generates 2+ pounds compostable waste each school day.
- 60-85% of school waste could be recycled or composted.
- Can significantly reduce waste stream & disposal costs.
- Offers hands-on learning that can be integrated into school curriculum—science, math, & more.
Why Compost, cont.

- Decomposition of organic material in landfills contributes to methane gas production ("climate change gases") in landfills

- Compost is a valuable soil amendment that provides nutrients to plants, soil stability, erosion control, & more
What is Compost?

- Value-added product: converts waste material to easy-to-handle, useful product
- Soil-like material, rich in organic matter & organisms
Benefits of Compost in Soil

- **Improves Physical Properties:** Increases water retention; improves soil aeration & structural stability; resistance to water & wind erosion; root penetration; soil temperature stabilization

- **Enhances Chemical Properties:** Increases macro- & micro-nutrient content; availability of beneficial minerals; pH stability; converts nutrients to a more stable form, reducing fertilizer requirements

- **Improves Biological Properties:** Increases activity of beneficial micro-organisms; promotes root development; can increase agricultural crop yields; suppresses certain plant diseases; acts as biofilter, bonding heavy metals
Start-Up

Step 1

- Form a committee
- Be sure there is administrative support for effort
- Include cafeteria & custodial staff
  - Custodial involvement in composting?
- Designate a coordinator
Start-Up, cont.

**Step 2**

- Decide if school will compost material on-site or ship food waste to a commercial compost facility

- To find a commercial compost facility:
  - Ask your current trash hauler
  - Look online or in the phone book under composting
  - Contact your state environmental agency

- Before deciding to compost at the school, confer with your state environmental agency & local Board of Health to learn about regulatory & permitting requirements
Start-Up, cont.

Step 3

- Decide student group(s) responsible for compost tasks
  - Environmental Club?
  - Representative class or group from each grade level?
    - Project-Based Learning?
    - Life Skills?
- Will classes or student groups rotate responsibilities or work together?
Start-Up, cont.

Step 4: Formulate a budget

- If composting off-site, hauling charges & container rental charges must be determined
- on-site composting will require an initial investment in compost bins
- Labor costs will vary depending upon the compost system & availability of students to assist
- Collection buckets, shovels, & other supplies will also be needed
Start-Up, cont.

- Enthusiasm = Success!
  - Students, staff, teachers, & administration

- Set a goal for the project
  - Such as, diversion of food wastes all lunch periods by end-of-school year
Dedication & Planning!

- Composting requires ongoing dedication & attention to ensure success
- Phase-in composting over the course of a year
  - One lunch session at a time
  - One grade at a time
Waste Sort

● Conduct a cafeteria waste sort
  ▪ Compostable: vegetables, fruits, bread
  ▪ Recyclables
  ▪ Trash: plastics, meat, dairy

● Estimated weights/volumes for each lunch session
  ▪ Calculations will help determine number of compost bins needed
How Composting Happens
Compost System

Raw materials
- Organic matter - including carbon, chemical energy, protein and nitrogen
- Mineral nutrients - including nitrogen and other elements
- Water
- Microorganisms

Process
- Water
- Heat
- CO₂

Product
- Finished compost containing organic matter - including carbon, chemical energy, nitrogen, protein, humus, mineral nutrients, water and microorganisms

Recycled Organics University, www.recycledorganics.com
Its Like Baking a Cake...

- One part food scraps
- Two parts leaves
- Moisture
- Aeration
- Containment & cover
Basic Compost Recipe

- **Nitrogen ("green") nutrients**: "Wet" green materials such as kitchen preparation waste, cafeteria lunch wastes (vegetable & fruit scraps, coffee grounds, napkins, etc.), fresh grass clippings, manure, & fertilizers

- **Carbon ("brown") nutrients**: "Dry" woody, "bulking" materials such as fallen leaves, dry grass, brush clippings, hay or straw, dry weeds, wood ash, sawdust, newspaper, & coffee filters

- **Create a "nutrient stew"**: Approximately 1/3 high-nitrogen containing material & 2/3 high-carbon containing material (by volume)
Recipe, cont.

- **Add a little soil**: Soil or finished compost provides microorganisms necessary in composting process.

- **Moisture**: School food scraps are usually wet. If not, add water or leave materials uncovered during rain. Materials should be moist like a damp sponge.

- **Air**: Microorganisms need lots of air to work & decompose the materials.
The Process

- Decomposers: bacteria, fungi, actinomycetes
- Heat is released by microorganisms during aerobic metabolism of an organic substrate (e.g. glucose)
- Temperature influences microbial population
  - Initial stage: *Mesophilic* bacteria
  - As temperature rises, mesophilic organisms begin to die off & *thermophilic* organisms begin to thrive
Do Not Compost

- Meat, Cheese, Creamy Sauces
- Small amounts of cheese & meats are okay, such as on pizza.
on-site
School Composting
Site Set-up
Location

- Find a convenient outdoor location that can be a permanent site.
- Before deciding on a compost area, discuss it with:
  - School officials, Board of Health, state environmental agency, custodians, food service staff, other teachers (especially physical education) & neighbors.
- Area: 10 ft. wide x 10 ft. in length.
Location, cont.

- Nearby vehicle access is helpful
- Do not pile next to a wood fence or building
- Slightly sloped to allow drainage
  - If necessary, drainage holes or channels can be dug around the compost bin or pile
- Avoid setting up near pine trees
  - Needles are too acidic
Location, cont.

- Soil or grass is best surface
- School garden area is ideal
- Water should be accessible
  - A bucket is okay; watering hose is best
- Some sun is preferable
- Away from buildings, streams
- Close proximity to the cafeteria
Begin Gathering Materials

- Begin gathering leaves, straw, & other carbon ("brown") sources
  - Distribute a message to teachers, parents, & community asking for sources to be brought to the school
  - Designate a drop-off location
  - Decide how materials will get from the drop-off location to the compost area
Gathering Materials, cont.

- Set-up compost area in preparation of storing the carbon materials
  - Consider building an inexpensive chicken wire fenced area for storage
  - Use a tarp, scrap sheet metal, or corrugated plastic to cover materials
  - It is best not to keep leaves in plastic bags
  - Leaves are bulky- plan for proper storage to prevent unsightliness
    - Mowing over leaves to reduce volume is preferable
Gathering Materials, cont.

- Other sources of carbon:
  - Animal bedding
  - Old straw
  - Shredded paper. Newspaper is best.
  - Sawdust
- Grass & leaves generated on campus?
  - Can these be brought to the compost area?
- Okay to mix carbon materials
Pile or Windrow

- At least 3 feet x 3 feet x 3 feet
- Start with a layer of carbon materials on bottom
  - Wood chips or sawdust, straw, or leaves
- Perforated pipe on the bottom
- Layer materials; always cover food with soil & leaves/bulking materials
- Water as necessary
Compost Bins

- If bins are to be constructed:
  - Who will make the bins?
  - How will materials be obtained?

- Solicit sponsorship
  - Donating materials or compost bins in exchange for signage & promotion
  - Carpenters Union to construct bins

- Tarp to cover bins (or pile) in the winter & during heavy rains
Bins, continued

- Wood, pallets, or concrete blocks
  - Nine pallets will make a 3-bin set
  - Landscape timbers can also be used

- 3-5 feet high
  - Enough capacity to hold ~4 cubic yards of material (16 wheelbarrows worth)
  - Widths can range from 5-8 feet
Bins, continued

- Layer materials; always cover food with soil & leaves/bulking materials
- Water materials as added, if necessary
- Fill the first bin until full
- When the first bin is full, begin filling the second bin
Bins, continued

- When the second bin is full, begin filling the third bin
- When third bin is full, harvest materials in first bin
  - Cover with tarp until fully composted
- Stir/mix materials regularly to aerate
- Add additional bins if necessary
Compost Bins

Supports should be buried for stability

Repeat design for two or three stage system
Hubbardston Center School, MA

Photo: Karen DiFranza, Hands To Earth
Mansfield Middle School, Connecticut
Mansfield Middle School, Connecticut

Photo: Virginia Walton, Mansfield, CT
Sample Compost Bin - Purchase
Food Scrap Collection System
Monitoring & Collection Tasks

- Assign project tasks & train students & teachers in ongoing composting tasks
- Develop a schedule of tasks & assign teachers/students to complete each task
  - Ensures that everything gets done without overburdening anyone
- Rotate tasks so that experiences can be shared & to avoid project “burn out”
Collecting & Transporting Materials

- Determine how food waste will be collected in kitchen & in cafeteria
  - Students, custodial staff, teacher, &/or parent?

- Food waste is heavy
  - Smaller containers work best, especially if students are transporting
Food Scrap Collection Bins

- Five-gallon buckets with lids
  - Often these are available at no cost from restaurants or stores, or through a Materials Exchange
- Curbside bins or small trashcans
- Carts (Toters) on wheels
Cafeteria Monitors

- Ensure that only compostable food waste & napkins (soiled paper) end-up in compost collection tubs
- Assist students sorting compostable scraps into collection bin
- Help students learn what is acceptable & not acceptable for composting
Collection Set-Up

- Provide collection bins in kitchen for prep waste
- Place cafeteria collection bins in one area
  - Near where students normally bus tables & place trays for washing
- Label each bin with a clear sign
- Monitor collection for at least first couple of months
Manchester Essex Regional School District

Compost Collection in the Hallways
Manchester Essex Regional School District

Kitchen

Cafeteria

© Manchester Essex Regional School District, Massachusetts
Mansfield Middle School, CT
Food Collection Barrel

Photo: Virginia Walton, Mansfield, CT
Mansfield Middle School
Sort Line

Photo: Virginia Walton, Mansfield, CT
Hubbardston Center School
Sort Line, Massachusetts

Photo: Karen DiFranza, Hands To Earth
Moving Collected Materials

- Buckets or bins can be placed on a wagon or flat-bed wheeled garden cart for transport
- Collection carts on wheels
  - Tilted for emptying
  - Lined with bags for removal
Taking Food Scraps to the Bins

Photo: Virginia Walton, Mansfield, CT

In the Snow...
Emptying Collected Materials
Covering the Food Scraps
Closing the Bin
Making Compost
Compost System Maintenance

- Regularly review tasks with participants
  - Acceptable materials, collection logistics, maintenance, etc.
- Review proper attire, proper hygiene (e.g., gloves, washing hands), proper lifting
- Review how to safely handle shovels/other tools
  - Proper way to hold & use shovels to load & mix materials
  - Proper method of aerating the compost
  - Use of compost thermometer
Turning or Mixing Materials

- **Turning = Air = Faster Composting**
  - 1-2x per week will make compost in 1-6 months, depending on compost ingredients & outside temperature

- Piles that are not turned will take up to 18 months to be ready
Equipment

- Shovels &/or pitch forks
- Small bobcat or tractor with bucket, if available
- An aerating tool
  - Metal rod, pipe, rake, or sturdy wood stick
- Compost thermometer
  - To study the biology of composting process
- Bathroom scale
  - Measure results
Turning the Compost

Photo: Virginia Walton, Mansfield, CT
Turning By Hand

Photo: Karen DiFranza, Hands To Earth
Aeration Systems
Mansfield Middle School – What Worked Best

- Teacher compost duty
- Town staff support
- Counterweighted lids
- Bins sized to fit tractor
- Special education class participation
Mansfield Middle School
Results – 10 year period

- 43.27 tons composted
- $3,030 in avoided trash fees
- 40-45% diversion (recycling & composting)
- 2,200 students participated
- ~22 cubic yards finished compost
Manchester Essex Regional School District, Massachusetts

Reduced trash by ~95% in dining hall & ~85% in kitchen
Edible School Yard


© Manchester Essex Regional School District, Massachusetts
Troubleshooting

Preventive help against critters/flies:

- Always cover food with leaves & finished compost/soil
  - Cover with thin layer of agricultural lime if fruit flies or rodents are a problem
- Chicken wire on bottom & sides of bins
Troubleshooting, cont.

Bears:

- Enclose bins in fence
- Keep bins away from school buildings
- Build heavy-duty wood bins with steel-framed lids/steel mesh (using pulley-system to lift lids)
Troubleshooting, cont.

Pile Smells “putrid”/like rotten eggs or is too wet:

- Turn pile & increase turning frequency until problem subsides
- Increase carbon/brown sources, such as bedding
- Cover to protect

Pile not heating up:

- Add additional nitrogen—vegetable scraps
- Turn pile & add water throughout pile
You Do Not Have to Start Over!!

- When in doubt, turn the pile
- Check moisture content
  - If too wet, add carbon sources & mix
  - If too dry, add nitrogen sources & water, then mix
How many Compost Bins?

Conversions for determining compost bin size:
- 50 pounds = 15 gallons
- 100 pounds = 30 gallons
- 200 pounds = 60 gallons
So...

- 50 pounds of food waste per week = ~15 gallons
- Add at least 2x the amount of brown "bulky" to calculate total gallons-per-week figure
  - 15 gallons of food waste + 30 gallons of brown materials = 45 gallons
  - There are 7.5 gallons in one cubic foot. So,
    - 45 gallons divided by 7.5 = ~6 cubic feet
So...

- A constructed bin with 3' x 3' x 3' dimensions gives you 27 cubic feet of space
- In ~4 weeks the bin will be filled
- A new bin can then be started, or the composted materials can be removed from the original bin & set aside in a pile to finish composting
Worm Composting or "Vermicomposting"
Worm Composting

- A process that uses worms to convert organic material into a dark rich soil amendment.
- A worm composting bin in the classroom offers an exciting demonstration of ecology & recycling in action.
- Larger outside bins can be built for composting cafeteria food scraps.
- Schools may find it beneficial to do a combination of both regular on-site school composting & worm composting.
Vermicompost Bin
Vermiculture Bin System at Wright Charter School, CA
Home Sweet Wormy Home

- 7 - 14 gallon plastic bin (colored, not clear or see-through), with holes drilled ~ every 2” (using a 3/8” drill bit works best) around bin & lid, with a few on the bottom
- Wooden box with holes around side & bottom (1.5’ H x 2’ D x 3’ W)
- Enough shredded cardboard to fill the bin ~ half-way full, loose
Home Sweet Wormy Home, cont.

- Garden soil (not potting soil) or finished compost, ~1 cup per bin
- A crushed egg shell
- ~¼ - ½ pound of worms or ~300 - 500 worms per bin
- A three-pronged hand fork or trowel
- A small water spray bottle (like kind used for plants)

*Worms & bedding must be moist at all times*
Home Sweet Wormy Home, cont.

- Soak cardboard, drain, & squeeze
  - The cardboard should be thoroughly moistened, like a damp sponge, but water should not pool in the bin
- Mix cardboard, soil, egg shell, & some water in the worm bin
- Put the worms into their new home
- Wait a few days to feed the worms
  - They will start eating the paper bedding & get used to their new home
A Healthy Wormy Diet

- Salad, veggies
- Lettuce
- Bread
- Crackers
- Coffee grounds
- Tea bags

- Shredded carrots
- Pizza crust
- Cheese
- Egg shells
- Cereal (no milk)
- Popcorn
Where to Get Worms

- Check the Internet
  - http://www.redwormcomposting.com/
  - http://www.unclejimswormfarm.com/
  - Google “Compost worms” or Red Wigglers
- Check with Garden Stores
- Bait supply stores
  - Make sure the worms are healthy & alive!
Off-Site Composting
Off-Site Food Scrap Diversion Options

- Locate a livestock operation or compost facility
  - Check with local solid waste official
  - Check Internet or phone book for farm listings, farm organizations, farms that raise chickens or pigs, have digesters for energy production, or have on-site composting
  - Contact farm or operation to see if would be willing to accept food scraps from the school
Off-Site Options, cont.

- Determine exact materials that are acceptable by farmer or compost operation
  - A compost operation or digester can often accept soiled paper (such as napkins) & all food scraps, even meat
  - Livestock operations may only accept specific vegetable scraps
Off-Site Options, cont.

- Develop a collection plan (same as for on-site composting)
- Determine how the materials will be stored before going to the farm or compost operation
- Determine how materials will get from the school to the farm or compost operation
  - Is there a local hauler that collects organics?
  - Would the farmer be willing to collect the materials?
  - Is there a volunteer that would transport the materials?
Food Waste Reduction
Cafeteria Food Waste Reduction

- Zero waste lunches
- “Offer Versus Serve”
  - Allows students to decline food items they do not want
  - Acceptable under USDA national school lunch & breakfast programs
- Smart Food Handling Techniques
  - Better management to reduce overproduction & trim waste
  - Losses due to spoilage, overcooked items, contaminated items, & dropped items
Resources Available on NERC Website: Action Tip Sheets

http://www.nerc.org/documents/index.html#SchoolWaste

- Waste Assessments & Waste Audits
- Waste Audit Sheets
- School Waste Assessment Form
- School Reuse Tips
- Paper Use Reduction in Schools
- School Cafeteria Waste Reduction
- Rural School Recycling Success
- School Composting Options
- Fundraising with Recycling
- Rural School Case Studies in Waste Reduction, Reuse, Recycling, & Composting
- School Web Resources
Resources Available on NERC Website, cont'd

Presentations
- Rural School Recycling Success
- Composting at School
- Sustainable Recycling for Schools
- Implementing a Successful Green School Program
- Hands to Earth: Educating for a Sustainable World
- Manchester Essex (Massachusetts) Regional School District Composting
- Mansfield Middle School (Connecticut) Composting

Case Studies
- Academy of the Holy Family, Connecticut
- Sayles School, Connecticut.
- John M. Clayton Elementary School, Delaware
- Pencader Charter High School, Delaware
- Eldred School District, New York
- Liberty School District, New York
Other Resources

- **Tools to Reduce Waste in Schools**
  [http://www.epa.gov/wastes/education/toolkit.htm](http://www.epa.gov/wastes/education/toolkit.htm)

- **Materials for Recycling**
  [www.ciwmb.ca.gov/gallery/wasteprev](http://www.ciwmb.ca.gov/gallery/wasteprev)

- **Lesson Plans & Other Resources**
  [www.paperrecycles.org](http://www.paperrecycles.org)

- **Go Green School Initiative**
  [www.gogreeninitiative.org](http://www.gogreeninitiative.org)

- **Green School Resources**

- **The Green Team**
  [www.thegreenteam.org](http://www.thegreenteam.org)

- **Various School Resources**
  [www.kab.org](http://www.kab.org)