Composting in Your Backyard

Mark King,
Sustainability Division

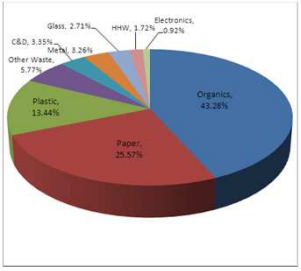
MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION

Protecting Maine's Air, Land and Water

What's Out There?

In Maine:

- the average resident produces approximately 150-200 lbs. of food scraps per year.

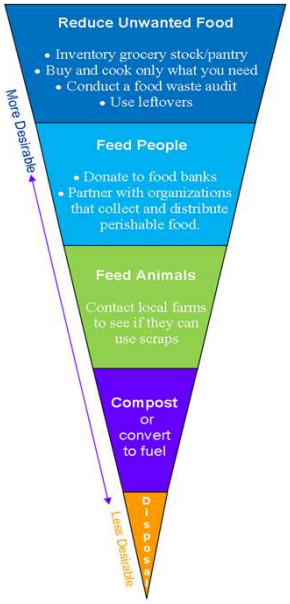


- 80% of Commercial food scraps (restaurant, cafetarias, supermarkets, etc.).

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION www.maine.gov/dep

Maine's Food Recovery Hierarchy

Adopted in 2016 by Maine Legislature



Source Reduction

Use it up, wear it out…Make it do or do without!!!

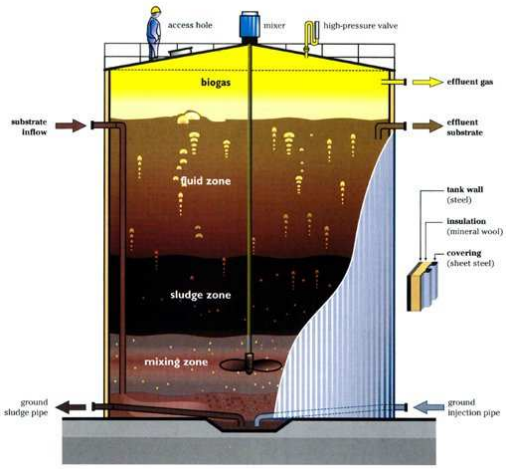
"Just because it is not perfect looking…Does not mean it isn't edible!"

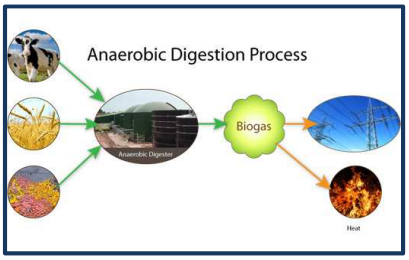
Aesthetics ≠ Nutrition

San Francisco Food Bank
Edible Food Redistribution

Feeding Food To Animals

Anaerobic Digestion





Composting

Land Application

Every Community Has a "Choice"… We Can Have This…..

Or We Can Have This…..

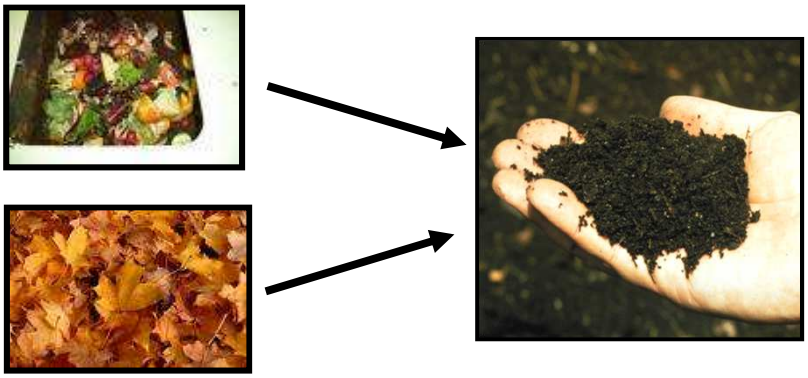
What is Composting?

"A biological process in which tiny organisms convert organic materials into nutrient rich, soil-like products".

Compost is a soil amendment, not a fertilizer!!!

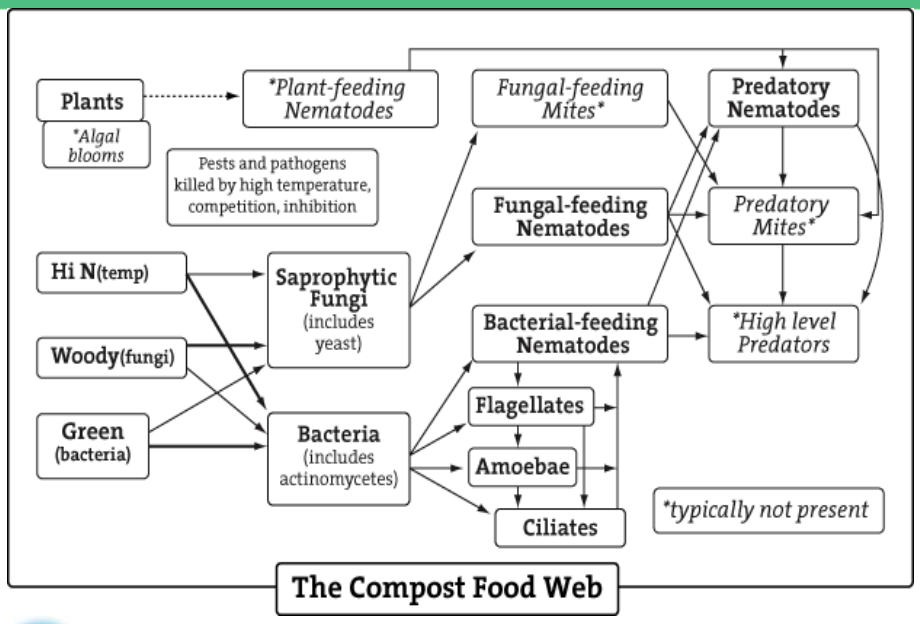
What is Composting?

- A biological process that *transforms* raw organic materials into a nutrient rich, biologically-stable soil additive suitable for plant and crop use.



Compost Community

- Macroscopic Invertebrates-do most of initial mechanical bread-down of organic materials into smaller particles
  - Snails, slugs, mites, sow bugs, worms, ants, centipedes, millipedes, beetles
- Microorganisms-digest and "transform" organic matter into stable humus-like particles
  - Bacteria, fungi, actinomycetes, and protozoa



What Makes a Compost Pile Work?

- C:N ratio
- Oxygen content (porosity)
- Moisture content
- pH
- Particle size

So…What is a C:N Ratio?

- Supply of total carbon compared to total nitrogen in compost feedstock
- If C:N is too high the compost process will slow
- If C:N is too low, more likely to lose Nitrogen as ammonia gas or in leachate
- Ideal initial C:N mixture range is 20 – 30:1

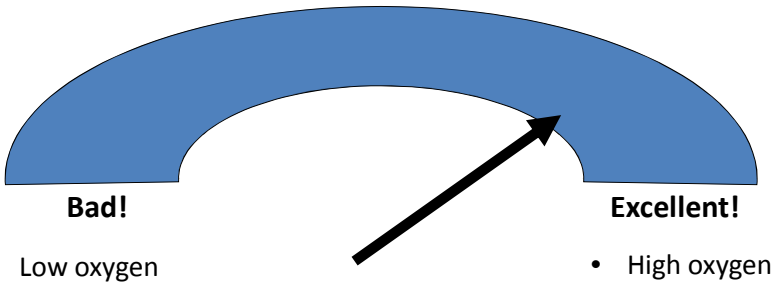
Carbon Feedstocks

- **Carbon: 30:1 or >**
  - **Leaves**
  - **Wood shavings**
  - **Card board: caution**
  - **Shredded Newspaper**
  - **Wood chips**
  - **Corn stalks**
  - **Straw**

Nitrogen Feedstocks

- **Nitrogen: 30:1 or <**
  - **Animal manures**
  - **Food waste**
  - **Lawn clippings: caution**
  - **Fish**
  - **Garden clippings: caution**

Oxygen, We All Need It!!



Bad!

- Low oxygen
- Slows Down
- High odors

Excellent!

- High oxygen
- Efficient
- Low odors

Microbial Classification

- Based on Two factors:
  - –Oxygen Consumption
    - Aerobes (use O_2, largest population)
      - –Facultative-use O_2, but can swap
      - –Obligate-use O_2 only!
    - Anaerobes (mostly killed or inhibited by O_2, but can be facultative

Oxygen!!!

- Aerobic respiration-use O_2 as primary oxidizing agent (most efficient)
- 5%-10% is optimal for compost process

Aerobic Decomposition is the "quickest" way to achieve biological stability!!

Aerobic Composting and Temperature

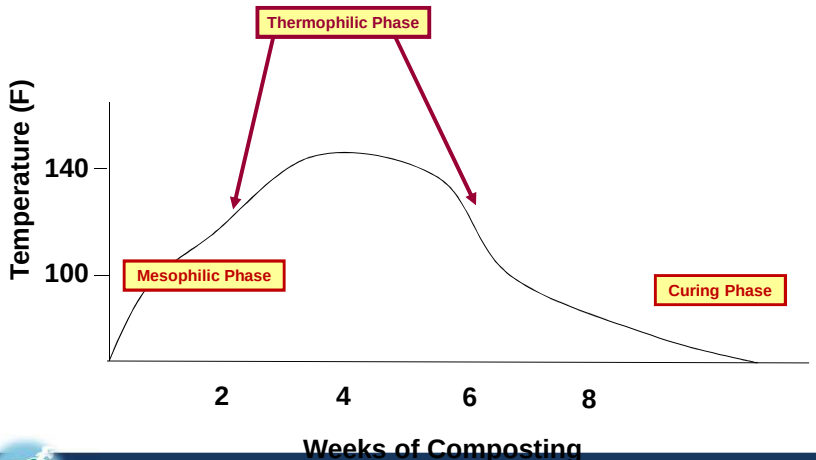
- Active composting occurs in the temperature range of 110°F to 160°F
- Pile temperature may increase above 160°F but this is too hot for most bacteria and decomposition will slow until temperature decreases again

Remember, compost pile heat is the direct result of bacteria working!

Phases of *Aerobic* Composting

- **Initial Mix-Materials are blended together (day one)**
- **Mesophilic phase-Moderate temperatures (50-110^{o}F) lasts for a few days**
- **Thermophilic phase-High temperatures (110-160^{o}C) lasts for 4-6 weeks**
- **Curing and Maturation phase-Temperature moderate down to ambient lasts for 3-6 months**

Typical Temperature Profile



Compost Moisture

0%

50-65%

100 %

Too dry

Optimal conditions for microbes

Too wet

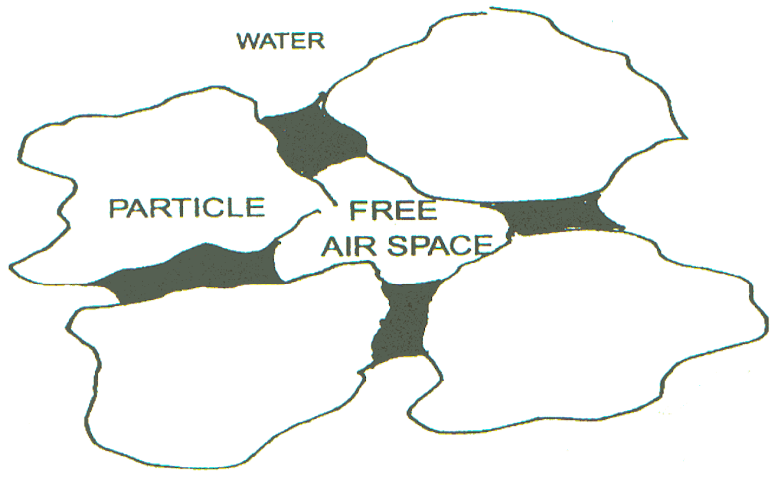
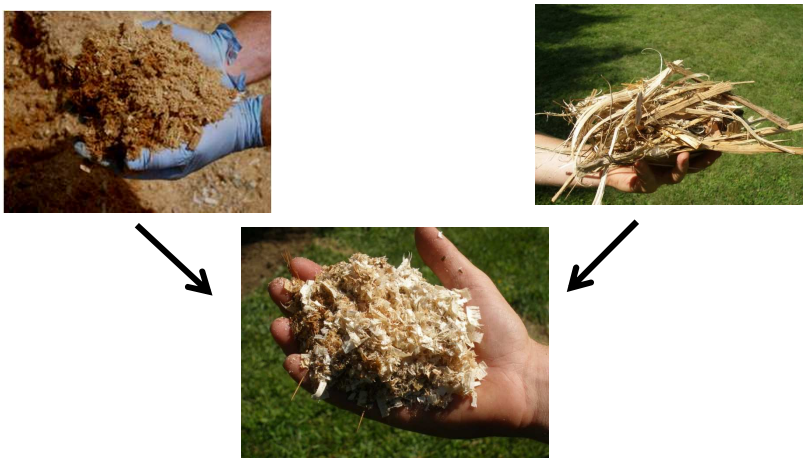
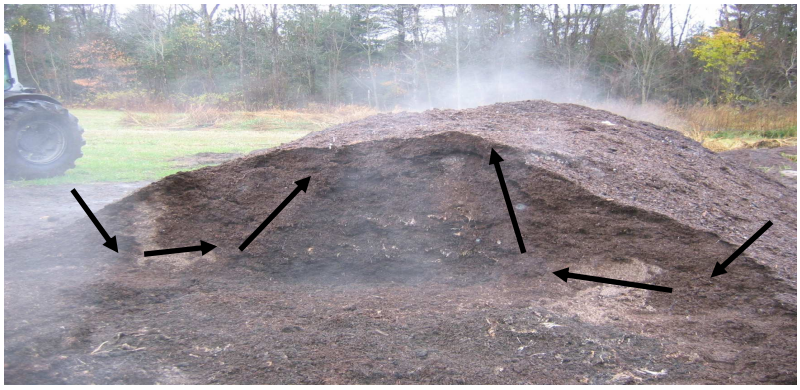


FIGURE 2.10. The relationship of free air space to water and particles in a composting media.

What Does Particle Size Do?



Moisture Distribution vs. Air Flow Through Compost Pile



How do I start a Compost Program?

Step 1: Getting Started

- Decide if Composting is right for your school
  - Do you want to reduce the amount of trash you generate?
  - Do you have or want to develop a school/community garden?
  - Do you want to save your school money?
  - Do you want to develop an educational program that promotes sustainable environmental practices?
- Develop your "Compost Team"
  - Include:
    - Principal
    - Food Service Staff
    - Custodians
    - Science and Art Teachers
    - Interested Parents
    - State and local Compost Experts

Step 2: Contact the Maine DEP—Why?

- We have seen and done a lot!
- Division of Sustainability can helps schools develop sustainable practices to reduce the amount of food scraps that are generated and wasted annually.
- Mark King, Organics Management Specialist serves as DEP's Compost Expert
  - 207-592-0455
  - Mark.a.king@maine.gov

Step 3: Hold Your First Team Meeting

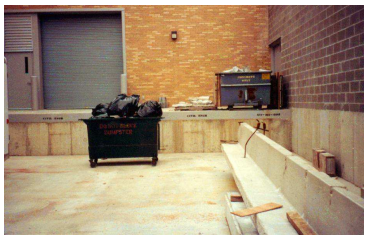
- Objective-Determine Team dynamics and how group will function
  - Focus on good communication
  - Clear definition of roles
  - Positive reinforcement
  - Commitment to education-based program

- Determine **Key Roles** and Responsibilities
  - **Compost Coordinator-Science teacher or Principal, most important position!**
  - **Compost Monitor-Usually Food Services staff member**
  - **Sorting Monitor-Can be teacher, custodian, parents or students**
  - **Compost Collector-Usually science teacher or custodian**
  - **Materials Coordinator-Teacher or Parent Volunteer**
  - **Site Monitor-Custodial Staff**

Step 4: Conduct a Characterization study

- Several Days Before:
  - Gather equipment: 5-gallon Buckets, Set of Scales, calculator, gloves, hand sanitizer, aprons and tarps.
  - Choose a location to do the collecting and sorting (adorn with proper signage).
  - Meeting is held to fully discuss process.
- Day of Study:
  - Survey of food in storage (focusing on expiration dates).
  - Collecting and sorting begins (weights recorded separately for breakfast and lunch.
  - Collected (compostable) material weights are totaled for each day of a five-day period and then a final total is determined for the week.
- Evaluation Phase:
  - Discussions held about how things went, possible improvements for future.
  - Results (weights) are used to help decide on collection system (**Step 5**) and compost system (**Step 6**).

Conducting the Residual Characterization




Food
Trash
Food
Trash


Trash

Step 5: Choosing a Collection System

- Setting-up the Collection area:
  - Clearly marked with good signage.
  - Efficient.
  - "Sorting Monitors" and positive feedback help reinforce good behaviors.
- Choosing the Container:
  - Based on size, cost and overall ease of use.
  - Match container to total weights generated by Characterization study.
  - Easily handled by students.
  - Easily cleaned.
- Time Budget:
  - Figure on 30-45 minutes per day and 1-1.5 hours extra per week for composting.
- Time to Run the Collection!

Collection and Storage

Daily task (30-45 Minutes)

- Collect compost material
- Weigh compost material (optional)
- Take to compost site
- Take compost temperature
- Mix in new ingredients
- Add bulking material
- Clean up

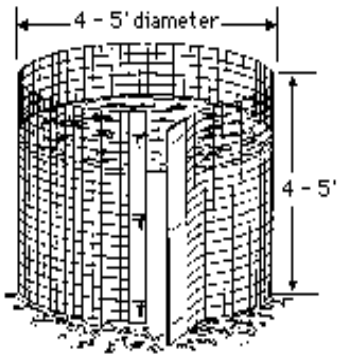
Weekly Task

- Maintenance of bins
- Turn piles
- Troubleshooting
- Supplying bulking material

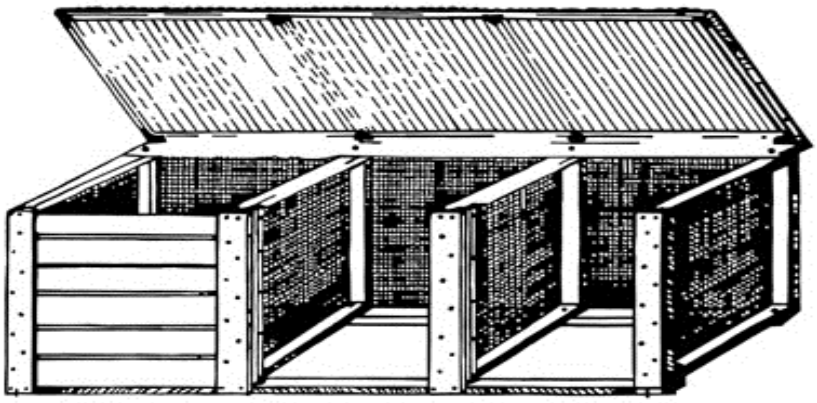
Step 6: Designing a Compost System

- Locate a Suitable Site:
  - Away from people
  - Dry
  - Shady to partly shady
  - Flat with well-drained soils
- Pick a System:
  - Bins
  - Piles
- Build it and Start Composting!

Simple Bins



Backyard Compost Bins
3 Bin System




COMPOST

Backyard Compost Bins
"Tumblers"

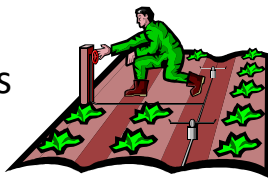
Open System

Tools…

- Spade fork
- Kitchen food collector
- Thermometer
- Aerator (Wing-digger)

Benefits of compost

- Add organic matter to soil
- Increase water holding capacity
- Increase infiltration
- Reduce erosion
- Enhance microbial activity
- Soil compaction
- Resistance to disease and insects
- Revolving nutrient bank account



When is the Compost Finished?

Okay, Now What??

- You now have a collection and compost system, understand how compost works, and have the full support of all involved…
- Let's give it a try!!!
  - Start small (pilot)
  - Success breeds success or as they say in the military…"Slow is smooth and smooth is fast!

Mark A. King
Mark.A.King@maine.gov
207-592-0455
www.maine.gov/dep

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION www.maine.gov/dep