Cornell Cooperative Extension
Cornell Garden-Based Learning

Organic Waste Management: Composting Session

Master Gardener Volunteer Core Preparation

Cornell Garden Based Learning

Learning Objectives

- **Understand** that composting is managed decomposition and that there is a link between compost and soil health.
- **Articulate** the proper management of compost including acceptable inputs and the balance of browns and greens.
- **Demonstrate** the proper technique of lasagna layering.
- **Assess** various composting systems (i.e. wire bin, tumblers, worm bin) and be able to assist the public in selecting the type that best suits them.
- **Understand** the process of how composting works and be familiar with the factors that facilitate or slow the process.
- **Determine** if compost is finished (mature) and be versed in how to harvest and use the compost.
- **Recognize** the current statistics regarding food waste and steps that can be taken individually and statewide to minimize the food waste stream.
- **Identify** common composting troubleshooting and problems and become familiar with composting FAQs.

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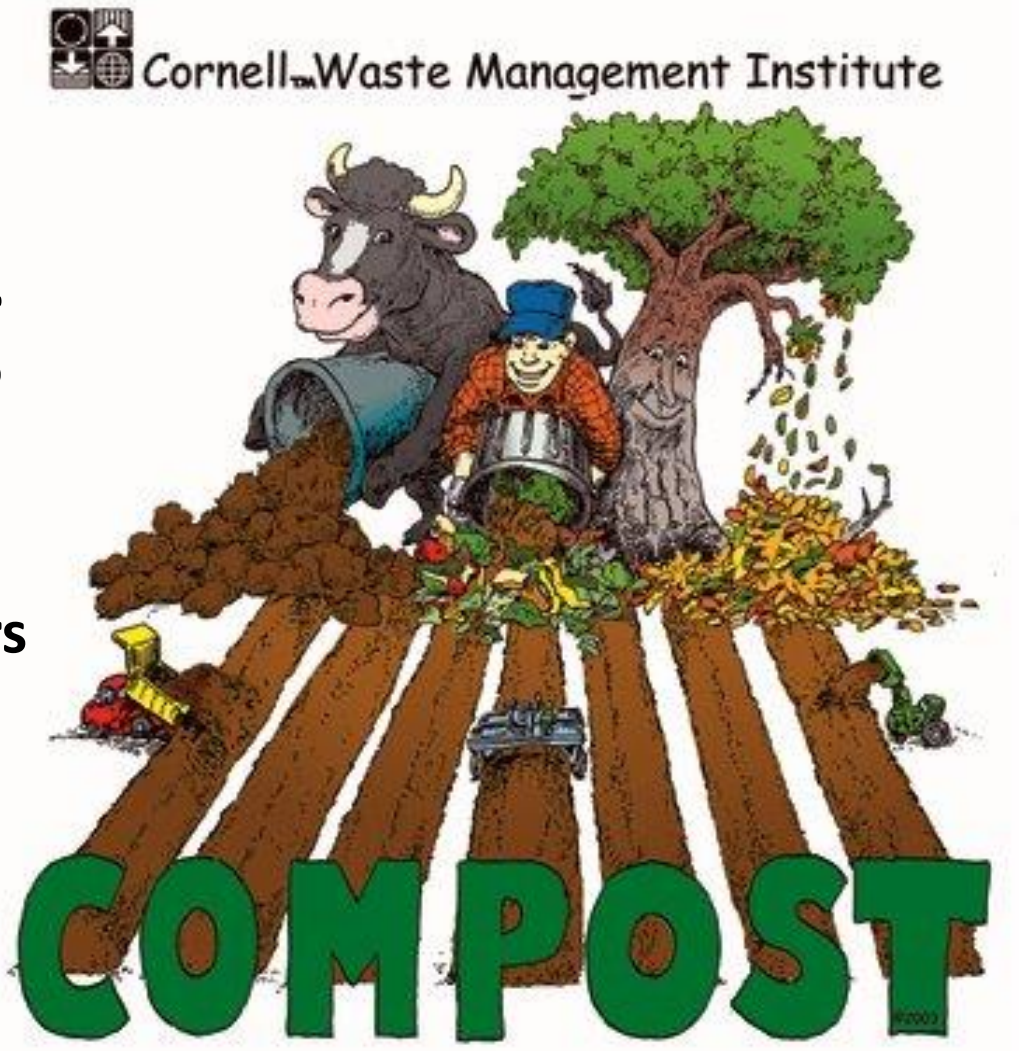
Home Composting

Lower Hudson Valley
CCE Master Gardener Volunteers
Training October, 2015

Joyce Tomaselli
CCEDC



Contents

1. Why Compost?
2. Composting Basics
3. Compost Uses
4. Compost Troubleshooting
5. Composting Systems

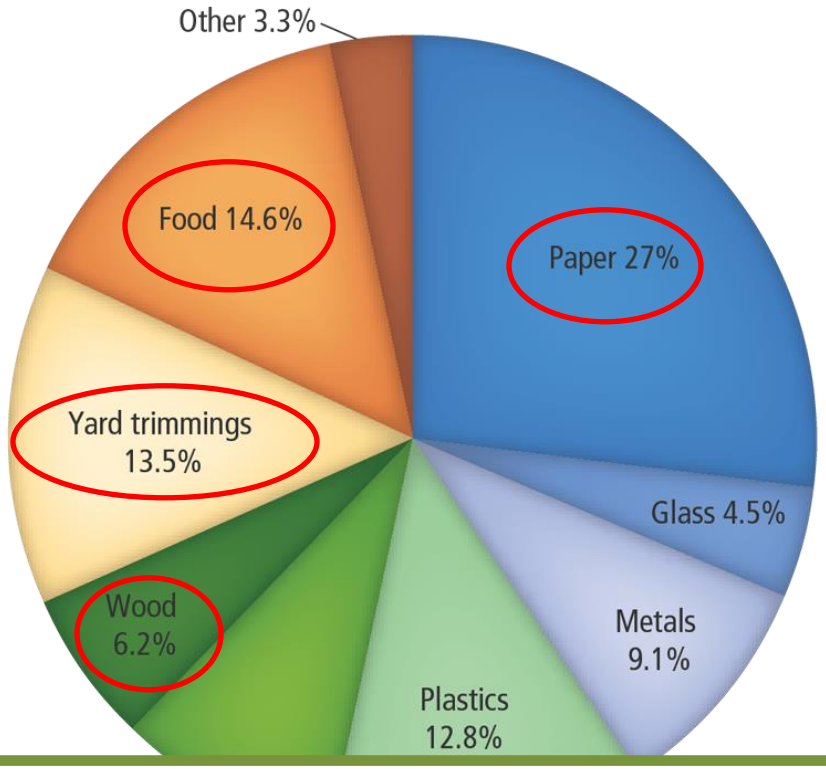
1. Why Compost?

"Because a rind is a terrible thing to *waste"*

Jean Bonhotal
Cornell Waste Management Institute
cwmi.css.cornell.edu

US Waste Facts

Total MSW* Generation (by material), 2013
251 Million Tons (before recycling)
*Municipal Solid Waste



- Over 87 million tons of MSW were recovered
  - recycling, 65 tons
  - composting, 22 tons
- This prevented the release of approximately 168 million metric tons of carbon dioxide - equivalent to taking 33 million cars off the road for a year.

Over 60% of US waste is organic materials that can be composted

The ultimate benefits from recycling and composting are cleaner land, air, and water, overall better health, and a more sustainable economy.

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USEPA Municipal Solid Waste – 2013 Facts and Figures

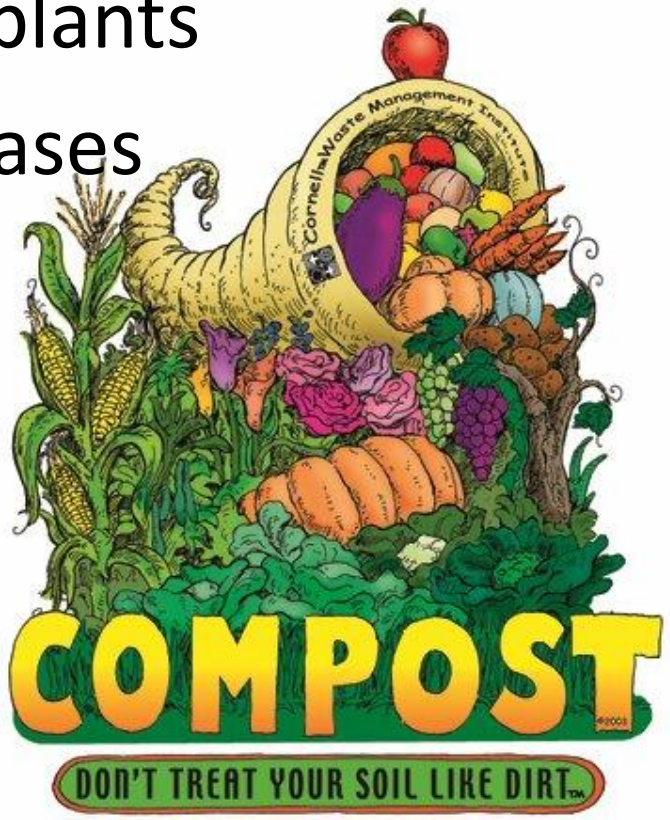
Why Compost?

Composting lowers MSW volumes

Compost improves soil

- Better soil grows heathier plants
- Healthier plants resist diseases

Compost has many other uses in gardens and on lawns.



2. Composting Basics

- What is it?
- The Biology
- Materials
- Variables

Composting Basics

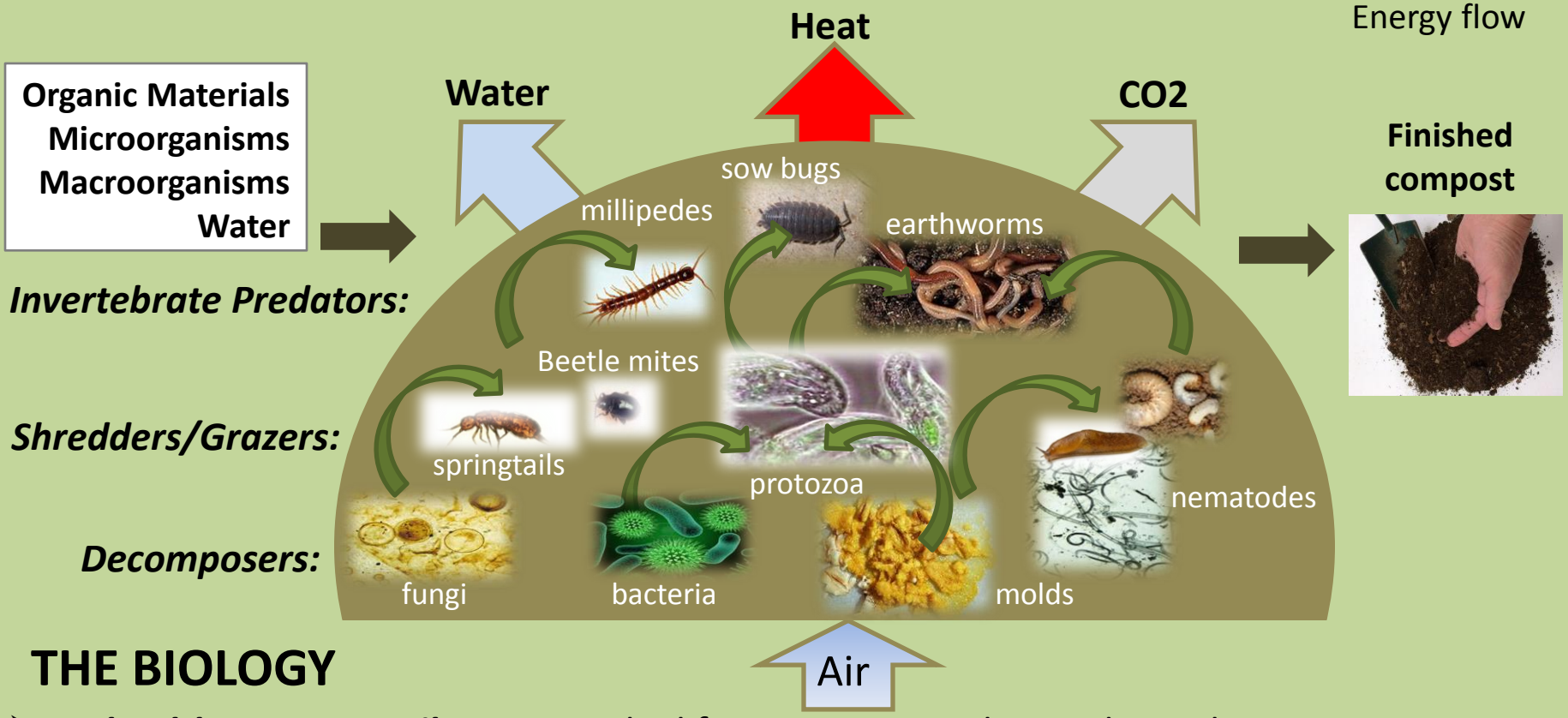
What is Home Composting?

Composting is the aerobic (oxygen requiring) decomposition of organic materials by macro/microorganisms under controlled condition

Compost = Managed Decomposition

Home Composting is small-scale, primarily including garden and yard trimmings and leaves, kitchen scraps, wood shavings, cardboard and paper.

Composting Basics: Inside the Compost Pile



THE BIOLOGY

- ***A healthy compost pile*** is a microbial farm teeming with interdependent organisms.
- **Decomposer** microorganisms such as fungi, bacteria, and mold start the process.
- ***Shredders and grazer*** macroorganisms such as protozoa and nematodes join the mix.
- ***Invertebrate predators*** such as sow bugs & earthworms eat decomposers & shredders.
- ***The end result*** is 'Black Gold' – rich organic compost!

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Composting Basics

Browns = Carbon Dry Materials

Organic Materials (Feedstock)

Greens = Nitrogen Wet Materials

Composting Basics

Materials: Carbon:Nitrogen (C:N) Ratio

Woodchips (400:1)
Cardboard (350:1)
Sawdust (325:1)
Newspaper (175:1)
Pine needles (80:1)
Straw (75:1)
Corn stalks (75:1)
Leaves (60:1)
Fruit waste (35:1)
Peanut shells (35:1)
Garden waste (30:1)
Weeds (30:1)
Hay (25:1)
Vegetable Scraps (25:1)
Clover (23:1)
Coffee grounds (20:1)
Food waste (20:1)
Grass clippings (20:1)
Seaweed (19:1)
Manures (15:1)
Alfalfa (12:1)

Compost requires a 30:1 mixture of browns & greens.

Browns are high in Carbon
Used by shredders/decomposers for food

C:N ratio refers to the material composition, not volume.

Greens are high in Nitrogen
Used by shredders/decomposers for growth /reproduction

Composting Basics
Materials: Mixing by Volume

Woodchips (400:1)
Cardboard (350:1)
Sawdust (325:1)
Newspaper (175:1)
Pine needles (80:1)
Straw (75:1)
Corn stalks (75:1)
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Rule of Thumb

For the best C:N ratio (30:1), mix:

1 part Green ***2-3 parts Brown***

Compost Basics
‘The Pile’

Bottom layer: Sticks and/or stones for air

Composting Basics
Layering Greens and Browns

Layers of Greens

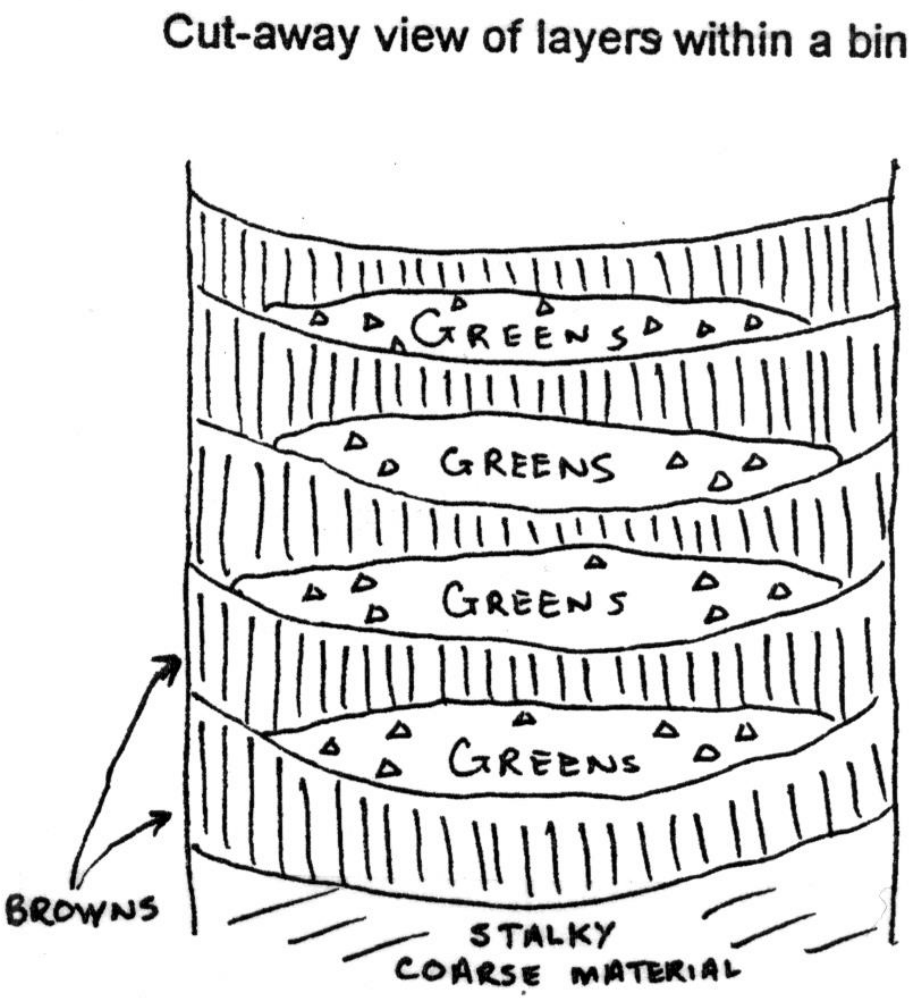
- Lawn & garden waste, food scraps

Layers of Browns around the Greens

- Allow air flow and aid drainage
- Are visual and physical barrier to pests

Bottom Layer

- Coarse materials to allow air in



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Composting Basics

What not to Compost

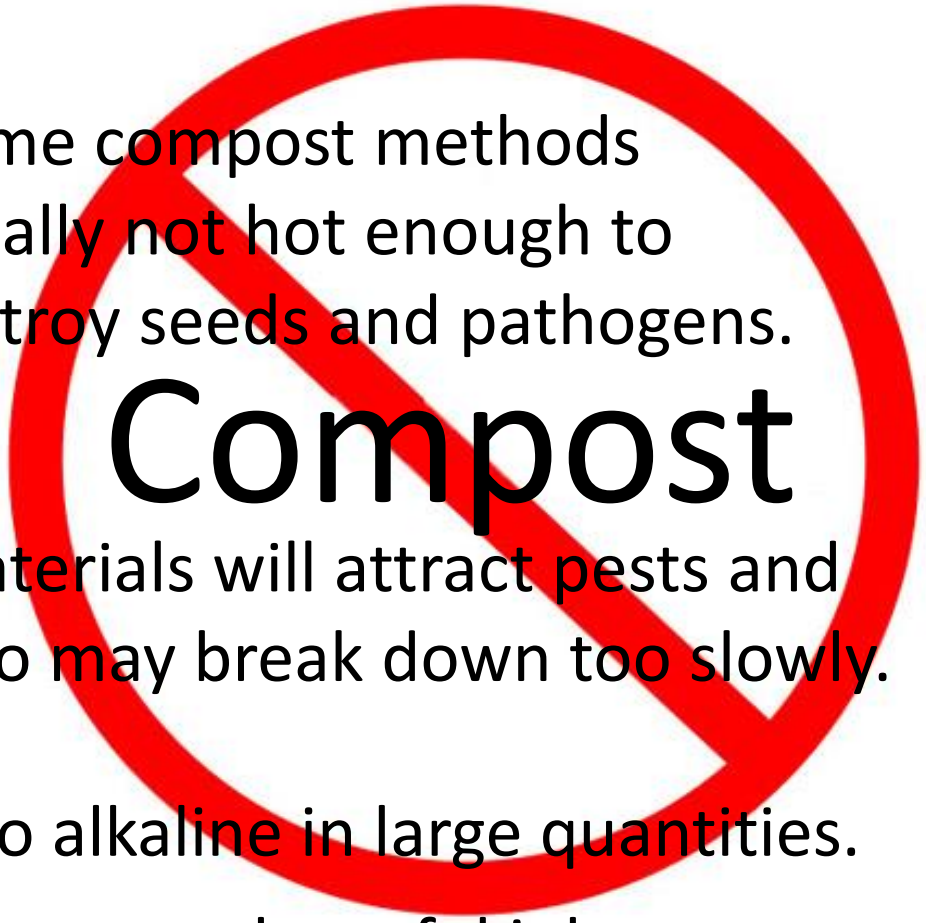
- Seedy Weeds
- Invasive plants
- Diseased plants
- Diseased potatoes or tomatoes
- Dog &cat manure
- Dairy products
- Grease and fats
- Meats and fish
- Bones
- Wood ash
- Coated or treated paper

Home compost methods usually not hot enough to destroy seeds and pathogens.

Materials will attract pests and also may break down too slowly.

Too alkaline in large quantities.

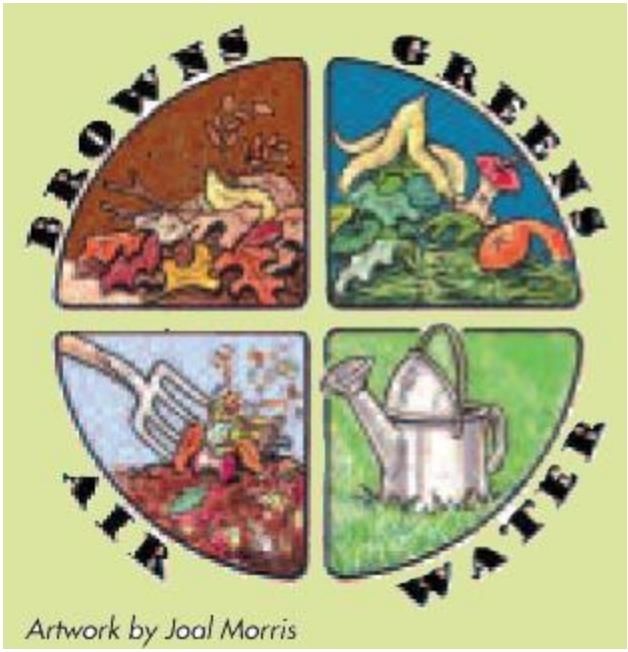
Some use harmful inks.



Composting Basics

The Variables

- Materials
- Oxygen
- Moisture
- Surface Area
- Temperature



Composting Basics

The Variables…Oxygen

- Air is needed for aerobic decomposition
- Frequencies of turning is governed primarily by moisture content and type of materials

Composting Basics

The Variables…Moisture

Organisms need moisture. Decomposition will slow with too much or too little moisture. The optimum moisture content for compost is 40-60%, damp enough so that a handful feels moist to the touch, but dry enough that a hard squeeze produces no more than a drop of two of liquid.

Composting Basics

The Variable…Surface Area

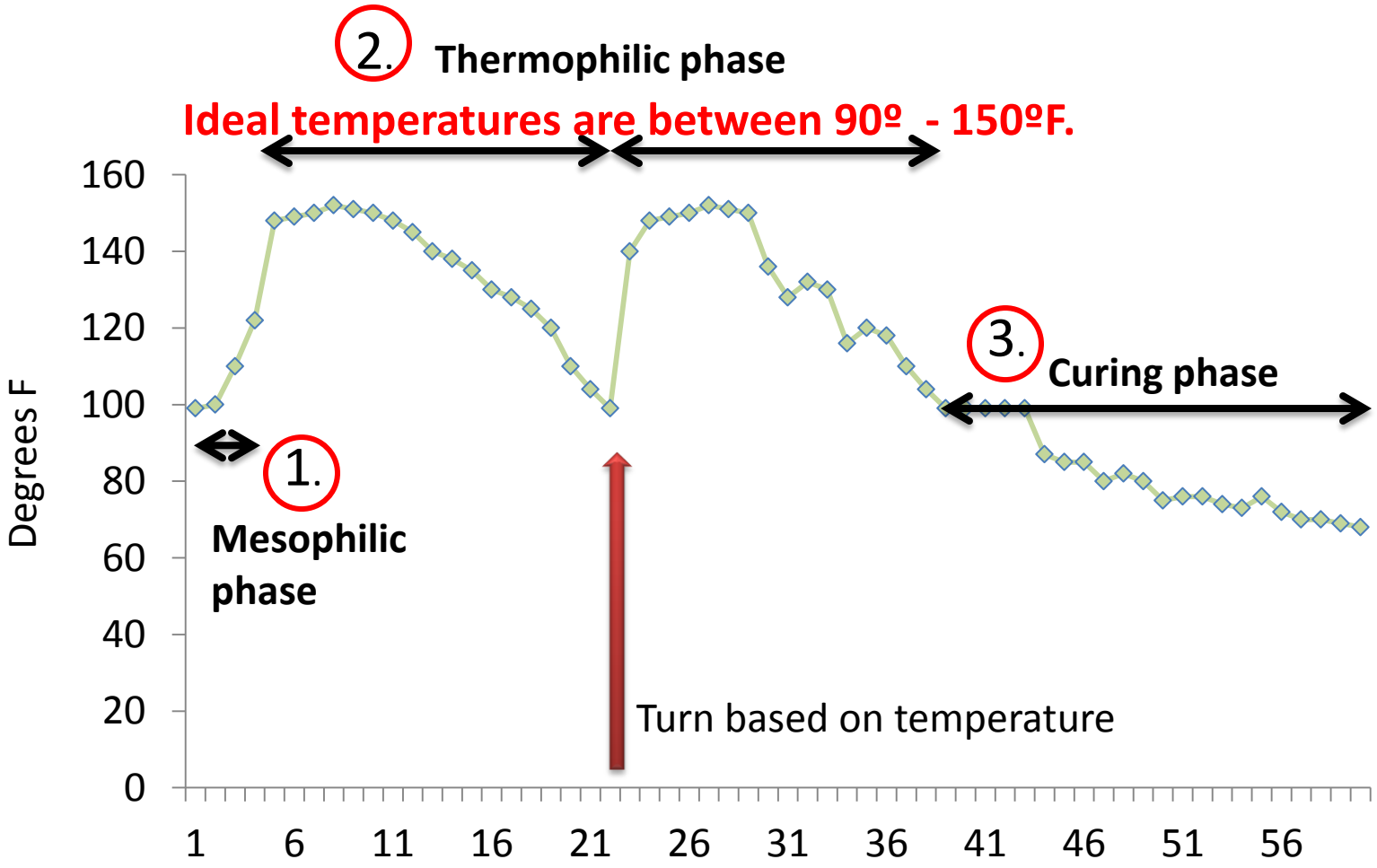
Woodchips

Sawdust

- Decomposition occurs on the surface of particles.
- Large particles (woodchips) = better aeration and less labor, but take longer to breakdown
- Small particles (sawdust) = more surface area, less space to circulate air and more labor to aerate

Composting Basics

The Variable…Temperature



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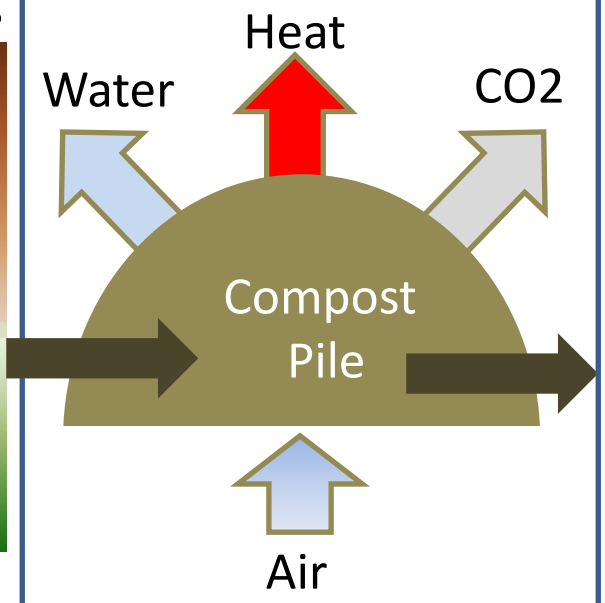
Composting Basics: Summary

Components | **Process** | **Results**

Organic Materials
- woodchip
- cardboard
- newspaper
- corn stalk
- leaves
- garden wastes
- vegetable scraps
- coffee grounds
- manures

Microorganisms
Macroorganisms
Water



Finished Compost

- ***Organic Materials****: add 1 part Green to 2-3 parts Brown.*
- ***Micro & Macroorganisms:*** *add soil, compost, or starters.*
- ***Water:*** *add as needed to make a handful feel moist.*
- ***Air:*** *add oxygen by turning the pile.*
- ***Shelter****: create a mass of at least 3'x3'x3'.*

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Finished Compost Uses

- ***Soil Amendment:*** create healthy soil by incorporating ½ - 1” layer of compost into top 6-8” of soil
- ***Mulch:*** retain moisture & suppress disease by spreading 2-3” of compost without contacting plant stems or trunks

- ***Potting Mixture:*** improve potting medium by adding up to 50% compost
- ***Top-dressing:*** boost established lawns with ¼ inch of fine material

3. Compost Troubleshooting

Compost Troubleshooting

Organic Materials

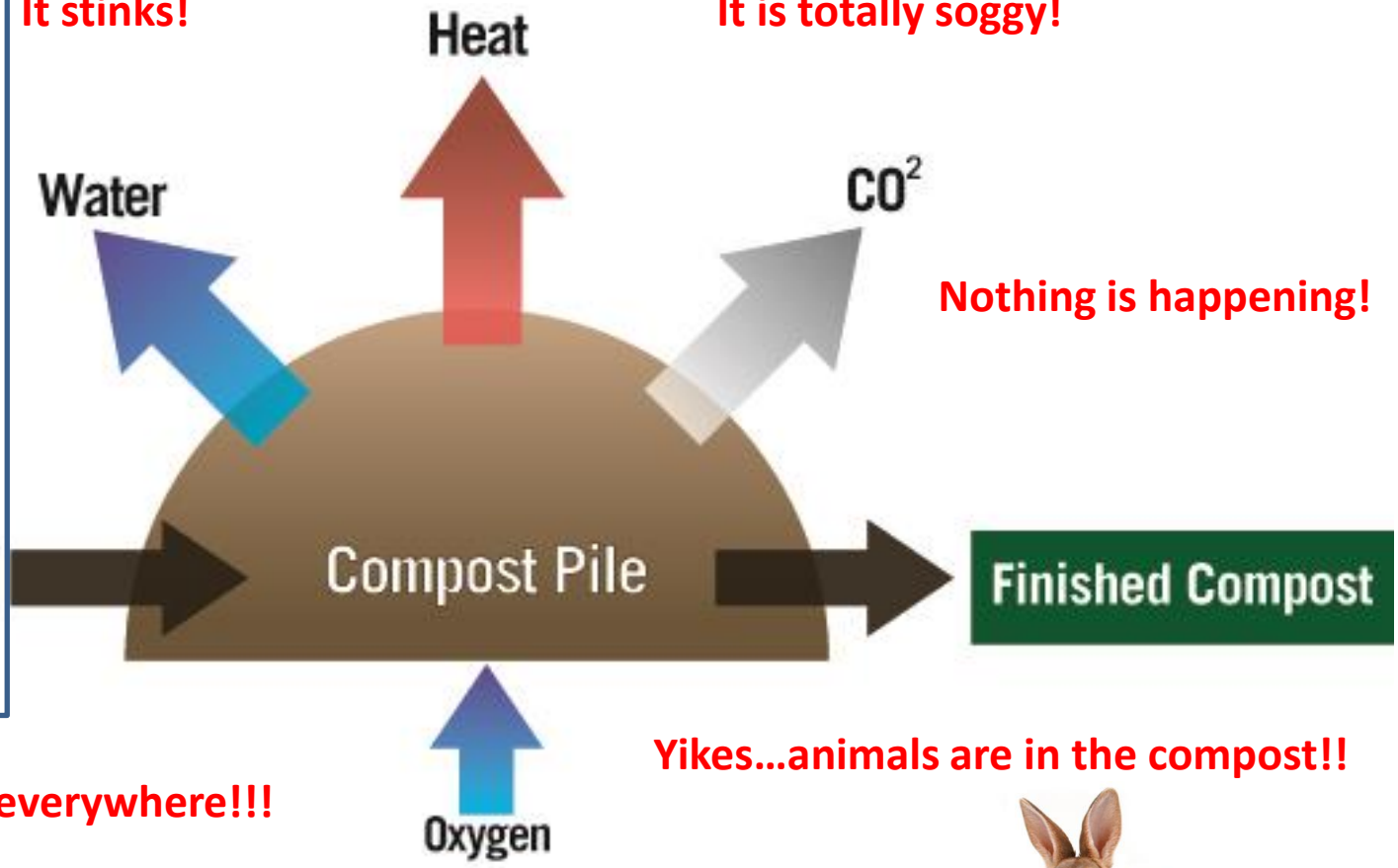
- woodchip
- cardboard
- newspaper
- corn stalk
- leaves
- garden wastes
- vegetable scraps
- coffee grounds
- manures

Microorganisms
Macroorganisms
Water

It is stone cold!

It stinks!

It is totally soggy!



Nothing is happening!

Bugs are everywhere!!!

Yikes…animals are in the compost!!

Troubleshooting

Problem	Issue	Resolution
Damp &/or warm only in middle	Pile could be too small or weather cold	Pile should be at least 3 cubic feet
Nothing is happening	1. Not enough nitrogen, oxygen, &/or water 2. Cold weather 3. Compost is finished	1. Add greens, aerate, &/or add water 2. Wait until spring 3. You're done!
Matted leaves/ grass clippings are not breaking down	Poor aeration or lack of moisture	Break up &/or shred the layers and turn pile
Smells like rotten eggs	1. Not enough oxygen 2. Pile is too wet &/or compacted	1. Aerate pile 2. Add dry materials
Smells like ammonia	Not enough brown/carbon	Add brown/carbon materials
Attracts rodents or other animals	1. Inappropriate materials 2. Kitchen scraps too close to surface	1. Bury kitchen scraps near the center 2. Switch to a rodent-proof closed bin.
Attracts insects	Normal composting	Not a problem
Attracts many ants	1. Pile too dry &/or not hot enough 2. Kitchen scraps too close to surface	1. Ensure right material mix & moist 2. Bury kitchen scraps near center

5. Composting Systems

- Large Scale
- Medium Scale
- Small Scale
- Your Selection

Composting System Selection Criteria

- How quickly do you want compost
- How much work do you want to do
- How much money do you want to spend
- Type of waste you will compost
- How much volume will you compost
- How much space do you have
- Where is the location in your yard
- What is your commitment

Composting Systems

Large Scale – Hot Composting

Composting Systems

Medium Scale - Cold and Hot Composting

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Composting Systems
Small Scale - Cold Composting

On the Ground

Above the Ground

Minimum 1 cubic yard (3X3X3)
No larger than 8x8x8

Composting Systems
On the Ground – Compost Pile

Cost: $0
Equipment: Pitchfork, a pair of gloves.
Speed: 4 months to a year

Pile yard waste in a mound about 3’ x 3’ x 3’ in a good location.
Add materials as they become available.
Enclose food scraps in “Browns”.
Turn pile to speed decomposition.

Composting Systems
On the Ground - Direct Incorporation

Cost: $0
Equipment: Shovel, a pair of gloves.
Speed: 4 months to a year

Dig holes 10-15 “ deep and less than 2’ across.
Place food scraps in the holes and cover with soil.
Bury food waste at least 6-8” deep to keep deter animals.
Take care not to damage the roots of nearby plants.

Home Composting Systems
On the Ground - 3 bin unit

More expensive to build, but is effective and long lasting.
Decomposes yard, garden waste and kitchen materials quickly.
Fill the first bin. Monitor temps. Turn before 155^{o} into the 2nd bin.
Repeat using the 3rd bin. Compost can be created in a month.

On the Ground – Tower Unit

Cost: $150-$200
Equipment: Turning tool or fork.
Speed: 6 months to a year
Useful for smaller yards, looks nicer than a compost pile.

Continuously add food scraps and cover with “Browns”.
Turn if desired. Add a second unit if first is full.
Remove decomposed material from the bottom.

Composting Systems
Above the Ground – Rotating Drums

Cost: $100-$300
Speed: 6 months to a year
Useful for smaller yards, looks nicer than a compost pile.

For best results, fill the drum, add some soil then turn.
Adding some active compost is also useful.
Monitor moisture level, ensure enough “Browns”.

Composting Systems
Other Above the Ground Options

Japanese for “Fermented Organic Matter”

Vermicomposting System
Red Wigglers
(Eisensia Fetida)

Vermicomposting: Composting with Worms

Produces a high quality soil amendment

Requires little space, labor, and maintenance

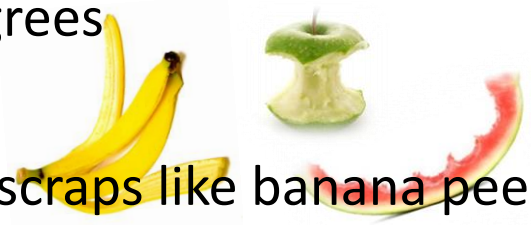
Reproduces new worms for continuous composting

The Worm Bin

- Shredded paper
- Food scraps
- Red wigglers (Eisenia fetida)
- Shredded paper
- Aeration holes

Vermicomposting: The Basics

- Keep worms dark & between 40-80 degrees
- Ensure shredded paper stays moist
- Feed once a week or less - organic food scraps like banana peels, melon rinds, coffee grounds, vegetable peels (no meats or dairy)
- Harvest worm castings and related compost when dark & crumbly



Using Your Vermicompost

- **Lawns:** 20 lb. per 1000 square feet
- **Gardens:** a handful in each hole
- **Potted Plants:** 20% or less of potting mixture

Make Your Own!

Leaf Paper Bags

Garbage Pails

Wire Bins

Composting Systems
Pros and Cons

On the Ground

- Inexpensive
- Easy to build
- Low maintenance
- Portable
- Space is not an issue
- May be difficult to turn
- 6 -24 months

Above the Ground

- More expensive
- More challenging to build
- Medium-high maintenance
- More difficult to move
- Space is limited
- Difficult to turn drum
- 6 – 24 months

Other Considerations

- Group Composting
  - Apartment Buildings
  - Communities
- School Composting
  - compost.css.cornell.edu/schools
- Municipalities
- Facts vs. Myths

Cornell Home Composting Resources

Web Sites

- Cornell Waste Management Institute
- Cornell Composting Fact Sheets
- Cornell Composting Science & Engineering
- Cornell Composting in Schools

Fact Sheets

- Home Composting Brochure
- Composting at Home – the Green and Brown Alternative
- Basics & Benefits of Composting
- Compost Uses
- Preparation of Food Scraps for Faster Composting
- Welded Wire Cylinder Bin
- Lasagna Composting
- "Stealth" (Indoor) Composting
- Troubleshooting
- Leaf Composting
- Winter Composting
- Vermicomposting
- Vermicomposting - Brochure
- Sources of Composting Worms
- Group Composting
- “Is it done yet?”

Recycling Organics Makes Good Sense!

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Funding for this presentation was provided by Cornell's NYS IPM Program and by Dutchess County.

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References

- The majority of the information in this presentation is based on the excellent content created by Cornell University Staff, at www.cwmi.css.cornell.edu and additional resources from CCE Tompkins County at www.CCETompkins.org/gardening/composting

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