

Agenda for the Day

- 9:30am to 11am – Composting Basics
- 11am to 11:15am – BREAK
- 11:15am to 12noon – Compost Situations
- 12:15pm to 1pm – Vermiculture

Basic Composting



Turning waste into a resource!

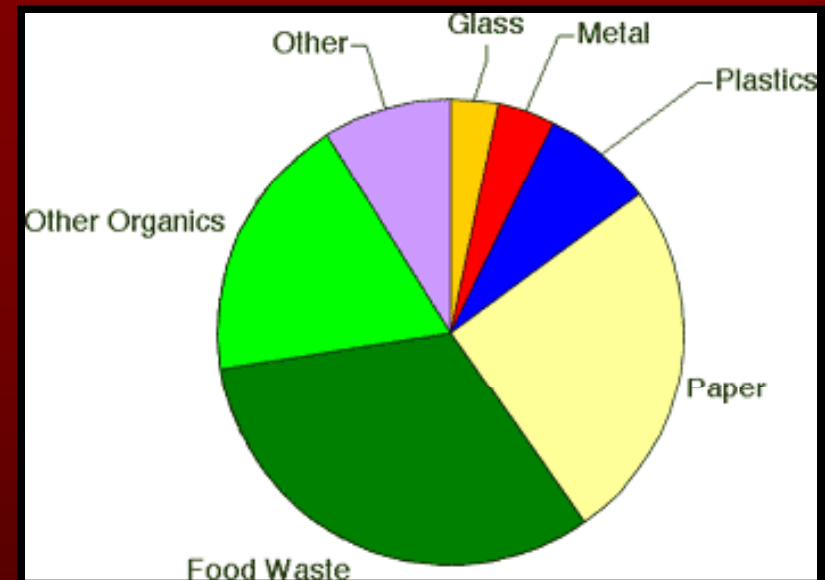
Kevin Marini, UCCE Placer/Nevada

Why Compost in Mariposa County?



Assembly Bill 939 (AB939)

- **1989** – Rapidly depleting landfill capacity, low potential for CA landfill expansion, more and more waste!
- **GOAL** – divert waste from landfills and recycle it – 50% by 2000.



Why divert from Landfill?

- **Organics + landfill =** methane gas, toxic soup leachate, and hydrogen sulfide (rotten egg gas)
- Extend landfill life
- Missing out on a great resource (\$ savings for landfill, homeowner, and community)



Mariposa Co. needs to Compost!

- From Cal Recycle (formerly CIWMB):
 - In 2009, California's estimated 38.3 million residents disposed about 31.1 million tons of solid waste for an estimated statewide per capita disposal rate of **4.5 pounds/person/day**.
 - 40% of this waste is classified as "other organic" which means its COMPOSTABLE

Mariposa Co. needs to Compost!

And you are!!

From the Mariposa Co. website:

The Mariposa County Solid Waste Compost Facility is a major step in the plans to resolve the County's waste-related problems. The 8.2 million dollar project will help the County meet the State of California mandated 50% diversion of all waste that would otherwise be placed in the Landfill. The Compost Facility will convert approximately 60% of the County's mixed solid waste into materials that can be used for other purposes, such as an amendment in the daily cover used on the Landfill.

The Compost Facility is the first of its kind in California with an in-vessel composting system entirely enclosed within a building, including an air and odor control system and a water re-circulation system. The facility was also designed with an observation room to allow visitors, residents and students to observe and learn about this technology.

Mariposa Co. is Composting!



Many benefits on many levels

Environmental Benefits:

- Waste reduction
- Keep soil fertile!
- Air Quality
- Resource conservation (water!)

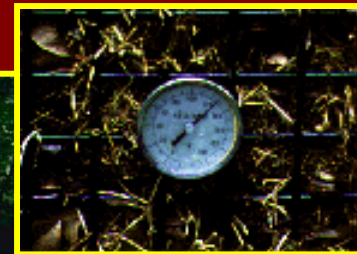
Gardening Benefits:

- Saves money
- Enriches soil
- Contributes to healthy lifestyle





Compost Processes & Critters in the Compost Pile

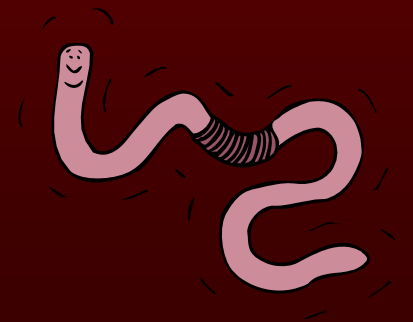


What is Compost????

UC definition of Compost:

“Compost is the biologically active material that results from microbial decomposition of organic matter under controlled conditions.”

(Compost Production and Utilization, UC ANR Pub. #21514)



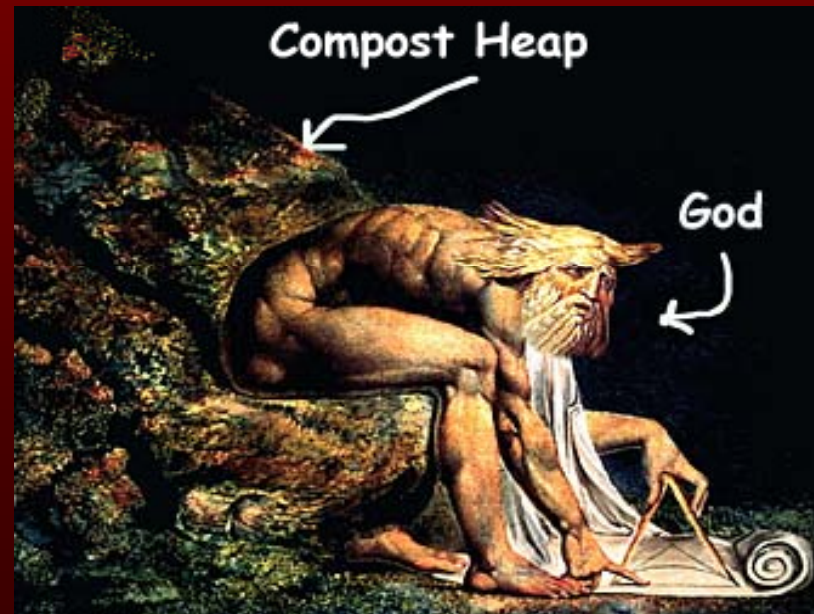
Compost Happens!

Felder Rushing's Two Rules of Composting:

- 1) Stop throwing that stuff away!
- 2) Pile it up somewhere!

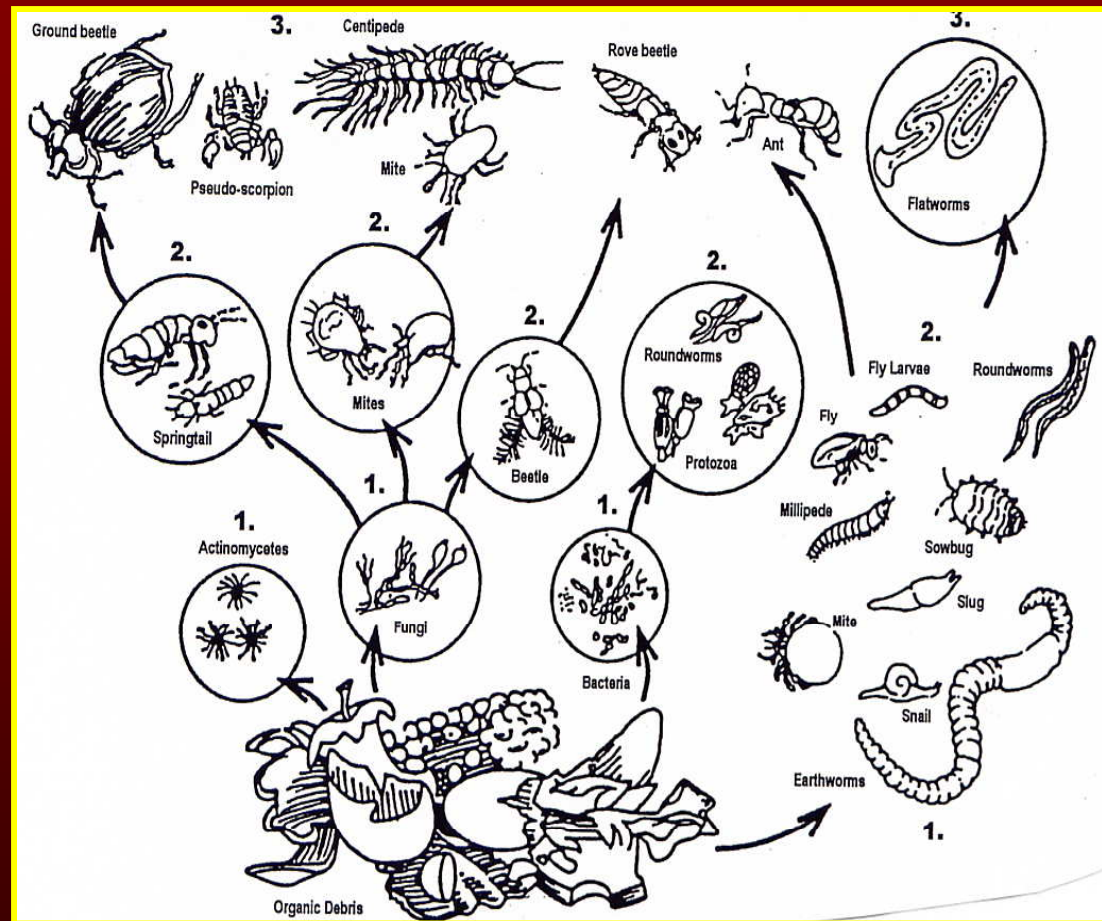
Quote – from guess who??

“My whole life has been spent waiting for an epiphany, a manifestation of God’s presence, the kind of transcendent, magical experience that lets you see your place in the big picture. ***And that is what I had with my first compost heap.***”



A Compost Pile is an Ecosystem

Function =
decomposition of
organic matter into
stable humus



What is Humus???

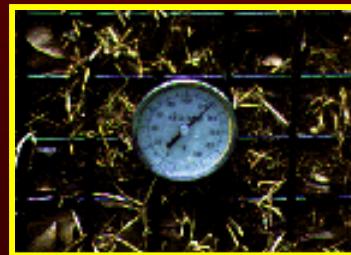
- **Stable aggregates** bound by sticky secretions from microorganisms
- **Biologically active** – microorganisms feed, ions stick, and toxins are bound...
- **Improves** aeration, water holding capacity and general **soil structure.**



The Compost Process depends on:



- Organic Matter Composition
 - Carbon (Browns)
 - Nitrogen (Greens)
- Microorganisms
- Macroorganisms
- Water
- Oxygen
- Temperature



Organic Matter: Carbon or “Browns”

- Carbon rich sources are called “*browns*”
- Usually dry, low moisture content, lightweight
- Examples: dry leaves, straw, sawdust, wood chips, corn stalks



Organic Matter: Nitrogen or “Greens”

- N is needed to get the decomposition process started and keep pile “cookin”
- Examples: vegetable and fruit scraps, grass clippings, coffee grounds, manures, and alfalfa hay



Carbon:Nitrogen Ratio

- **Optimal C:N ratio is 30:1** at an elemental level
- Carbon supplies energy for bacteria and Nitrogen supplies nutrients (proteins).
- Balance material ratios to get **30:1** ratio: e.g.

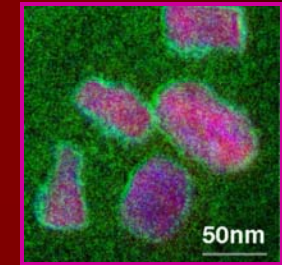
1/5 oak leaves 26:1	1/5 poultry manure 10:1
1/5 pine needles 85:1	1/5 grass clippings 20:1
1/5 food scraps 15:1	C:N ratio = ~31:1

Approximately equal volumes of greens and browns provides a good C:N ratio

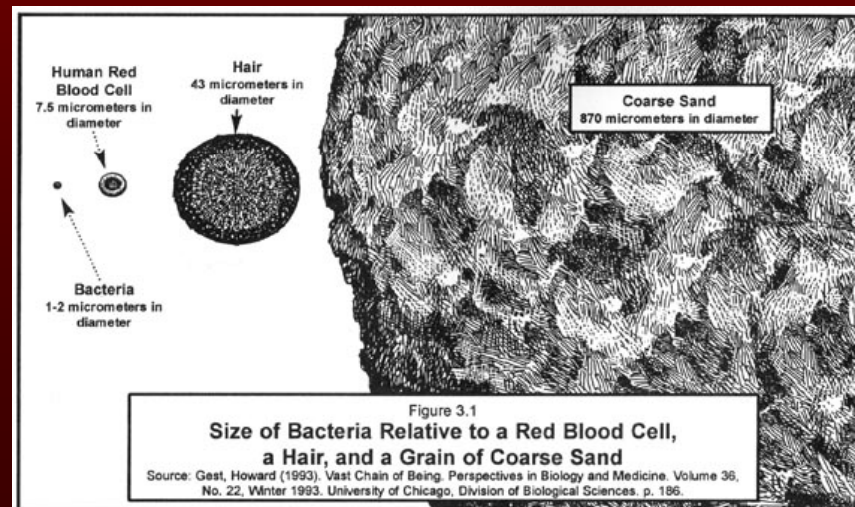
C:N Ratio explained

- the compost pile provides "the energy for the bacteria to accumulate nutrients needed to grow and reproduce".
- If there is more C than needed – inefficient. **They have the energy but hardly any proteins to eat.**
- If there is more N than needed, **they don't have the energy to eat it and it volatilizes.**

The Decomposers: Microorganisms



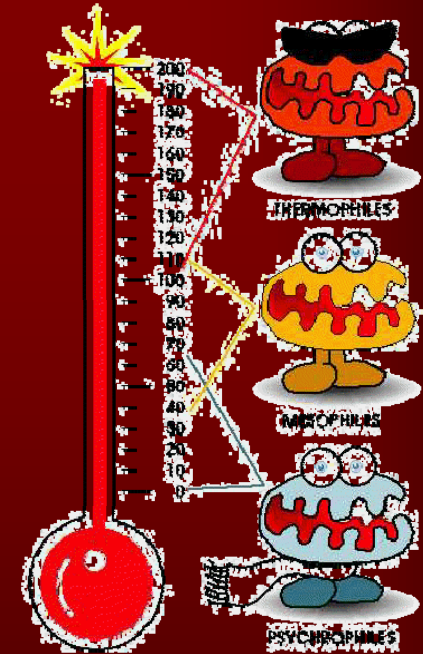
- **Bacteria** begin breakdown process – aerobic bacteria feed on plant sugars and respire to “heat up” pile
- In the right conditions, population growth is amazing—bacteria can double every hour!



“If you build it, they will come...”

Four Types of Bacteria

- **Psychrophilic:** work at lower temperatures
- **Mesophilic:** thrive between 70-90°F
- **Thermophilic:** work from 113-200°F
short “work week” 3-5 days, turn pile to reactivate
- **Anaerobic**
 - Closed air bins, wet piles or too dense - not aerated
 - Fermentation & odors from anaerobic decomposition
 - Pile does not heat up, so doesn't kill pathogens/weeds

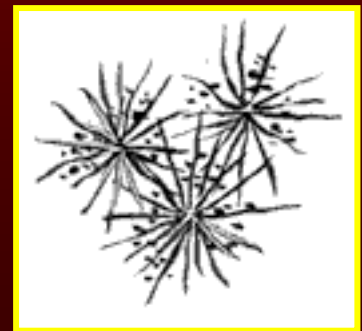


More Microorganisms...

- ***Fungi***: active in end stages of composting - live on dead or dying material
- ***Actinomycetes***: halfway between bacteria & fungi – gray-white cobweb type material in compost pile, also active in later stages of composting



actinomycetes



Macroorganisms

- As temperatures decline, population diversity increases:
 - *Nematodes*: sightless, brainless roundworms, <1 mm long. prey on bacteria, protozoa, fungal spores
 - Fermentation or mold *mites*
 - *Springtails*, tiny white insects



Macroorganisms

- **Wolf spiders:** build no webs, run free hunting their prey
- **Centipedes:** flattened body, long legs, fast moving
- **Millipedes:** worm-like body with hard plates, up to 6" long. Slow moving vegetarians that help in breaking down OM.
- **Sowbugs & pillbugs (Isopods)** small, fat-bodied decomposers with gills. Pillbugs roll into a ball, sow bugs don't. Feed on rotting woody materials



Sowbug



Pillbug

Macroorganisms

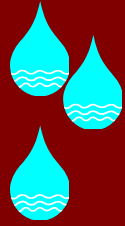
- **Beetles:** rove beetle, ground beetle, and feather winged beetle
- **Earthworms:** native redworms
- **Enchytraeids,** (Ehn kee tray' id) white or pot worms, 1/4 - 1" long, white & segmented
- **Flies:** feed on any organic matter.
Bury kitchen scraps well, keep fatty foods out of the pile to control.



Macroorganisms

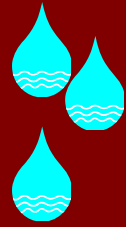
- ***Snails and Slugs***: Feed on living plant material, garbage and plant debris.
- ***Fruit beetle larvae***: large grubs, 2" long & C-shaped; translucent white, head is dark brown.
- ***Ants***: feed on aphid honeydew, fungi, seed, sweets, scraps, other insects, and other ants. Compost provides food and shelter. Ants usually mean pile is too dry.
- ***Earwigs***: predators of all stages of insects, mites & nematodes, also algae, fungi & plants.





Water & Oxygen

- Balance oxygen and water in the compost pile: 50% moisture + 50% O₂
- Consider moisture content of added materials (food scraps!)
- *Compost should be about as moist as a well wrung-out sponge. It should be moist to touch but yield no liquid when squeezed.*



Water in the Pile

- ***Wet pile***: pull it apart, loosen it, incorporate dry materials and remake it.
- ***Dry pile***: turn & rewet material as it is being turned (some browns are hard to moisten)
- **Seasonal considerations!!!**

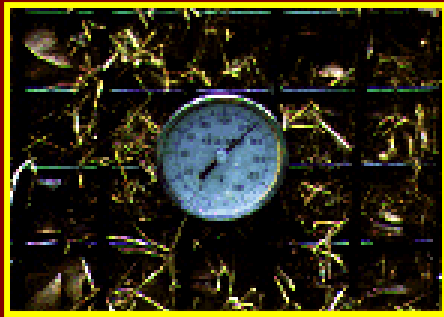




Oxygen



- Aerobic composting is preferable
- Anaerobic decomposition or fermentation
 - may produce compounds toxic to plants
 - produces ammonia & methane gas – smelly!
- ***Passive aeration:*** air is warmed by the compost process, rises through the pile, pulls in fresh air from the sides.
- ***Active aeration:*** turn and mix the compost, or build the pile effectively so surface air diffuses in

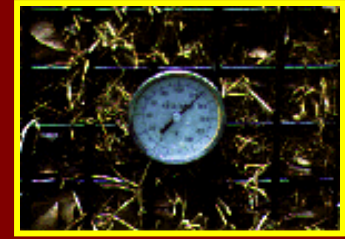


Temperature!



- *Temperature is a function of:*
pile size, oxygen & moisture content
- *Temperature affects biological activity:*
Most microorganisms active between 95 - 160°F
Best decomposer bacteria thrive at 122 - 131°F.
- Above 140°F kills pathogens & weed seeds, but slows decomposition.

Temperature



- Optimum is 2 weeks of temperatures around 135°
- Turning the compost whenever temperatures get above or below the optimum range produces high quality compost in the shortest possible time.
- If compost is properly moist and turning does not cause temperatures to rise, the compost is finished or needs more nitrogen.

How long does it take?

“It depends” on:

- *Density of material*

- *Particle size*

(amount of exposed surface area)

- *C & N content*

- *Moisture content*

- *Aeration*

- *Volume*

- *Insulating materials around the pile*



Making the Pile

What kind of bin should I use?



Making the Pile: Important Considerations

- Size of pile should be 3'x3'x3' to 5'x5'x5'
- Do you have all the organic material (batch) or will you add continuously (continuous)?
- Have you chopped up your materials?
- Moisture and aeration: what's the rule?
- Compost tools: hay fork, aerator...

Composting Methods

Standard Method:

- Need a variety of materials
- Turn it each week
- 4-6 weeks for finished compost (summer)



Rapid Composting Method

- Need large supply of organic materials
- Requires substantial chopping and shredding and more turning of the pile
- Can take less than one month in ideal conditions.



Slow, Continuous or Static Method

- If a steady supply of organic materials is not available
- Takes very little time or labor
- Requires 6 months to 2 years to produce compost
- Smaller compost area needed, because pile is built as materials are available
- Little if any heat is produced, so weeds & pathogens are not killed

What goes in the Pile?

- Grass clippings
- Yard waste
- Leaves, pine needles
- Vegetable trimmings
- Food scraps
- Wood chips (shredded to size)
- Newsprint
- Sawdust

What does NOT go in the Pile?

- Disease infected plants
- Plants with severe insect attack
- Ivy, morning glory and succulents
- Pernicious weeds, e.g. Bermuda grass, oxalis, cheeseweed
- Cat and dog manures
- Meat and fish scraps
- Wood ash (add after composting is finished)

Compost Happens!

BUT...

*What are some issues that
complicate composting???*



Composting issues



- Rodents
- Raccoons
- CC&Rs
- Smell
- Other???

Composting ?'s

- ROTLINE: 530-889-7399
- Kevin's email: krmarini@ucdavis.edu