Worm Composting

& Other Methods of Composting in Small Spaces

UCCE Composting Education Program

Santa Clara County

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What is Composting?

The bio-oxidative degradation of organic materials under controlled conditions

Large scale composting: Commercial composting facilities, farms
Small scale composting: Homes, schools, offices

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Why Compost?

- Waste Diversion
- Soil Fertility
- Water Retention & Quality
- Carbon Sequestration

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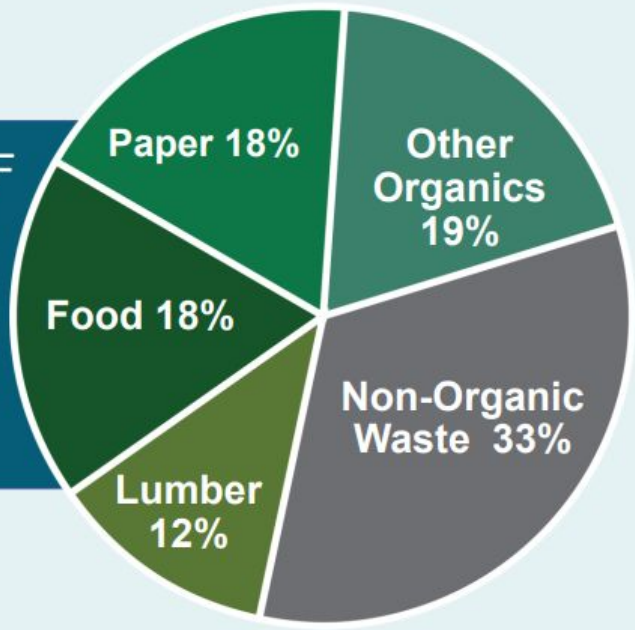
Organic Waste: Largest Waste Stream in California

California Disposed of approximately **27 million tons** of organic waste in 2017



California's Waste Stream

In California, Millions Are

Food Insecure

1 in 8 Californians

1 in 5 Children

California Throws Away **More than 6 Million Tons** of Food Waste Every Year!

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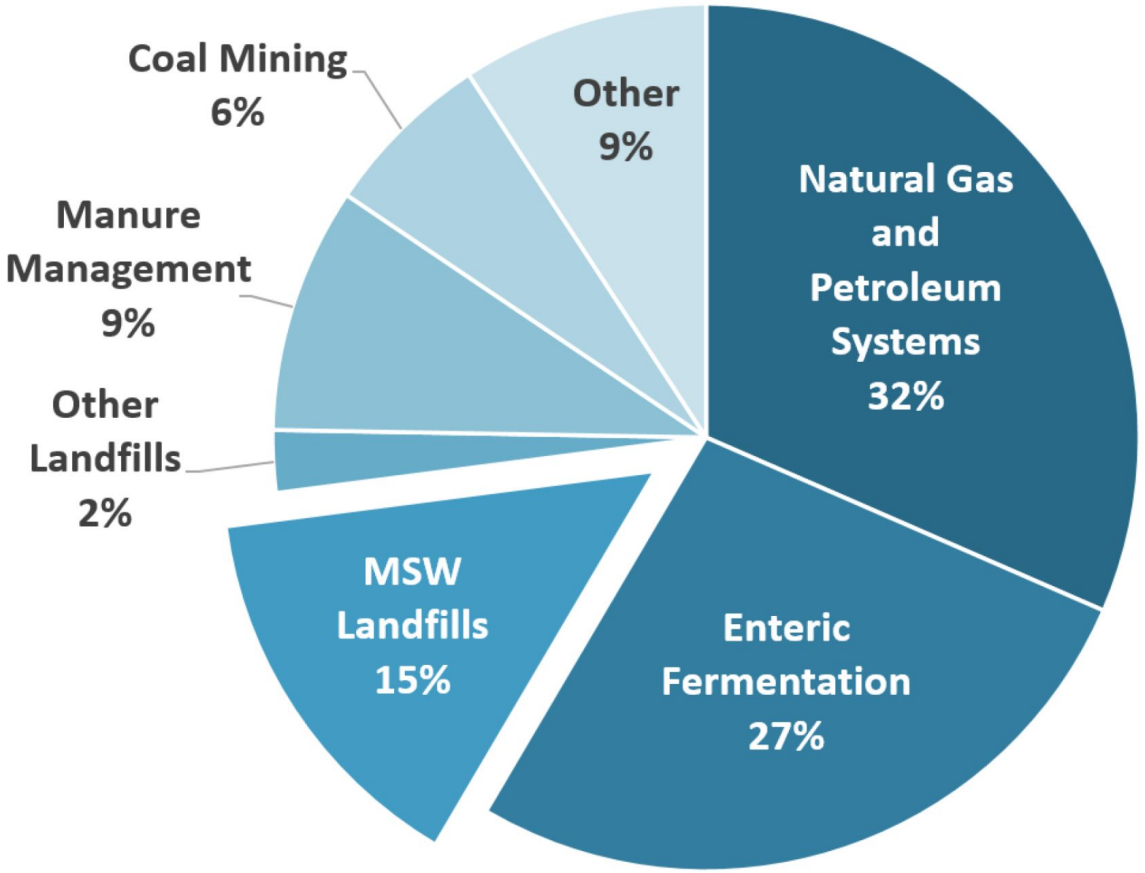
METHANE
LEACHATE

2020 U.S. Methane Emissions, By Source



Note: All emission estimates from the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020*. U.S. EPA. 2022.

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CLIMATE CHANGE NEGATIVELY IMPACTS CALIFORNIA

Landfilled Organic Waste Emits

Methane Gas— A Super Pollutant

More Powerful than C02

Methane Gas Contributes to Climate Change in California

CALIFORNIA

is already experiencing the impacts of CLIMATE CHANGE

IN 2015 THE DROUGHT COST THE AGRICULTURE INDUSTRY IN THE CENTRAL VALLEY AN ESTIMATED $2.7 BILLION & 20,000 JOBS

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SB 1383

Reducing Short-Lived Climate Pollutants in California

An Overview of SB 1383's Organic Waste Reduction Requirements

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1383 Requires California Jurisdictions to:

Provide Organics Collection Services to All Residents and Businesses

Establish Edible Food Recovery Program

Provide Education and Outreach to Community

Buy Recyclable and Recovered Organic Products

Confirm Capacity for Organic Material Recycling and Edible Food Recovery

Monitor Compliance and Enforce Ordinances

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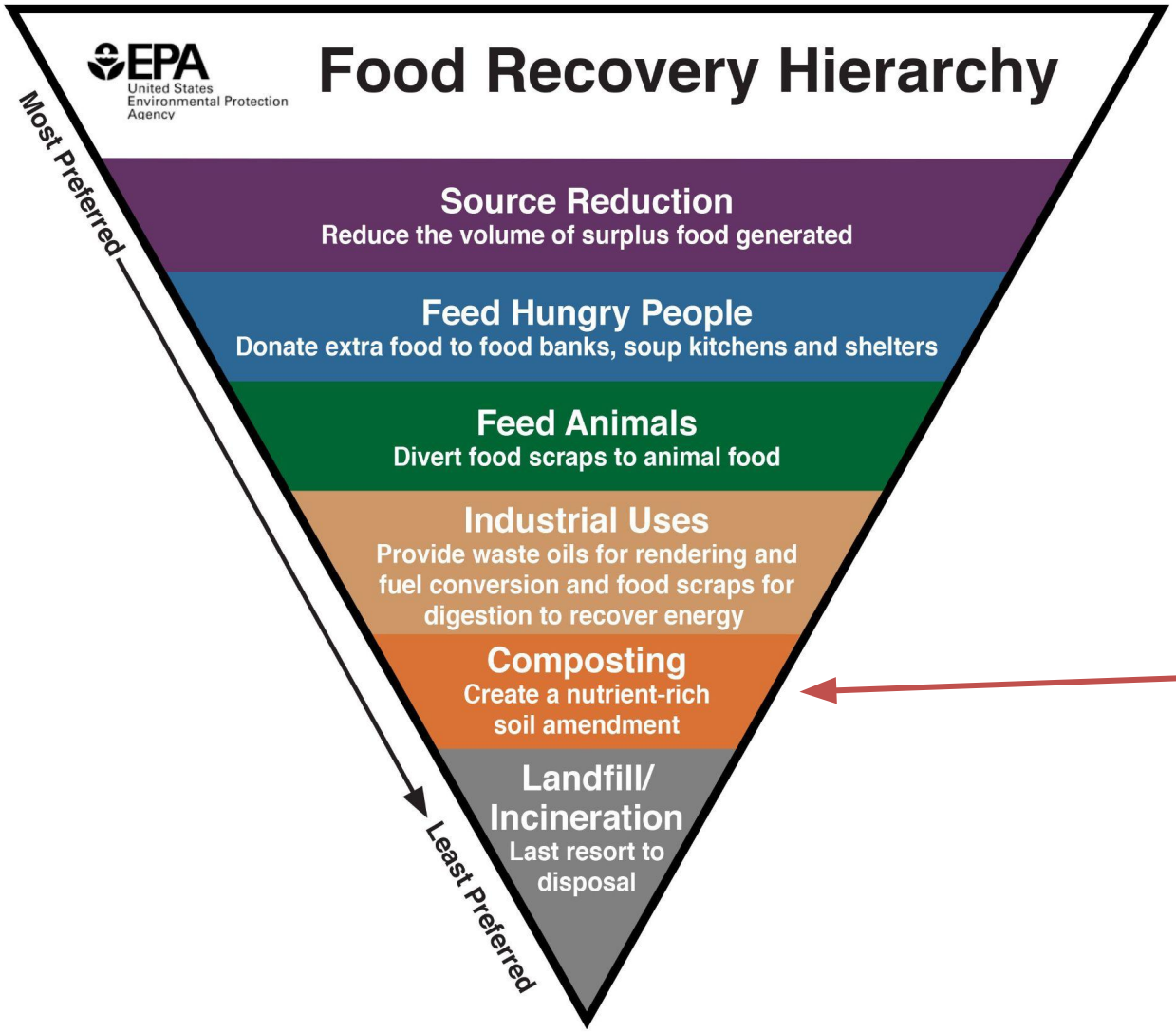

this is us!

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SB 1383 IN ACTION

JURISDICTION REQUIREMENTS

Provide organics collection service to all residents and businesses

Organic Waste Collection Services

One to Three-Container Collection to keep Organics Out of Landfill

- Organics prohibited from grey container
- OR sent to High Tech sorting facility
- Educate Residents about waste reduction and contamination
- Required contamination monitoring

Each Jurisdiction has adopted a new Solid Waste Ordinance, and many are revising their Collection Franchise Agreements to meet SB 1383

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Home Composting Advantages

- Reuse valuable nutrients to feed your plants & trees
- Use less water and fertilizer in your garden
- Grow healthy plants
- Good exercise
- Fun and rewarding
- Get in touch with nature
- Reduces carbon emissions
- Promotes a more sustainable lifestyle

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Soil Fertility

Compost is a source of organic matter in soil

- Macro- and micronutrients
- Microbiology
- Water retention
- Structure
- Stability

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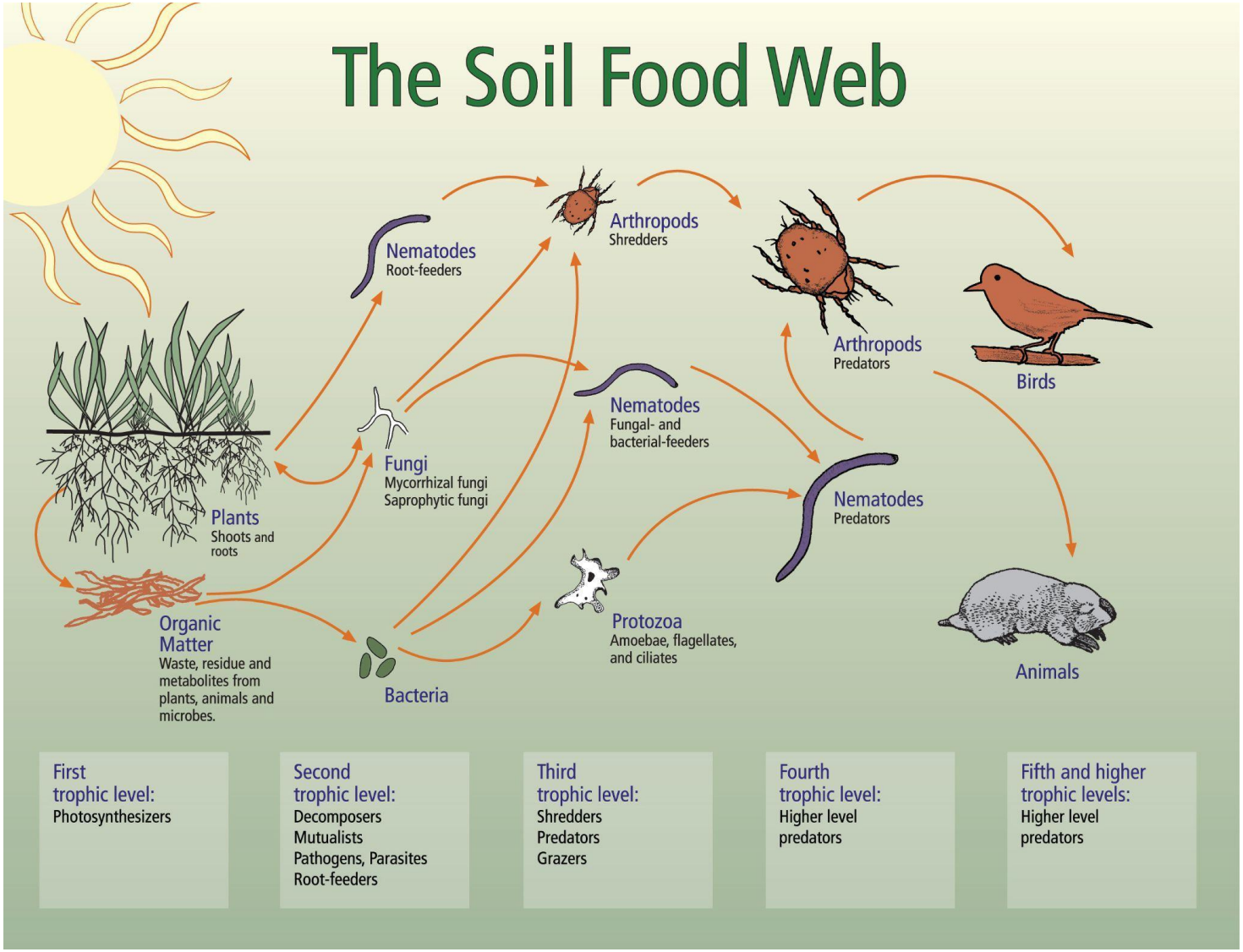

Source: Elaine Ingham, NRCS USDA

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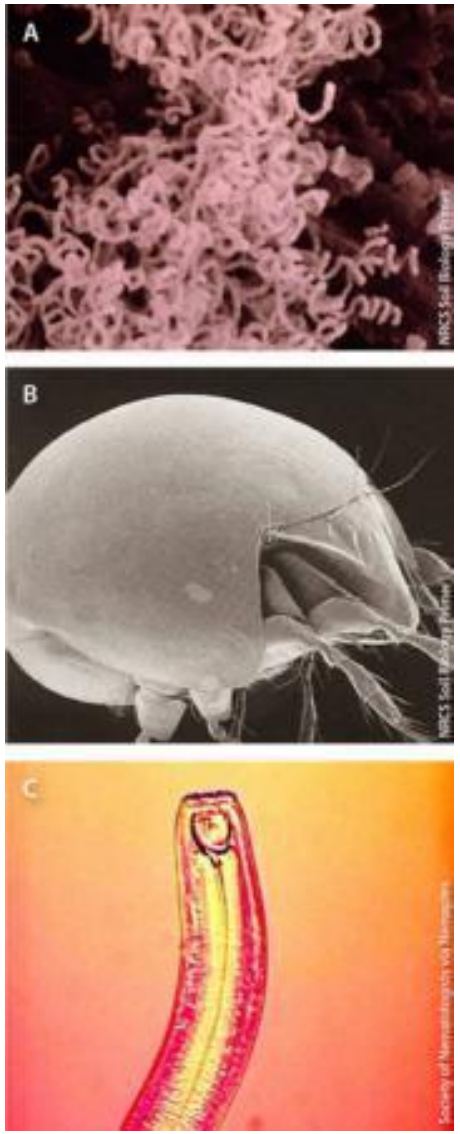
Compost Microorganisms

(A) actinomycete bacteria, which decompose organic matter into compost (0.0005 mm)

(B) turtle mites (*Orobatidae*), which shred plant material into pieces, facilitating decomposition (0.05 mm)

(C) predatory nematodes (*Monochidae*), which regulate populations of pest nematodes (3 mm)



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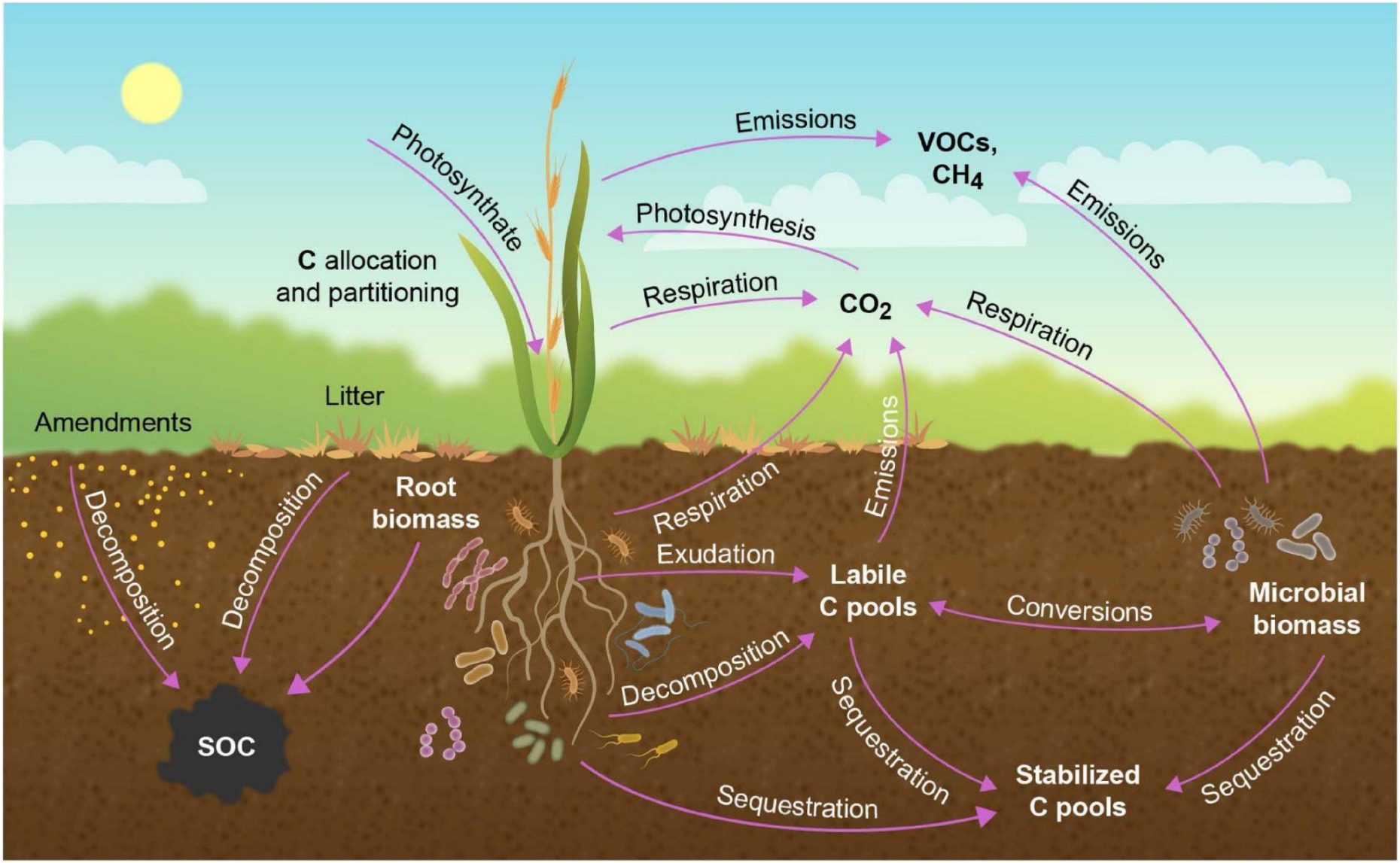

Source: Jansson C, Faiola C, Wingler A, Zhu X-G, Kravchenko A, de Graaff M-A, Ogden AJ, Handakumbura PP, Werner C and Beckles DM (2021) Crops for Carbon Farming. *Front. Plant Sci.* 12:636709. doi: 10.3389/fpls.2021.636709

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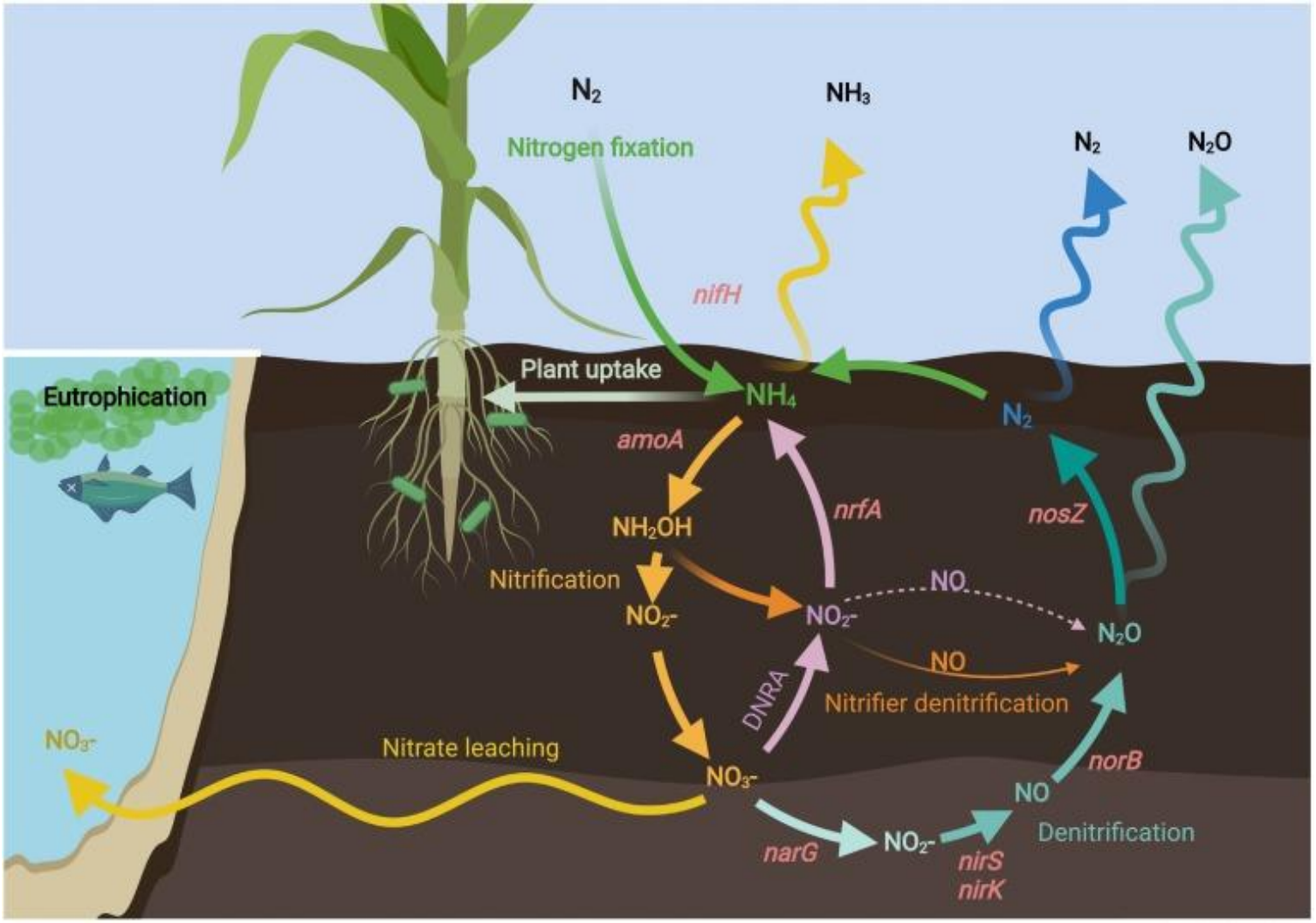

Source: Klimasmith, IM, Kent, AD (2022). Micromanaging the nitrogen cycle in agroecosystems. Trends in Microbiology, https://doi.org/10.1016/j.tim.2022.04.006.

Trends in Microbiology

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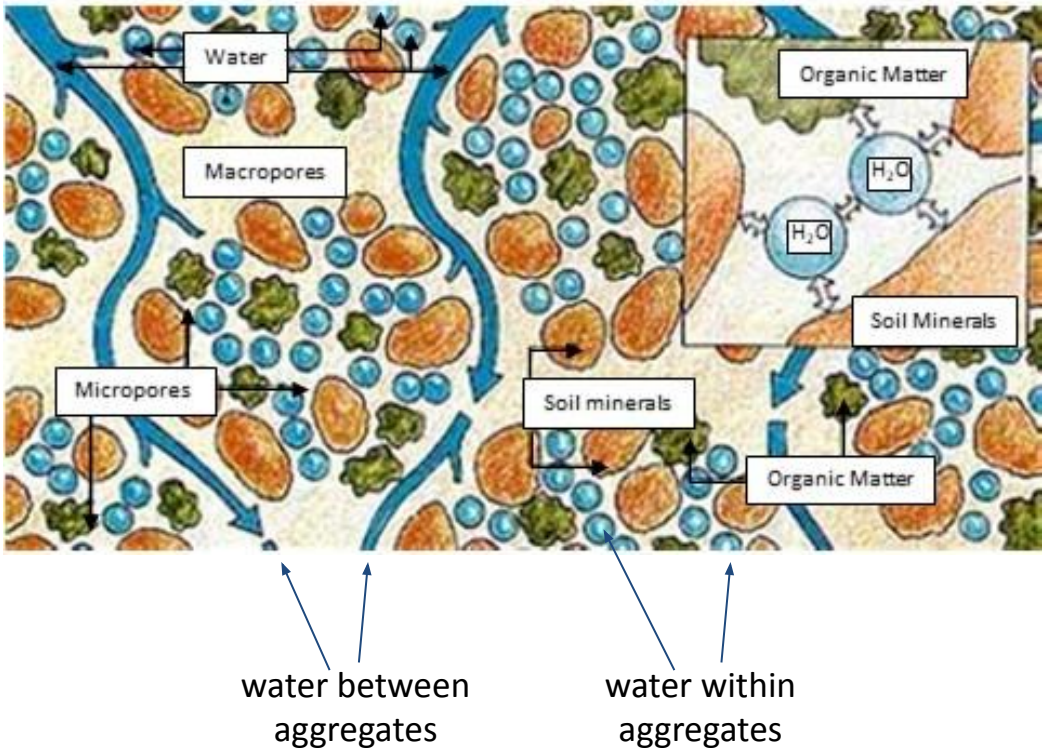
Water & Compost

- Increased water holding capacity
- Reduced irrigation demand
- Bio-filtration

Source: FAO



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Composting & Climate Change

- Uptake of both CO2 and CH4
- Long term carbon storage
- Reduced emissions

Source: Zero Waste Sonoma

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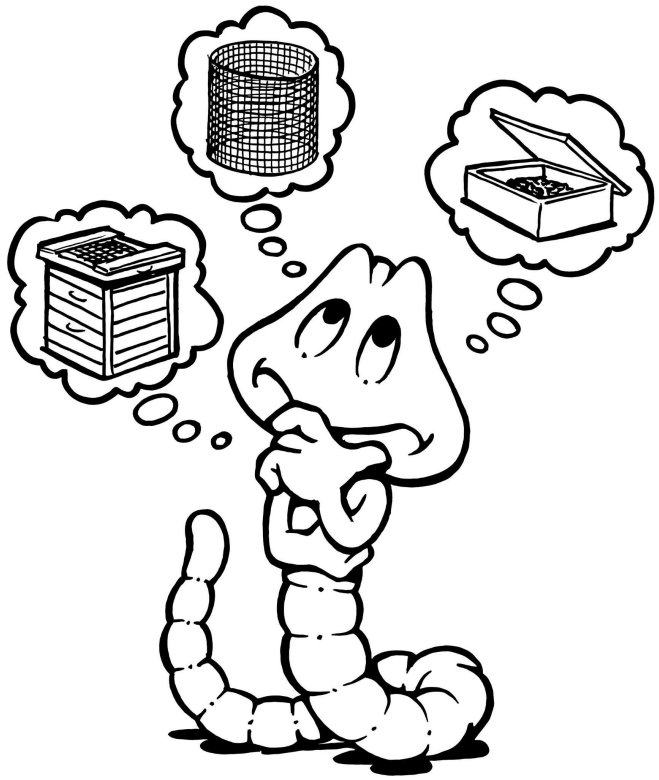
Composting Comes in All Sizes

You don't need to have a lot of space to compost!

Methods of composting in small spaces:

- Vermicomposting
- Bokashi
- Compost tea
- Countertop composters



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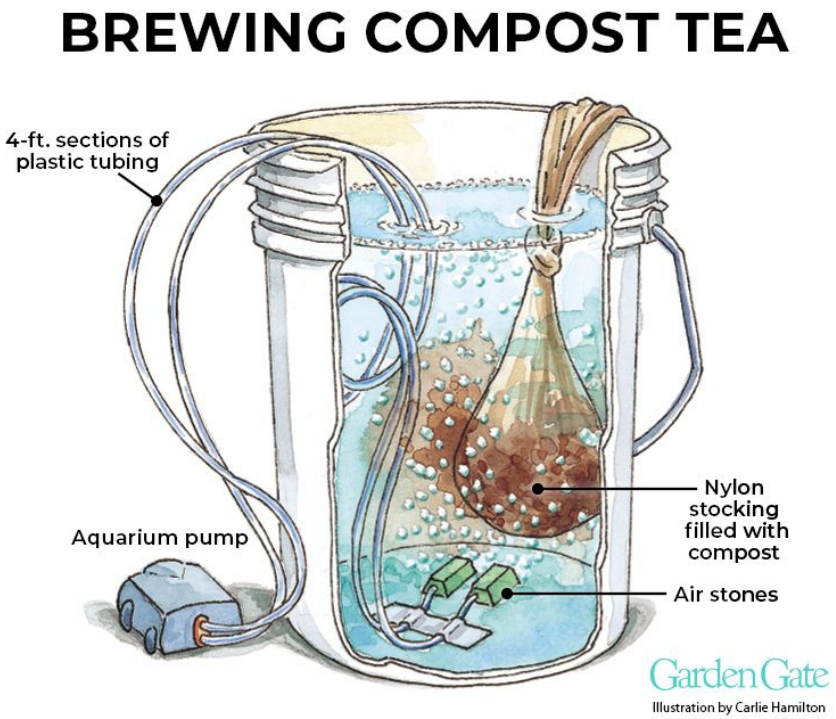
Bokashi

- A Japanese method that relies on fermentation to turn food waste into plant available nutrients
- Does not break down materials like traditional composting, but the fermentation process takes much less time
- Product must be buried in trenches and cannot be applied to the soil surface

Compost Tea

- Uses already finished compost, especially vermicompost, to brew a liquid fertilizer rich in nutrients and microbial activity
- Can be done with easily accessible materials



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Countertop Composters

- Electric appliances made to compost your food scraps wit the click of a button
- Best for busy people
- Expensive ($300-$500)
- End product: “nutrient-rich dirt” **NOT compost**
- Odorless, no labor required, quick

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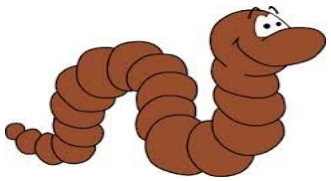

Vermicomposting
a.k.a
Worm Composting

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Vermicomposting

Cultivating worms to eat our food and paper waste and produce the best “fertilizer” for our plants

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Vermicomposting

- Worm composting is neat, easy, and odorless – when properly maintained
- A great way to recycle hard-to-dispose food waste and paper waste
- Can be done indoors, in garage, on the patio or porch, or in any moderate temperature place (50ºF - 90ºF)

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Vermicomposting

- And…
  the finished product, worm castings, is a nutrient-rich, organic "fertilizer" which can be used on plants both indoors and outdoors
- Reduces or eliminates the need for purchased fertilizer

Gardener's Black Gold

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Worms for Composting

- Thousands of worm species live in the soil, we find some in our gardens and compost piles
- Only a few species are feasible for vermicomposting, including the red wiggler, red tiger, and African nightcrawler.
  - Live in the uppermost layer of the soil that is rich in organic matter
- Best compost worm for our area is the Red Wiggler, *Eisenia fetida*

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Bedding Material

- Shredded newsprint, brown packaging paper
- Shredded cardboard
- Shredded office and junk mail paper
  - Use sparingly, mix with shredded newsprint
- Coir (shredded coconut husk)
- No slick, shiny paper or plastic windows

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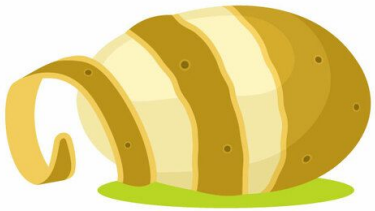
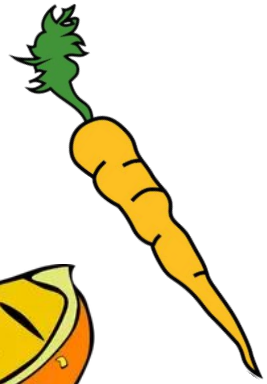
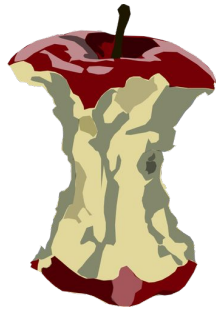
Worm Food

- Vegetable and fruit scraps
  e.g., banana peel, apple core, lettuce, potato peel, carrot tops, etc.

  Cut into small pieces, bruise/pierce hard skins to speed decomposition
- Pasta, cooked beans (minimize sauce/oil)
- Coffee grounds, including paper filters
- Tea leaves, tea bags
- Paper towels, napkins (food soiled)
- Egg cartons (paper mache)
- Human/pet hair!
- Egg shells (crushed) -
  Worms need a small amount of grit!







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What to Avoid

- No animal products - meats, bones, fish, etc.
- No dairy products - cheese, milk, yogurt, etc.
- No pet wastes (from carnivores)
- No oils or plastics
- Be careful with breads (for folks with mold allergies)
- Avoid seeds and nuts with hard hulls & shells – they break down slowly and may sprout later when conditions are right
- Avoid large amount of acidic or pungent produce, like citrus, ginger, onion, and garlic
- Yard clippings – may include herbicides, pesticides; branches & woody stems break down slowly

Egg shells are okay!

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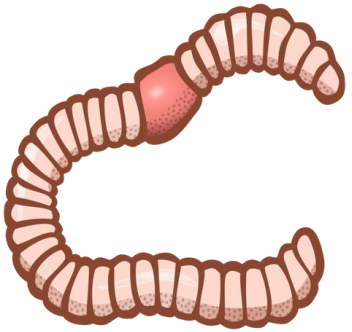
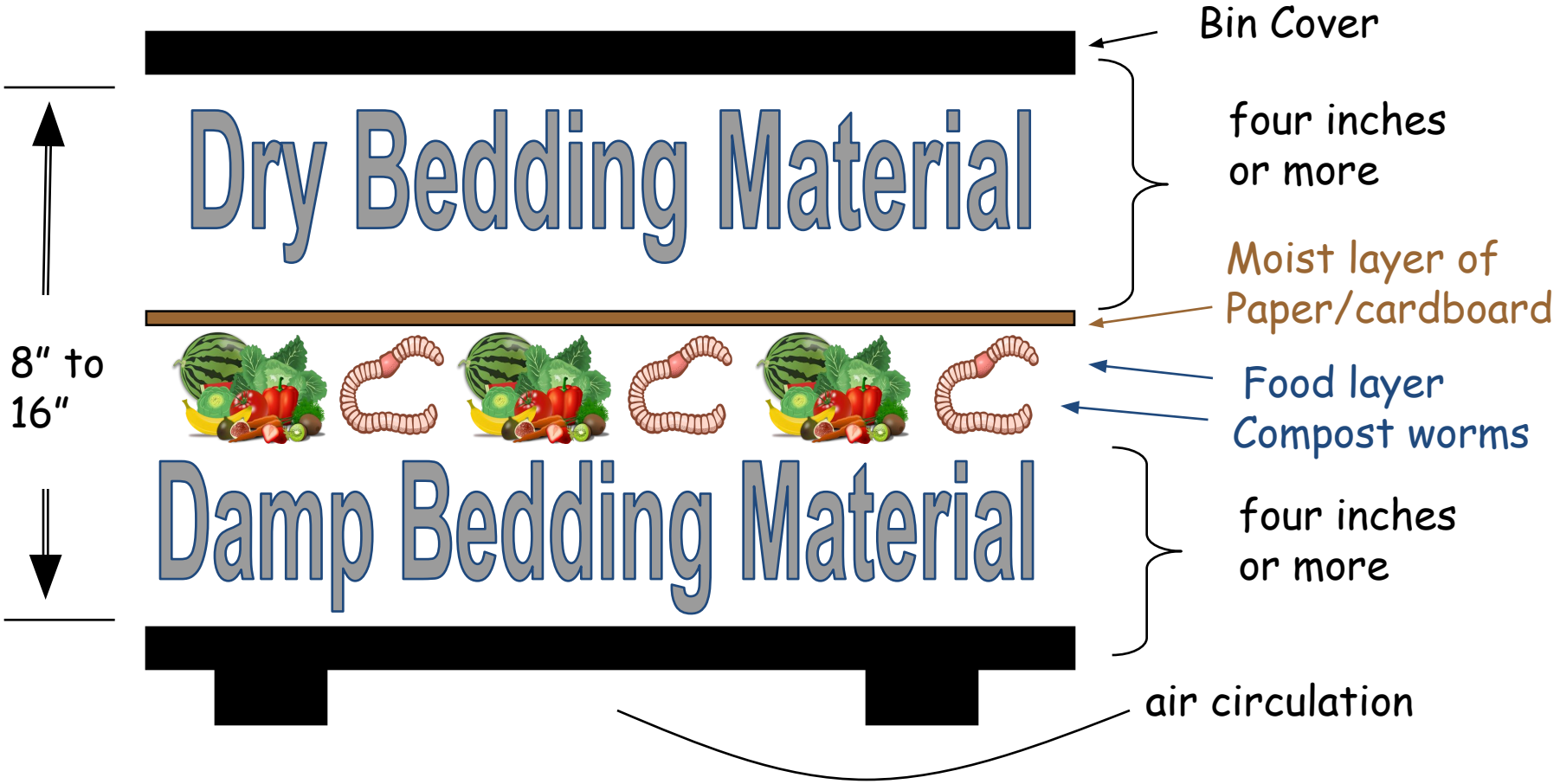
Putting It All Together



Bedding + Moisture + Air + Food + Worms

Q: How much water?
A: Keep bedding as damp as a wrung-out sponge (moist, not dripping)

Inside a Worm Box



Selecting a Worm Bin

Build Your Own Bin – box style

Don't use chemically treated or highly aromatic wood

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Selecting a Worm Bin

Worm bins are available in many designs and styles!

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Where to Get Worms

Order worms for delivery!

Or ask a friend who has a worm bin for some extras!

Sources for local worms

Tips for starting a new worm bin:

- Set up the bin, add bedding & food
- If you can, wait 1 – 2 weeks before adding worms, so don't order your worms until the bin is set up
- The first tray or bin section will be ready to harvest in 6 months, then every 3 months thereafter

*Worms are safe to ship in mild temperatures

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Where to Keep the Worm Bin

- Temperature range: 55ºF - 80ºF
- Temperance tolerance depends on moisture level and location of bin

Worms need:

- Plenty of air circulation
- Shade during summer, <u>especially</u> if a dark plastic bin is being used
- A sunny spot during winter, e.g., against stucco wall of house with southeast exposure

Maintaining Your Worm Bin

- Check weekly (more often if temperatures are very low or very high)
- Move to a different location if needed
- Add food if previous batch is being eaten (disappearing)
- Don't over-feed! Remove food if there's too much (smelly)
- If bedding is dry, sprinkle/spray with water
- If bin is too moist, add dry bedding & mix in to absorb
- Add moist bedding if bedding layer is thin
- Sprinkle a small amount of grit every month or so

Harvesting Worm Castings

Several methods:

- Horizontal migration
- Vertical migration
- Worm filter
- Tarp & sunlight

Use the one that works best for you!

Harvest when <u>most</u> of the bedding materials have become dark castings

Slow harvesting allows cocoons to hatch, baby worms to migrate

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Using Worm Compost

- Slow-Release Nutrient-Rich Amendment
  - Use it instead of fish emulsion on bedding plants in greenhouse
  - Spread around potted plants
  - Spread around vegetables or flowering plants in the garden
  - Can be sifted onto lawns
  - Incorporate into soil around shrubs and trees
- Can be incorporated into a planting soil mix
- Preferred ingredient for brewing compost tea

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Troubleshooting a Worm Bin

Worms Die

- Worm box overheated (more than 100°F) common with plastic bins
- Keep worm bin in shady area
- Add a few ice cubes for quick cooling
- Consider using a wood worm bin if adequate shade can't be found
- Bedding material has dried out
- Check moisture when feeding, add extra water on hot, dry days
- No food scraps have been added for long period of time (weeks/months)
- Don't be mean to your pets, feed them as required!

Fruit Flies in Worm Bin

- Food scraps not adequately covered
- Add four or more inches of dry or slightly moist shredded paper over food scrap layer
- Set a bowl of vinegar in the bin on top of the shredded paper
- Fruit flies already present in food scraps before adding to bin
- Store food scraps in covered container or freezer before adding to the worm bin

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Thank You

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Rotline: (408) 918-4640

Website: www.ucanr.edu/compost

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Backyard Composting

(In case you all had questions about traditional composting)

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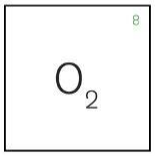
Compost Ingredients

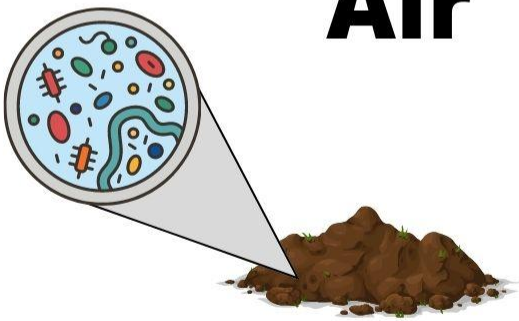
Greens

Water

Air



Soil Organisms



Browns

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Ingredient #1: Greens (~50%)

Nitrogen-rich organic material

- The majority of our kitchen waste
- Green yard waste
- Nitrogen is food for fungi and bacteria

Examples:

- Disease-free green leaves and stems, grass clippings, weeds (before they go to seed), vegetable/fruit peels and scraps, coffee grounds, tea bags, flowers, fleshy roots, leguminous plants
- Herbivore manures: cow, poultry/bird, rabbit, horse droppings and cage cleanings (none from meat-eating animals)

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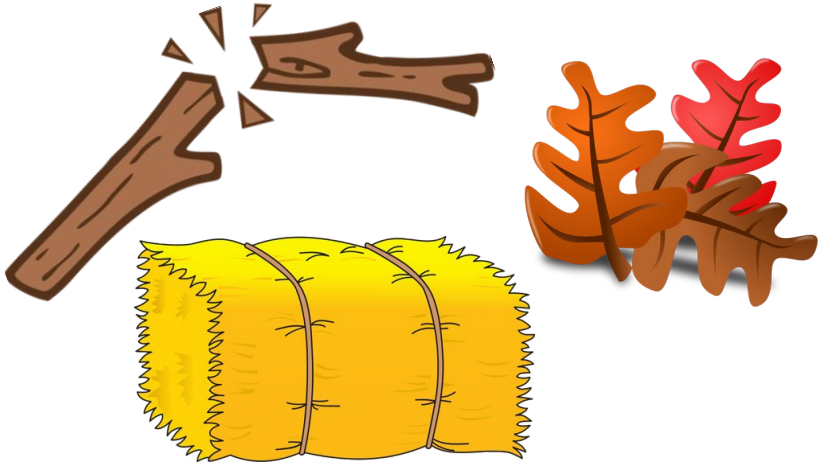
Ingredient #2: Browns (~50%)



Carbon-rich organic material

- Dry, dead yard waste
- Brown, woody plant material
- Carbon is food for fungi and bacteria

Examples:

- Dried leaves, evergreen needles, straw, coir (coconut husk), shredded woody stems/stalks/branches, dried tree/shrub prunings (a few stalks and thin branches provide good air pockets)
- Also, dryer and vacuum lint, wood chips, sawdust (from untreated wood) and shredded paper/cardboard — use sparingly

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C/N Balance

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Ingredients #3 - #5

Ingredient #3 Air

- Air is necessary for microorganisms to thrive and to breakdown the organic materials into compost.
- A compost pile needs aeration by turning or fluffing.

Ingredient #4 Water

- Moisture allows microorganisms be active and to move around.
- Moisture is easier to regulate in bins that are contained and have lids.
- Your pile should be kept as moist as a wrung-out sponge.

Ingredient #5 Soil

- Not always necessary! Soil contains very helpful microorganisms (bacteria and fungi) but most greens and browns have them also. If soil is added, only a small quantity is needed.

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What to Avoid

- No animal products - meats, bones, fish
- No dairy products: cheese, milk, yogurt
- Be careful with breads (because of molds)
- No pet wastes or litter from carnivores (e.g. cat or dog feces)
- No oils or plastics
- No wood ash or charcoal
- No diseased plants
- No plants treated with herbicides

Egg shells are OK

No toxic materials!

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Ingredient Tips

These items may spread undesirable plants or have negative effects when using your compost:

- Bermuda grass
- Bind weed (wild morning glory)
- Oleander or any weed with seed heads or persistent roots (ok if hot composting higher than 140°F)
- Ivy (ok if dried and finely chopped)
- Thorny plants (ok if finely shredded)

Location

- Site Assessment
  - Too Wet
  - Too sunny or dry
  - Rodents
  - Traffic & access

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Compost Bins – Build Your Own

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Compost Bins – Many Designs

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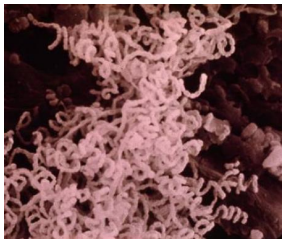
Inside a Compost Bin

Bacteria



Actinomycete

Fungus

Sow Bug

Mite

Springtail

Ant

Green June Beetle Larvae

Worm

Nematodes

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Troubleshooting

Symptom	Problem	Solution
Smells like eggs	Too much moisture	Add dry ingredients
	Too compact not enough air	Mix more often, turn or aerate
Smells like ammonia	Too much nitrogen (green)	Add more browns (carbon) and mix, turn or aerate
Process is slow	Not enough surface area	Shred or break organics into smaller pieces
Large critters are interested in my compost pile	Wrong material has been added	Don't add any grains, meat or bones
	Vegetable scraps are exposed	Make sure food is covered with soil or 6" of material
Winter is coming – process has slowed	This is normal for cooler temperatures	Continue adding to your compost bin. Process will speed up again in the spring.

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