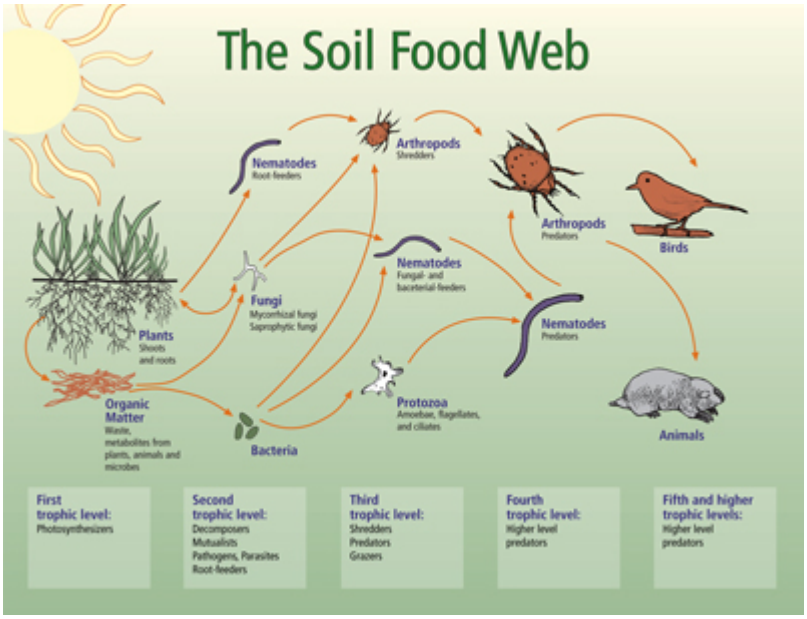
# Concepts of Compost




**Compost** is organic matter that has been decomposed and recycled as a fertilizer and soil amendment. Compost is a key ingredient in organic farming. Composting as a recognized practice dates to at least the early Roman Empire since **Pliny the Elder** (AD 23-79). Traditionally, composting involved piling organic materials until the next planting season, at which time the materials would have decayed enough to be ready for use in the soil for spring planting.

The process of composting simply requires making a heap of wetted organic matter known as green waste (leaves, food waste) and waiting for the materials to break down into humus after a period of weeks or months. Modern, methodical composting is a multi-step, closely monitored process with measured inputs of water, air, and carbon- and nitrogen-rich materials. The decomposition process is aided by shredding the plant matter, adding water and ensuring proper aeration by regularly turning the mixture. Worms and fungi further break up the material. Aerobic bacteria and fungi manage the chemical process by converting the inputs into heat, carbon dioxide and ammonium. The nitrogen is the form of ammonium ($NH_4$) used by plants. When available ammonium is not used by plants it is further converted by bacteria into nitrates ($NO_3$) through the process of nitrification.

Compost can be rich in nutrients. It is used in gardens, landscaping, horticulture, and agriculture. The compost itself is beneficial for the land in many ways, including as a soil conditioner, a fertilizer, addition of vital humus or humic acids, and as a natural pesticide for soil. In ecosystems, compost is useful for erosion control, land and stream reclamation, wetland construction, and as landfill cover.

People excrete far more water-soluble plant nutrients (nitrogen, phosphorus, potassium) in urine than in feces. Human urine can be used directly as fertilizer or it can be put onto compost. Adding a healthy person's urine to compost usually will increase temperatures and therefore increase its ability to destroy pathogens and unwanted seeds. Urine from a person with no obvious symptoms of infection is much more sanitary than fresh feces. Unlike feces, urine does not attract disease-spreading flies (such as house flies or blow flies), and it does not contain the most hardy of pathogens, such as parasitic worm eggs. Urine usually does not stink for long, particularly when it is fresh, diluted, or put on sorbents.

Vermicompost is the product or process of composting through the utilization of various species of worms, usually red wigglers, white worms, and earthworms, to create a heterogeneous mixture of decomposing vegetable or food waste (excluding meat, dairy, fats, or oils), bedding materials, and vermicast. Vermicast, also known as worm castings, worm humus or worm manure, is the end-product of the breakdown of organic matter by species of earthworm. Vermicomposting is widely used in North America for on-site institutional processing of food waste, such as in hospitals and shopping malls. This type of composting is sometimes suggested as a feasible indoor home composting method. Vermicomposting has gained popularity in both these industrial and domestic settings because, as compared to conventional composting, it provides a way to compost organic materials more quickly (as defined by a higher rate of carbon-to-nitrogen ratio increase) and to attain products that have lower salinity levels that are therefore more beneficial to plant mediums.

The earthworm species (or **composting worms**) most often used are red wigglers (*Eisenia fetida* or *Eisenia andrei*), though European nightcrawlers (*Eisenia hortensis* or *Dendrobaena veneta*) could also be used. Red wigglers are recommended by most vermiculture experts, as they have some of the best appetites and breed very quickly. Users refer to European nightcrawlers by a variety of other names, including *dendrobaenas*, *dendras*, Dutch Nightcrawlers, and Belgian nightcrawlers.

Containing water-soluble nutrients, vermicompost is a nutrient-rich organic fertilizer and soil conditioner in a form that is relatively easy for plants to absorb. Worm castings are sometimes used as an organic fertilizer. Because the earthworms grind and uniformly mix minerals in simple forms, plants need only minimal effort to obtain them. The worms' digestive systems also add beneficial microbes to help create a "living" soil environment for plants. Vermicompost tea in conjunction with 10% castings has been shown to cause up to a 1.7 times growth in plant mass over plants grown without.

Researchers from the Pondicherry University discovered that worm composts can also be used to clean up **heavy metals**. The researchers found substantial reductions in heavy metals when the worms were released into the garbage and they are effective at removing lead, zinc, cadmium, copper and manganese.

## Making compost—***Air + Water + Carbon + Nitrogen = Compost***

**Air.** Like most living things, the bacteria that decompose organic matter, and the other creatures that make up the compost ecosystem, need air. Compost scientists say compost piles need porosity—the ability for air to move into the pile. I like to think of porosity in terms of fluffiness. A fluffy pile has plenty of spaces—or pores—for air to move about. A flat, matted pile of, say, grass clippings does not. Even fluffy piles compress during the composting process. Occasionally turning your pile refluffs the material, moves new material into the center, and helps improve air flow into the pile, says Craig Cogger, Ph.D., extension soil scientist at Washington State University.

**Water.** Compost microbes also need the right amount of water. Too much moisture reduces airflow, causes temperatures to fall, and can make the pile smell; too little water slows decomposition and prevents the pile from heating. Conventional wisdom says that compost should feel like a wrung-out sponge, says Abigail Maynard, Ph.D., agricultural scientist at the Connecticut Agriculture Experiment Station.

**Carbon ingredients.** The microbes that break down organic matter use carbon as an energy source. Ingredients with a high percentage of carbon are usually dry and brown or yellow in color. The most common high-carbon ingredients are leaves, straw, and corn stalks. Sometimes people call these ingredients ***browns*****.**

**Nitrogen ingredients.** Microbes need nitrogen for the proteins that build their tiny bodies. Ingredients high in nitrogen are generally green, moist plant matter, such as leaves, or an animal byproduct, such as manure. These ingredients are called ***greens***, but in reality they can be green, brown, and all colors in between.

**C/N ratio.** In order for a compost pile to decompose efficiently, you need to create the right ratio of carbon (C) to nitrogen (N) (C/N). Piles with too much nitrogen tend to smell, because the excess nitrogen converts into an ammonia gas. Carbon-rich piles break down slowly because there's not enough nitrogen for the microbe population to expand. An ideal compost pile should have a 30:1 C/N ratio. Grass clippings alone have about a 20:1 C/N ratio. Adding one part grass clippings, or other green, to two parts dead leaves, or other brown, will give you the right mix.

# Trash Audit

How much trash does your family make in a year? What kind of things do you throw away? How much can be reduced by recycling or composting? To answer these questions, perform a **trash audit**.

1. Estimate the total trash you produce in a year:

- Take a week's worth of trash in garbage bags and weigh or estimate the volume of each bag. Assume the bag is a sphere, so **volume = 4.19 x radius$^3$**.
- Multiply the weight or volume by 52 weeks.

2. Determine the make-up of your family's trash:

- Wearing rubber gloves, sort through the garbage bags and separate the trash into various garbage bags for different categories of trash, such as glass, newspaper, plastic bottles, aluminum cans, white bond paper, glossy paper/magazines, fruit/vegetable food waste, meat/dairy food waste, non-food waste and yard waste.
- Seal and weigh or estimate the volume of each individual category bag (**volume = 4.19 x radius$^3$**).

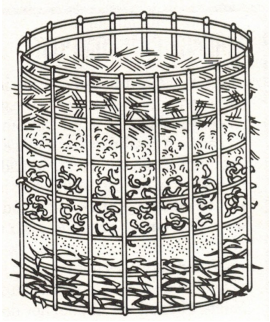
3. Determine the percentage of total trash for each category:

- Divide the weight or volume of each category's trash bag by the weight or volume of the combined trash.
- Multiply each quotient by 100.

4. Look at the categories and determine what percentage of your trash output you can reduce by recycling or composting.

- You can recycle such items as glass, newspaper, glossy paper, aluminum cans, aluminum foil and plastic bottles.
- You can compost newspaper, yard waste and most kitchen wastes (although meat/dairy products take special composting).
- You can see how much of your garbage is made up of packaging, some of which may be excess packaging. You can reduce this trash category by buying products with minimal packaging, such as bagged cereal instead of boxed cereal.


If you can reduce your trash output by recycling and composting, you can save landfill space and reduce your (or your town's) waste expenses, which can ultimately lead to better uses for your (or your tax) money.



AWARD-WINNING FOOD plus! RECYCLING
Yard Debris • Compostable Paper • Food


## ALL FOODS/FOOD SCRAPS

- Fruit/Vegetable Scraps, Peels, Trimmings
- Spoiled/Outdated Foods
- Dairy Scraps (such as yogurt, cheese, sour cream, ice cream, milk)
- Paper Coffee Filters, Coffee Grounds
- Eggshells
- Leftovers / Table Scraps
- Dough Scraps (wrap or bag in PAPER)
- All Meat, Fish, Shellfish Scraps (including bones and shells). No roadkill.
- Tea bags

## ALL COMPOSTABLE FOOD-SOILED PRODUCTS

- Pizza Boxes
- Paper Milk/Juice Cartons
- Ice cream/Frozen Food Cartons
- Paper Deli/Take-Out Cartons
- Napkins/Paper Towels/ Tablecloths
- Paper Plates, Bowls, Cups
- Parchment/Waxed Paper
- Paper Bags
- Pet Food Bags (wax paper-no plastic / foil)
- Bakery Boxes / Paper Liners
- Wax-coated Cardboard Boxes
- Compostable Dishes / Utensils / To-go Containers (Ex. Corn, Potato, Bamboo)
- Tissue Paper
- Small Wood Scraps
- Corks (real, not plastic)
- Instant oatmeal packets
- Boxed cracker wrappings

## YARD DEBRIS

- Grass Clippings
- Garden Trimmings/Weeds
- Leaves
- Brush/Branches (max. 7" diameter)
- Floral Trimmings, Houseplants
- Expired Floral Arrangements
- Waxed Floral Paper
- Seasonal Greens (Pumpkins, Cornstalks, Hay, Gourds, Garlands, Wreaths, Swags, Etc.)

**NO** Plastic(s)/Plastic Bags, Pet/Human Waste, Diapers, Roadkill, or Garbage
Aseptic Cartons/Boxes (non-refrigerated, shelf-stable),