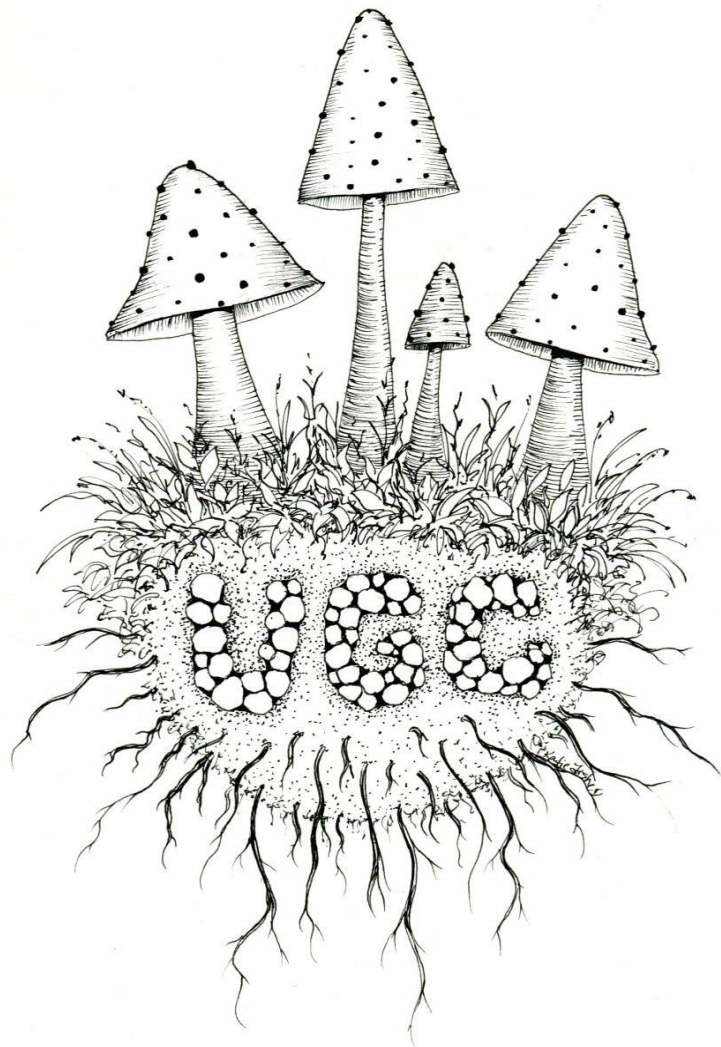


# Composting: Foundation of a Nourishing Food System



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**The Underground Center**

[www.theundergroundcenter.org](http://www.theundergroundcenter.org)

*All UGC artwork by Katie Fisher*

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### Compost overview:

A good way to think of a compost bin is an active living thing that will “eat” any organic matter and turn it into soil to grow food with. If done right, it takes stinky rotting things and “burns it up” eliminating any of the nastiness we think of with rotting food. The end product is rich organic matter that is incredible for improving the soil or you can grow plants directly in it.

Compost relies on *Aerobic decomposition*: heat-loving Bacteria (thermophiles, mesophiles) that need air and water to break down food scraps and any other organic matter. This process generates heat, releases carbon dioxide, evaporates water out of the organic matter and reduces its mass to about 1/3 its original size.

The finished product is a (beautiful) dark brown or black product that is fluffy, lighter than dirt, and full of nutrients and organic matter. It has an earthy smell, but no stink. If your compost reaches high enough temperatures or is given a long enough time to break down, the process destroys harmful pathogens but is full of beneficial bacteria, and benefits fungi and other lifeforms (soil biota).





## Why compost is good for the soil and your plants

two main elements that compost contribute to the soil are biota and organic mater

**Soil biota** are the living things that thrive in the top inch of healthy soil including bacteria, protozoa, fungus and small invertebrates. Biota convert elements in the soil into nutrients that plants need to eat. Without biota in the soil, the plant can't make use of nutrients (like nitrogen and phosphorus) in the soil.

**Organic matter** is dead parts of the contents that broke down in the compost. It adds soil structure, provides medium for bacteria and fungus to grow, keeps the soil "fluffy" so roots can grow more easily, holds moisture longer, prevents erosion, traps carbon in the soil slowly releasing it for plants use and keeping it out of the atmosphere, and provides the raw material for bacteria around the roots to convert into food for the plant.

Compost also has a plethora of micro and macro nutrients depending on what you put in the compost (for example if you put eggshells in, it will have calcium)

Compost is superior to liquid fertilizer. It builds up soil structure and adds biota *creating soil conditions* that benefit the plant. Chemical Fertilizer gives the plant nutrients directly benefitting it short-term while *destroying soil conditions* that plants need to thrive. Healthy soil=healthy plants=healthy humans!



## **Why compost infrastructure is important for the environment**

Topsoil is one of the most important resources on the planet for human survival. Industrial agriculture and reckless land use are destroying soil globally at an alarming rate. Without healthy soil, plants can't grow, water runs off quickly into the oceans, floods have a huge impact on our infrastructure and erosion washes away precious nutrients for growing food. In short, if soil dies, we die (if you think this is an overstatement read up on Easter island, the Ancestral Puebloans, fall of the Han dynasty, the dust bowl in the US, or the current civil wars in Syria and Yemen). One of the most important things we can do as a society is protect the soil. Compost is an easy way to create topsoil to improve soil and create food infrastructure.

Another global crisis on the horizon is climate change. The primary cause is Carbon dioxide emissions in the atmosphere. A close second is methane. Methane is created when organic matter decomposes without oxygen (anaerobically). This is what happens when food scraps and other compostable things get trapped in landfills. Landfills are giant methane generators. When you compost, you break down food with oxygen (aerobically). The bacteria traps carbon in the compost. By adding it to the soil, plants convert carbon into food and fungi traps carbon deep in the ground through its mycelium. In other words, healthy soil is a giant carbon battery taking carbon out of the air and locking it in the soil. Compost is a great way to create healthy soil, therefore it is arguably the best way to mitigate and adapt to the dangers of climate change. We can make carbon sequestering compost bins in our back yards, instead of creating expensive, complex machines to pull carbon out of the air as techno-capitalists advocate. This seems like a no brainer to us!

## **Why compost infrastructure is good for our communities**

This is the most sanitary, safe, cost effective and efficient way to deal with "waste" products from our homes, businesses and institutions and turn it into something useful. If it wasn't for plastic and other non-biodegradable garbage, backyard compost bins or mid-scale neighborhood compost facilities could completely replace the need for landfills. We wouldn't need any garbage trucks or any fossil fuels, just simple infrastructure that almost anyone can make with resources in our community. The end product can be taken out of the bin and applied directly in gardens to grow food.

This will be increasingly important as landfills become overcrowded. Currently, Ulster county needs to figure out where to put our garbage. Right now, our garbage is shipped out to Seneca Meadows near Syracuse. Aside from absurd amounts of fuel and money wasted doing this (9% of levied tax in Ulster), Seneca meadows said they won't take our garbage much longer. This means we are going to need to start dumping garbage in our own neighborhoods. Interestingly, *most of our garbage by weight is compostable*. A great way to mitigate this problem is widespread composting.

## **Benefits of composting at home**

One improvement compost provides is limiting your garbage. If you separate compostable waste and real garbage (plastic, metal, etc) you can have a bag storing somewhere until it is convenient to take it to the dump. Because all of the stinky stuff is out, there is no rush. The most obvious benefit is that you are transitioning the land where you stay into a means of production. You are that much closer to food sovereignty by producing your own soil.

One of the most important reasons to compost, in our view, is food security. A compost bin is the first step in creating food infrastructure to grow your own food. At the UGC we have compost bins and piles going at various stages of decomposition. When we heard news of a potential long term quarantine we contemplated our ability to survive if we couldn't leave our farm. We decided we would have to ration our supplies but would be fine once the growing season hit. We have immense wealth in the form of fertile compost all over the property. Because we've invested our labor in collecting and creating compost (an easy job once you get in the swing of it) we have the potential to grow food. This is the most fundamental form of security (much more valuable than guns and ammo!). Some compost enthusiasts point out that if we ate completely from our garden and returned all of the food and human waste back to the garden in the form of compost, the gardens would stay indefinitely fertile. A complete closed loop system. Wouldn't that be great!

### **Why not send compost to a commercial compost company?**

This is an option. In Saugerties we have a cheap composting service located at the material depot off of North Street in town. The food scraps are shipped to New Paltz to be commercially composted. Not many people use it. This is a good service if you just want to get rid of your food waste, keep it out of landfills and prevent it from turning into methane. But there are a few reasons backyard composting or mid-scale neighborhood composting is superior to large scale compost companies.

First, if more people collect compost (which institutions in Ulster County will have to start doing in 2021) there will not be enough companies to meet the demand. We can start making more companies, meeting the demand, creating economy of scale and blah blah capitalist jargon, or we can just localize this important infrastructure in our communities. Large scale composting companies require a central location, they need heavy equipment to transport the food waste, like a garbage truck, they need tractors to turn and flip the compost. These massive piles will stink, so they will have to be far away from residential areas. The whole process requires large money investments, huge fossil fuel inputs, and lots of bureaucratic red tape. Of course, these costs, require charging "customers" for the service and the finished compost will be sold off. From an ecological perspective, we are shipping nutrient resources away from our soils that desperately need to be improved<sup>1</sup>. This process is totally unnecessary and wasteful

The main reason hyper local composting is best is because the economic benefit of composting is already built into the process. Unlike garbage, which is a waste we want to get rid of, food scraps are a resource that can easily be converted into something useful. Local composting takes advantage of a simple process of bacteria breaking down organic matter. It can be done within feet of where we generate our "waste" and the finished product can be applied in gardens right in our back yards or neighborhoods. The whole thing can be done with some wood scraps, 5-gallon buckets, shovels and wheelbarrows. No loans, insurance or permits necessary. Even if one wanted to commodify this process, eliminating the costs by localizing production can make the product that much more profitable without the negative impacts on the consumer (high prices) or the environment (fossil fuel emissions). Compost should stay in our communities, enriching our soils, creating food for us and our neighbors.

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<sup>1</sup> To learn more about this process of extracting nutrients from the soil where food is grown and shipping them to a spot where food is consumed where it is then turned into sewage which poisons the water, look up the concept of **metabolic rift**.

## Fears about composting.

The most common fears about composting are smell and pests. These are not a problem if composting is done correctly. Since these are such a huge barrier for people, we'll break down each of these fears and how to avoid them. If you don't believe us, come visit our site and you won't see flies or smell anything but the earthy smell of hay as you approach the bin.

- 1) **Stink:** When food rots, it stinks. We've experienced this in our kitchen garbage or kids forgotten lunch boxes. Rotting is not composting! A common saying among compost enthusiasts is "if it stinks, you're doing it wrong." The key to avoiding stinky compost is COVER MATERIAL! If the compost is covered with at least 4 inches of cover material (hay, leaves, saw dust, wood shavings) it will not stink at all. If it stinks when you take it out of the bin to apply it in the garden it isn't done decomposing. Give it more time to break down. Finished compost never stinks, it smells like earthy dirt.
- 2) **Rats, mice or other critters:** In the decade that we've been composting, we have never had a problem with any of these things. Cover material is again the solution to this problem. For rats, mice or other creatures, compost actually *deters*, not attracts them. There is nothing more appealing to critters than food rotting in your garbage bin. Compost is different in that the bacteria in the bin is HOT and as soon as you put the food in the middle of your bin, it starts breaking down, consuming the scraps. When you cover the material it completely conceals the process inside the bowels of the bin! Take food out of your garbage and into compost to avoid rats, racoons and other garbage pirates.<sup>2</sup>
- 3) **Bears:** bears love garbage cans, not compost bins. A good way to test if your bin is going to attract bears is to see if your dog is attracted to it. If the dog pays no attention (aside from when you move away cover material to add fresh food scraps) then you are in good shape. Again, the cover material is the cure-all<sup>3</sup>.
- 4) **Flying Insects and other bugs:** We've been lazy in covering the bin and seen small fruit flies around the bin. Once we apply more cover material, the bugs instantly disappear. Flies don't hang around our bins. Also, hot compost creates an environment un-inhabitable for insects. All you will find in your bin is bacteria when the bin is active. Not even worms will be in there.

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<sup>2</sup> Some books on compost point out that mice may take residence on the outskirts of your compost bin in the winter because it is warm. We haven't experienced this, but it probably can happen. This shouldn't deter you though, cars, garages, attics, walls, piles of clothes, etc. also provide winter refuge for mice but don't produce soil!

<sup>3</sup> One time we found a dead chipmunk in a bucket of water. It had been there for a few days and smelled bad, so Chase casually tossed it on top of the compost bin on top of the cover material. Within an hour a little bear showed up attracted by the carcass. It didn't disturb the bin or its contents but took the dead mouse. This showed that even with a lot of bears in the area, the compost didn't attract it, a dead carcass did.

## Potential for contamination

Some people fear that the pathogens in compost will contaminate the soil, water sources or vegetables we grow. This fear usually comes up when we discuss composting poop. Fortunately, there has been extensive research done on this topic. Scientists who study the spreading of disease through water or soil contamination recognize the value of composting as a way to kill pathogens, not spread them. An active compost bin acts as a “bio-filter”. Given time (3 months), the biodiversity of microorganisms in the compost will destroy pathogens through antagonism, competition, consumption, and antibiotic inhibitors. When dealing with pathogens found in human excrement or meat (hook worm, e. coli, etc.) heat generated by bacteria in compost destroy harmful bacteria at a rapid rate. Complete pathogen die off (including worm eggs) will happen at a temperature of 149°F(65°C) in minutes, 143.6°F (62°C) for one hour, 122°F (50°C) for one day, 114.8°F (46°C) for one week, or 109.4°F (43°C) for one month.

How easy is it to get those temperatures? The hottest we’ve ever gotten compost was in a large compost bin (4’ wide x6’ long x4’ tall). A day after we flipped the contents into a new bin, it reached 157°F (70°C). Usually when we start a new compost bin with the dimensions 4 wide x4 long x3 tall it will get to the high 120°F (49°C) range when it’s a third full. When you add more nasty, stinky stuff like meat or nitrogen rich urine it tends to get hotter. It is relatively easy, even without meat or humanure to get to temperatures above 115°F (46°C) and keep it there for weeks or months.

As for the danger of runoff, the organic matter in a compost bin absorbs massive amounts of water like a giant sponge. We once dumped 60 gallons of water in our compost when we transferred contents of one bin to another, not a single drop dripped out from under the bin which was on a downhill slope. Runoff will only be a problem if your bin is placed in a swamp, or there is a massive flood. At that point, bacteria in your compost will be the least of our concerns in terms of contamination of the water supply! (think of antifreeze, overflowing septic tanks, graveyards, etc.)

In short, if you aren’t composting meat or human waste, the danger is minimal, and 3 months is enough to kill anything that may be dangerous. If you are introducing raw contents in the compost bins that may contain pathogens, the heat from composting it is a great way to neutralize the danger of contaminating water or soil. These contents rotting in landfills or even septic tanks (which don’t reach high temperatures and still leech into the ground) are ultimately more dangerous places than a hot compost bin.





## **How to compost!**

If we've convinced you that it's a good idea to start composting and calmed your fears, here are some basic principles to guide the process and prevent some of the mistakes beginners make.

### **What goes in**

Compost needs the right mix of "Greens" (nitrogen rich material) and "Browns" (carbon rich material).<sup>4</sup>

A simple way to understand this concept is like this

**Greens:** Things that have the potential to rot and be stinky and have moisture in them (old vegetables, rotting meat<sup>5</sup>, milk, coffee grounds, dead animals, flowers that have been sitting in water too long, recently cut grass clippings, green leaves, urine, poop<sup>6</sup> etc.).

These provide the nitrogen and bacteria into the mix. We like to think of this as the "fire" that creates heat in the compost bin.



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<sup>4</sup> Confusing note: "Greens" aren't always the color green and "Browns" aren't always the color brown!

<sup>5</sup> A lot of resources say don't put meat in your compost. Don't listen to them. Again, if you cover the material and get the compost hot (which meat will help with) there is no problem with pests or pathogens.

<sup>6</sup> If you're going to compost feces, make sure the compost reaches high temperatures to kill pathogens, give it over a year to break down, or just use it to fertilize trees. See *Humanure Handbook* for more info.

**Browns:** Things that are fibrous and dry and not stinky. (dead leaves, dead grass, hay, rotted wood, dead pine needles, sawdust, paper towels, cardboard, newspaper, corn stalks or any dry dead plant, wood chips<sup>7</sup>)

These provide the carbon to the mix. We like to think of browns as the “fuel” for the bacteria to eat and start the “fire.” Also this is the cover material for your bin.



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<sup>7</sup> A lot of commercial compost facilities use woodchips and bark in their compost. This works, but it takes longer to break down. Bacteria isn't a shredding device. We prefer using woodchips for our garden paths. Invertebrates and fungi do a better job of breaking it down when woodchips are in direct contact with the earth. You can add it directly to garden beds after that if you want.

## Collecting materials

### **Browns**

We can't overstate the importance of having abundant cover material near the compost bin at all times. If you have trees by your house, collect all the leaves in fall. If you have foresight you can get plenty of leaves from the side of the road in bags or piles that people throw away. Leaves are a precious resource and can make a good compost on its own. Another good cover material is hay or straw. We are able to get a bunch for free after the garlic festival packs up. Any "Browns" can work as cover material. Pick a designated spot to stash any leaves, grass clippings, weeds, pine needles, cardboard, etc that you accumulate throughout the year. We either make a big pile next to the bin, or if you want things tidier store cover material in a separate bin or garbage can.

Since we started seriously composting, onerous chores like raking leaves, cleaning out gutters, weeding, and weed whacking have become a thrilling process of acquiring free loot for our soil building process!

### **Greens**

The easiest way to get nitrogen rich rotting material for your compost bin is from your home. We use a five gallon bucket with well-sealed lid. This should replace your garbage as the primary receptacle for waste. Remember everything but plastic can go in there including paper towels, bones, egg shells, etc. For people who don't do a lot of cooking, it might make sense to have a smaller bin in the house and a 5 gallon bucket close by outside so the compost isn't sitting inside rotting for a long time which can attract fruit flies. A five gallon bucket with a tight lid will prevent this problem. If the bin starts to smell when you open it up, toss it in the compost bin!

If you don't like how slowly your bin is filling and want to make more soil, you can ask neighbors to start collecting compost and bringing it over. We have a system at our place where people drop off a 5 gallon bucket and swap out for a clean one. The more diversity of scraps and the more compost you have in the bin, the better the decomposition process will be and the higher quality the compost will be when it is done breaking down<sup>8</sup>.

If you're ambitious, you can start to collect coffee grounds from coffee shops or buckets from restaurants. Most restaurants will oblige and might even give you a gift certificate at their place. This is a good example of a non-money exchange that benefits all parties and is providing a community service. As long as you have plenty of "Browns" on hand, you can put a lot of "Greens" in the bin without bringing bad smells or pests.

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<sup>8</sup> A diversity of bacteria in compost creates a competitive environment in the soil so viruses, bacteria, molds and other pathogens that can infect food crops have a harder time taking hold. The soil is like the stomach of the plant, rich, diverse compost is like a probiotic is for our stomach.



### **How to start off the compost bin**

- 1) Put a layer of browns on the ground at least 4 inches thick. More is better. (we like to start with corn stalks and leaves but use whatever you got.)
- 2) Add greens in a pile in the center of the bin making sure to keep the rotting material away from the outside edges of the bin (we like collecting the food scraps and any other household compost in a five gallon bucket so you get a good amount at once)
- 3) Surround the pile on all four sides with a layer of browns. make sure there is no rotting material close to the outside of the bin. This is how you avoid smell! (leaves or hay work well for this. Leaves are preferred because they break down into great compost, hay will keep away smell and pests but won't decompose as quick as everything else.)
- 4) Cover the contents on top with at least four inches of cover material. (if you can smell anything rotting, add more!)
- 5) If you have a lot to compost, you can continue these steps to have alternating layers of greens and browns. Just make sure there is always a layer of cover material concealing anything that can stink on all sides, top and bottom!

### **Adding new compost**

- 1) move aside the cover material in the center of the bin (like making a bird nest) until you see the rotting material beneath it.
- 2) Dig into this material with a shovel to make a hole for the new scraps. If the bin is working, you will probably see steam when you do this. (you may experience momentary stink here, but you will be surprised by how little it smells if the compost bin is hot.)
- 3) Dump the contents of the buckets into the hole.
- 4) Move the partially decayed compost over the new material to "bury it" in the hot center of the bin.
- 5) Clean the bucket by adding water and using a toilet brush or stick to get the caked-on material off the sides and bottom of the bucket.
- 6) Dump the water from the bucket into the hole in the compost bin.
- 7) Move the cover material you pushed aside in step 1 back over the hole.
- 8) Add more cover material if necessary, to cover smell and block insects.



## Maintenance and equipment

**5-gallon buckets:** These are ideal to transport compost to the bin. It's a good way to accumulate a good amount of "Greens" without getting too heavy. A tight lid will keep out insects and stop smell before it gets to the bin. Its also easy to dump the compost in without getting it on your hands. Avoid using big garbage bins as they get heavy, also don't use plastic garbage bags to hold food scraps! It is really hard to dump out the contents without getting dirty and then you are left with a nasty ripped up garbage bag that ends up in the landfill.

**Toilet brush:** this is a good option for cleaning out the dirty compost bin after you dump in. Fill it with water, clean the bucket, and dump in right in the compost bin. Don't use bleach or non-biodegradable soap. The 5-gallon bucket doesn't need to be that clean, you're going to fill with scraps again soon. After a long time, if the bin gets very gnarly, you can fill it with bio-degradable soap and let it soak to clean all your bins.

**Old shovel:** It's good to keep a shovel in or near the bin at all times. This is good for moving aside cover material, and digging the hole for depositing new compost.

**Rake, pitch fork or flat shovel:** If you don't want to use your hands to apply the cover material a rake, pitch fork or flat shovel can work. Don't forget to put a lot of cover material around and on top of the "Greens"!

**2 or 3 foot thermometer:** A hermetically sealed thermometer will help you understand what temperatures your compost is reaching. From this you can see what changes you need to make or when it is done breaking down



## Principles of good composting

### Right combination

If you mix “Greens” and “Browns” together in layers, chances are it will break down nicely. Be careful, not to add TOO much rotting material (Greens) at once. We tried this once with food scraps from a restaurant with exclusively woodchips as the cover material and it didn’t end up breaking down but instead putrefied. When we turned it after 3 months in the bin, it was still stinky. We had to turn it and mix in a lot of leaves. This solved the problem. It’s best to add alternating layers of a 2-3 inches of “Greens” and 4-6 inches of “Browns.” This happens intuitively if you follow the steps above. Just remember to cover any potentially stinky and rotten stuff with lots of cover material!

You can also have too much “Browns.” This is less of a problem as the compost won’t stink, it just won’t break down for a long time. This is like what happens when you have a big pile of leaves. If you add water too it, it will eventually rot, but adding the “fire” of nitrogen and bacteria from “Greens” will make the decomposition take off.

A good way to see if you have the right mix is by measuring the temperature if the temperature is 20°F or more above the outside temperature it’s breaking down but its good to aim for the 120°F range or higher.



Paulie showcasing the alternating layers of “Browns” and “Greens” in the bin after we removed the door to empty it into the garden.



### Give it air/turn it

Compost needs air to break down. By mixing “Browns” and “Greens” together in layers, there will be air pockets which will help break it down. Additionally, when you add a new bucket of material into the bin, it will aerate the compost. Time will usually break everything down, but to speed up the process, you can flip your compost. We usually wait until the bin is full and then flip it into a second bin or empty it in a pile in the garden (by this point it doesn’t smell much and is mostly broken down).

Some people turn their compost a lot. We find this unnecessary and really labor intensive. Some compost “purists” think turning compost at all is bad because it disrupts the bacteria in the bin. We don’t go that far, but we do avoid turning as much as possible. From our experience turning the material before it is 75% decomposed will be stinky. We try to leave the material in the bin until it is absolutely full, then put the least broken down stuff on the bottom of the next spot you move it (bin or pile).

After you turn the pile, it get’s really hot again as all the contents mix together. If you aren’t doing a lot of composting, and you have two bins, once the first bin is full you can just leave it in place until its broken down (at least 3 months after you stop adding fresh material) and apply it directly to your garden. Alternatively, if you run out of room, you can add partially broken down compost into a “lasagna bed”.<sup>9</sup>

If for some reason your compost isn’t breaking down (which you can tell by a cold temperature, wet clumpy look or a “rotten” smell), turn it and add more “Browns” to the mix.



Wet unfinished compost vs dry fluffy finished compost

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<sup>9</sup> A method of placing varying layers of organic matter on the earth to build soil without tilling.

### **Bigger is better**

Compost needs to be in a dense mass for it to get hot and start breaking down. This is why we prefer bins over piles. As piles get higher, they get wider. A bin can get taller and keep the same width, making it easier to create a dense cube. We've heard tales from town workers of giant woodchip piles reaching internal temperatures above 200°F.

To reach temperatures above 144°F (the temperature that kills all harmful pathogens almost immediately), the bin needs to have dimensions of at least 4'x4'x4'. Although these are ideal temperatures for killing pathogens quickly, it isn't necessary as long as you give it time (see above for contamination). Just remember that it won't start getting hot and breaking down until you have a about a quarter of the bin full.

### **Compost needs to stay moist (but not soaked)**

Moisture is necessary to activate the bacteria that break down compost. "Greens" like vegetable scraps have water content and usually provide plenty of moisture. As the temperature increases in a bin, water evaporates from its contents. Make sure, when you clean your bucket dump the water in the bin. This practice combined with keeping the contents exposed to rain usually keep it sufficiently moist, but if you find it is drying out, make sure to hit it with a few buckets of water or soak it down with a hose. It will absorb more than you expect!

On the flip side, if the compost is too wet, the bacteria can become waterlogged, and this can slow down decomposition. This has only happened to us one time. The contents had a wet, pasty look and it smelled bad. To solve this, we flipped it to aerate it and cut in some dry leaves. Two days later the temperature went up and the compost broke down nicely in a few months.



### **Keep compost bins close to your home**

A big mistake people make with compost bins is keeping the bin far from your house for fear of smell. If it's too far away it becomes a burden and doesn't get used. A tour of many a' gardens includes the ruins of a compost bin of a forgotten, Pinterest inspired, age. Place it somewhere where it is convenient to use.



## Types of compost bins

A well designed compost bin makes all the difference in keeping out pests and achieving high temperatures to break down organic matter. What type of bin you use depends on your composting goals and quantity of compost you break down over the course of the year. The following designs are examples we see in the community and systems that we have built and used over the last 10 years.

### **Store bought bins**

#### Cheap plastic compost tube



One type of bin that we've encountered all over the place are these plastic bins. Maybe the reason so many people have them is because they are given out free by the Ulster County Resource Recovery Agency (UCRRA). It's certainly not because they are effective! We couldn't have harsher words for these bins.

**Pros:** free (but you have to pay to bring it to the dump!)

**Cons:** They are small so they can't reach high temperatures, they are made from extremely brittle plastic so they often break, they are covered so they don't get air or water, and they are difficult to get a shovel in to stir it up.

Our suggestion is, if you have one of these, give them to some neighborhood kid so they can dress up as R2-D2 for Halloween!

#### Tumbler

Another bin you see around town is a compost tumbler. These are widely available online or in big box stores.

**Pros:** These are nice because you can turn them to help the contents break down faster. The tumbler is off the ground and compost is sealed from pests and smell without the need for lots of cover material.

**Cons:** These bins don't hold that much compost and they are usually designed so you can't get a wheel barrow underneath when its time to empty it. Well made bins usually run from \$200 up to \$1000.

We don't have too much experience with them, so we can't speak on whether its worth the investment or not.



## Handmade designs

From our experience, handmade compost designs work better than store bought systems. More often than not, you'll see broken or abandoned store bought compost bins in people's back yards or community gardens, which is a sign that they aren't effective. A simple compost bin design that follows the principles outlined above will have you building soil very quickly without a big investment!

Here are examples of systems we've tried over the years that are easy to implement, can be designed with little skill, utilize widely available tools and can be constructed with materials already in our community.

### The compost pile

The simplest way to make compost is putting it in a pile. If you have room somewhere this definitely works. If you have a big pile of leaves or wood chips, you can dig right into the pile and dump your compost inside.



**Pros:** no materials necessary. You can rake "Browns" right up to the pile to cover it. If you're doing a lot of compost, it's easy to add on a pile vs build a new bin. Easy to shovel to flip it or apply to your garden. Works well with tractors or machines

**Cons:** As the pile gets taller, it also gets wider. Not an efficient use of space if you aren't dealing with a lot of compost. You need lots of cover material to conceal smell.

We always start with a compost bin, but after the compost is mostly broken down, we transfer it to the garden or some other spot in a big pile to let it continue breaking down. We'll often add leaves on top or cut in freshly cut weeds as we are piling it up to give it a little more "kick" as it continues to decompose.

### The pallet compost bin

If you need to make a bin in a hurry and don't have wood on hand, a pallet compost bin works well. You can always find pallets for free behind businesses that ship inventory. All you need to do to construct these is stand them up and nail, screw, or tie them together with ropes. You can add a hinge on the front to open it, but we've found that securing it tight is better because you only need to open the door once every few months and hinges can be tricky.



**Pros:** These bins can be constructed in minutes. Pallets are strong and can be found all over the place. You can build them in lots of different configurations (1 bin, 3 bin, 1 large bin etc.). Pallets last a long time before they rot. Pallets are usually good dimensions for reaching high temperatures in compost

**Cons:** Unless you find nice uniform pallets, these bins can be ugly. They also have nooks and crannies that compost can get stuck in.

We used pallets exclusively for our compost bins for years because they are really effective. We have made pretty ones. If you make a bin like this, don't put a pallet on the bottom, let the compost touch the earth directly. The compost will fertilize the soil, and biota from the ground will help break down your compost. Also, when it's time to empty the bin, a pallet on the bottom is a real pain and gets in the way of your shovel. Check online for cool design ideas if you choose this method.

### Chicken wire compost bin



This is a simple design of stapling chicken wire or hardware cloth around some pieces of wood to give the compost structure as it breaks down.

**Pros:** simple design, lots of air flow, protection from pests

**Cons:** If you make this bin large, it can't hold its own weight without compost in it.

We tried this system once, but had a hard time getting it to stand in the beginning and the compost didn't break down well. This was probably our fault. We think we added too many woodchips as cover material. We prefer wood compost bins, but don't want to discourage you from trying this simple design!



## Handmade wooden bins

The design we have used the most is the handmade wooden box. As we've built relationships with people with sawmills and done different building projects, we have access to a lot of wood scraps. If you use closely spaced wood, the cover material will contain the compost, otherwise chicken wire is recommended. These bins offer protection from pests and structure for your compost. The nice thing about these bins is that you can make them look however you like.



4' wide x4' long x3' tall design, single bin

**Pros:** contains compost well, easy to cover, because it is only 3 feet tall, most people can reach above it to dump in compost (you can add a step if not).

**Cons:** because it isn't 4'x4'x4' it won't reach the highest temperatures.

This compost design takes us about 3 months to fill adding 5-8 bins a week. Once it gets to a certain height, it will start to sink as the decomposition process begins. At this point, it seems like you can add buckets indefinitely as it "eats" any bucket you throw in!

When we started collecting more compost, we added two more bins of the same dimensions on the side. This 3 bin system is commonly used with the idea that you can flip the contents of the first bin into the next empty bin. By the time all three bins are full, the third bin should be broken down enough to go in the garden. This timing works for us composting 5-8 bins a week and putting lots of leaves in. If the last bin isn't totally broken down, we just put it in a pile in the garden and give it a little more time, or add it to the bottom of a new "lasagna" garden bed.





Variation on the 3 bin system with the same dimensions, this was made from lawnmower shipping boxes. It relied on chicken wire since the wood was spaced so far apart. This system worked really well for humanure. We shocked visiting engineer, architect and art students from the Cooper Union with our beautifully composted "human waste" which had no bad smell. In reality, the humanure is 95% sawdust with an additional 5% feces, urine, paper towels, and food scraps. This is then mixed with equal parts coffee grounds and smothered in rotting leaves. The end product is worth its weight in gold!



The same 3 bin system with pallets (sorry for the crappy picture, we took this from online. No record remains of our old pallet compost bins.)







4' wide x 4' long x 4' tall design

**Pros:** the dimensions are the minimum dimensions to reach 144°F (62°C). This is only important if you are composting human waste.

**Cons:** You must be tall or have a step stool to comfortably dump in buckets.

This is a bin that a friend made for humanure. It's constructed with six, 2x4's and some 1x8 lumber. This bin is dependent on chicken wire. It has a nice hinged door on the side to empty the contents when the compost is done breaking down.

4' wide x 6' long x 4' high



**Pros:** stores lots of compost!  
Reaches high temperatures.

**Cons:** takes a while to get hot if you don't have a lot of material to start it off with since it's so wide.

This is our new favorite compost design. We were able to get our record temperature of 157°F (70°C) in this bin. It stayed around this temperature for a few days then slowly leveled off to the low 130F (54°C) for over a month. We dug this into a hill so the one side is easier to reach over (Cassandra still can't reach over though).



A Variation of the same design. This one doesn't need chicken wire because of the close spacing. Also, because of the uniform boards, we can add boards as we fill it making it easier to reach above the top in the early stages of filling the bin. We also added a hoop house on top of this to take advantage of the heat and grow seedlings!





## Other types of composting

**Humanure** (compost toilet, dry toilet): A waterless toilet that collects human urine and feces and is mixed with sawdust or other bulky material. It is moved to a compost bin or has a built-in composter to break it down.

**How it works: Oxygen loving Bacteria create heat and break down organic matter into rich soil.**

**“Hot” version:** bacteria that thrives in high temperatures (thermophiles). Destroys pathogens that are harmful. This makes it safe to apply in gardens or fruit trees sooner. (if temperatures reach 131 degrees all the pathogens in feces die within hours)

**“Cold” version:** bacteria (mesophiles) break down material. Toilets require less maintenance, but more time to break down into soil. Doesn't reach as high temperatures. Takes longer before it is safe to apply on the soil (2 years)

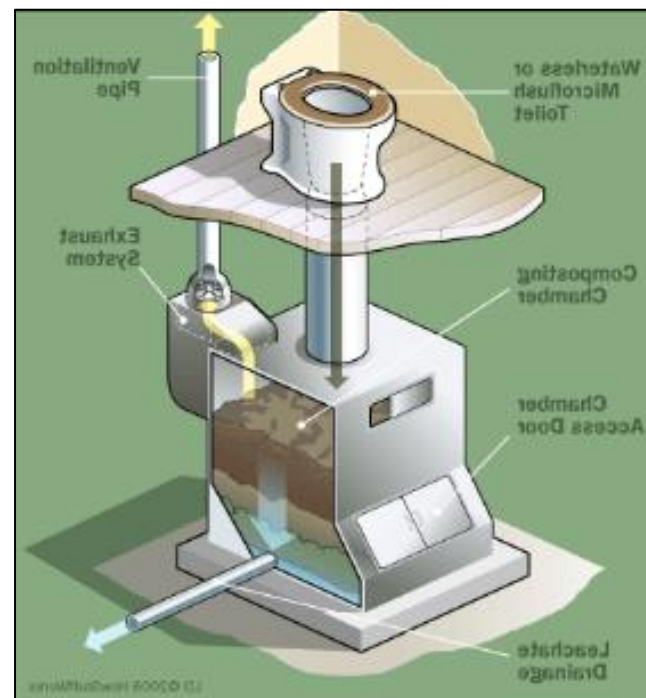


### Benefits

- Requires little to no water, no electricity, little space
- Prevents harmful pathogens from entering the water table
- Doesn't require adding chlorine and other chemicals to treat water that has feces in it
- Cheap and easy to make
- Provides sanitary recycling system during disasters or in places that don't have sewage systems
- Takes advantage of LOTS of nutrients that usually end up in the water

### Limitations

- Fecaphobia: People are scared of poop!



## Sheet Mulching (Lasagna Bed):

Stacked layers of organic matter\* left to break down to soil

\*(cardboard, woodchips, leaves, Mushroom straw, newspaper, grass clippings, weeds, manure, soil, etc)

**How it works:** Bacteria, worms, fungus and other Biota break down layers into compost over time.

Finished compost can be tilled into the soil or planted in directly

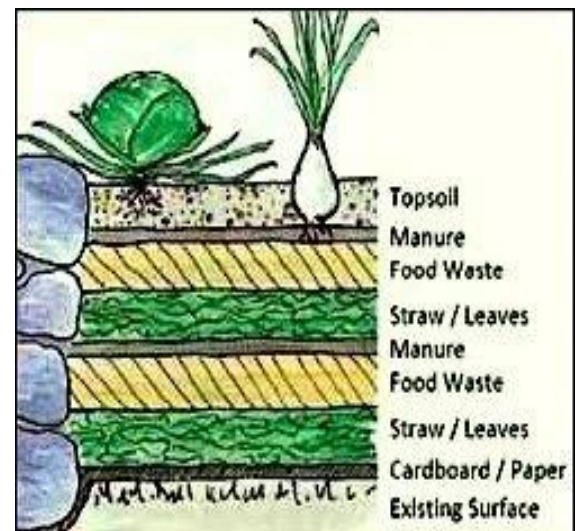


### **Benefits:**

- create healthy soil in places where the ground is too rocky or has contaminants.
- No need to dig, encouraging biota in the soil
- Can make out of free materials

### **Limitations:**

- Need to move a lot of material
- Lasagna bed shrinks, so process needs to be repeated for a few years to have enough soil
- Have to wait before you can plant deep rooted crops





**Methane Digestion: A process of decomposition that breaks down organic matter in a covered tank and releases Methane. Usually happens under water.**

**\*\* (NOT TECHNICALLY COMPOSTING) \*\***

**How it works:** Anaerobic decomposition. Bacteria that thrives without oxygen breaks down organic matter. Process releases methane.

The decomposition happens in a tank that fills with methane. Pipes from the tank can be used to cook or create electricity. Also known as Bio-gas.

**Benefits:**

- Takes advantage of decomposition to make energy
- Can use simple techniques to replace propane in your house!
- Prevents Methane from entering the atmosphere

**Limitations:**

- More complicated than Aerobic forms of decomposition. Requires special equipment.





**Compost Water Heater (Pain Mound):** A large pile of woodchips, straw and manure with water pipes in it that generates heat.

**How it works:** Bacteria (thermophiles) create heat as it breaks down organic matter. This heats up water pipes in the pile.

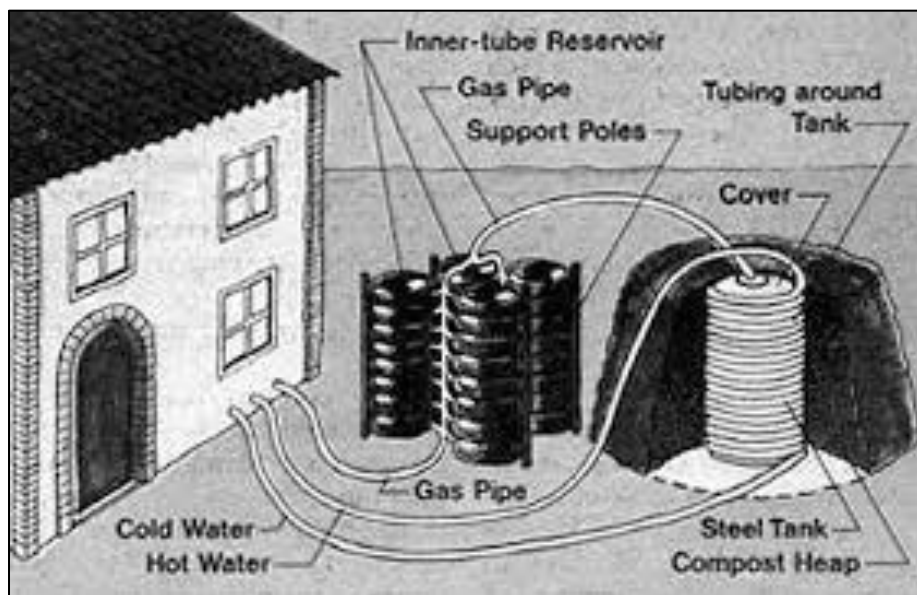
The water can be used for showers or it can be piped into homes for heat!

**Benefits:**

- Sustainable way to generate heat without fossil fuels or electric
- Creates fertilizer when the process is done

**Limitations:**

Requires a lot of wood chips and manure. (piles need to be large)



**Vermiculture (worm bin, worm farming):** A system of feeding food scraps to worms to create high quality fertilizer.

**\*\* (NOT TECHNICALLY COMPOSTING!) \*\***

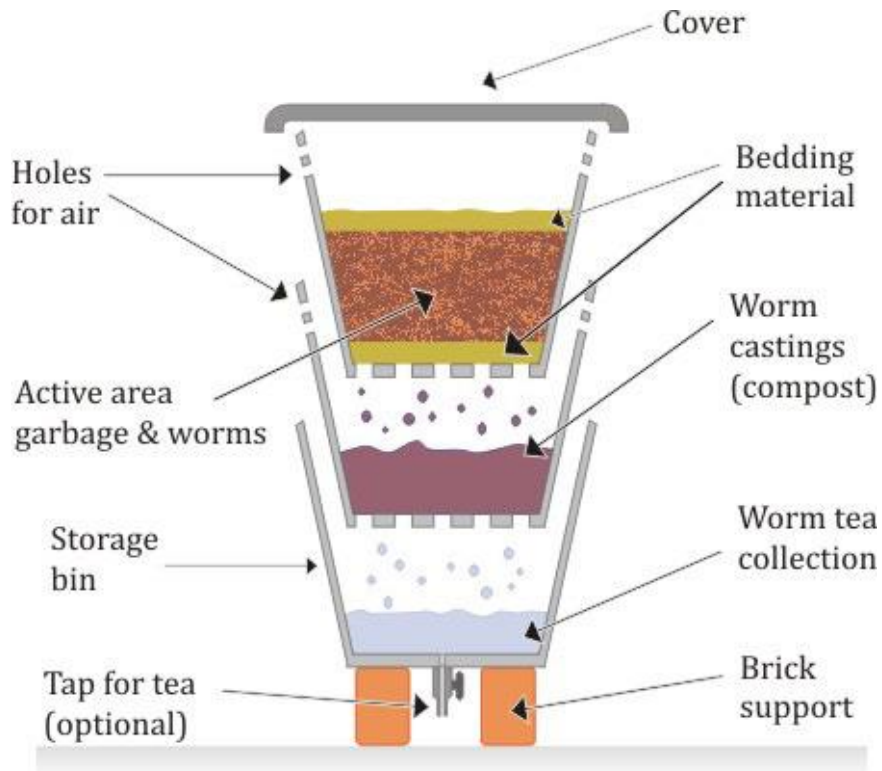
**How it works:** Worms are kept in a bin in a moist dark place. They are fed food scraps and other organic matter. They break them down to fertilizers called “worm castings,” and “worm Tea.”

**Benefits**

- Can be done inside a kitchen or a small area
- The worms reproduce, so you can create more bins to break down food scraps
- Worms can be used to feed chickens
- or added to the garden

**Limitations**

- If you put in too much food scraps at once or too much water, the worms will die



## **Resources and References**

Most of the information in this text is from a decade of firsthand experience composting with various methods and scales. Trial and error have taught us a lot of what works and what doesn't. As for the science and statistics in this text, we referenced the following books.

### **Books:**

*How to Grow More Vegetables than you ever thought possible on less land with less water than you can imagine* by John Jeavons.

\*This book is an awesome resource for growing food in the Bio-intensive method which relies heavily on composting to maintain soil fertility. It has a good section on compost science, technique and bin design.

*The Humanure Handbook* by Joseph C. Jenkins

\*All you need to know about composting human "waste," but also a great resource on composting in general. Jenkins has 40 years of experience composting. He wrote this book as his graduate thesis, but has been updating it as he applies his techniques around the world. He cites thorough scientific studies from the World Health Organization and other individual scientists and organizations. The book is free online as a pdf.

*Cows Save the Planet: And Other Improbable Ways of Restoring Soil to Heal the Earth* by Judith D. Schwartz.

\*This is a well-researched book about the science of soil biota, carbon sequestration, and the role animal husbandry can play in creating soil and addressing climate change. The author includes up to date scientific research about compost and aerobic decomposition.

### **News article:**

<https://hudsonvalleyone.com/2019/02/22/return-of-an-ulster-county-landfill/>

\*story about landfills in Ulster County