

PART ONE

Chapter One

EVERYONE NEEDS A TOILET

If you drink or eat in the morning, you know that a toilet will soon be needed. You will want to have a private, clean, pleasant, and convenient toilet nearby. But what if you don't have running water, drains, pipes, or even electricity? Will you have to trudge outdoors, in all kinds of weather, any time of the day or night, to relieve yourself behind a tree or in a hole in the ground? And possibly drag small children with you? Or do you have to use a toilet that simply discharges raw sewage into the environment?

Not if you have a compost toilet. A compost toilet can be located anywhere, indoors or out. No pipes, drains, running water, vents, chemicals, or electricity are needed. Your compost toilet can be right beside your bed, or beside your handicapped grandmother's bed. You can have it in your office, garage, shop, barn, or camp or in a tent, a mansion, a palace. If you know how to use it, it will be odor-free. The toilet will be part of a waste-free system that makes compost, and gardens.

Common definitions of the word "toilet" include "*a fixture that consists of a water-flushed bowl and seat used for defecation and urination.*" Or "*a bathroom fixture consisting of a bowl, usually with a detachable, hinged seat and lid, and a device for flushing with water, used for defecation and urination.*" Or "*a large bowl with a seat, or a platform with a hole, which is connected to a water system for when you want to get rid of urine or feces from your body.*"

No mention is made in any of these dictionary definitions, and undoubtedly in scores of others, of a toilet *not* being something connected to a water system and used for disposal. However, a toilet is any device or system, even a hole in the ground, that is used for the collection of body excretions for the purpose of disposal, or *recycling*.

The insistence that toilets require water for flushing is probably why two and a half billion people in the world have no toilets at all. The excretions of these people are deposited into the environment wherever the person can find a suitable place to squat. They can't deposit their "waste" into

Child drowns in school pit latrine, again

**Pit latrine collapses,
two children die**

15 March 2018 - 14:45

The Unending Tragedy Of A 5-Year-Old
Who Drowned In A Pit Latrine

September 24, 2018 - 9:40 AM ET

Another child dies in a pit latrine

Athandiwe Saba Bongekile Macupe Raeesa Pather 16 Mar 2018

Mom blames school for boy's toilet death

Five-year-old learner drowns in a pit toilet

PROTECT SCHOOL
CHILDREN FROM
DROWNING IN PIT
LATRINES!

**Arua pupil dies in school
pit-latrine**



Typical pit latrine in Tanzania, Africa.

a bowl of drinkable water, as the civilized world would do, as there are no flush toilets to be found. When a flush toilet is being used in low-income communities, the sewage may discharge directly into a ditch, stream, or backyard because permitted sewage treatment systems are unaffordable.

Billions of humans risk disease through inadequate sanitation systems that expose them to human excrement in their outdoor living space, in their drinking water, on their fruits and vegetables, and through recreational water activities. Nearly a billion people still practice open defecation; they squat outside in a field or in their yard or garden, every day. Still many more only have a hole in the ground for a toilet. These “pit latrines” are located away from the living area because they’re full of excrement, the stench is awful, they breed large fly populations, and small children can fall into them; some even die there. Pit latrines also pollute groundwater, a primary source of drinking water throughout the world.

Providing comfortable, secure, convenient, odorless, indoor, sanitary, ecological toilets for so many people is a dilemma that has puzzled developers and sanitation workers for generations. Yet human excrement is a recyclable resource, and when thought of as something of value rather than as a waste material, an entirely new direction in sanitation is revealed.



Public toilets in Kolkata, India, offer little in the way of privacy.



Pit latrines, such as this one in Mongolia, can be very dangerous for young children who fall into them and sometimes die there.

HUMANURE

Nothing that is recycled should be referred to as “waste.” Recycled human excrement (feces and urine), known as “humanure” (not “human waste”), provides food for microorganisms. Microbes consume humanure, then convert it into soil. Although humans find their own excretions disgusting, thankfully microbes don’t. When *composting* is used as a sanitation system, sewage can be greatly reduced or entirely eliminated, as can diseases and parasites associated with fecal contamination of the environment; toilets can be located indoors where they’re safe and convenient; and they can be odor-free. The resulting compost is suitable for growing food.

In 2018 the World Health Organization declared that people have a right to water and sanitation, and that after decades of neglect, the importance of access to safe, sustainable, and well-managed sanitation systems for everyone, everywhere, was recognized as an essential component of universal health coverage. The human right to sanitation entitles everyone to private, dignified sanitation services that are physically accessible, affordable, safe, hygienic, secure, and socially and culturally acceptable. The United Nations agrees that sanitation facilities must be available and affordable for everyone, even the poorest. When people don’t have access to functioning water toilets, compost toilets can provide an alternative.

A “compost” toilet is a toilet designed to collect the organic material that typically goes into any toilet, namely feces, urine, toilet paper, and so on, for the purpose of recycling it by composting. We will refer to this organic material as “toilet material.” Toilet material can also include other human excretions such as vomit and menstrual blood. When using a compost toilet, all the toilet material is collected and recycled. No waste goes into a compost toilet, and none comes out. Organic material goes into a compost toilet system. The finished product is compost.

WHAT IS COMPOST?

Compost, like agriculture, is a human creation.¹ You will not find compost in nature unless humans created it. You will not find a field of wheat,

¹An astute reader has pointed out that the Australian Brushturkey makes compost piles and uses them to incubate its eggs!



Above: This is a pit latrine at a girl's high school in Kwale, Kenya, Africa. School children complain of slipping and getting their leg caught, and maybe broken, in the squat hole.
Opposite: The author, in 2018, is cementing a pit latrine hole shut to block the punishing odor and swarms of flies and to convert the space into a clean compost toilet stall at a school in Uganda, Africa. The contents of the pit latrine are teeming with maggots. The resulting odorless, fly-free, compost toilet is shown on the next page. The toilet receptacle simply slides out the front of the toilet cabinet when it needs to be “swapped out.” This is a WeltHungerHilfe project in collaboration with GiveLove.org.

Photos by Samuel Autran Dourado.



an apple orchard, or a vineyard either, unless humans put them there.

Compost, by definition, has three components: (1) human management; (2) the generation of internal biological heat; and (3) aerobic organisms that thrive in the presence of oxygen. If all three of these conditions don't exist simultaneously at some point in the process, then it's not composting, and the end product should not be referred to as "compost."

To make compost, humans pile organic material, such as plant products and manures, aboveground in such a manner that microscopic organisms consume them. The finished material is sometimes referred to as "humus," "earth," or "soil," but the correct term is "compost." The process that converts the material into compost requires internal heat generated by bacteria inside the compost pile. These microscopic organisms live in the presence of oxygen and are classified as "aerobic." If dumped into a pit, the organic material is likely to become inundated by water and to become "anaerobic," or without oxygen. Anaerobic organisms do not make compost.

In 2018, the US Composting Council defined compost as *the product manufactured through the controlled aerobic, biological decomposition of biode-*



This is a pit latrine converted into a compost toilet at the Police Academy children's school in Moroto county, Karamoja, Uganda (a WeltHungerHilfe project).

gradable materials, which have undergone internal biological heating, thereby significantly reducing the viability of pathogens (disease-causing organisms) and weed seeds, while stabilizing the finished product such that it is beneficial to plant growth.

The Association of American Plant Food Control Officials approved the new definition for compost because it emphasized the pathogen removing biological heating process, differentiating it from many products often confused with compost, such as earthworm castings.

This definition helps the producers of other products, from biochar and mulch to dehydrated plant material and anaerobic digestate, to differentiate their products as *not being compost*. “Vermicomposting,” as an example, is a misnomer. The correct term is “vermiculture,” where earthworms eat rotting organic material and convert it into worm poop. The end product of vermiculture is not compost; it’s worm castings. Vermiculture is not dominated by aerobic bacteria generating biological heat. It’s dominated by red worms. Heat-producing microorganisms would kill those worms and turn *them* into compost. Worm castings are not the same as compost and should not be referred to as compost.

Most, if not all, so-called “*composting* toilets” are not toilets that make compost at all. Composting does not take place inside toilets unless internal biological heat is being generated, which is unlikely. What people incorrectly refer to as “composting toilets” would correctly be referred to as “dry toilets,” or “biological toilets,” even “eco-toilets.” The composting industry has worked hard to train and educate people about natural processes that use microbes to reduce or eliminate pathogens. The correct use of language is important. This is particularly relevant to compost and to toilets.

The conversion of organic material by microorganisms through the composting process is nothing short of magical. When we compost toilet material, we eliminate human disease organisms, or greatly reduce them, often to undetectable levels. Although the raw application of human excrement to agricultural fields has been practiced in various parts of the world for centuries, this practice can allow disease organisms to reinfect humans. Composting, on the other hand, destroys the disease organisms, creating a friendly, pleasant-smelling compost safe for agricultural use.



Pit latrine in Mozambique, Africa.

COMPOST TOILETS AND DRY TOILETS

A “dry toilet” is any toilet that doesn’t use water to flush away the material collected in the toilet. A dry toilet can be a urine-diverting toilet, a chemical toilet, an incinerating toilet, a biological toilet, an eco-toilet, or any of a multitude of devices designed to collect, process, dispose of, or recycle toilet material without relying on water.

Composting is unlikely to take place inside a dry toilet because sufficient biological heat will not be generated, for several reasons. For one, the mass of the collected toilet material may be too small; for another, the collected material may be too dry due to urine separation or intentional dehydration. Too *much* liquid in a dry toilet can create anaerobic conditions with consequent unpleasant odors. Although these toilets do not make compost, they can create decayed organic material, or what’s known as “septage,” which has *not* been subjected to the biological temperatures of true compost and is therefore not sanitized. The septage from dehydration toilets can be used as a soil additive where the material will not contact food crops, or it can be composted in a compost bin.

One of the reasons dry toilets don’t generate biological heat is that the volume of the material inside the toilet chamber is too small. Compost bins of at least a cubic meter in size have a greater potential to maximize heat generation. Composters should attempt to somehow insulate compost bins and keep some type of cover on top of the compost to protect from excessive rainfall and to insulate the pile. Chambers in dry toilets tend to be much smaller than a cubic meter, and even when they are large, it is difficult to insulate around the organic material inside the receptacle, where the toilet contents may be right up against a plastic or metal wall.

Most dry toilets are designed to dehydrate their contents. This is often achieved by “urine diversion,” by either diverting the urine away from the solids at the source utilizing a toilet seat designed for this purpose, or by allowing the urine to drain away from the toilet contents, perhaps directly into the soil underneath a toilet stall. Dry toilets may also utilize electric or solar heating elements to further dehydrate the toilet contents. These toilets are often referred to as “urine diverting dry toilets” or UDDTs. The

conditions needed for pathogen or parasite elimination are not likely to be achieved in urine diverting dry toilets.

Another type of dry toilet is a “compost toilet.” It isn’t called a “composting” toilet, because that implies that composting is taking place inside the toilet. Since the toilets themselves don’t create compost but only collect organic material, there’s no point in calling them *composting* toilets. A *compost* toilet, on the other hand, is any toilet that collects toilet material so that it can be composted in a separate area apart from the toilet. And composting, as stated, requires human management, aerobic conditions, and the generation of biological heat. Since compost toilets collect material to be composted rather than dehydrated, urine separation is neither necessary nor recommended. Urine is a beneficial additive in compost piles and is easily and conveniently collected inside a compost toilet receptacle. There is no need to separate the liquids from the solids as in a UDDT. There are scores of dry toilets available on the market today, worldwide.

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Finished compost from toilets at the Petion-ville Children's Academy and Learning Center in Haiti, is hygienically safe, odorless, and fly-free. The toilet building is shown on the opposite page. Rainwater is collected in a large black tank off the roof for washing purposes. The composting is conducted in bins immediately behind the building. Many toilets produce polluted water, waste, sewage, odors, maggots, and flies. Compost toilets produce compost, a valuable resource used to grow plants.



Urine diverting
dry toilets
(UDDTs)
in Finland
(opposite page)
and in
Mozambique,
Africa.



If the contents of the toilets are collected and then composted, they could correctly be referred to as compost toilets. Otherwise, they're dry toilets, not compost toilets. And they are certainly not *composting* toilets.

We humans are peculiar in that we are the only land animal that intentionally defecates in water. Water toilet users will seek out drinkable water to poop in even when there is little water to be found, such as during severe drought conditions. Water toilet cultures often don't have any viable alternative to defecating in water supplies, other than to revert to open defecation or pit latrines, which could be environmentally disastrous during a prolonged power outage, natural disaster, or other emergency.

A 5-gallon (20-liter) compost toilet receptacle and a bag of clean, finely ground, slightly moist organic cover material, such as sawdust, peat moss, sugarcane bagasse, rice hulls, or whatever you can grind up in your chipper/shredder, creates an instant compost toilet. If the contents of the toilet are regularly deposited into a compost bin, and a steady supply of cover material is available, such a compost toilet system can be used continuously for a lifetime, while producing no sewage. Compost bins can be built easily and quickly. A durable pallet bin can be built in 10 minutes. A wire bin or a straw bale bin can be erected in a very short time, too.

Drinkable water is arguably our most precious resource; without it we would soon die. Because very little water is used or required during the operation of compost toilets, human excrement is kept out of our water supplies and out of our environment. When we consider that 97 percent of the Earth's water is saltwater and that two-thirds of the fresh water is locked up in ice, we realize that less than one percent of the water on planet Earth is available as drinkable water. Considering that we have nearly eight billion people on Earth, and each person can produce about 25,000 pounds of excrement in his or her lifetime (11,340 kg, about a pound or 0.45 kg per day, according to Livescience.com), or, if you add it all up, about 640 billion pounds per year (290 billion kg, 2018 statistics), the idea that this giant mountain of excrement must be dumped into our drinkable water supplies on a continuous basis, as some sanitation professionals insist, is insane.

HUMAN EXCREMENT: FRIEND OR FOE?

When we discard our excretions as waste, we create pollution and health hazards. When we compost them and return them to the soil, we create health benefits. Although the former situation is well known, most people don't know anything about the latter. One misconception is that fecal material, when composted, remains fecal material. It does not. When the composting process is finished, the end product is compost, not poop. When microbes eat your poop, they convert it into something else. Your poop is gone.

Human excrement is a substance that is widely denounced and has a long history of condemnation throughout the world. Ancestors who failed to responsibly recycle the substance created monumental public health problems. Consequently, the attitude that human excrement itself is dangerous has been widely held to the present day. This fear, fostered and spread by government authorities and others who know of no constructive alternatives to waste disposal, still maintains a firm grip on many people. A more constructive attitude is displayed by people with a broader knowledge of recycling manures for agricultural purposes. Informed persons know that the benefits of proper humanure recycling far outweigh any disadvantages from the health point of view.

Compost toilet users don't grow food with "human waste," nor do they grow gardens with "night soil." Instead, they feed microorganisms in a compost pile, not only with toilet material, but also with other animal manures, fruit peels, rinds and seeds, coffee grounds, meat, bones, fats, all sorts of food scraps, animal mortalities, garden residues, grass clippings, leaves, and so on. The microorganisms, over time, convert these organic materials into compost. People then add the compost to soil, which makes it available to plants. Then either they eat the plants or they feed the plants to animals; then they eat the animals or their by-products.

When compost toilet users relieve themselves, they aren't "taking a shit." They're giving a shit. Think about that for a moment.

DON'T SAY "BUCKET"

There are two words that should never be used in association with compost toilets. One is "waste." A compost toilet is a device that recycles organic material; it does not collect or dispose of waste. It collects humanure, and it completely recycles it. No waste goes in, and none comes out.

The other word is "bucket." Some compost toilets utilize 5-gallon buckets as toilet receptacles. Others use drums, urns, barrels, bins, or any toilet receptacle that is watertight and manageable.

Five gallons, or approximately 20 liters, is a convenient capacity for easy handling by one person, and a 5-gallon container will hold approx-



This "bucket toilet" in Haiti is an open, fly-infested, bucket of excrement that stinks like hell. Bucket toilets can easily be converted into odorless, fly-free compost toilets by the simple addition of a carbon-based cover material and a compost bin.

imately one week's excretions of one typical adult, assuming an appropriate cover material is used in the toilet. Five-gallon plastic buckets are easy to come by in some countries, such as in the US, where they can be acquired cheaply or, when recycled, for free. In other countries they are nearly impossible to find.

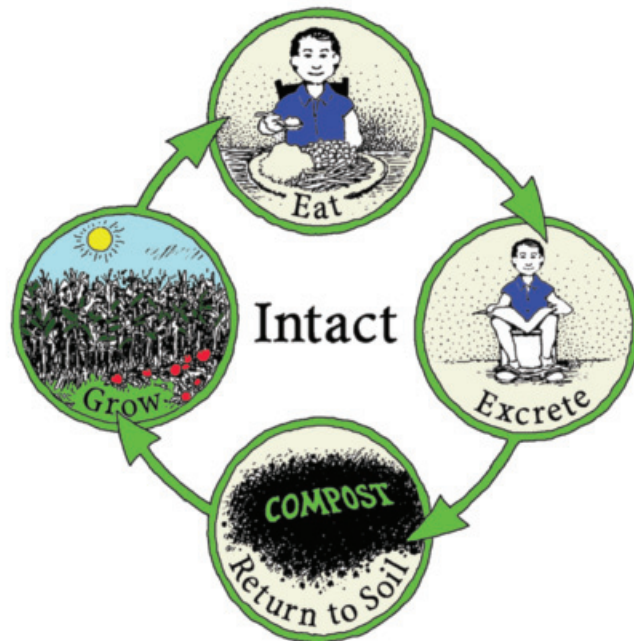
"Bucket toilets" however, are not compost toilets. Bucket toilets were commonly used in, for example, prisons, where inmates had to defecate and urinate in open buckets. No cover material was used, and the bucket contents were simply dumped outside. The bucket toilets smelled horrible, attracted flies, polluted the environment, and severely undermined the quality of life. They are still used in some parts of the world.

Bucket toilets date back generations, are widely condemned by sanitation professionals, and are not to be confused with compost toilets. Even when a compost toilet utilizes buckets as toilet receptacles, it is still not a bucket toilet; it's a compost toilet. It's a good practice to avoid the use of the word "bucket" altogether when discussing compost toilets. Compost toilets have receptacles or containers in which the toilet material is collected. When someone uses a compost toilet that has a 5-gallon receptacle, they are not "shitting in a bucket." They're using a compost toilet. When people use a flush toilet are they "shitting in drinking water"? Well, yes, they are, but we don't use that terminology; we say they're using a toilet.

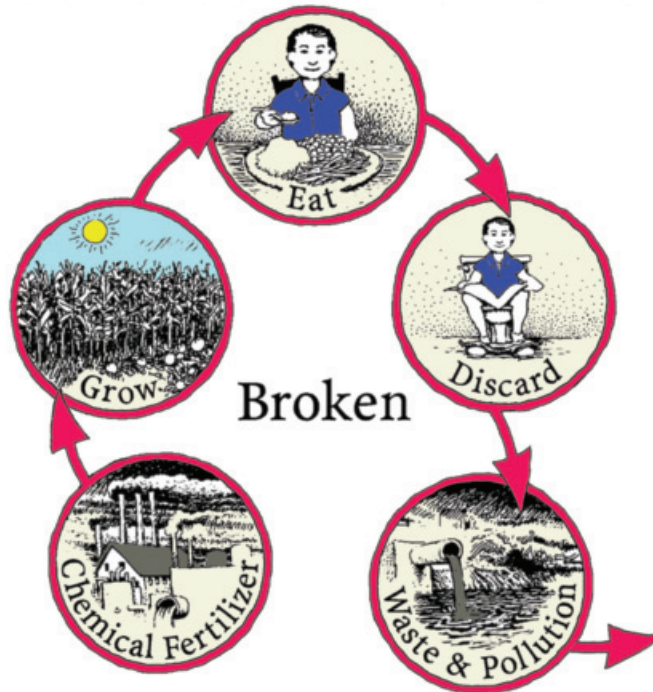
Most people know little about compost toilets, but bucket toilets have a long history. They are not the same thing and are not to be confused. Choose your terms carefully when referring to compost toilets so as not to spread misunderstanding.

HUMAN NUTRIENT CYCLE

The "human nutrient cycle" is when a human consumes food (nutrients), then the human's *excretions* become food for other organisms. Those organisms convert the excretions into soil from which more food is grown. Humans eat *that* food, excrete, recycle, grow more food, and continue a natural, endless cycle. When we dispose of our excretions as waste, the cycle is broken. When we *compost* our excretions, we provide nutrients



HUMAN NUTRIENT CYCLE



for beneficial microorganisms, which in turn convert them into compost, thereby returning the nutrients back to the earth where they provide soil fertility and crops, and the cycle continues unbroken.

The recycling of organic material should be taught to our children in schools and to adults in universities. Learning how to live on our planet in ways that are benign, sustainable, and symbiotic is critical to the long-term survival of the human species. What about fifty generations from now? If considering the future when conducting our daily affairs seems unrealistic, at least consider enough of the future to include your grandchildren and great-grandchildren. The way we live today may have a significant impact on the way our descendants live in the future.

Government authorities may be unwilling to teach you how to make compost from toilet material. They often have no training in composting, nor do they understand how it works. Many government authorities in water toilet cultures have a nineteenth century attitude about human excrement, believing it is to be a dangerous waste that must be disposed of.

The world's billionaires, who have hoarded the Earth's wealth for themselves, are unlikely to be helpful. So far, the efforts to "reinvent the toilet" have been efforts to create a product that can be patented for profit. Many people who don't have toilets don't have money either. If reinventing the toilet is based on profit motives, it is unlikely to succeed in a manner that benefits the billions who need effective, affordable sanitation.

Organics recycling can be a profitable business when responsibly managed, on both large and small scales. Compost toilet construction, compost bin construction, and compost toilet training can also be profitable ventures for small local business enterprises. People without toilets can also construct compost toilet systems on their own, or maybe with a little help from their friends.



Above: This is a toilet at the Mekelle University main campus, Mekelle, Tigray, Ethiopia, where piles of feces littered the entryway to the toilet stalls. The pit latrines behind the doors had filled up, making the entryway the most attractive place to find relief. The photos above show the same hallway before and after compost toilets were installed.

Below: The photos below show the same university toilet stall before and after it was converted into a composting system. It's amazing how little knowledge exists throughout the world about using composting as a sanitation alternative. These photos illustrate the stark contrast between an outdated, obsolete pit latrine sanitation system and a modern, biological, compost toilet sanitation system.

Photos provided by Samuel Autran Dourado.





Compost bins at the WeltHungerHilfe headquarters in Moroto, Karamoja, Uganda (above), contain months of collected toilet material without odors or flies. Microbes inside the bins convert the organic material into compost.



This is a compost toilet building at the Ayder Referral Hospital & medical school, Mekelle, Tigray, Ethiopia.

Photos by Samuel Autran Dourado.



CHILD AND ADULT COMPOST TOILETS

Wayuu tribe, La Guajira, Riohacha, Colombia,
South America. A WaterAid America project.

