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Composting Toilets: Urban Sustainability Solution

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Abstract: This project examines traditional and alternative sanitation systems. It focuses on current urban sewage treatment and its shortcomings. To find a necessary alternative, the project explores composting toilets. Composting toilets use aerobic decomposition to break down human excreta without the use of water or manmade chemicals and produces pathogen-free and nutrient-rich soil. The project explores the many benefits of composting toilets and their feasibility in urban environments, while addressing many of the real and perceived drawbacks of this technology. Composting toilets are faced with a great deal of cultural resistance in the United States. By looking at studies on environmental communication and psychology, this project suggests possible educational tactics to make composting toilets a mainstream sanitation practice. It also discusses Washington DC as an appropriate city for a large scale composting toilet pilot program.

As environmentalist author David Orr has famously said, "By the evidence of pollution, violence, social decay and waste all around us, we have designed things badly"[1]. Our problem, especially in cities, is one of design. Cities have traditionally had trouble dealing with human excrement. Historically, people defecated in rivers or even on local streets or alleyways. Sanitation and modern society evolved together. Healthy sanitation enabled people to live longer and to a higher standard. Flushable toilets became mainstream in Europe at the end of the 18th century.[2] With them came more sanitary living conditions in cities. The exact design of the flushable toilet has evolved since then and become ubiquitous in the Western world. Simultaneously, people have become less connected with their bodily excretions, with the luxury of flushing away their "waste," not to be thought of again. Western society is slowly paying the price for this luxury. The way cities have been designed to deal with human waste is both an engineering marvel and inefficient waste of resources. The design must be altered to create sustainable cities and it starts with sanitation.

Sustainable sanitation starts with ecological sanitation, which experts describe as a system "that protects and promotes human health, minimizes environmental degradation and depletion of the resource base and is technically and institutionally appropriate, socially acceptable and economically viable also in the long term."[3] Composting toilets represent a new frontier of environmentalism, one that restores the connection between humans and their place in the nutrient cycle. Cyclic systems are what David Orr had in mind when he called better design in human systems. Composting, turning waste into food is becoming a more common

[1] Orr, David. *Earth in Mind*. Washington DC: Island Press. 1994. p 105.
[2] Suddath, Claire. "A Brief History of Toilets." *Time*. November 19, 2009. Web. May 04 2013.
[3] Rosemarin, Arno et al. *The Challenges of Urban Ecological Sanitation: Lessons from the Erdos Eco-Town Project.* Stockholm: Practical Action Publishing. 2012. p 5.

closed loop system, indicating better planning and forethought. Human waste is an old taboo. Composting human waste is the next frontier.

This paper explores the history, benefits and obstacles of composting toilets. It also examines the feasibility of implementing a composting toilet system in cities, specifically Washington DC. It also examines the social barriers to composting human waste on a city, or even neighborhood scale and specific strategies for overcoming those barriers.

Conventional Sanitation System and Why It Should Be Flushed

Before discussing its many problems and short-comings, it is important to recognize the engineering and public health marvel that is modern sanitation. When asked to vote on biggest medical milestone of the last two hundred years, readers of the British Medical Journal in 2007 chose sanitation.[4] Modern sanitation has saved countless lives by removing the threat of fecal matter from direct water and food supplies. After sewers and toilets were widely implemented in Britain, child mortality dropped twenty percent.[5] Sanitation systems in the Western world, as they are now, are wildly convenient. The flush toilet removes disease carrying excrement, doesn't take up much space, can be inside the home, and rarely smells.[6] Yet, there is a great deal happening after the "flush and forget" that calls for a reevaluation of the current system.

In the environment, everything is cyclical. Death leads to disintegration, which leads to new life. Animal waste is used to fertilize plants that are then fed to animals, which create more bodily excretions. Composting organic waste has become mainstream in recent decades. Food scraps, yard waste, and other organic material are placed in a receptacle and over time the

[4] George, Rose. *The Big Necessity.* New York: Metropolitan Books. 2008.
[5] Ibid.
[6] Ibid.

"waste" becomes nutrient rich fertilizer. However, most nutrients taken from the soil in the form of food are eaten by humans—rather than composted. The majority of nutrients removed from the soil are excreted by humans and removed from the system. The human nutrient cycle is the cyclical cycle during which nutrients are used by humans and then returned to the soil. Plants use nutrients in the soil to create food. The food is eaten by humans, who excrete refuse. In the closed loop cycle, the refuse is returned to the soil, which replenishes soil nutrients so more food can be grown.[7]

The current system is a broken loop. Nutrients are removed from the soil to grow crops. The food is eaten by humans and discarded as refuse. Conventional sanitations systems carry away the refuse that end up wasted in sewers, oceans or landfills. Meanwhile to replenish the nutrients now missing from the soil, factories consume energy and resources to create chemical fertilizers that can be sprayed on crops. According to The Fertilizer Institute, 67 million pounds of nitrogenous fertilizer is applied to land daily, during the same time that Americans are flushing 100 million pounds of nitrogen-rich solid waste.[8]

Apart from the nutrient cycle, current sanitation practices are unnecessarily water intensive. In America, 100 million pounds of human excrement are flushed with 32 billion gallons of water every year. It's estimated that US sewers spill more than 850 billion gallons of raw sewage per year.[9] Sadly, that is an improvement compared to past practices. Only in 1992 did the US government mandate that all toilets go from 3.5 gallons per flush to 1.6 gallons per flush. We halved our water use from toilets and are still wasting billions of gallons of potable

[7] Jenson, Jospeh. *The Humanure Handbook*. Grove City, PA: Joseph C. Jenkins. 1994.

[8] Praeger, Dave. "Scatologically Correct." *The New York Times*. The New York Times, 15 Apr. 2007. Web. 04 May 2013.

[9] http://www.cloacina.org/files/an-unsolicited-design-review-sm.pdf

water each year. Each1.6 gallon flush of drinkable water is only removing a half pint of human excrement. The average American uses 80-100 gallons of water each day, according to the US Geologic Survey, and the largest use of household water is flushing a toilet.[10]

In American cities, water and waste from toilets, along with other used water and sometimes even storm water are sent to a wastewater treatment plant. The solid material is extracted and treated with chemicals. The treated water is released back into the environment while the solid waste is buried, burned or sprayed on fields.

The solid material extracted at wastewater treatment plants is sprayed on farms in an effort to return the nutrients back to the soil. The solids are commonly known as sludge, though have been rebranded as "biosolids" since the early 1990s. However, biosolids are not just the organic matter that goes down a household toilet. The sewage that flows into wastewater treatments plants contains inorganic chemicals and metals from industrial and household byproducts.[11] The EPA has guidelines set for biosolids spread onto land. Class B biosolids can be applied to agricultural land, with restrictions, despite the pathogens that legally needn't be completely removed from the sludge. Class A Exceptional Quality biosolids must have no pathogens and a lower amount of heavy metal (There is no class that requires removing all heavy metals from sludge).[12] Class A EQ biosolids can be spread over farms, parks and schoolyards—despite the heavy metal content, which inevitably seeps back into the ground.

[10] "Water Questions & Answers: How Much Water Does the Average Person Use at Home per Day?" *Per Capita Water Use. Water Questions and Answers; USGS Water Science School*. Web. 04 May 2013.
[11] Preager, Dave. *Poop Culture: How America is Shaped by America's Grossest National Product*. Los Angeles: Feral House. 2007.
[12] George, Rose. *The Big Necessity.* New York: Metropolitan Books. 2008.

Sludge that is not spread over land is buried in landfills, incinerated or illegally dumped into oceans. Though large bodies of water were once considered to be renewable sinks for human waste, the excess of human waste continues to threaten water systems globally. One cubic meter of wastewater can pollute ten cubic meters of water.[13] Incinerated sludge releases emissions of particulate matter, sulfur dioxide, nitrogen oxides, carbon monoxide, lead, volatile hydrocarbons, acid gasses, trace organic compounds and trace metals.[14]

Meanwhile the water that was removed from the sewage is purified and then released back into rivers, lakes and reservoirs where purified water mixes with the water is usually contaminated by agricultural run-off—a painful ironic reality. Before the water is released into the environment, wastewater treatment facilities add chlorine to the water to kill disease causing microorganisms.[15] The addition causes chemical pollution, with repercussion ranging from damage to fish gills and migrations to links to cancer, neurological damage, and reproductive and developmental effects in humans.[16]

Into the Bowels of Composting Toilets

Composting human excrement bridges the human-nutrient cycle that animals in farms across the world are a part of. There is nothing taboo or unacceptable about using cow feces on crops. Manure has a positive connotation. Many in ecological sanitation movement, refer to human feces as human manure, or humanure—a term coined by Joseph Jenkins, the lay expert

[13] Jenson, Joseph. *The Humanure Handbook*. Grove City, PA: Joseph C. Jenkins. 1994.
[14] Ibid.
[15] Ibid.
[16] Ibid.

on composting toilets—when it is composted.[17] Human waste should be valued and utilized like other animal excreta. Enter the composting toilet.

Composting toilets exist in many different forms. There are commercially built composting toilets and those that are homemade with five-gallon buckets. They can range from a hundred dollars at the hardware store or several thousand dollars at one of several companies per toilet. Some are built to store the refuse right beneath the toilet while others have pipes that lead to a large compost reactor. Composting toilets on a large scale in urban environments necessitates the use of commercial toilets. The most popular commercial brands are Clivis Multrum, Biolet, and SunMar.

The composting process yields humus, which is defined by urban sustainability experts as "organic matter rich in nutrients and microbiological life."[18] Humus is created from products of living or recently living things and eventually becomes soil. The composting process occurs due to naturally occurring bacteria and fungi that rely on aeration, with no need for water or manmade chemicals. They break down feces into an oxidized soil-like material.[19]

At its most basic level, each composting toilet captures human excrement and stores it in an aerobic chamber. The matter undergoes the composting process and is eventually spread on the land. Composting toilets can be passive or thermophilic; the difference essentially lies in the temperature of pile. Thermophilic composting heats quicker while passive composting may take up to a year before all pathogens die.[20] This paper will primarily discuss passive composting toilets as they are the more popular, commercial version. Passive composting takes

[17] Ibid.
[18] Kellogg, Scott and Stacy Pettigrew. *Toolbox for Sustainable City Living.* New York: South End Press. 2008.
[19] "Water Efficiency Technology Fact Sheet." US EPA. 1999.
[20] Jenson, Joseph. *The Humanure Handbook*. Grove City, PA: Joseph C. Jenkins. 1994.

place at temperatures below that of the human body.[21] They consist of three components: a composting reactor, a leaching system and a ventilation system. The first, a composting reactor, stores the refuse. The leaching system separates liquid and solids, either at the source or inside the reactor.[22] Composting toilets do not use water, which differentiates them from septic tanks. The third component, the ventilation system, ensures that gas produced by the composting material can exit the chamber.[23] The steps are simple: separation, containment, sanitation and recycling. Separation is important to maintain the proper chemical ratio in the compost. Efficient composts have a ratio of thirty parts Carbon to one part Nitrogen.[24] The mix of urine and feces contains too much nitrogen for proper composting and a foul odor is released. Toilets that do not divert urine can also be effective but require the addition of a carbonous material to the reactor.[25] The most common example is sawdust. Using a dry, high-carbon material removes the smell and excess liquid from the compost.

Human waste can be safely returned to the soil after pathogen removal. This happens by one of two natural processes: biodegradation or dehydration.[26] Different toilets are manufactured to perform differently. Some toilets use an active system which uses energy to accelerate the composting process while others use a passive system that does not use any mechanized means to speed composting.[27] Regardless, natural or electric heat kills the pathogens ensuring the safety of humanure after a certain amount of time. There is some

[21] Ibid.
[22] Rosemarin, Arno et al. *The Challenges of Urban Ecological Sanitation: Lessons from the Erdos Eco-Town Project.* Stockholm: Practical Action Publishing. 2012.
[23] Canitia, Thomas. "Composting Toilet as Sustainable Design." 2006.
[24] Jenson, Joseph. *The Humanure Handbook*. Grove City, PA: Joseph C. Jenkins. 1994.
[25] Ibid.
[26] Redlinger, Thomas et al. "Survival of Fecal Coliforms in Dry-Composting Toilets." *Applied and Environmental Microbiology,* 67: 9 September 2001.
[27] Canitia, Thomas. "Composting Toilet as Sustainable Design." 2006.

disagreement about the amount of time that must pass for all pathogens in excreta to die but most composting toilets advertise that the feces must compost for about a year before it is put back on the land.[28]

There is also disagreement among experts about the breakdown of human manure. The EPA claims that a properly maintained composting toilet will break down the excrement to 10 to 30 percent of its original volume.[29] The composting toilet design firm Cloacina claim that the volume of human waste decreases by half every six to eight weeks.[30] Exact volume is difficult to measure but companies like Clivus Multrum have extensively researched the load capacity of each of their toilets and have received positive reviews.[31]

Toilet paper and toilet paper rolls can be composted along with the human excrement easily. Female sanitary products can also be composted although many products have strips of plastic that will not break down.[32] This is not a major obstacle, since most conventional toilet owners advise strongly against flushing female sanitary products. An education campaign helps to inform toilet users about what is good and bad for composting.

Perks of Reusable Poo

The benefits of composting toilets have been extensively researched by the few brave enough to explore the subculture of recycling human waste. The benefits range from reducing domestic water use to improving soil quality to connecting users with their own byproducts.

[28] "Science & Technology." *Composting Toilets and Greywater Systems*. Web. 04 May 2013.
[29] "Water Efficiency Technology Fact Sheet." US EPA. 1999.
[30] http://www.cloacina.org/files/an-unsolicited-design-review-sm.pdf
[31] "Science & Technology." *Composting Toilets and Greywater Systems*. Web. 04 May 2013.
[32] Jenson, Joseph. *The Humanure Handbook*. Grove City, PA: Joseph C. Jenkins. 1994.

As an alternative to traditional flush toilets, it's estimated that households experience a 15-25% saving in household indoor water use, an 80% reduction in nutrient loads to sewers, and a 50% reduction in salt load to sewage systems[33].

Composted humanure has incredible benefits to soil. Compost can improve soil structure, increase microbiological diversity, and degradation of toxins.[34] It also neutralizes soil pH, which is especially valuable as acid rain—from manmade greenhouse gas emissions—continues to acidify soils worldwide. It enhances the moisture retention of soil. According to Joseph Jenkins, humus is said to hold nine times its weight in water as compared to sand and clay which can only hold .02 and .2 times their weight in water respectively.[35] Humus also darkens the color of the soil which helps it absorb heat.

As described earlier, composting organic matter keeps the human-nutrient cycle intact. Studies have also indicated that composted material can even help keep heavy metals out of the food chain. Lettuce grown in soil with high lead contents had 64 percent more lead than lettuce grown in the same soil with compost added.[36]

Costs of Composting Toilets

Costs are a necessary consideration when discussing composting toilets. According to the US Environmental Protection Agency, "it is more cost-effective to treat waste on-site than it is to build and maintain a central sewer system to which waste will need to be transported."[37]

[33] http://www.ghdglobal.com/pdf/CompostingToilets.pdf
[34] Kellogg, Scott and Stacy Pettigrew. *Toolbox for Sustainable City Living.* New York: South End Press. 2008.
[35] Jenson, Joseph. *The Humanure Handbook*. Grove City, PA: Joseph C. Jenkins. 1994.
[36] Ibid.
[37] "Water Efficiency Technology Fact Sheet." US EPA. 1999.

One study found that for a development of 2000 residential units, composting toilets are cheaper than replacing old sewer systems with new ones.[38]

Cost-benefit analysis is sometimes difficult because of the controversy over the "true cost" of water. While water prices for customers vary in different regions, water and sewage systems add a significant cost to users that pay for these infrastructures through taxes. As water becomes increasingly polluted by various synthetic products and communities sprawl across large areas, usable water becomes scarce and prices are expected to rise.[39] It also difficult to quantify the value of things like clean water, health benefits from food produced with natural fertilizer, and making individuals responsible for their own waste.

Where Humanure Is Happening

Composting toilets have been most popular in places where more traditional sanitation systems are not available. They are more common in rural areas where toilets cannot be connected to conventional sewage systems or soil isn't suitable for septic systems. Composting toilet companies, like Biolet, find their largest markets in Maine, Alaska, Texas, and the upper Midwest, according to Operations Manager, Jim Weaver.[40] Though many composting toilets can be found in rural vacation homes, they are not the only market for these toilets. One of the fastest growing markets for composting toilets is in the American southwest where water shortages are common. The savings of waterless toilets offer is an alluring prospect in these dry climates. One woman recounts her experience in the Los Angeles Times. Though originally horrified by the idea of a composting toilet, she bought one because she needed a backup for

[38] http://www.ghdglobal.com/pdf/CompostingToilets.pdf
[39] Preager, Dave. *Poop Culture: How America is Shaped by America's Grossest National Product*. Los Angeles: Feral House. 2007.

[40] "Cities Contemplate the Composting Toilet." *Green Cities Contemplate the Composting Toilet Comments*. Web. 04 May 2013.

her constantly failing toilet and the impending threat of water rationing in 2009 Southern California.[41]

Composting human waste is certainly not a glamorous topic or one that environmentalists could market as sexy to the public. Yet the state of current waste systems demands a shift toward a more sustainable solution. Composting human waste no longer has to be something only done in rural communities. It is a sustainable solution that can and should be implemented in cities.

Composting in the City

More than half the world's population lives in cities. In the US today, eighty percent of the population lives in an urbanized area.[42] The amount of waste produced in cities is tremendous but so is the opportunity to harness and recycle that waste. Urban density presents a more environmentally friendly way to live and the "possibility for a better quality of life and a lower carbon footprint through more efficient infrastructure and planning," according to C40 Cities.[43] Urban composting toilets is not only a possibility, it's an imperative. Composting toilets, implemented in cities, would save water, improve local soil quality, relieve burdened wastewater treatment facilities, create jobs, and bring people closer to their own bodily functions. The instances of urban composting toilets so far in the US have been met with acceptance, though most are happening in parks or buildings that are heavily marketed as "green buildings."[44]

[41] Carpenter, Susan. "Taking the Plunge with a Composting Toilet." *Los Angeles Times*. Los Angeles Times, 28 Feb. 2009. Web. 04 May 2013.
[42] "Geography." *2010 Urban and Rural Classification*. Web. 04 May 2013.
[43] "Why Cities?" *C40 Cities: Climate Leadership Group.* Web. 04 May 2013.
[44] "Cities Contemplate the Composting Toilet." *Green Cities Contemplate the Composting Toilet Comments*. Web. 04 May 2013.

An urban composting toilet system also goes back to the idea of good design. The quantity and composition of human excreta varies according to socioeconomic level, food diet and climate.[45] It is recommended that sites are studied before the composting toilet system is designed. It is difficult to design a one-size fits all system that is easily transferred to different cities, or even different parts of the same city. There would be no room for a "one size fits all" composting toilet system. A comprehensive and well thought out design would be necessary to implement a human waste recycling system. Designs done deliberately are far more likely to be successful.

Once a system is designed intelligently, the largest issue will be shifting the public perception of composting toilets. It will require a paradigm shift in how we conceptualize sanitation.

Problems with Poop

While many of them have to do with public perception, there are real potential problems like the issue of transporting waste out of buildings and off-site without the use of water or a very high energy system. Others include the possibility of human waste being used as manure before all bacteria and pathogens have died.

On an individual level, switching to composting toilets is not difficult. On a community level, making the switch is a lot more complicated. The refuse must be transported safely and efficiently, a public education plan must be implemented, and there must be a place for the refuse to be stored and spread on land.

[45] Jenson, Joseph. *The Humanure Handbook*. Grove City, PA: Joseph C. Jenkins. 1994.

One of the biggest problems with composting toilets is their questionable legality in most places. The EPA warns that human manure must be dealt with in accordance with state and local regulations, minimizing human contact with the material and the materials contact with disease vectors.[46] Current laws dictate that composted human waste must either be buried or removed by a licensed septage hauler.[47]

One of the common objections to composting toilets is that they will produce offensive odors. Much of the civilized Western world has enjoyed the luxury of an odor-free excreting process. Yet when properly managed, urine and feces do not produce offensive odors.[48] National news corporation, Fox News, even reported a story about the surprisingly odor free nature of composting toilets.[49]

Despite its smell, it is difficult to convince people composting toilets are a worthy idea due to the taboo nature of human feces and urine. Joseph Jenkins calls it fecophobia. Author of *Poop Culture: How America is Shaped by its Grossest National Product* Dave Praeger calls it fecal denial.[50] Both terms adequately describe how most people feel about human waste. The *Toolbox for Sustainable City Living* aptly summarizes the social resistance to composting feces: "Raised in a society that disassociates itself from its own wastes, most people are very squeamish about the subject. Feces are seen as something deeply unclean that should immediately disappear. Overcoming cultural obstacles is an enormous task." The flush and forget culture needs a transformation.

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[46] "Water Efficiency Technology Fact Sheet." US EPA. 1999.

[47] Ibid.

[48] Kellogg, Scott and Stacy Pettigrew. *Toolbox for Sustainable City Living.* New York: South End Press. 2008.

[49] "Composting Toilets: Not Gross at All." *Fox News*. FOX News Network, 01 June 2012. Web. 04 May 2013.

[50] Preager, Dave. *Poop Culture: How America is Shaped by America's Grossest National Product*. Los Angeles: Feral House. 2007.

Cultural Transformation

The biggest barrier to the implementation of composting toilet is human perception. People worry that composting toilets will be odorous, difficult to clean, cumbersome and expensive. Others worry about using human waste as plant fertilizer. Does human waste seep into the ground? Will it harm the plants? Will people be comfortable eating food grown with human waste? These are all questions and issues that need to be addressed. Changing the way we deal with waste requires a paradigm shift. It is necessary to examine specific measures we can take now to move toward an urban composting toilet system.

There is a growing field of researchers dedicated to science and environmental communication, especially since the environmental movement has traditionally required help communicating the need for people to alter their behavior.[51] As of now, there is no strategy within the environmental movement to make composting toilets a mainstream product, but environmental communication research can be applied to create one. A common misconception in the field of communications is that the more information people are exposed to, the more they will alter their opinions and behaviors. This has been proved many times incorrect.[52] Just because people know that soda is bad for their health does not necessarily mean they will stop drinking soda. Even when people know that car emissions contribute to global climate change, they will usually continue to drive their cars.[53] If the public knows the environmental benefits of composting toilets, it's likely that they still wouldn't buy a toilet that composted their own feces.

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[52] "Mind the Gap: Why Do People Act Environmentally and What Are the Barriers to Pro-environmental Behavior?" *Taylor and Francis*. Web. 04 May 2013.
[53] Ibid.

As Michael Schellenberger and Ted Nordhaus explain in their popular essay, *The Death of Environmentalism*, the environmental movement historically has narrowly defined itself, pitting human interest against environmental interest and calling for sacrifice in the name of the environment. This is usually alienating for a large portion of the public.[54] Composting toilets, then, should not be primarily marketed as a necessary action in order to preserve the nutrient cycle for the Earth. Instead it should be framed as a course of action necessary to preserve the nutrient cycle to grow food for human consumption.

A study by Sol Hart and Erik Nisbet on climate change communication, suggests that focusing on the immediate and local effects of climate change drives behavior change more than a focus on more dramatic effects at a further social and geographic distance. Their findings show that the best way to convince both sides of the political spectrum to support policy action is to frame the environmental problem as a local public health issue.[55] Framing environmental problems as public health problems is an increasingly popular way to affect change in communities. Ecological sanitation is easily framed as a local public health issue, as every community has a wastewater treatment plant and a local source of water. In rural areas, composting toilets decrease the amount of feces that can seep into local water supplies from septic tanks. Health issues are slightly more difficult to present in urban environments, where there is a great disconnect between residents and the natural environment. For example, in Washington DC many people do not know where their water supply comes from. However, if

[54] Schellenberger, M. & Nordhaus, T. "The Death of Environmentalism: Global Warming Politics in a Post-Environmental World." The Breakthrough Institute. 2004.
[55] Hart, P., & Nisbet, E. "Boomerang Effects in Science Communication: How Motivated Reasoning and Identity Cues Amplify Opinion Polarization About Climate Mitigation Policies Communication Research." 2003.

people can be educated on where their water comes from, they may also be educated on the likelihood that their water can be contaminated.

Additionally, research cited in the World Wildlife Fund's report, *Weathercocks and Signposts: the Environmental Movement at a Crossroads*, shows that intrinsic motivations for behavior change are far more likely to lead to pro-environmental behavior. The report goes on to suggest that in order to extend the reach of the environmental message and ensure it is a pervasive one, leaders must appeal to people's intrinsic motivations, like seeking personal growth or community involvement. The messenger must also be transparent on their motivations. *Weathercocks and Signposts* critiques the more traditional marketing approach to behavior change which traditionally attempts to preserve the current lifestyle and drives small behavior change by promising social status or self-interest.[56] For example, marketing composting toilets as a way to save money on water bills will likely be less effective at changing the social status of composting toilets than marketing them as a way to become closer to the environment and the health of the earth.

When it comes to environmental issues, the media has demonstrated their commitment to portraying a balanced perspective. More times than not, this balance is a false one. For example, climate change skeptics in the US are fueled by the so-called experts who claim climate change is not manmade, despite the fact that 98% of climate scientists are in agreement that climate change is indeed caused by human activity. Skeptics believe the issue is a highly controversial one within the scientific community, despite the general consensus

[56] Crompton, T. "Weathercocks and Signposts: The Environmental Movement at a Crossroads." UK World Wildlife Fund. 2003.

among scientists that climate change is manmade.[57] The facts on composting toilets must be established so that they are irrefutable to the skeptics. It's also valuable to avoid mentioning the implication composting toilets have for climate change.

Composting toilet literature must increase. Many people do not even know what a composting toilet is. Countless times I have mentioned composting toilets to liberal college educated peers and received, "I didn't know you could compost toilets." Rarely are composting toilets discussed in the mainstream media. Thus it continues to be viewed as a "radical environmental" practice. A great number of the articles that exist discuss composting toilets as a solution to sanitation problems in the developing world. Rarely are they discussed as a feasible or practical solution to the wasteful current human waste disposal system.

Composting in the Capital

Currently, the majority of Washington, D.C. operates a wastewater collection system of separate sewers. One piping system is for, what DC Water calls, "sanitary sewage (i.e., sewage from homes and businesses)" while the other system is for storm water. A geographic two-thirds of the city is served by this kind of sewage system. However, one-third of this city of 617,000[58], is still served by a combined sewer system where storm water and human sewage travels in one pipe. Washington, D.C.—infamous for its storm water runoff problems—often experiences overflow of these pipes. The excess waste water and human waste, or Combined Sewage Overflow, is "discharged directly into the Anacostia River, Rock Creek, the Potomac River, or tributary waters."[59] This pollutes natural water systems. The water from the Potomac

[57] Dunlap, R. & McCright, A. "Organized Climate Change Denial." *Oxford Handbook of Climate Change and Society*, ed. David Schlosberg, John Dryzek, and Richard Norgaard. Cambridge: Oxford University Press. 2011.
[58] "Rural and Urban Households." US Census Bureau. July 2011.
[59] "District of Columbia Water and Sewer Authority." *Combined Sewer System*. Web. 04 May 2013.

is also extracted again to be purified to become drinking water—an energy intense process, especially given the highly polluted nature of the water.

Unfortunately, the soil in the region is sub-optimal for large scale crop production[60]. It is time for the city of Washington, D.C. to move toward a sustainable system where human waste can safely and sustainably support local food production.

The legal regulations are stringent. Section 900 of the DC Zoning Code prohibits all methods of human excreta disposal other than a "water-closet connected with a public sewer." However, individuals may apply for permits that meet certain guidelines. To use composting toilets in the District, one must obtain a permit from the DC Zoning Commission as per Section 904. The application process is arduous and requires that the applicant to prove that "the method can be maintained without endangering the public health or otherwise creating a nuisance." This is up to the Director's—Sarah Benjamin Bardin—discretion. Section 908 of the DC Zoning Code lays out the guidelines for "disposal of human excreta," stating that all body wastes must be handled, transported, stored and disposed of by an District authorized entity. The handling, transport, storage and disposal of human excreta must be done quickly and cannot endanger public health or cause a public nuisance. There is special consideration to make sure flies cannot come in contact with the excrement, by mandating that any transport of the waste is in air-tight containers.[61] The receptacle must also be located to prevent the pollution of a water supply, pond, pool or lake and prevent the contents from overflowing.[62]

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[60] Jenson, Joseph. *The Humanure Handbook*. Grove City, PA: Joseph C. Jenkins. 1994.
[61] "DC Office of Zoning." *DC Office of Zoning*. Web. 04 May 2013.
[62] Ibid.
[62] Jenson, Joseph. *The Humanure Handbook*. Grove City, PA: Joseph C. Jenkins. 1994.
[62] "DC Office of Zoning." *DC Office of Zoning*. Web. 04 May 2013.
[62] Ibid.

The codified regulations are somewhat ironic considering the rampant pollution that occurs as a result of the so-called "sanitary" conventional sewer system.

Washington DC would make an ideal place to pilot an urban composting toilet system. The city is a national leader in green technology. Using the research on environmental education and knowledge of the city's inhabitants, different educational materials can be created.

Educational material should be circulated to help make composting toilets more appropriate. Infographics that can easily be circulated online are a valuable way to reach young people (see Appendix A) Research by the National Science Foundation on attitudes toward science and technology indicate that people get more of their news on science and technology from the internet, over traditional news outlets (i.e. television and print newspaper).[63] The same study found that younger Americans tend to know more about science and technology than older Americans.[64] This bodes well for the future of science in America and possibility for superior sanitation systems to become the new normal.

Composting toilets represent an incredible opportunity to improve sanitation systems and address several environmental issues. Most importantly it is an opportunity to market a sustainable solution that can have far-reaching value in shifting cultural attitudes toward waste. Architect William McDounough says that to reach true sustainable systems we need not to eliminate "waste" but rather need to eliminate the *concept* of waste.[65] The etymology of the

[63] National Science Foundation. "Public Attitudes Towards Science and Technology." Science and Engineering Indicators 2012. Washington, DC: National Science Foundation. 2012.
[64] Ibid.
[65] McDonough, William. April 22 2013. American University. Washington, DC.

word “waste” is traced back to the Latin word, “vastus” meaning unoccupied or uncultivated. Human feces are not waste until it is wasted. The colloquial and often vulgar word “shit” is believed to come from a Proto-Indo-European word meaning “to separate.” Ironically shit is the more appropriate word for bodily excrement when discussing composting toilets. It is only human “waste” when it is unused. When human excrement is composted to become a valuable soil additive, it is more aptly called “shit.”[66] The future of sustainability may be filled with more shit than we could expect.

[66] George, Rose. *The Big Necessity.* New York: Metropolitan Books. 2008.

Appendix A: Composting Toilet Educational Material Example