The SOIL Guide to Ecological Sanitation

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First Edition, February 2011

Sustainable Organic Integrated Livelihoods (SOIL)

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This document is dedicated to SOIL's incredible team. We are so grateful to the people on the ground that made this possible!

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And thank you to the SOIL board for their constant support.

Moira Duvernay, Sister Mary Finnick, Jennifer Benorden, Jessica Covell, Kefryn Reese, Jessica Lozier, David Reese and Lavarice Gaudin.

With love and respect,

Sasha Kramer
Co-Founder and Executive Director

Acknowledgements

This guide is based on our five years of experience working with ecological sanitation (EcoSan) technologies in Haiti but it would not have been possible without the collective knowledge of many EcoSan practitioners around the world and those that have supported our work over the years, through success and failure.

SOIL was co-founded in 2006 by Sarah Brownell and Sasha Kramer. Though Sarah no longer works with SOIL, many of the ideas and designs in this document were developed while Sarah was still directing the organization and she has made an indelible contribution to the work of SOIL.

SOIL first learned about ecological sanitation through the work of Peter Morgan (Zimbabwe), Cesar Anorve (Mexico), Ron Sawyer (Mexico) and Joseph Jenkins (USA). Building on their years of dedication and experience, we have worked to modify and adapt EcoSan to the cultural and environmental context of Haiti. Innovation is an iterative process and we are proud to be part of the global community that is working to promote EcoSan. It is our hope that this guide can become part of that process, serving as a springboard for new advances.

Though several individuals carried out the writing of this guide, the work described herein was performed by SOIL's incredible staff on the ground in Haiti. We are honoured to work with a team of dedicated Haitians who share our mission of promoting innovative solutions to combat poverty. They have worked selflessly for years to ensure that this technology is presented through engagement and dialogue with local communities and to guide our interventions according to demand and need.

We are especially grateful that Oxfam GB partnered with us for the past two years to help us realize our goals in northern Haiti and Port-au-Prince. Without their support this work would have taken many more years to achieve. We have also benefitted from the input and guidance of DINEPA, the Haitian government agency responsible for water and sanitation, and we look forward to collaborating with them in the future.

And most importantly we are thankful for our families, friends and colleagues around the world who have followed and supported our work, and for the individuals, businesses and foundations who have made this guide possible.

A Note to Our Readers

The SOIL Guide to Ecological Sanitation was created in response to increasing requests from individuals and organizations interested in starting ecological sanitation (EcoSan) projects across the globe. This guide is meant to be as comprehensive as possible within the scope of our experience. This first edition of The SOIL Guide to Ecological Sanitation focuses on urine diversion toilets (also called UD toilets or dry composting toilets), though there exist, and SOIL has built, many other types of EcoSan toilets.

We hope that this guide can help others interested in implementing EcoSan projects to avoid some of the mistakes that we have made and capitalize on our successes. We look forward to your feedback and are anticipating that future editions will be much more thorough as a result of this feedback.

This guide has been created as a resource for all those interested in EcoSan and as such we are pleased to have it shared widely. That said, we ask that the following guidelines are respected. The SOIL Guide to Ecological Sanitation may be copied and distributed without SOIL's permission with the following conditions:

1. No information is changed,
2. SOIL is credited for the document, and
3. the distribution is not for profit.

We also wish to add that although this guide contains an overview of our work to date and of the lessons we have learned, many of the details will not be applicable in every situation. In particular, we wish to draw your attention to the following:

1. The implementation of a successful ecological sanitation project is heavily dependent upon appropriate training, education and community buy-in. The relevant sections in The SOIL Guide to Ecological Sanitation on software should be read closely before attempting to construct EcoSan hardware (toilets or compost facilities).
2. Technical terminology in English or American English has been used wherever possible in this document and in the technical specification. However, the document was created in Haiti and certain elements have been described in Creole, e.g. 'Blok 15' instead of '15 cm wide cinderblock'.

SOIL assumes no responsibility for the success or failure of other's projects; we only hope that our experiences will provide some insight that will be useful.

Thank you for your interest in ecological sanitation and good luck in your future endeavours.

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Glossary of Terms

Term	Definition
A	
Ascaris worm	A pathogenic worm which is the most resistant of all the pathogens to heat, and therefore to treatment of excreta by thermophilic composting. Ascaris is used as an indicator organism for determing pathogen kill-off in thermophilic compost treatment.
Arborloo	A simple toilet technology. Essentially a very shallow pit latrine which is covered with earth when full, and then a tree planted in it.
B	
Bagas	Sugarcane bagas is the shredded husks of the sugarcane. It is usually created as a waste product by factories which use sugarcane to produce alcohol.
C	
Chamber, toilet	Toilet chamber: Usually refers to the space beneath the toilet cubicle where the poop is collected or composted, i.e. the space beneath the poophole.
Child User	Toilet user, child. Defined by having a physical size unable to effectively use a standard UD toilet seat. Child user age is usually less than 6 years old.
Communal toilet	A toilet shared and managed by a small population, e.g. 5 families. Only members of these families have a key to access the toilet.
Composting	The process of decomposing organic matter to create humus.
Compost site	Location where composting occurs, usually containing specialized compost structures.
Compost structure	A specialized structure designed and constructed to hold a compost pile.
Compost pile	A mass of compost, irrespective of the structure (or lack thereof) containing it.
Compost operative	Trained staff member working at compost site.
Cubicle, toilet	Toilet cubicle: Usually refers to the space above the poophole where the user sits and poops.
D	
Drums	A vessel of variable size and material. The guide often refers to drums, meaning the 15 gallon poop drums which collect the poop.

Term	**Definition**
Double vault UD toilet	A UD toilet with 2 vaults, or chambers, beneath the cubicle. When one vault is full, the poophole is closed and a new poophole is opened above the new vault.
E	
F	
Female User	Adult toilet user, female.
G	
H	
Hardware	Tangible, or 'hard', components of an EcoSan project, i.e. construction.
Household toilet	A private toilet for use by a single household. The household is responsible for maintenance of the toilet.
Humanure compost	Compost created using human excreta.
Humanure toilet	A simple EcoSan toilet designed by Joe Jenkins, which collects both urine and faces arrive in the same container.
Humus	Completely decomposed organic matter.
I	
IDP	Internally Displaced Person. Some 1.5 million IDPs lived in IDP camps after the 2010 Haiti earthquake.
J	
Ji kaka	Kreyol for leachate from a compost pile'
K	
Kaka	Kreyol for 'Poop'.
L	
Leachate	Liquid from a compost pile, usually dark brown and turbid with a high microbial content. Often referred to as 'ji kaka'.
M	
Male User	Adult toilet user, male.
N	
O	
Operator	Used to describe the person responsible for the good operation of the toilet, either paid or unpaid. Term

Term	Definition
	covers a multitude of alternatives including: Toilet cleaner, Toilet manager, Responsab twalet, Responsable assainissement.
P	
Poop	Human excreta.
Poophole	Hole built into toilet seat structure to allow poop to pass from the toilet seat to the poop collecting vessel below.
Public toilet	A toilet open to the public, regardless of which community they come from. Public toilets can be free or cost.
Q	
R	
S	
Soak away (or soak away pit)	A hole in the ground, in-filled with granular material such as rocks or gravel, which allows liquid such as urine to infiltrate the soil and soak away.
Software	Intangible, or ‘soft’, components of an EcoSan project, i.e. education.
SOIL UD toilet	The finished constructed urine diversion toilet designed by SOIL, can be of wood or concrete construction.
SOIL UD seat	The urine diversion seat used in the SOIL UD toilet, designed and fabricated by SOIL.
T	
The SOIL Guide / The Guide	The SOIL Guide to Ecological Sanitation
U	
UD toilet	Urine diversion (UD) toilet, sometimes referred to as a ‘dry’ toilet. Uses a special UD toilet seat to separate urine and faeces and directs them to separate containers.
User	Toilet user of adult age, male or female.
V	

Term	Definition
W	
WASH	A professionally used acronym for: Water, Sanitation, Hygiene.
X	
Y	
Z	

Introduction to Ecological Sanitation

What is ecological sanitation?

Some call it feces and some call it humanure and some call it other things not fit for this document, but for simplicity's sake, let's just call it poop. Everybody poops and it has to go somewhere. So it should be important to everyone where it goes…

> *"Our poop does more for this community than you do."*
>
> *Community leader Madam Bwa of Shada speaking to an on-looker who was making fun of community members who emptied a dry toilet in her neighborhood.*

Ecological sanitation (EcoSan) is an integrated sanitation strategy developed through traditional knowledge and biological science in which natural processes are utilized to transform human wastes (poop and pee) into fertile soil (Esrey, 2001). EcoSan is based on three principles:

1. the prevention of pollution rather than an attempt to control or mitigate it after the fact;
2. the sanitization of urine and poop; and
3. using the resulting safe products to enhance agricultural production.

EcoSan provides an innovative, low-cost solution to multiple problems faced by the world's poor and has the potential to simultaneously improve a community's:

- **Health** by reducing open defecation and contamination of drinking water supplies that lead to waterborne illnesses and associated diarrhea, malnutrition, growth stunting, and death.
- **Environment** by keeping human wastes out of rivers, lakes, and oceans (where it causes nitrification and algae blooms and kills fish) while providing organic fertilizer for agriculture and reforestation.
- **Food access/nutrition** by improving agricultural yields through organic fertilizers.
- **Economy** through sales of compost, development of small scale community waste management businesses in urban areas, increases in agricultural yields and reduced medical costs and sick days.
- **Aesthetics** by keeping beaches, streams, ravines, fields, forests and city streets beautiful, safe and stink free.

Why is ecological sanitation important?

Despite the fact that the United Nations General Assembly dedicated a decade (1981-1990) to water and sanitation issues, as of 2010 diarrhea related to poor sanitation, water, and hygiene still accounts for 2 million deaths per year worldwide (WHO, 2011). The burden of waterborne illness falls disproportionately on children, contributing significantly to high mortality rates in those under age five, malnutrition and growth stunting.

Nearly half of the world's population has no access to a sanitation system and most sewer water in impoverished countries is discharged without treatment, posing a serious public health risk and contaminating aquatic ecosystems.

Meanwhile, as nutrients from human wastes accumulate in estuaries and other aquatic ecosystems, much of the world's farmland is being progressively degraded, and in many regions of the world productive capacity has stagnated or even declined. This phenomenon disproportionately affects poor farmers, who seldom have access to fertility-enhancing agricultural inputs and are, therefore, dependent on ecosystem services to maintain soil fertility. Without substantial inputs of organic matter to balance harvests, soil biological activity and nutrient availability are reduced and yields decline. Low soil fertility forces many small farmers to find other land, or leave their land and families in search of other work, fracturing the social fabric of rural communities.

The environmental, social, and public health crises faced by poor rural communities point to the urgent need to combat rural poverty and to promote research geared towards regenerating the deteriorated resource base of rural communities. Improved quality of life in rural communities has a much wider scope, as it can reduce the flood of people and resources into already overburdened urban centers.

History of Ecological Sanitation

The concepts behind ecological sanitation are based on natural processes and, as such, have been understood and practiced by indigenous cultures for centuries. In China, human wastes, called “night soil”, have been collected and used to enhance agricultural productivity for over 500 years (McNeill, 2004). Throughout Africa and Latin America, peasants will explain that their most productive fruit trees can be found on or near old latrine sites. Even an observant suburban American has noticed that the grass is greener near the septic tank.

Organized efforts to study and promote ecological sanitation as a development strategy are relatively new. The first International Conference on Ecological

Sanitation (EcoSan) was held in Nanning, China, in 2001 and included scientists and promoters from Europe, Africa, Asia and Latin America. Since that time, EcoSan projects have been initiated around the world. These projects however, have mostly been small pilot projects and examples of large scale implementation are lacking.

Issues with Traditional Approaches: The Price of Sewers and the Problem with Pits

The two primary sanitation approaches promoted globally are:

1. to flush the wastes away with water through sewers that lead (sometimes) to a treatment plant, or
2. to soak the wastes into the ground and let the soil filter it as is done for deep-pit latrines and septic tanks.

Both of these approaches remove raw human wastes from the immediate household environment, and, as such, the spread of these technologies has significantly reduced the transmission of waterborne disease (Montgomery M., 2007). However, both approaches have unintended environmental consequences, which affect both public health and the long-term sustainability of these sanitation systems.

Sewer systems

The standard approach to sanitation in industrialized countries is to use water to carry sewage away from the source. Water flush toilets can range from manual pour-flushing into an underground holding tank to automatic flushing into a municipal sewage system. The public health and environmental consequences of water flush toilets is highly dependent on how the sewage is treated after it leaves the toilet. The vast majority of sewage produced in Africa, Asia and Latin America is discharged into aquatic systems without treatment, and is a major source of water pollution. All water flush toilets share the feature that they require significant amounts of water (up to 6 gallons per flush).

Problems with water borne sewage arise when:

- ***Public money is tight:*** many developing countries do not have the resources for sewer projects for cities that have burgeoned with unplanned settlements and are stressed beyond the capacity for which they were designed.

- ***Sewage is discharged untreated***: when raw sewage is discharged into aquatic ecosystems it increases both nutrient concentrations and faecal pathogen loads. If these aquatic systems are near or upstream from human habitations sewage can pose a serious public health risk. Even when sewage is discharged far from humans, the nutrients can cause shifts in aquatic ecosystems, which ripple throughout the food chain.

- ***Water is scarce:*** when water is scarce or people live far from a water source, flush toilets are dependent on constant labor(usually performed by women and children) and often experience problems with clogged pipes. Access to running water is largely determined by economic status, and flush toilets are not designed to cater to the poor. As clean water resources become more and more scarce it will become increasingly difficult to maintain flush toilets, even in wealthy countries.

Pits and septic tanks

Deep pit latrines can be anywhere from 6-25 feet deep and are often lined to prevent collapse. The pit latrine is one of the simplest and cheapest means of disposing of human wastes. If well designed and built, correctly sited and well maintained, it contributes significantly to the prevention of diseases transmitted through human wastes. If pits are dug at least 30 meters from water sources and at least 1.5 m above the water table then the faecal material will be slowly decomposed over a period of years and safely converted to soil.

Problems with pits arise when:

- ***Groundwater is high or the area floods:*** When the groundwater rises above the bottom of the pit, nutrients and microorganisms from human wastes mix with the water table and can cause serious environmental and public health problems.
- ***Mosquitoes breed in the sludge:*** Because volumes of urine are so much higher than faeces, pit latrines generally contain standing water, especially in clay soils which can be breeding zone for flies and the mosquitoes that carry malaria and dengue fever.
- ***Ventilation is poor:*** Pit latrines can have terrible

odors when they are not well ventilated.

- ***Soil is vulnerable to collapse:*** deep latrines are prone to collapse in some soils, particularly if they are not lined. Pit collapses can be fatal depending on the depth of the latrine and the construction material.
- ***Latrine fills up:*** When pit latrines are full the only options are to abandon the latrine or pay someone to empty it. In many countries these latrines must be emptied by hand, which is a difficult and dangerous task. Latrines are often emptied into water sources, like the ocean or river to dispose of the wastes, and are sometimes left in gutters on the sides of streets.

Septic tanks similarly dispose of wastes on site by settling out the solids from flush water in a tank or series of tanks and filtering the excess water into the surrounding soil, often through a leach field. Again if they are correctly sited away from water sources, above the water table, and with enough drainage space, they can safely manage wastes. But they have similar problems to pit latrines in areas with high water tables or flooding and must also be emptied when full.

Ecological Sanitation Addresses These Problems

Ecological sanitation is a concept that grew out of traditional knowledge, recommendations and observations from people with experience using pit latrines. Many people with pit latrines have noticed that addition of ash or soil speeds the decomposition process, reduces smell and cuts down on fly and mosquito breeding. Ecological sanitation seeks to harness ecological processes to ameliorate some of the problems associated with traditional sanitation approaches by:

- **Using shallow pits or above ground structures:** Arborloos and Fossa Alternas are variations of the traditional pit latrine with the major difference being the depth of the pits. These are always shallow, not more than 1 meter deep, so they are less likely to reach the groundwater table. It is possible, however, that these shallow pit toilets cause groundwater contamination in areas with a very high water table or during floods. Urine diversion (UD) toilets, which will be the focus of this document, are completely above ground and there is no contamination of the toilet site.
- **Reducing standing water:** the addition of ash and/or other carbon materials to composting pit latrines and urine diversion toilets reduces moisture to avoid having standing water where mosquitoes can breed. Reducing standing water also cuts down on smells and flies.
- **Reusing contents as fertilizer:** the reuse of composted human wastes constitutes a beneficial way to treat the wastes and means that the

structures can be used for long periods of time as the contents are removed for fertilizer.

- **Keeping nutrients and pathogens in the soil and out of the water:** well-maintained ecological sanitation systems do not seek to dispose of waste but rather to transform it into rich soil, where nutrients are conserved and pathogens are killed during the composting process.
- **Not requiring water:** ecological toilets do not require water to flush or maintain, reducing the environmental costs by conserving a precious resource.

How can ecological sanitation create livelihood opportunities?

Ecological sanitation not only benefits the public, by reducing the spread of disease and improving environmental quality, it can also benefit the individual or family using or promoting the toilets by providing livelihood opportunities. The compost and urine that is collected from ecological toilets are valuable fertilizers that can either be sold or used to enhance agricultural productivity on the home garden or family farm. Family income can also be increased by improved health resulting from sanitation as healthy family members are more able to work and less money must be spent on hospital bills.

There are also numerous small business opportunities associated with ecological sanitation. Toilet seats for the various types of toilets can be manufactured and sold by entrepreneurial promoters, as can fruit trees for Arborloo toilets, encouraging the development of nursery businesses. Also, as many people will not want to maintain their own toilets, individuals, businesses, and governments can provide cleaning services, whereby they remove the compost and resell it to farmers. In many countries where deep pit latrines are prevalent there are people who are paid to empty the latrines. This is a dirty and dangerous job that requires coming in contact with untreated human wastes. With ecological sanitation these same people could be employed but their jobs would have the added dignity of harvesting a much-needed resource and the reduced risk of handling only composted, pathogen-free waste.

EcoSan is for Everyone

EcoSan is not just for the poor. As potable water supplies become scarce and more people crowd onto the earth, it makes less and less sense to use gallons of perfectly good drinking water to flush away our poop every time we go to the bathroom. Cities that experience water shortages are starting to ration water and even recycle their wastewater back to the drinking water plant (with treatment, of course) (American Chemical Society, 2008). We must ask the question, then, where does all that dirty water go? In the US alone, more than

50 billion gallons of water needs to be treated every day before being dumped back into rivers and oceans. Mexico City treats approximately 10% of its wastewater (LEAD, 2004) and every time it rains in San Francisco or New York those cities combined storm sewers dump millions of gallons of untreated wastewater into the ocean. Because of these problems, some wealthy cities have decided it makes more sense to keep the poop out of the water to start with.

Ecological sanitation projects are popping up all over the world. These projects range from small composting toilets in National Parks in the United States to large scale development projects in South Africa and Malawi (Morgan, 2007).

Why is ecological sanitation important in Haiti?

One of the most severe examples in the Western Hemisphere of both soil fertility and sanitation problems is located just 700 miles off the coast of Florida. Haiti, once known as the *"Pearl of the Antilles"* for its incredible productive capacity, is now a largely deforested landscape where the vast majority of the country's eight million inhabitants live in abject poverty. Environmental degradation is both the cause and the consequence of poverty in Haiti.

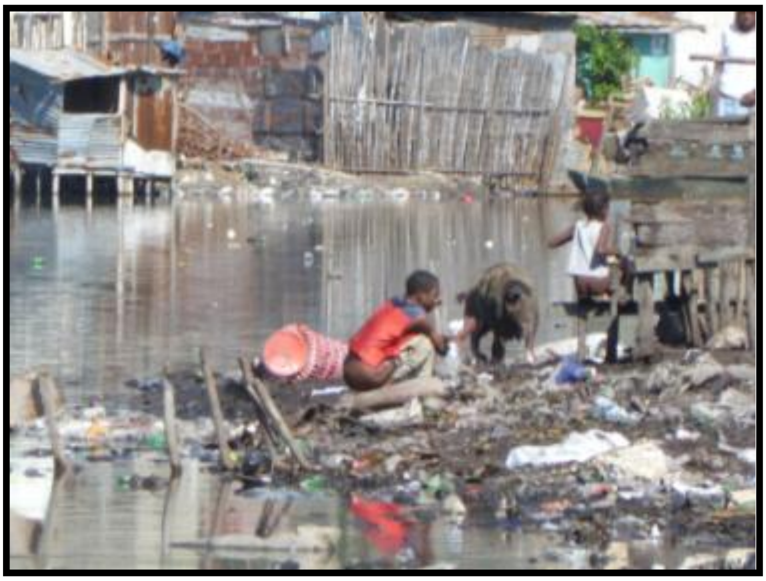
Many of Haiti's resources have been mined over the past two hundred, as a growing population struggles to recover from slavery and colonialism while continuously servicing massive international debt. Haiti's current resource crisis did not occur in isolation nor did it originally spring from mismanagement of resources on the part of the majority of Haitians, but rather the international pillaging of Haiti's extraordinary fertility began with slavery and colonialism, and continues through the more subtle and insidious forces of economic globalization.

Agricultural exportation using slave labor was only the beginning of the massive exportation of Haitian soil, first to Europe in the form of produce and wood products, and later to the sea from the deforested mountains. Haiti suffered the unique and economically devastating punishment of having to pay reparations to French slave-owners after the revolution of 1804, a struggle that represents the only successful slave revolution in history. In 1825 the Haitian people were forced to assume a debt to France of 90 million gold francs (equivalent to US $21.7 billion today) as "reparations" to their former "owners" in return for diplomatic recognition and trade. It took Haiti over 100 years to pay off the debt. To make the first payment the government had to close the few public schools that existed at the time, in what is called the hemisphere's first case of structural adjustment. In addition to preventing the newly independent nation from establishing a basic infrastructure for development, these payments to France contributed to massive deforestation, as Haiti's trees were exported to service the debt.

Through colonialism and economic manipulation, Haiti's resources were used to build Paris, not Port-au-Prince. Haiti's fertile soil was mined to provide the French with luxury imports of rum and coffee, while the majority of Haitians lived (and still live) on the brink of starvation.

The other major cause of deforestation is poverty, much of which can also be traced back to international debt. The lack of electricity infrastructure and inability to afford gas means that wood is the primary source of cooking fuel, and as a result only 3.2% of Haiti's forests remain intact, leading to soil erosion and reduced fertility for farming (Haiti, 2004).

Haiti is the only nation in the Western Hemisphere in which the majority of citizens subsist as small farmers. Over 60% of its 8,000,000 habitants live in rural areas and two-thirds of the workers are employed in agricultural production. Haitian agriculture is practiced by approximately 600,000 small farmers using an average surface area of 1.8 hectares. Yet, 80% of these farmers cannot satisfy the basic food needs of their families and the majority of producers depend on agriculture for less than half of their family revenue. SOIL nutrients have been depleted after 200 years of harvests with minimal nutrient inputs. In the past decade, per capita food production in Haiti has dropped 20% forcing the country to import 54% of its food supply. Haiti's health indicators are the worst in the region with a life expectancy rate hovering around 53 years of age and the incidence of childhood malnutrition is severe (Haiti, 2004).



One of the root causes of poor health in Haiti is lack of sanitation services. Only 12% of rural Haitians and less than 29% of those living in urban areas have access to improved sanitation facilities, by far the lowest coverage in the Western Hemisphere (UNICEF, 2010). Diarrhea and other infectious intestinal diseases cause 5% of all deaths and 15% of deaths in children under five. Acute diarrheal disease is the number one health problem of Haitian children under age five (PAHO, 2010).

Given the severity of the sanitation problem in Haiti and the implications for human health and the environment, there is a need for innovative solutions that can address these problems through interdisciplinary research and community-based implementation.

Introduction to SOIL

Sustainable Organic Integrated Livelihoods (SOIL) was founded in 2006 with the mission to transform wastes into resources in Haiti. From 2006 to 2009, SOIL worked in northern Haiti promoting integrated approaches to the problems of poverty, poor public health, agricultural productivity and environmental destruction. SOIL's primary objective has been to facilitate the community-identified priority of ecological sanitation (EcoSan), where human wastes are converted to valuable fertilizer. Following the earthquake in January 2010, SOIL expanded sanitation activities to Port-au-Prince to respond to the sanitation needs of those affected.

SOIL's work to date includes:

Construction of over 250 public EcoSan toilets in rural and urban areas and in IDP camps in Port-au-Prince. 	Conversion of portable toilets to urine diversion toilets. 
Establishment of 5 composting sites in Port-au-Prince and northern Haiti, the largest of which can treat the wastes of over 30,000 people. 	Production of over 150,000 gallons (568 m3) of compost from human waste. 

As a small, locally based NGO, SOIL has had the luxury of getting to know the communities in which we work making it easier to successfully pilot innovative technologies and adapt them to the needs of both rural and urban Haitians. Our work prior to the earthquake in a development context allowed us the time to make mistakes and respond to them accordingly. We offer this guide in the hope that our successes and failures can serve as a resource for others who wish to promote ecological sanitation.

For more information about SOIL, visit www.oursoil.org.

Frequently Asked Questions

- **Is EcoSan safe?**

  Yes. According to World Health Organization standards, fecal pathogens are killed after one week at a sustained temperature of 122 degrees Fahrenheit. When collected and composted properly, human faeces contain no harmful organisms and is indeed an excellent way, as it replicates nature, to return plant nutrients to the soil.

- **Doesn't it stink?**

  No. If a carbon source is properly added to the toilet and to the compost pile, there should be little to no smell.

- **Will EcoSan work anywhere in the world?**

  Yes, but each location will have different resources and challenges. Materials and management might vary greatly while the principles remain unchanged.

- **What are the advantages of urine diversion?**

  Urine is an excellent source of plant nutrients however it is very high volume and difficult to transport. Mixing urine and poop also leaves toilet contents wet which can cause increased smell and odours unless carbon cover material is significantly increased as well. For ideal composting, urine should be integrated into the compost pile to increase the final nutrient content, however it is often advisable to separate the urine from the poop in the toilets themselves to meet the following objectives:

  - Reduced volume of material requiring sanitization and transportation. In urban contexts, where offsite composting is necessary, urine diversion can significantly reduce transport costs.
  - Less carbon cover material required to reduce odor and flies

  SOIL has built and continues to build non-separating ecological toilets (such humanure toilets and arborloos) in combination with public UD systems. These toilets are primarily used by children (as their anatomy doesn't allow them to properly utilize a urinediversion toilet) and for those unable to climb the steps up to a urine-diversion toilet.

- **Can I do this at home?**

Absolutely! Please see our *Resources* section for further information on building a household EcoSan toilet. As well, SOIL is presently working on household toilet designs and we hope to add this information to future versions of the SOIL Guide to EcoSan.

- **What if I don't have access to bagas or another carbon source?**

Having a carbon source is key to successful primary and secondary composting. In addition, the use of carbon materials greatly reduces odors and makes the toilet and compost much less attractive to flies. Carbon sources will differ from site to site, but the following criteria are important to maintain a properly functioning toilet and compost system:

  - The material should be as fine as possible to ensure that it covers the poop completely, reducing access for disease vectors such as flies.
  - Cover material should have high carbon content and decompose quickly for production of high quality compost.
  - Material must be locally available in quantity.

Good choices are ash, shredded leaves or corn cobs, shredded cardboard or paper, sawdust and wood chips (though some wood products can be very slow to decompose). Soil may also be used if nothing else is available and soil is locally abundant.

- **Will SOIL build a toilet for my organization?**

Unfortunately, SOIL does not have the capacity to build toilets around the country - our operations are solely focused on Port-au-Prince and on the three northern Haiti communities of Cap-Haitien, Milot and Borgne - but we do want to do whatever we can to assist you because SOIL wholeheartedly supports the spread of EcoSan in Haiti and abroad. We worked very hard to include in this document all the best information possible on our toilet designs, compost techniques, lessons learned and best practices, so that your organization has the tools to develop its own EcoSan toilet project.

We also welcome you to come see one of our toilets in person, if your organization is based in, or will be traveling to, one of our project areas. Please contact us at info@oursoil.org for a toilet tour.

- **Where can I find more information?**

  You can find more information about SOIL at www.oursoil.org or you may email us at info@oursoil.org. Please see our Resources section in this document for further information on EcoSan and related topics.

Resources

Documents

World Health Organization. Guidelines for the Safe Use of Wastewater, Excreta and Greywater. Volume 4: Excreta and Greywater Use in Agriculture. 2006. Available at: http://www.who.int/water_sanitation_health/wastewater/gsuweg4/en/index.html

Uno Winblad, Mayling Simpson-Hébert, Editors and co-authors. Ecological Sanitation: Revised and Enlarged. Stockholm Environment Institute, 2004. Available at: https://wiki.umn.edu/pub/EWB/Uganda/SIDAGuidebook.pdf

Kamal Kar with Robert Chambers. Handbook on Community-Led Total Sanitation. Plan International (UK), 2008.
Available in English, French, Spanish, Hindi and Bengali (with links to Portugese and Khmer translations and Arabic available soon) at: http://www.communityledtotalsanitation.org/resource/handbook-community-led-total-sanitation

Elke Mullegger, Gunter Langergraber, Markus Lechner, EcoSan Club, Editors. Sustainable Sanitation Practice. Sanitation as a Business. Issue 5, October 2010.
Available at: http://www.ecosan.at/ssp/issue-05-sanitation-as-a-business/issue-05-sanitation-as-a-business

Anna Richert, Robert Gensch, Håkan Jönsson, Thor-Axel Stenström and Linus Dagerskog. Practical Guidance of the Use of Urine in Crop Production. EcoSanRes Programme Stockholm Environment Institute, 2010.
Available at: http://www.ecosanres.org/pdf_files/ESR2010-1-PracticalGuidanceOnTheUseOfUrineInCropProduction.pdf

Books

Peter Morgan. Toilets that Make Compost: Low-Cost, Sanitary Toilets That Produce Valuable Compost for Crops in an African Context. 2007.
Available in English and French at: http://www.ecosanres.org/toilets_that_make_compost.htm

Joe Jenkins. The Humanure Handbook: A Guide to Composting Human Manure, Third Edition. Joe Jenkins, Inc., 2005.
Available at:
www.josephjenkins.com

Organization Websites

Ecological Sanitation Research Programme
www.ecosanres.org

Centre Régional pour l'Eau Potable et l'Assainissement à faible coût (Centre for Low Cost Water Supply and Sanitation)
www.reseaucrepa.org

Direction Nationale de l'Eau Potable et de l'Assainissement (DINEPA)
http://www.dinepa.gouv.ht/

Humanitarian Response Haiti
http://haiti.humanitarianresponse.info/Default.aspx?tabid=61

Interim Haiti Recovery Commission, Water and Sanitation Goals
http://www.cirh.ht/sites/ihrc/en/Goals/Pages/WaterSanitation.aspx

Sustainable Sanitation and Water Management
http://www.sswm.info/home

Sustainable Organic Integrated Livelihoods (SOIL)
www.oursoil.org

Contact Us

SOIL supports all efforts to increase ecological sanitation practices in Haiti and abroad. We look forward to sharing more information with you about this exciting, low-cost way to provide effective, sustainable sanitation and simultaneously produce valuable fertilizer critical for agriculture and reforestation efforts.

SOIL offers consultation services on a case-by-case basis in the areas of education and waste treatment as related to ecological sanitation.

We hope and expect to have the SOIL Guide to Ecological Sanitation translated into Kreyol and Spanish. As well, we hope to release further editions with even more information and in other languages whenever possible. SOIL is also working in partnership with other organizations and the Haitian government to develop national guidelines for the use of ecological sanitation technologies in Haiti. If you have questions about national regulations or are planning a large scale project in Haiti, please contact DINEPA (the national water and sanitation authority) through their website which is listed on our resources page.

Lastly, we welcome your questions, comments, suggestions, experiences and lessons learned.

Please direct all correspondence regarding The SOIL Guide to Ecological Sanitation and all other SOIL activities to:

info@oursoil.org

We will respond as quickly as we are able. Thank you.

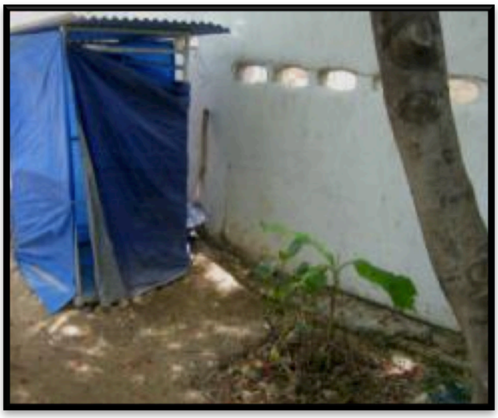
Sustainable Organic Integrated Livelihoods (SOIL) is a 501(c)3 US-based non-profit organization that has been working in some of the poorest areas of Haiti since 2006. SOIL is dedicated to protecting soil resources, empowering communities and transforming wastes into resources in Haiti. SOIL promotes integrated approaches to the problems of poverty, poor public health, agricultural productivity, and environmental destruction.

Visit us at: **www.oursoil.org**.

Introduction to EcoSan Toilets

There are many different toilet structures that could be described as ecological sanitation technologies. However, for the purpose of this section we will focus primarily on the urine diversion (UD) toilet which we have used extensively in Haiti. We have also used the humanure toilet developed by Joe Jenkins and the arborloo which has been widely promoted in Africa. A brief overview of each toilet type will be provided here, but the detailed operations and technical guidelines which follow will focus on the UD toilet as this is the design we have implemented most widely. Our designs are adapted from the work of others and in response to user feedback. The designs are constantly being adjusted to meet the needs and preferences of local communities. This introduction will briefly describe each type of toilet that SOIL has constructed and list some of the most relevant lessons learned.

Arborloo



The arborloo is a very low cost toilet ideal for rural areas where there is ample space and low risk of flooding. This toilet is a simple shallow pit (less than 1 meter) toilet with a light weight superstructure placed over a hole. The toilet itself can be either squatting or sitting and has a single hole with no separation of poop and urine. Each time the toilet is used, cover material (either soil or carbon rich organic material) is added to the pit to reduce odors and flies and speed the decomposition of the wastes. When the toilet is almost full the superstructure is moved to a new hole, the old pit is covered with a layer of soil and a tree is planted in the old pit. The decomposing wastes provide nourishment for the tree and the user never has to handle the wastes. This method is extremely low cost and a toilet can be built using only local materials.

Humanure Toilet

The humanure toilet that we have used in Haiti was designed by Joe Jenkins when he visited us in April 2010. This toilet is also very low cost (~$75 US) and can be constructed using local materials. The toilet itself consists of wooden box with a 15 gallon receptacle below the toilet seat. The box opens to allow easy removal of the receptacle when full and the toilet seat on top of the box provides comfort for users. These toilets do not separate poop and urine and are very good for children and handicapped users who may have difficulty with the UD toilets. This toilet is also an excellent option when the nutrients from the urine are desired in the compost, provided that transportation to an offsite composting facility is not necessary. Each time the user uses the toilet they apply a layer of cover material to reduce flies and odours and when the receptacle is full it is emptied into a compost bin and replaced with a clean receptacle.

Urine Diversion (UD) Toilet

The UD toilet is characterized by a special seat or squat plate which separates the urine and poop, ideally preventing any mixing of the two. Urine can be collected and used in agriculture or compost production or it can be drained into an underground soak away. Poop falls into the chamber below the toilet, which can either be a removable receptacle or a vault that is emptied only after long intervals of storage. UD technology has been used throughout the world but is particularly prevalent in Sweden, South Africa, Germany, India and Mexico. Urine diversion is based on the understanding that from a public health perspective it is most important to remove the poop from the environment, whereas urine does not pose a significant risk to humans. Urine diversion toilets facilitate the removal and treatment of poop, and also have increased user approval. The main benefits are:

- Reduction of odors and flies by reducing the moisture of the wastes
- Reduction in the amount of cover material needed
- Reduction in the volume of wastes needing to be removed from the toilet and treated
- Facilitation of pathogen die off through desiccation of the poop

SOIL has built three types of UD toilets to date, each of them relevant for different development and emergency contexts

A. Double vault toilet: This design was based on models in South Africa where each toilet seat has two chambers underneath. The poop falls directly into the chamber below where it is covered with carbon material. When one chamber fills the toilet seat is moved to the other chamber and the first chamber is sealed. The poop is stored in the first chamber until the second is full (length of storage will be dependent on the size of the chamber and the number of users). When the second chamber fills up the first is emptied so that it can be reused. Under ideal conditions or with very long storage times, the poop may have decomposed by the