


Title	Various Aspects of Ecological Sanitation in El Salvador and several countries in Latin American
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Short CV for Introduction Purposes (100 words max)	Born in Guayaquil-Ecuador. 14 February 1974. BSc in Civil Engineering, MSc in Sanitary Engineering from IHE-Delft, The Netherlands. Experience with the test and evaluation of composting latrine named SIRDO. Support for preparation of Workshop in Ecological Sanitation in El Salvador carried out by WASTE-Urban Advisors in Urban environment and Development. Currently working with Environmental Consulting Company Efficacitas, based in Guayaquil-Ecuador.
Photograph attached (jpg)	

Various Aspects of Ecological Sanitation in El Salvador and several countries in Latin American

Introduction

Accordingly with EHP, 2002, the population in the Latin America and Caribbean region with access to sanitation facilities is 80% (49% connected to conventional sewerage and 31% served by on-site sanitation systems, such as latrines and septic tanks). On-site sanitation in Latin America is applied widely in rural areas and small towns mostly through dry and wet conventional latrines, septic tanks and in fewer cases composting latrines. Urban areas in small and large towns have sewers, however only 10% to 15% of all domestic wastewater that is collected receives any sort of treatment before being discharged.

Ecological sanitation is based on three fundamental principles: preventing pollution rather than attempting to control it after we pollute; sanitizing the urine and the faeces; and using the safe products for agricultural purposes. This approach can be characterized as 'sanitize-and-recycle' (Winblad et al., ed. 2004). In many Latin-American countries (LAC) these principles have been implemented through different on-site sanitation projects with the know-how and technical support of an international organization (UNICEF, UNDP, GTZ).

In Latin America the "sanitize and recycle" approach was introduced into Guatemala in 1978, with the double-vault latrine (LASF- *Letrina abonera seca familiar*) adapted from the Vietnamese double-vault system and was replicated in Mexico, El Salvador and the Andean countries (Ecuador, Perú, Bolivia). Over the past 25 years many thousands of units have been built in Central America and Mexico (Winblad et al., 2004). Different type of latrines were built such as solar latrine, ventilated pit latrine and composting latrine. According to the system it is possible to separate urine from faeces, add soil, ash or organic waste.

Today there are many initiatives and projects involving ecological sanitation in México, Perú, El Salvador, Guatemala and the Andean Region (Ecuador, Bolivia and Perú). These initiatives are different in each country. In Mexico and El Salvador there are more intervention and many organizations promoting the Ecosan concept than in other countries. In Tepoztlán, a town located close to Mexico City, since 2002 is planning an ecological sanitation pilot program aiming at expanding and improving sanitation coverage within the town and surrounding periurban areas. The pilot project is taking into account a holistic approach to solve different aspects: grey water reuse, toilets design, municipal environmental and sanitation regulations and solid waste station.

The future of ecological sanitation in LAC is not clear, as governmental institutions don't yet implement and support sustainable sanitation solutions and there are not national or local agendas to address sanitation in a sustainable way. The principles of Ecosan (sustainable sanitation) and projects seem to propagate lengthy in most countries of the region despite the fact that the first pilot projects were initiated in the 80's. Consequently there are many questions to be answered: is there an effective way to approach Ecosan principles and projects? What lessons can be learnt from the implementation of Ecosan projects? Is there a promising or hopeless trend for ecological sanitation in the region?

Ecological Sanitation in El Salvador

El Salvador is a country in Central America that has carried out successful interventions with the double-vault urine diverting toilets (LASF-*Letrina Abonera Seca Familiar*) introduced in 1986 with UNICEF. LASF latrines store faecal waste for a period of time under conditions that are intended to promote thermophilic microbial decomposition (i.e., composting) or dehydration or inactivation of faecal pathogens. In 1992-1994, in a project financed by IDB,

the Ministry of Public Health of El Salvador initiated a national program to promote LASF toilets and the population was encouraged to use the biosolids as fertilizer for agriculture. The government of El Salvador built 50,263 LASF toilets and total investment at that time was USD 12.5 million. The lessons learnt of the program were the importance of appropriate training and education, the problems of non-use or improper use of the system detected in the first two years were not because of the technology itself but because of the interaction between technology and user.

Gradually other type of latrines were implemented in the country, the solar dehydrating latrine (LS) and improved dehydrating latrine (LHM). Different kind of research projects were undertaken with the support of international and local organizations and the involvement of the Ministry of Health. These projects have been implemented along the rural areas of the country and microbiological research has been carried out in order to evaluate the quality of the by-product or biosolids produced. The Scientifics from Rollins School of Public Health, Department of International Health, of Emory University carried out different kind of microbiological studies in double-vault urine-diverting (DVUD) toilets, and single-vault solar toilets. One study evaluated the impact of latrines on intestinal parasitic infection in rural communities of El Salvador with the aim of guide future latrine interventions. It showed that solar latrines appear to be a more effective intervention than LASFs in the environment were they were tested and therefore were promoted. Another one-year study demonstrated that improvements in toilet design (*larger, portioned vaults and good solar exposure*), longer storage time and consistent use of high pH additives will result in an end product that meets USEPA standards for Class A biosolids that are safe for agriculture reuse (Moe C., Izurieta R., 2003).

The activities carried out by the Ministry of Health are not isolated initiatives; they are part of the program: Integral Environmental Health (Atención integral a la Salud Ambiental) and the sub-program Sanitary disposal of Excreta (Disposición Sanitaria de Excretas). The aim of the sub-program is to conduct research, to prepare a strategy for excreta disposal, to update the national normative (solar and desiccating toilets); to contribute with other municipals and expand the number of toilets installed (MSPAS; 2005).

Aspects and quality of Ecosan projects and interventions

Different aspects of ecological sanitation projects and interventions carried out in El Salvador and LAC mainly in the last years are presented here according to the following qualities: strengths, weaknesses, opportunities and threats. The subjects mentioned in strengths and opportunities should be considered in future projects and interventions and should be replicated when appropriate. The subjects mentioned weaknesses and threats should be improved to establish the basis for successful Ecosan projects in the future. At the end of each paragraph, the subjects presented are identified according to the aspects legal, political, economical, environmental, health, social and cultural.

Strengths

- The vision of Ministry of Health to support research initiatives and connect the sanitation aspects to environmental health has been a key element in the promotion of ecological sanitation systems. The *cooperation* between the Ministry of Health of El Salvador and the Rollins School of Public Health of Emory University has been decisive for the upgrading of ecological sanitation projects carried out in the country. Microbiological research conducted in different projects made it possible to improve the operation, maintenance and design of desiccating and solar toilets and to increase the confidence to handle and reuse the biosolids. The cooperation also made possible to equip a laboratory fitted for all kind of microbiological analysis, which is the best in its kind in El Salvador and probably in the region. The outcome of research has encouraged the

Ministry of Health to develop regulations for design and construction of three types of toilets used in the country and to improve the design, construction and test of the solar latrine prototype IV to overcome defects found out in previous designs. *Social-cultural Health and Environment*

- Integral wastewater management with affordable components is possible in Lima-Perú. Among the institutions implementing ecological sanitation projects (double-vault urine diverting toilets and grey water reuse) there are two organizations CENCA and Alternativa that have implemented a module or “ecological bathroom”. It has four components, the double-vault urine separating toilet, two chambers for collection and composting of faeces, a constructed wetland for grey water treatment, the shower and two sinks (hands and washing). The ecological bathroom (baño ecológico) is promoted and incorporated as an integral component of the house with the aim of linking sustainable sanitation to food security as the grey water after is treated in constructed wetlands and irrigates a field where Alfalfa is produced. The Alfalfa is finally used to feed rabbits. More than one hundred units have been installed with overall positives and promising results. This module has been installed inside, besides and outside the house in peri-urban areas of Lima. *Technical*
- Local manufactured Ecosan toilets. Among the various Ecosan projects carried out in México there is one named SIRDO (Integral System for recycling of organic waste). SIRDO is promoted by the NGO Tecnología Alternativa as a transportable decentralized. Dry SIRDO is a prefabricated double-vault, solar-heated composting toilet made of fiberglass and later of rotomolded polyethylene that can be placed almost anywhere. Wet SIRDO collects and treats black, grey water and organic waste. Both technologies were patented in Mexico using indigenous knowledge. They prove that it is possible to have a ready to use toilet after two hours of assembly and that it is possible in Latin America to manufacture technologies, at less costs and more adaptable to local necessities. The use of a unit made of plastic is an opportunity for the production of new toilets out of plastic waste and an opportunity for an appropriate disposal of the unit after the end of its life cycle. *Technology-Environment*
- There is an active regional and national participation on Ecosan meetings. In September 2003 in the city of El Triunfo, El Salvador an Ecological Sanitation Workshop was carried out with the participation of regional experts and local stakeholders from many countries of Latin America and Europe. The aim was to share the performance and lessons learnt of Ecosan projects and analyse different tools to approach and put into practice the concept and principles of Ecosan. In April, 2004 thirty institutions among them, three universities, two local governments and NGOs established in Lima-Perú, the first “National working group on Ecological Sanitation” (Grupo de Trabajo Nacional de Saneamiento Ecológico ECOSAN-PERU). The aim of the Ecosan-Perú group is to spread the concept among other institutions and civil society in the country and promote sustainable sanitation with research and projects. This working group is the result of lobbying and strong compromise with the principles of sustainable sanitation. *Institutional*

Weaknesses

- Operation and Maintenance is the most important component in any project. Many on-site projects using double-vault toilets that were implemented some years ago in rural areas of El Salvador, didn't receive good maintenance and follow up by the promoters. In a project sponsored by an international cooperating agency, in el Triunfo-El Salvador, the broken urine-diverting toilet seats were not replaced by similar ones but for conventional toilet-seats, even though the urine-diverting seats were built locally at the beginning of the project. The urine that was being diverted from the toilet was not reused but infiltrated into the soil. (Ecosan Workshop, El Salvador- 2003). *Institutional*
- Ineffective training and follow up. A promoter of Ecosan stated that in some dry-dehydrating projects carried out in El Salvador, the reuse of the by-products (biosolids)

for agricultural purposes is limited, inadequate or inexistent. The training doesn't address how to deal with the by-products and this becomes an adverse factor for the replication of the project. At the same time grey water that is collected separately goes into rivers and street without further treatment. The solution resulted worst than the problem. *Institutional*

- In Ecuador and other countries in the region, it is found that academic thinking of universities is still stagnant and fixated on conventional sanitation solutions and in a centralized approach to address sanitation. Educational institutions need to integrate new approaches to sanitation into regular university curricula of civil and sanitary engineers, and the technologies should be applicable to local situation. *Institutional*

Opportunities

- The application of raw wastewater and animal-manure to agricultural fields is practiced since long time ago especially in indigenous communities and regions facing extreme dry conditions in LAC. The concept of ecological sanitation linked to food security is quite new for some countries in the region. This approach that is being practiced in Mexico, El Salvador and Perú is a strong argument and opportunity to promote and implement ecological sanitation principles, especially in rural areas and regions with poor soil characteristics and facing extreme dry conditions. *Health-Environment*
- In peri-urban district of Lima-Perú (San Juan de Lurigancho), the users of Ecosan toilets are organizing cooperatives to be able to offer different services for collection and emptying of latrines. On-site ecological sanitation in urban, peri-urban and rural areas is an opportunity to generate employment with the creation of micro-enterprises for testing, collection and emptying of biosolids from collection-chambers. Additional enterprises can be organized for the production of a safe and ready to use product out of biosolids. In this area there was carried out an intensive training with Ecosan users to learn about the adequate use the system, use of the toilet, cleaning and emptying of the collection chamber. The intensive training was important to the success of the toilets. The most effective way was to make the attendance compulsory to one member of the family having an Ecosan-system. *Socio-cultural*
- According to some professionals, indigenous communities in Andean regions are culturally more prepared for alternative solutions than other groups. The social acceptance of non-conventional toilets and reuse of biosolids produced in dehydrating and composting toilets for agricultural purposes can be straightforward in these communities because they are accustomed to fertilize its fields adding guano (animal manure). *Cultural*
- The design and construction of components that adapt to local and individual necessities is an advantage when implementing Ecosan solutions. In Lima-Peru, two NGOs CENCA and Alternativa introduced a design in which the toilet is conceived as an integral part of the house and can be placed anywhere according to the requirement of the user. The design includes a shower, two basins for hands and for washing, a toilet for urine and a double-vault urine diverting toilet. Additionally the design incorporates grey water collection, grease trap and treatment of grey water. This solution is being promoted in peri-urban areas of Lima where the idea of having a shower was far away from their possibilities. *Technology and Hygiene*.
- The conventional sanitation solution could be an opportunity to promote ecological sanitation solutions. WHO-UNICEF assessment found that although 245 million people are connected to sewerage systems in Latin America, only 13% of the collected wastewater goes to wastewater treatment plants. However these treatment plants are not functioning properly and effluents don't meet their countries' wastewater quality discharge standards (PAHO, 2000 in EHP, 2002). Typically effluents contaminate freshwater and groundwater sources (on-site systems). Many countries in Latin America have not yet reach the MDG targets about improving sanitation facilities WHO/UNICEF-JMP 2004. *Technology*

Threats

- The lack of guidelines, regulations or normative for Ecosan systems in most Latin American countries make these systems illegal and difficult to be implemented and constructed as they don't meet any legal requirement. El Salvador is in its way to approve regulations for different types of latrines that have been tested for long period of time already. *Legal*
- In Latin American countries wastewater treatment projects are the campaign's promise of governmental officials in elections time. This project involves large investments that in most of the cases are used for laying sewers and not for the wastewater treatment plant. Most governmental officials are not aware of the differences and usefulness of conventional wastewater system (sanitary sewers) and a non-conventional dry or wet system (desiccating, solar, vacuum, composting). And is these Governmental officials are the ones that usually decide the technology to be implemented for the town. *Political*
- International organizations have a big influence in the type of technology and approach that is applied to address sanitation in developing countries. In El Salvador, an NGO from Spain working in sanitation didn't want to sponsor an Ecosan project because according to them "there is lack of positive experiences reported using alternative sanitation systems" and they didn't want risks (participant WS, 2003). Finance-Economics
- International organizations working through different departments or projects (building and sanitation) in developing countries should work in closer cooperation and aware of new approaches promoted in the same organization. The GTZ Ecosan Project started its international Ecosan research and development project in May 2001, financed by the German Federal Ministry for Economic Cooperation and Development (BMZ). The engineering department of GTZ has worked in developing countries since long time ago in building projects and sanitation programs; however they don't work in cooperation with the principles of the GTZ Ecosan department and project. *Institutional*
- Independently from the responsibility of local governments to request appropriate solutions, international funding organizations have the responsibility to finance sustainable projects or at least projects that will improve sanitary conditions in an integral way and not partially. Funding is a constraint for the implementation of conventional sanitation (sewers and treatment plants), that usually includes only the installation of sanitary sewers and not the wastewater treatment plant. In Perú, the international funding organization, World Bank, is promoting small-bore sewerage system as an alternative solution to conventional sewers. However this organization is not yet promoting and supporting ecological sanitation solutions in the same way compared to small-bore sewers. *Economic*
- Privatization of water and sanitation services proves to be against the promotion and implementation of sustainable sanitation. In Guayaquil-Ecuador, the water and sanitation company is interested in the provision of adequate solutions for drinking water but is less interested in the provision of appropriate sanitation because it becomes easier to lay sewers that discharge off-site without the need of providing treatment, as the contract doesn't include it. Even in peri-urban areas of the city, were there is possible to explore sustainable solutions the company is laying sewers. *Institutional*

Trends, challenges and recommendations for better performance of ecological sanitation in the region

- The future and trend of ecological sanitation practices and projects in Latin America are difficult to predict. However these trends or tendencies will be influenced by different factors from within and outside each country and context, culture, education, know how, weather, availability of fresh water, acceptance, NGOs, professionals, local authorities, technology.

- In El Salvador and Mexico the future of ecological sanitation projects appears optimistic and promising, and therefore the challenges are greater. Existent projects should be managed with a holistic approach and registers should be generated from the whole process through periodical monitoring. Failed projects should be monitored to find out the mistakes and lessons learnt, and if possible they should be reactivated. The trend will be the execution of environmental audits and environmental impact assessment to this kind of projects.
- In Central America in general the trend in Ecosan solutions will be influenced by the decentralization of water management and sanitation systems. The aim of decentralization is to have stronger institutions to address local necessities. A challenge within the decentralization process will be to have more opportunities to implement sustainable sanitation solutions. This could be explored with CBOs, Community based organizations that has proved to work well in Guatemala and Honduras.
- Among the most important challenges of Ecological sanitation are the straightforward socio-cultural acceptance of the system and handling of by-product, the production of a safe by-product ready to use in agriculture and the design of components that adapt to the necessities of users and evolve according with the requirements. Ecological sanitation has to demonstrate that ecological sanitation alternatives are not temporal solutions but permanent ones, and that are applicable indifferently to urban and peri-urban areas.
- A big challenge in Latin American countries is to defeat corrupted political structures and institutions because they have a big impact on water and sanitation services and choices. Corruption prevents to have the right person, to make the right choice for a sustainable solution and to have enough resources to finance ecological sanitation programs to address sanitation. Governmental officials have the decision making capacity to choose an alternative solution for sanitation instead of a conventional if the conditions are suitable.

Conclusions

The aspects, predictions and recommendations about ecological sanitation mentioned in this paper denote positive and negative practices being carried out in El Salvador and LAC. Most subjects are not new (proper maintenance, training, normatives), some are not easy to overcome (funding, corruption, government support) and the majority of subjects are related to institutional aspects. It is noticeable that the amount of ecological sanitation projects in LAC has not increased so much in the last ten years, perhaps because of the lack of a decisive support of international funding organisms. However there are more countries that are starting to implement the Ecosan approach with good results. Perhaps there is need for official statistics about numbers of Ecosan toilets implemented every year, as a way to measure the progress.

To promote and implement Ecosan projects in the best way there are not formulas but is possible to have a good start taking into account existent practices and experiences applied in similar projects of the LAC region. Successful strategies should be replicated according to local situation and good opportunities should be explored.

El Salvador and Latin American countries have made their own way towards the achievement of ecological sanitation principles and there is a promising future ahead.

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