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Sanitation without water in a rural community: Junín, Ecuador

Bruno Bellettini Cedeño[1]
[1]*Lecturer, Pontificia Universidad Católica del Ecuador, Portoviejo, Manabí*
Corresponding Author: Bruno Bellettini Cedeño

ABSTRACT*: Sanitation is an unmet basic need in rural areas. Conventional technology to cover the population without access to this human right does not respond to the reality of the segment of the users who are excluded of this service.*
Most of rural communities in Junín lack of any type of sanitation access. The implementation of standard technologies failed to increase the coverage of sanitation due to costly civil works and environmental consequences which also affect human health.
For this reason, sanitation without water is positioned as a simple and cheap alternative for rural communities in Junín. This research will analyze the impact of a pilot WASH unit where the sanitary component doesn´t require water but soil. The cost-benefit of implementing this type of solution is three times cheaper than conventional sewerage network and transform faeces into solid fertilizer for crop production.
KEYWORDS: *Access, cost-benefit, impact, Junín, rural, WASH.*

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I. INTRODUCTION

In Ecuador we still haven´t approach alternative solutions for the treatment of excreta, despite the important deficiency in the access to sanitation services that still exists. According to INEC data the coverage of this service in Junín roughly reaches 33% and it is estimated that it has stagnated around this value because of the hydric deficiency, thus worsening the critical water and sanitary situation.

It is of vital importance to plan, design and build human settlements in an harmonic way with natural patterns and cycles. The success of these systems lies in establishing, through design, the maximum relation between all the elements or components of human settlements (system) to satisfy our needs and the needs of other forms of life that may inhabit the place.

When it comes to sustainable sanitation is necessary to acknowledge sanitation has played a key role in enabling and catalyzing development throughout history. The mixture of sanitation and sustainability is relatively new and the Sustainable Sanitation Alliance (SuSanA) defines it as: "the one minimize depletion of the resource base, protect and promote human health, minimize environmental degradation, are technically and institutionally appropriate, socially acceptable and economically viable in the long term. It should be sustained and contribute to broader socio-economic and environmental sustainability".

The absence of sustainability in the strategy to reach Millenium Development Goals of halving the share of population without access to basic sanitation brought as a consequence the missing of this target by 9 percentage points1. For this reason, it is of vital importance to plan, design and build human settlements in an harmonic way with natural patterns and cycles. The success of these systems lies in establishing, through design, the maximum relation between all the elements or components of human settlements (system) to satisfy our needs and the needs of other forms of life that may inhabit the place.

Also, the low levels in the results of objective seven and the goal 10 of the Millenium Development Goals (MDG) indicates, the worsening of the human development, health and dignity indexes of the population. On this regard Schriber affirms that the rhythm of accomplishments that these MDG left as a result, that 2,430 millions of people still remain without access to excrement disposal installations, furthermore, it states that basic sanitation constitutes an overdue debt with the world´s poorest.

Figure 1. Key sustainability dimensions in sanitation and wastewater management
Source: Stockholm Environment Institute

As figure 1 points out, the resource management should be at the heart of sustainable sanitation and wastewater management systems. In order to implement this logic, the middle of many changes should come out of houses. Inside of it may be produced an important percentage of the food that a family in the world consumes. Likewise, with simple water separating systems we could reuse the resource without needing to eliminate it through the sewage, even more if these systems are vulnerable to drastic weather changes.

In this sense, an innovative solution –quasi revolutionnary – to the sanitation crisis due to particular conditions of ruralhood is: ecosanitation. As Cruz states it is based in the principles of zero emissions and recycling of all its products, turning each of the residues into an useful material for agriculture, in an hygienically and safe manner and with a notable water saving, or even without using this resource.

DeFries et al refer ecosystems as highly efficient at recycling resources. Organisms interact with each other and with the environment, allowing nutrients, water and other resources to move through the system, with the "waste" products from one process becoming valuable inputs to the next process. Very little is lost except energy, which is replenished by sunlight. However, human interventions such as agriculture have resulted in large-scale extraction of resources from certain ecosystems and the release of various wastes and by-products into other systems. But since volumes of waste are growing and the capacity of natural systems to absorb them – and to produce new resources- is shrinking… it will require to keep resources in circulation, making productive use of them at every stage.

The concept of ecological sanitation (EcoSan) may be interpretated as an integral proposal for the management, disposal and reuse of the human waste (fluid and solid) in rural and urban kitchen garden; thus preventing the pollution instead of solving it after producing.

The Panamerican Center of Sanitary Engineering and Environmental Sciences (CEPIS in Spanish) considers ecological sanitation a solution given the absence of this service in different countries, particularly in rural areas. This technology arises due to the high costs implied in the construction of sewer networks and further treatment, which cost increase in places with disperse houses typical of rural communities.

This paper aims to demonstrate alternative sanitation is not only adequate, cost-effective investments for sustainability, but also practical, affordable for countryside areas in Junín. Also, is a manner to overcome unsafe management of excreta and widespread wastewater, creating significant health and environmental risk.

II. SANITATION WITHOUT WATER

Sanitation without water is approached as a new and improved technological alternative, specially if we compare it to versions like traditional latrine (hydraulic sanitation). Its operation allows to build it up near or even inside the house, without health risks when it is used in a suitable manner.

The lack of access to water supply and sanitation in developing countries makes the use of waterless sanitation a priority; this unfilled gap remains an issue in the frame of human rights to water and sanitation, declared by the United Nations.

The Comission for Social Studies of Health registers that almost half of the inhabitants of developing countries lack of access to sanitation. In this framework, we can point out that insufficient investment in sanitation increases the propagation of a of pit latrines that pollute the groundwater and harm public health.

The advantages of sanitation without water, compared to with hydraulic sanitation, are based on aspects related to environmental degradation, water saving and reusing the nutrients of excreta and urine. In this vision, Wagner and Lanoix indicate that feaces disposal must be separated of urine, because we can obtain an elaborate product from each one of them rich in Nitrogen and useful for activities like agriculture.

Recent studies conducted by Feachem points out as the solution to health´s problems caused by the wrong management of excreta does not only consider technical aspects but human ones. He prioritizes the prevention of diseases through community participation with a strategy of adapting "viable solutions" to local conditions, financial resources available, political decision of the authorities and –most important- to the culture and habits of the population subject to intervention.

Nevertheless, the introduction to this type of technology requires a deep education process that will allow to raise awareness about the utility of an adequate sanitation. We must work in deepening the understanding of the importance aligning concepts, action and intentions to induce transformations in people´s health, thus igniting the transition from vicious cycles to virtuous cycles.

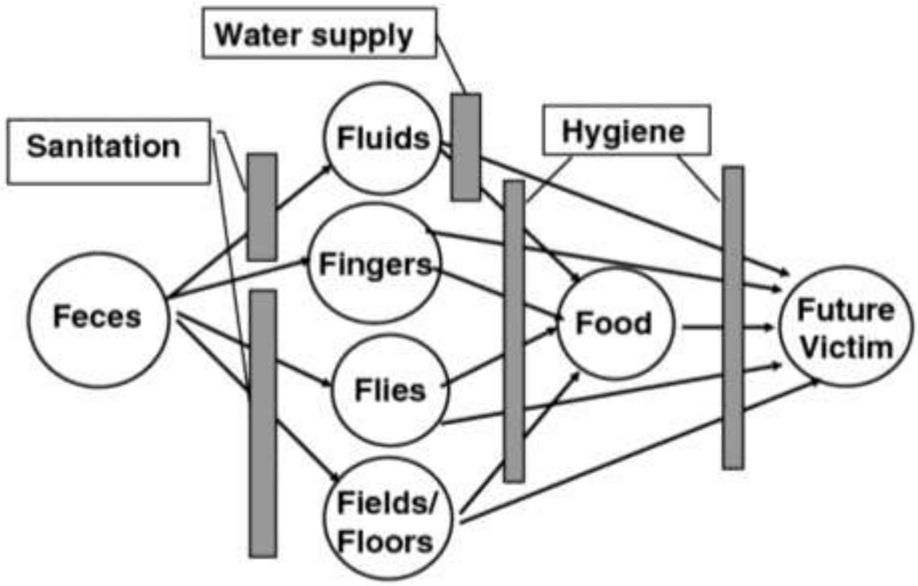

Figure 2. Scheme of barreers of the sanitation without water for the transmission of diseases.
Source: Guerrero T, Fritche T, Martínez Z, Hernández Y (2006)

Among the positive aspects dry sanitation has, we can count the interruption of the fecal-oral transmission of diseases, developed by Wagner and Lanoix. As "Fig 2" indicates, in this concept two types of barriers must be considered: "primary or physical barriers constituted by the insulation cameras and the separating toilets", while the "second ones consider the integration of urine and feaces together with the disposal of dry soil as the primary treatment of excreta with the handwashing sink, which purpose is to avoid the contact of them with flies and roaches".

III. JUNIN: A SUITABLE PLACE FOR DRY TOILETS

On 2013 the Municipality of Junín (Manabí) in coordination with the initiative "Governance of the water and sanitation sector in Ecuador within the framework of the Millennium Development Goals" a United Nations Development Programme made an effort to expand the coverage of this service in the rural area of this municipality. Dry toilets were designed and conceptualized for the local conditions and build up using a participatory approach among the families.

Its hilly topography made centralized waterborne systems less feasible, since wastewater needed to be pumped from one sub-catchment area to another. Similarly, rock formations close to the surface make it difficult and costly to lay sewerage pipes. Systems dependent on infiltrations, such as pit latrines or leach pits/fields, the soil type and the level of the local groundwater table are both a constraint for such options.

As follow, dry sanitation was recognized as an appropriate technology to mitigate the high incidence of health problems caused by the inadequate disposal of excreta into water streams, as targeted by investing on this alternative solution. Nevertheless, today there isn´t enough information that may give evidence of the appropriate use and acceptance of this pilot project.

Figure 3. Scheme of a dry toilet.

IV. THE SYSTEM INSTALLED IN JUNIN

The system installed through this research project collect and treat urine and faeces separately for resource recovery. Faeces is composted into a drying vault which use solar radiation to boost temperature within the vault while urine is treated by storage. Greywater from showers and sink is channelled to a irrigation network for dripping into a cocoa plantation.

This system besides achieving a secure sanitation treatment of excreta, it has important benefits, among the ones we can count:

- Preserve drinking water;
- Can be used as an agriculture substrate, full of nutrients;
- Decrease the cost of building and maintenance of sewer networks;
- Prevents the contamination of water bodies;
- Less vulnerable to extreme natural phenomena such as earthquakes, hurricanes and droughts, among others.

A WASH unit installed in a rural community, Junín, Ecuador. Photo: Bruno Bellettini.

The system above is different from conventional ones since it includes urine-diverting dry toilets, to minimize water use. The unit have a single vault in which faeces is collected in 30-litre plastic containers and urine in 20-litre jerry cans. Faecal matter is composted for about three months in the vault attach to the WASH unit, under the black metallic plate oriented towards the sun direction to maximize the effect of solar radiation inside the plastic container. The immediate consequence of this innovation is to speed up the destruction of pathogens by exposure to moderately elevated temperatures.

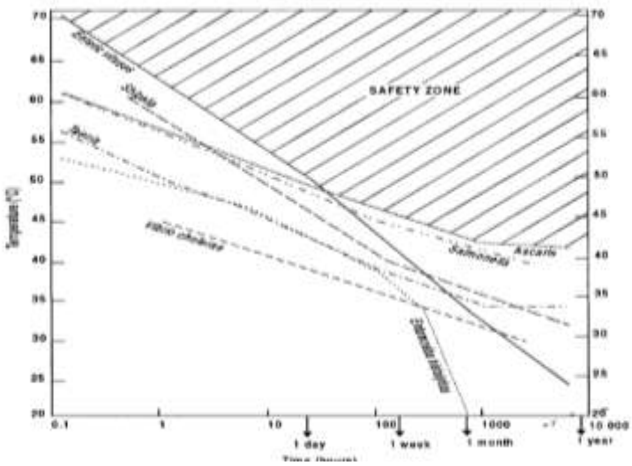

Figure 4. A temperature-duration curve for pathogen inactivation in soil and sludge.
Source: South Pacific Applied Geoscience Comission

However, as Rapaport states, over-elevated temperature can be counterproductive to producing good compost. High temperatures will produce just a desiccated substrate because the bacteria and other agents, for compost formation, operate in the mesophilic range, (19-45 degrees C). For this reason composting latrines need to provide optimum temperature and time for excreta decomposition.

As per request of the family members living in the household, showers and hand-washing sinks were installed for improved hygiene. The greywater outed of the system does not need to be pre-treated (except for the grease trap) since only biodegradable soap is used by the benefiters. Currently, about 50 kilograms of solids (faeces and sawdust) and 125 liters of urine are collected each month and processed on the farm and used for the family´s orchard.

V. COST-BENEFIT ANALYSIS OF SANITATION WITHOUT WATER

Attempts to quantify the cost of inadequate sanitation at global and regional estimates are rare, Andersson estimated that inadequate water supply and sanitation together cost around 1.5 per cent of global GDP. Regions like Latin America and the Caribbean experience an economic loss estimated at 0.9 per cent. The sanitation gap is strongly connected with low GDP and consumer poverty, remarking the fact that the gap has its roots in issues related to mistaken social priorities and inequality.

Figure 5. Economic losses associated with inadequate water supply and sanitation by region, as percentage of GDP
Source: Stockholm Environment Institute

The construction per WASH unit was USD $2,113 and its lifecycle is estimated in 25 years. Normally a WASH unit would be used for an average family of 5 members. It means the initial investment per capita is USD $422. As indicated in figure 5, losses in the ecuadorian economy due to inadequate water supply and sanitation represents about USD $55.2 per capita, annually. It means the investment will be recovery in less than eight years, and the WASH unit will pay for itself at least three times.

VI. CONCLUSION

Rural areas represent a *bottle neck* to “close the loop” in provision and access to sanitation services. Coverage in Junin´s ruralhood is currently poor and innovation to cope with inadequate services needs to happen urgently. Sanitation without water is an evolution of the old unsustainable model. Here, the “wastes” become inputs to productive activities like agriculture, energy generation, water saving, and potentially many others.

The water saving due to the installed system is estimated at 10 m^3 per month equivalent to 30% of the bill. This decentralized technology has proved cost-effective compare to previous “no system” reality and outputs as fertilizer are used for soil conservation and urine replace synthetic urea as a source of Nitrogen for crops.

Experience in the project indicates change of perceptions about what sanitation is for, as a key factor to embrace sustainability of the system. Sanitation without water won´t be suitable for anyone unless it matches the needs and constraints of the specific context. The lack of a comprehensive social process will necessarily result in a low acceptance rate.

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