

PAPER: THIRD INTERNATIONAL CONFERENCE ON ECOLOGICAL SANITATION

Title	Linking Ecological Sanitation and Urban Agriculture in Sub-Saharan Africa
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Short CV for Introduction Purposes (100 words max)	¹ Constanze Windberg studied Civil Engineering and Environmental Techniques at Hamburg University of Technology (TUHH), Germany. She focused on Solid and Liquid Waste Management (Master Thesis: "Ecological Sanitation Systems World-wide"). She participated in a scholarship program for advanced training in the field of personal development work and policy, worked at FAO-Headquarter, Rome and the FAO-Regional Office for the Near East, Cairo and was employed as an environmental consultant. In 2004 she started the PhD research on "Potentials and Constraints of the Link of Urban and Peri-urban Agriculture and Ecological Sanitation".
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ABSTRACT

The interdisciplinary PhD research “Potentials and Constraints to the Link of Urban and Peri-Urban Agriculture and Ecological Sanitation” carried out at Hamburg University of Technology (TUHH) comprises the evaluation of both the hygienic safety and the socio-cultural acceptance of human derived nutrients from ecosan-toilets. The hygienic safety of the ecosan-material is assessed by the continuous monitoring of temperature and humidity and the repeated analyses of bio-solids for pH and microbiological parameters. The assessment of the socio-cultural acceptance of human derived nutrients is conducted by interviews. First results from interviews and observations indicate that ecosan-users in the project area are eager to use the ecosan material as soil conditioner and fertilizer. However, the knowledge about using the dried faecal material is more wide spread than the knowledge about the use of urine as fertilizer. Often animal urine and in cases human urine is used as insecticide. Cultural hindrances to the use of human derived nutrients were expressed more frequently in expert interviews than in household interviews. Ecosan is perceived as a modern technology. As stated in interviews, the main obstacle for families to install ecosan-toilets is the cost.

THE RESEARCH PROJECT

The linking of **urban and peri-urban agriculture** and **ecological sanitation**, in short UPA-Ecosan-Concept (Figure 1), could play an important role for the solution of the problems accompanying rapid urbanisation, such as growth in urban poverty, food insecurity, and malnutrition, severe environmental degradation and lacking hygiene.

Agriculture within city limits, so-called urban agriculture, became a survival strategy for many poor families in the last decades. These families would not be able to secure their nutrition without urban agriculture. This form of agriculture can be a vehicle to increase food security and health, to generate economic opportunities for people with low income, and to promote recycling of waste and wastewater. The philosophy of any ecosan technology is based on the consequent implementation of the “closing the loop approach” (Nutrient Cycling). Urine and faeces are regarded as resources to be used as fertilizer respectively as soil conditioner. Hence linking ecosan with agriculture, in particular urban agriculture is crucial for the sustainability of both ecosan and urban agriculture and will be essential for the achievement of the Millennium Development Goals.

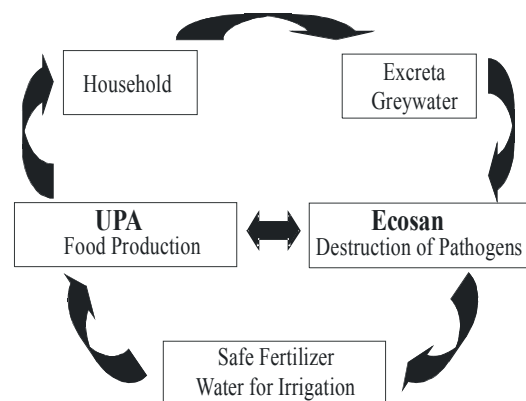


Figure 1:
Closing the Loop with an UPA-Ecosan Concept

The UPA-Ecosan-Concept enables sustainable sanitation and hygiene, sustainable resource management, prevention of environmental degradation through urban agriculture, an increase in soil fertility and therefore higher yields. The challenge is to prove this theoretical statement scientifically. It has to be evaluated, if an UPA-Ecosan concept fulfils the requirements of a system, which is safe, easy to maintain and transferable to local conditions. However, such a system has to be as effective as possible with respect to nutrient recycling, sanitation and public health.

The research project “Potentials and Constraints to the Link of Urban and Peri-Urban Agriculture and Ecological Sanitation” carried out at TUHH is addressing this challenge. The

objective of the research is to evaluate the ongoing activities, regarding the potentials and constraints of an UPA-Ecosan concept. A vital part of the studies is the investigation of the safe reuse of faeces and urine and the social acceptability of re-circulation of human-derived nutrients.

The final results of the research will complement already conducted (e.g., Moe, Izurieta 2004) and on-going research, and facilitate the often expressed but rarely established link to agricultural research and activities. A catalogue of appropriate methods and technologies on which a sustainable UPA-Ecosan concept can be based will be developed. Such a catalogue is imperative for the development of clear political guidelines, which should allow an effective integration of urban and peri-urban agriculture and ecological sanitation in existing urban economies.

METHODS

Hygienic safety of the material and the social acceptability of human derived nutrients as fertilizer respectively soil conditioner are the two main aspects of the successful link of ecosan and agriculture. The research project aims at assessing both aspects.

Socio-economic and socio-cultural parameters

Socio-economic and socio-cultural parameters will be investigated to assess the social acceptability and the potential of re-circulation of human-derived nutrients. Quantitative and qualitative research will be conducted using reactive and non-reactive methods.

During the quantitative research, statistical data regarding economy, education, sanitation coverage, health status, environment and agriculture is collected.

Information about habits and attitudes of the target groups are collected during the qualitative research by household interviews. Semi-structured interviews are used, while observations complement the findings. Each interview covers three areas of interest, general information about the household, hygiene and sanitation, and agriculture.

The respondents are selected from three target groups, I Ecosan-User, II Farmer, and III Farmer using ecosan material as fertilizer or soil conditioner. Table 1 illustrates the different sampling parameter for each target group.

Table 1: Target groups and parameters for theoretical sampling

Target Group	Parameter	Specification
I Ecosan	Ecosan -Technology* Demographic	single v./double v./basket location/income
II Farmer	Agricultural Practice Organisation** Reason Demographic	organic/"conventional" informal/organised market orientated/subsistence location/income
III Farmer-Ecosan	Ecosan -Technology* Agricultural Practice Organisation** Reason Demographic	single v./double v./basket organic/"conventional" informal/organised market orientated/subsistence location/income

* Dehydration- composting, basket, single - double vault, solar - non solar

** Community, school, backyard, park, enterprise

Furthermore expert interviews with key persons at the municipal level will be conducted. All interviews will be semi-structured. A specific questionnaire is used for the expert interviews. The interview design for the households was developed using a gender analytical framework.

Hygienic safety

The rate of pathogen destruction in a dry sanitation system is dependent on temperature, moisture content and pH (Hoglund 2001, Winblad 2004). The monitoring of these parameters will allow conclusions on functionality, maintenance, and hygienic safety. Therefore, the storage conditions of the faeces are monitored in about forty toilets. In order to guarantee the significance of the gathered data the monitoring lasts for a period of twelve months. The analysis of the data retrieved from the monitoring facilitates the assessment of the pathogen destruction (indirect analysis). The continuous monitoring of temperature and humidity is assured by the use of programmed data loggers. Measurements are taken three times a day and stored at the loggers memory.

Faecal samples are periodically taken from the study toilets and tested for hygienic indicator micro-organisms (direct analysis) to double-check the conclusions drawn from the monitoring of the ambient conditions. Total coliforms (including e-coli) have a very short survival rate in the environment and are capable of regrowth in the environment (Hoglund, 2001). Therefore they are not suitable as an indicator and are not used in this research. Parallel to the monitoring a study on the survival of *Ascaris suum* eggs in the faecal matter is carried out using the method of Phi, D. T., B. C. Chung, et al. (2004).

Table 2 lists the parameters for a direct and an indirect analysis of pathogen destruction.

Table 2: Analyses of hygienic parameters

Pathogen Destruction	
Direct Analysis	Indirect Analysis
Hygienic indicator micro-organisms	Ambient conditions
- Salmonella	- pH
- Fecal Streptococcus	- Water content
- Cryptosporidia	- Temperature
- Ascaris eggs	

SITE SELECTION

The research is carried out in various settings in Uganda and South Africa. The site selection had to facilitate the evaluation of the influence and importance of the socio-economic, socio-cultural, technical, and climatic conditions to the physical and microbial safety of human derived nutrients from ecosan-systems for use in agriculture.

For the selection of the project sites the following criteria were mandatory:

- A functioning ecosan system already exists,
- Partnerships with other key institutions (e.g. NGO's, International Organisations).

The following criteria were optional:

- The ecosan material is/or has been reused or
- An interest in the reuse exists or/and
- There are considerable activities in urban agriculture.

Project sites should be located in different climatic zones and the comparison of different dry sanitation technologies should be possible.

On this basis Ishasha, Rwemshama, Kisoro, Kabale, Maracha and Kalungu were chosen as project sites in Uganda. The site selection in South Africa is not yet finalised.

In order to ascertain and analyse information through a participatory process in collaboration with ecosan users and UPA farmers, the research will be conducted in co-operation with

relevant institutions in the cities selected (municipality, NGOs, academic institutions). The focus is on poor, low-income, middle-income ecosan users and small-scale UPA farmers whose livelihoods depend largely on UPA-related activities.

STATE OF THE RESEARCH

Currently the field work has started in Uganda in co-operation with South Western Towns Water and Sanitation Project (see below), Uganda, the Austrian Development Agency (ADA), and Makerere University, Uganda. Project sites are identified, approximately 100 ecosan toilets inspected and 30 interviews conducted. Samples of solid materials were taken. Laboratory results are not available yet.

SOUTH WESTERN TOWNS WATER AND SANITATION PROJECT, UGANDA

The South Western Towns Water and Sanitation Programme (swTws) is a Government of Uganda (GoU) programme, funded bilaterally with the Government of Austria. It is under the Rural Towns Water and Sanitation programme of the GoU under the Directorate of Water Development (DWD), and operates mainly in Growth Centers of populations between 1,000 – 10,000. The programme districts include – Kabale, Rukungiri, Kanungu, Ntungamo, Kisoro, Mbarara and Bushenyi (see figure 2). SwTws is a water supply and sanitation programme, mandated to provide appropriate technologies for the Growth Centres.



Figure 2: The swTws programme area

The main objective of the swTws Programme is to maintain the safe water chain through hygiene education, health living and water safety. The programme insists on promotion of the latrine (as a receptacle for the excreta, to avoid the spread of faeces on the ground). It is a policy of the programme to achieve 100 % basic sanitation coverage. Unless this is achieved in the towns of operation, the water component cannot be released to the community. Further, the Programme promotes Ecological Sanitation in its towns of operation to provide suitable alternatives to the communities.

The water situation in the programme towns and the major sources of water for the communities at the time suggests ecological sanitation as a solution to the water and environmental sanitation problems in South Western Uganda.

History of the swTws program and the evolution of Ecological Sanitation

- SwTws programme was formulated in 1995 to implement water supply and sanitation activities in 19 small towns and rural growth centres in the South West Uganda. Implementation of the program started in 1996 with a grant from the Austrian Government.
- The focus was on providing water supply and sanitation systems with low operation and maintenance costs to ensure sustainability given the low-income levels of the beneficiaries.
- Basic sanitation (at least a pit latrine with a sanitation platform, sanplat) for each house hold was made a condition; for water to be supplied in a town.
- According to a 1997 hydro-geological study a possibility that the Kisoro town community could be contaminating their water source existed. The study showed that the veins of their Chuho source were passing beneath the town.

- Muhanga also one of the towns found in a water logged area had a problem of collapsing pits and was therefore not suitable for pit latrines.
- It was then that Ecological sanitation (Ecosan) toilet technology was identified as one of the possible solutions in both towns.
- An attempt to introduce ecosan was met with stiff resistance, as the community felt it was unheard of to reuse human excreta. The very first attempts to construct ecosan units especially the urine diverting pans left a lot to be desired. The pans were constructed on site, and they were not standard, as each mason would construct it differently.
- The first constructed units composting toilets, partially under ground and mixing urine and faeces, but these were later abandoned in favour of dehydrating above the ground types. Maintaining compost toilets was found not to be easy for the community. They looked more like the traditional pit latrines and so people either failed or neglected to add the carbon adding materials. At other times ground water would find its way into the chambers and turned them anaerobic.
- Later in 1999, swTws staff in collaboration with Linköping University and SanRes program acquired training in ecosan. Through the SanRes program, the swTws programme acquired urine-diverting pans from China and a mould from Mexico, and then interested one private factory (CRESTANK) to start manufacturing plastic pans. This greatly improved the quality of construction and people's confidence.
- Promotion of ecosan by construction of ecosan demonstration units at public places, drama shows and establishment of demonstration gardens on reuse of sanitized human excreta started in the small towns and rural growth centres. Local artists and masons in the programme area were then trained in ecosan toilet design, construction and management, to assist in replicating the system in their communities.
- In 2002, Austria availed another grant to fund the second programme in South Western Uganda, covering 35 small towns and rural growth centres.
- The area of operation has now expanded to cover the whole country after attracting more donors (SIDA, GOU, AUSTRIA and DFID). A 5 year program for promotion of ecosan in the country has been developed. The first year of the program was devoted to documenting existing experience in the South Western region, construction of demonstration units, research, creation of awareness of the technology, training and networking.
- The 5-year programme developed to introduce and promote ecosan toilets in the country with a vision of replicating the implementation approach, applying lessons learnt and challenges, in other regions of the Country. The program is implemented by the Ministry of Water Lands and Environment (Directorate of Water Development), Ministry of Health (Environmental Health Division) and Makerere University Kampala the major stake holders in the promotion and implementation of Ecological Sanitation in the country.

Establishment of Ecological Sanitation Demonstration Gardens

The project has further gone into carrying out experiments using ecological sanitation sanitized materials; establishing gardens using the sanitized faeces and urine. With the harvest, the stigma of the taboo on these materials has reduced greatly and is evidence that materials are better recycled than disposed of. Crops grown using faecal manure have been found to be of better quality and of high yield than crops grown on the control plots. The project has demonstration gardens at it's headquarters in Kabale, at Kyera Agricultural training farm in Mbarara, Kisoro and in Rukungiri districts.

FIRST FINDINGS OF THE CONDUCTED INTERVIEWS

- Ecosan toilets in the project areas are seen as a modern and desirable but expensive technology.
- The majority of the respondents stated the production of manure as one of the three main reasons for their decision for ecosan.
- The knowledge about the agricultural use of the faecal material is more wide spread than

the knowledge about the use of urine as fertilizer. Often urine of animal and human origin is used as insecticide.

- None of the interview partners at household level stated any doubts eating food which is fertilized by human derived nutrients. However, expert interviews suggest that there is a considerable resistance towards food fertilized with ecosan-material.
- Farmers without ecosan showed interest in the faecal material as manure.
- The dissemination of information by swTws using the mass media, like radio and newspaper is crucial to the success of ecosan in the area.
- Washing communities did either ask for a separate washing section, or did use the urinal part as washing section. The interviewed families were completely satisfied.
- The main problems stated are the high installation cost, misuse by visitors, and the shortage of ash.
- It was evident that there is not enough knowledge of indoor solutions.
- Main problems in the design are the low durability of the urine pipes. They get broken easily and the caps get stolen. The metal sheets for solar heating are subject to heavy corroding in certain areas and therefore are not watertight.

NEXT STEPS

The socio-economic and socio-cultural survey will be extended to project areas in the north of Uganda, outside the swTws project area. The north of Uganda is characterized by different cultural beliefs and different agricultural practices.

The monitoring, sampling and analyses will start in May 2005. In June, July 2005 the research will be carried out in South Africa.

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