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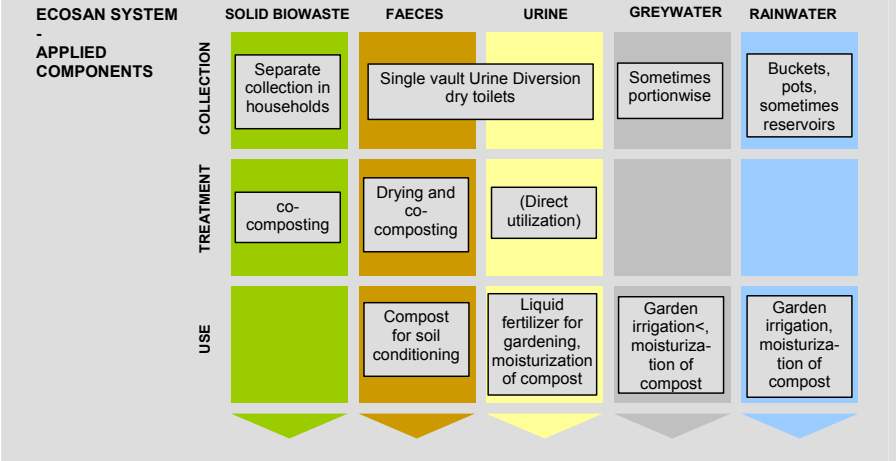
# ecosan within the community based natural resources management project

# Hanahai and Paje, Botswana




## 1 General Data

**Type of Project:**

Rural upgrading

**Project Periods:**

Phase 1, Research and Planning:
06/2001 – 06/2002
Ph. 2, Assessment and Implementation:
07/2002 – 12/2004
Ph.3, Advocacy and Capacity Building:
01/2005 – 04/2006

**Project Scale:**

East Hanahai: 5 households

West Hanahai: 5 households

Paje: 10 households

Village population: 400 - 700 inhabitants

**Address:**

East and West Hanahai (Ghanzi district)
Paje (Central district)

**Planning Institutions:**

IUCN Botswana
Permaculture Trust Botswana (PTB)
Deutsche Gesellschaft für Technische Zusammenarbeit GmbH (GTZ

**Executing Institutions:**

The World Conservation Union (IUCN)
Permaculture Trust Botswana (PTB)
Deutscher Entwicklungsdienst (DED)

**Funding Agencies:**

BMZ

## 2 Objective of the project

In this case ecosan is a central component of a bigger holistic environmental project with the following overall goal:

- To develop, test and demonstrate a holistic / integrated approach to environmental management, sanitation and waste management at household and community level in selected communities.

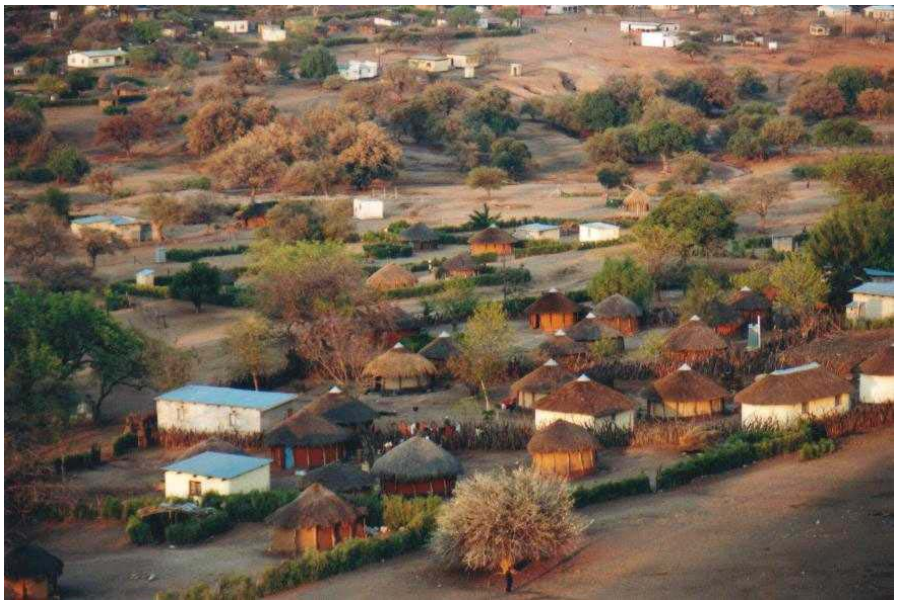


Figure 1: Project location, Paje *(source: GTZ)*

In the context of this project goal ecosan is defined as a cross-cutting concept having three main aims:

- Protection of health and environment
- Reduction of water consumption for sanitation systems
- Recycling of excreta as conditioners and fertilisers for agricultural purposes to improve agricultural productivity

## 3 Location and general conditions

The settlement structure of the project communities is rather typical for the rural southern region of Africa: People live in rather unstructured agglomerations of compounds, connected by a complex system of unsealed roads and footpaths. The village of Paje is affected by strong winds, extreme erosion and soil degradation, whereas the Hanahais settlements are characterised by an ex-

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tremely dry climate and sandy soil.


Figure 2: Location of Paje (right) and Hanahai (left) *(source: GTZ)*

Generally yards are spacious, ranging from 1200-3000 m². Some of them are fenced and can contain several houses / huts (2-8) as well as an external kitchen, a pit latrine (if available), a garden (all participating households) and a fenced area for livestock (goats, sheep, donkeys, etc.). Up to three generations can live together in the same yard.

The selected villages offer two constrasting challenges: East end West Hanahai are typical for the numerous remote settlements in the district: Households are generally poor, in many cases reliant on social welfare and feel dependent on the government. Although natural resources management is a dominant feature of the peoples´ cultural heritage as Bushmen, always having been dependant on natural resources, the active project participation was rather low as the motivation for self dependent changes in general is limited.

In Paje the interest was higher as sanitation already was an object of interest and existing concerns about groundwater pollution served as a strong motivating factor. About 10 years ago a number of boreholes were closed because of groundwater pollution caused by pit latrines. Livestock rearing is a major economic activity, while sustainable utilisation of natural resources was not a strong aspect of the households´ livelihood stratgies.

The selection of households participating in the first two stages of the project was mainly a community and individual household decision. A major requirement for them was the availability of means to contribute to the cost of developing the ecosan technologies for their yards. Interested families could register, 9 (Hanahai)/ 17 (Paje) households were interviewed and were offered participation, 10 households in each village were selected by a raffle system. In Paje the project meanwhile has expanded from the original ten households selected by the VDC, and there are now 28 other households participating in the project in one way or another..

Water consumption varies from 12 to 340 l/p/d depending on the existence of a tap connection and gardening activities. Water consumption for gardening purposes is estimated to account 60% of that quantity.

Households mainly used pit latrines or the bushes for toilet purposes; water toilets are largely unknown; hence there is no scepticism concerning dry toilets from that side.

To establish ecosan and other environmental technologies and practises the project emphasised a participatory approach, with the project staff taking on board the views of the communities on how the project should be implemented. The project also focused on a 'learning by seeing' approach, educating and raising community and household awareness of ecosan through tangible activities undertaken in all households. These activities included

- Household surveys, workshops
- Demonstration of possibilities
- Training measures

in the following fields:

- Building of ecosan facilities
- Preparation of compost
- Rainwater harvesting with shade construction
- Waste management and recycling
- Utilization of greywater

## 4 Technologies applied

In the framework of the ecosan project toilets became an umbrella activity that could be linked to all other activities (gardening, water conservation, waste management, veldproduct domestication, beekeeping and chicken rearing etc). In a household survey undertaken at the end of 2001 / beginning 2002 most of the families chose the ecosan UD toilet to be the adequate and most feasible solution out of several options. Hence in the first pre-pilot step 20 ecosan single vault urine diverting (UD) dry toilets were implemented and adapted stepwise. The toilet design was modified in the course of the process and it is to be stated, that the degree of completion as well as the mode of de facto utilization of the facilities varied after a time.

But in the synopsis a UD toilet with one faeces collection chamber above ground, a 20 l urine collection container situated either within the chamber or outside and a locally produced toilet pedestal can be regarded as the adapted model.

Figure 3: Training workshop *(source: GTZ)*

Figure 4: Traditional hut with ecosan toilet (collection chamber underground) and composter *(source: GTZ)*

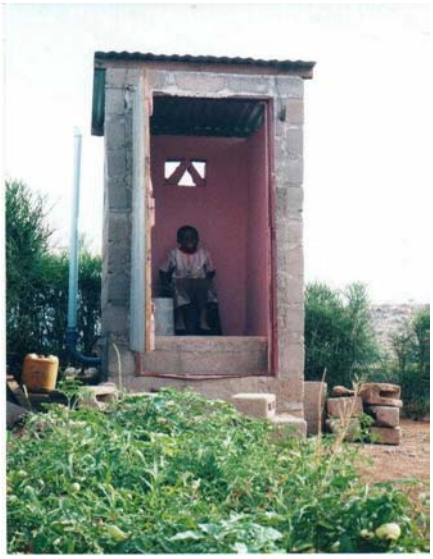

Figure 5: Ecosan toilet in use *(source: GTZ)*

A closed room with a door upon this structure is recommendable, but not indispensable as the superstructure can be built with different material such as stone, wood, shadenets etc.. This system is to be complemented by a composting unit, best a brick-built composter (to set boundaries against children and animals), for the further hygienisation of faecal matter after emptying the collection chamber.

Composting, together with organic waste and animal refuse, should last 1-2 years to eliminate health risks when using the product.

The ground structure and the pedestal, which form the toilet itself, were financed by the project, while the households had to erect the superstructure.

Since the current practise of rainwater catchment means nothing more than collecting it with pots etc. from the roof runoff the construction of small rainwater harvesting systems, for example with a shaded plastic sealed pit at the roof runoff, was introduced to interested households. (The conditions for such simple constructions containing water were good, as for example fly breeding did not occur and Malaria does not exist in the area.) Furthermore water reticulation systems were designed to direct rainwater to the plants and reduce soil erosion problems where occurring

The question of greywater handling depends on water availability and was postponed by the coordinators. Greywater from the baths/washing was collected and used to irrigate mainly trees in the yards. No household had any other type of greywater production Traditionally water is rare and is used very economically. Used water is often collected and directly applied to trees etc.

## 5 Type of reuse

According to the Tswana lifestyle many people move to their lands outside the village (normally between 2 and 10 hectares) during the wet season to plough and sow for example sorghum and maize. Since rainfalls have become unreliable in the last years many people have given up this, which makes backyard gardening more important for the food supply. Although gardening is not common in Botswana many families in the project area fence off a part of their yard to.

Figure 6: Urine fertilization *(source: GTZ)*

Figure 7: Demonstration plots *(source: GTZ)*

Figure 8 : Participant´s garden *(source: GTZ)*

Figure 9: Erosion protection for trees *(source: GTZ)*

Due to the central role of cattle farming in Botswana, cow manure is available in many places and is used for soil conditioning and also for building purposes.

The use of human excrement is uncommon. The implemented facilities implicate a fertilization with collected urine in liquid form and with faeces as compost.

Since pilot trials were identified as the best way of convincing people of the advantages of this reuse several participants and the village chief could be interested in demonstration beds on their plots. In 16 field trials (in agricultural demonstrator´s garden, PTB demonstration garden and school garden, participating households) each with 3 comparative plots fertilized with urine / urine and compost / nothing, a monitoring, sampling and evaluation was carried out.

It can be summarized that fertilization with urine and compost achieved a 40-50% higher production than the unfertilized plot. Overfertilization effects were not recognized and plants were stronger and more resistant against pests.

Overnight urine is often collected separately and applied to the compost, sometimes to trees etc.

A professional approach to greywater reuse is postponed, as said in the beginning. Its reuse is yet restricted to collection and portioning it out onto plants or for compost irrigation as it is very limited due to a general lack of water. grow vegetables.

## 6 Further project components

As said in the beginning ecosan is a component of a bigger resource management project .

Inter alia erosion control measures like protection and stabilization of erosion-affected trees were carried out with the population. Trees in central locations were enclosed by simple field stone walls; the bed filled with earth and planted. Also individual yards designed soil reticulation structures to guide rainwater to specific plants or to be collected in undergroundwater dams and avoid soil erosion.

## 7 Costs

Amongst a range of facts the households were interviewed about prices that influence the feasible measures (prices in BWP; 1 BWP = appr. 0,2 €):

| | |
|---|---|
| Acceptable price for use of public toilet | 0,7 |
| Average price of existing toilets | 455 |
| Acceptable toilet price nowadays | 800 |
| Market price for pit latrine | 1500 |
| Setswana house (20 m²) (relevant for superstructure) | 2250 |
| Brick house (15-25 m²) | 6800 |

Prices in BWP for the construction of the latrine ground structure:

| | |
|---|---|
| Bricks (big, 44*22,5*11) | 91 |
| Bricks, small | 21 |
| Cement (slabs, brickwork, plastering) | 125 |
| Riversand (wheelbarrow) | 60 |
| Plaster sand | 20 |
| Mashwire | 50 |
| Brickreinforce | 25 |
| Timber for frame (10% of total costs9 | 7 |
| Timber for evacuation door | 36 |
| Joints, nails, screws etc. | 30 |
| Labour | 240 |
| **total** | **705** |

Time needed for that construction was 2,5 to 3 days.

Prices in BWP for toilet pedestal:

| | |
|---|---|
| Cement | 12,5 |
| Riversand (wheelbarrow) | 1 |
| Plaster sand | 1 |
| Chickenmash | 4 |
| Oil | 4 |
| Mashwire | 50 |
| Rope | 8 |
| Sand paper + crack filler | 67 |
| Paint | 12 |
| Rental of mould | 1 |
| Labour | 24 |
| **total** | **73,5** |

Price of the locally built composter: 308 BWP.

(All the above tables are based on activities in Paje as an example of a relatively central location close to a major village and along a main tarred road.)

## 8 Operation and Maintenance

The participants and workers were trained in the necessary O&M measures.

Faeces collection chamber: Faeces are collected in buckets or as heaps. Addition of one cup of a mixture of ash and sand after every defecation is recommended to reduce the humidity of the faeces, reduce flies and odour. A family of 2 adults and 4 children needs 2-3 months to fill a 50 l bucket. This has to be emptied carefully onto the compost (Users asked for protective clothes, esp. For hands and mouth). It was also recommended to use smaller 20 L buckets, that are to be emptied more often (once/month), but are smaller and lighter thus easier to handle even by one person alone.

Urine collection: Urine is collected in a 20 l container placed either inside the chamber or outside next to it. Cooking oil containers, available almost anywhere in the country were used for this., One is filled by the “average family” mentioned above in about 3 weeks (Esp. men and children often urinate in the nature and overnight urine is collected separately.) It is to be removed in time and is used as liquid fertilizer in the garden.

Compost: Mixing of organics, lifestock dung if available, faeces and a regular moisturization with greywater and e.g. overnight urine are indispensable in the local climate. Hygienization by composting takes 1-2 years. The compost has an earthlike appearance in the end.

Toilet structure: The pedestal has to be cleaned for hygienical reasons, fly and odour prevention etc. It is important that the collected excrements in the chamber beneath are not diluted by cleaning water or substances and that ash is added to the faeces. The urine pipe should also be cleaned every 14 days with some hot water.

## 9 Design information and technical specifications

All Project participants started by choosing a toilet design “imported” from a study visit of the project leaders through South Africa in April 2002, and the first 8 toilets were built accordingly. The faeces collection chamber of that model is built half or totally under ground (substructure appr. 1-1,5 m deep). 2/3 of it is covered with a concrete slab which supports the super structure ; 1/3 is covered by a removable slab to be lifted for emptying from the outside. Due to occurring difficulties like e.g. the complicated emptying of the chamber and leakiness against rainwater the toilet model was stepwise adapted to household needs and ideas.

Figure 12: Plastic pedestal from SA *(source: GTZ)*

Figure 10: Maintenance at composter *(source: GTZ)*

Figure 11: Revised ground structure *(source: GTZ)*

The final adapted model included a ground structure built above ground with a door at the back or at the side for better handling and maintenance and a ground and top slab made of concrete.

The toilet pedestals, initially purchased as plastic pedestals from South Africa, later were locally produced of cement with a mould acquired from SA. The project organised a moulding workshop to train the toilet builders for that workstep. The cement pedestals were reworked with crack filler and painted with a water resistant floor paint. A standard ceramic pedestal, available in local shops, is appr. 30% more expensive.

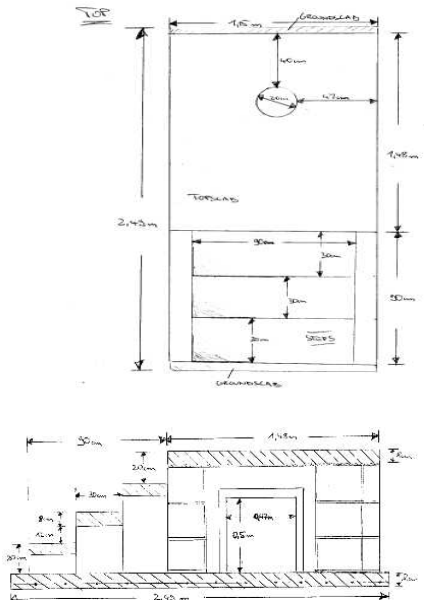

Figure 13: Section and ground view of improved ecosan toilet *(source: GTZ)*

Faeces are mostly collected in buckets, sometimes as heaps, in the collection chamber. Faeces are best emptied into the composter, a simple brick structure of appr. 1 m³ with aeration openings for a co-composting with earth, organic waste and chicken dung as far as existant.

## 10 Practical experience and lessons learned, comments

People became convinced of the utilization of anthropogenic fertilizers by seeing the positive planting results. Several spectators started to collect and use urine even without having an ecosan toilet. Most of them showed strong interest in extending their gardens and increasing vegetable production to generate income. However often this is ostensible hindered by financial, organisational or even natural (pests, termites) obstacles.

Maintenance of the toilets was adequate in all cases, and the positive effects for the users like minimization of odour and flies were appreciated very much. Furthermore people asked for protective clothing for hands and mouth when emptying the faeces (ash flies around).

Since excrements are generally regarded as something very dirty and a taboo, which has to be outside the living area using them in the garden raised a connotation of defecating / urinating in the garden. The indirect use of urine for compost humidification for example often seems to be better acceptable than its direct use on the field. Processing and terms can make a difference: using “fertilizer produced with human excrements” is more attractive than using “excrements as fertilizer”.

A lot of participants did not finish the superstructure as fast as foreseen. Reasons for that often were a lack of means or motivation, but also the effort of cleaning the toilet compared to a pit latrine (if one was still available) or feeling of less comfort of the pedestal compared to the latrine seats (e.g. bench with a hole).

Crucial points / questions that occurred while monitoring the project and discussing dissemination options with participants were e.g.:

Agricultural utilization possibilities and logistics for the high amount of byproducts of a large number of ecosan users have to be defined. Therefore a cooperation with farmers or a sort of service system for O&M should be conceptualised as well as a neighbourhood centred solution to integrate those users who are not willing or able to care about their excrements properly.

The more the sanitation system leaves the individual level, the more important becomes a hygienic product quality control. It needs skilled and motivated personnel as well as a minimum of analytic capacity to reduce health risks.

Composting is only relatively hygienically secure if the composting process develops under correct conditions, esp. regarding humidity and mixture. These aspects have to be monitored.

An intensive user attendance and training is necessary to ensure an adequate handling and sustainable maintenance of the new technologies. Albeit the positive effects difficult habit changes are required: E.g. former “bush users” are confronted with other people´s excrements in the toilet and flies etc., esp. if toilets are not well kept. Pit latrine users, used to a “drop and forget system”, now have to handle their excrements.

Builders have to internalize the central functional quality requirements of the system in order to be able to build proper facilities self dependently – especially when they have to work under market conditions after the project.

Figure 14: Gardening demonstration *(source: GTZ)*

Figure 15: Meeting of two villages *(source: GTZ)*

Visits and experience exchange amongst the participants and the two villages showed very positive results in terms of motivation and progress.

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