sustainable sanitation alliance

Case study of sustainable sanitation projects

Rural urine diversion dehydration toilets (after 6 years) Hanahai and Paje villages, Botswana

Fig. 1: Project location

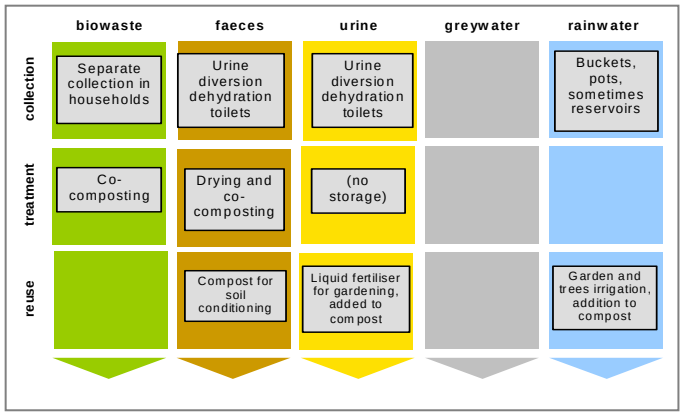

Fig. 2: Applied sanitation components in this project

1 General data

Type of project:
Rural upgrading

Project period:
Start of construction: Aug 2002
Start of operation: Dec 2002 (of first toilets)

Project scale:
In total 42 UDD toilets (East Hanahai: 5 households, West Hanahai: 5 households, Paje: 11 households initially, expanded to 32 households)
Average household size in 2004 was 6 people, hence approx. 252 people reached

Address of project location:
East and West Hanahai (Ghanzi District)
Paje (Central District)

Planning institution:
International Union for Conservation of Nature (IUCN) in Botswana with support from German Development Service (Deutscher Entwicklungsdienst, DED; Cathrine Wirbelauer)
Permaculture Trust Botswana (PTB)
Deutsche Gesellschaft für Technische Zusammenarbeit GmbH (GTZ) in Botswana and Germany

Executing institution:
International Union for Conservation of Nature (IUCN) – project coordination
Permaculture Trust Botswana (PTB) – implementing field component

Supporting agency:
German Federal Ministry for Economic Cooperation and Development (BMZ) via GTZ

This project description was first composed in 2005. In September 2009, Stefanie Lorenz from GTZ-Botswana made a follow-up visit to the initial 21 participating households to assess the ecosan systems. The case study has been reviewed in light of these findings.

2 Objective and motivation of the project

The overall goal of this ecosan project (which was a component of a larger program called CBNRM, see Section 4) was to develop, test and demonstrate a holistic/integrated approach to environmental management, sanitation and waste management at the household and community level in selected communities.

In the context of this project goal, ecological sanitation (ecosan) was defined as a cross-cutting concept having three main aims:

- improvement of health and sanitation within households and communities,
- reduction of groundwater pollution and better conservation of water resources,
- recycling of excreta as soil conditioner and fertiliser to improve land and agricultural productivity.

Fig. 3: Mrs. Goitsemang in Hanahai village says that her vegetables grow bigger since she applies urine and compost from the ecosan UDD toilet (source of all photos: S. Lorenz, Sept. 2009).

3 Location and conditions

Three communities were selected for the pilot project: **Paje Village**, in the Central District in eastern Botswana near the city of Serowe, and **East Hanahai and West Hanahai settlements** in the neighbouring Ghanzi District in western Botswana (near the city of Ghanzi). The village populations from a 2001 national census were 2,088 for Paje and 965 for East and West Hanahai together.

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These two villages were chosen as they were close to two towns where the implementing partner, Permaculture Trust Botswana (PTB), had offices (the Serowe office of PTB was closed in the meantime).

Paje is situated along a main road and is close to Botswana's second largest village (a large semi-urban centre), Serowe. It is nestled between two hills and traversed by the Paje River. Livestock rearing and farming have traditionally been the main economic activities; however, lack of water due to unreliable rainfalls and inadequate water from boreholes has been a critical threat to livelihood. The river has also dried up and only carries limited water during the rainy season. Moreover, the village is affected by strong winds and water erosion, resulting in extensive degradation of the sand and loamy soils in the area.

East and West Hanahai are located 80 km from the town of Ghanzi and are new settlements established by the government in the late 1970s for tribes working and living on Afrikaaner farms around Ghanzi. In contrast to Paje, the people were originally hunters and gatherers, and they did not own any land or permanent structures. After settling, their way of life changed significantly; they were given livestock and agricultural seeds for their livelihood and not allowed to hunt without a license.

The relatively recent activities of livestock rearing and arable farming remain difficult to implement in the sandy soil and the extremely dry climate of the Kalahari Desert. The groundwater table is very deep, there is no permanent surface water, and households rely on reticulated water supply, mainly through public standpipes.

Fig. 4: Location of Paje Village (right arrow) and East and West Hanahai settlements (left arrow).

In all three villages, unemployment was a major concern and households have become very dependent on government assistance. In the Hanahai settlements in particular, it was reported that government welfare schemes were an integral part of the livelihood strategies of many households. In Botswana in general, the government is known for reliably providing food and medicine to those in need; however it also appears to lead to a low motivation of rural communities to maintain development projects in their area, even when they have requested such assistance themselves.

The settlement structure of the project communities was typical for the rural southern region of Africa: People live in unstructured agglomerations of compounds, connected by a complex system of unsealed roads and footpaths. Generally, yards are spacious, ranging from 1200 - 3000 m² with an external kitchen and a fenced areas for livestock (goats, sheep, donkeys etc.), and up to three generations can live together in the same compound. The ploughing fields and cattle posts are outside the village and many people move to their lands (normally between 2 and 10 hectares) during the wet season to plough and sow crops.

Although not common in Botswana, backyard gardens were found in Hanahai, where they had been introduced by Permaculture Trust Botswana to supplement livelihoods. Cow dung and chicken manure were typically used, without composting, to fertilise the vegetable plots. No gardening activities had been introduced in Paje.

The sanitation conditions varied between the two settlements. The government had promoted and subsidised pit latrines in the rural areas and many pit latrines were found in Paje Village. Alternatively, people there used the bushes and men often used trees and hedge fences for urinating purposes. It was found however, that concerns existed about groundwater pollution in Paje, and that in the past, boreholes had been closed because of groundwater pollution caused by pit latrines.

In East and West Hanahai, on the other hand, people generally did not have any toilets and hence were practising open defecation. All three communities were generally unaware of water toilets and not skeptic towards dry toilets. However, urine and especially faecal matter were considered dirty and to be forgotten as soon as possible. Superstitions and taboos also strongly supported this attitude.

The village institutions were important in carrying out any developmental activities in the three villages. The highest institution is the *Kgotla*, which is headed by the village chief and is responsible for administration and law and order, and it also serves as an arena for public debate. Next in importance is the Village Development Committee (VDC), which is considered the village parliament and coordinates most of the developments within the village.

4 Project history

The ecosan concept was a central component of the larger "*Community-Based Natural Resources Management (CBNRM) - Missing Link Project*", a pilot project in which research, planning and implementation of activities with households was carried out in two phases from June 2001 to December 2004[1]. The project was funded by GTZ (on behalf of the German Federal Ministry BMZ), coordinated by IUCN Botswana and implemented in the field by PTB (for abbreviations see box on page 1). PTB is a local NGO focused on disseminating improved stoves and improved gardening techniques and had already been working with the Hanahai communities in developmental activities since the late 1980s.

[1] A third phase for advocacy was planned but unfortunately never carried out.

The emphasis of the Missing Link Project was a "bottom-up" participatory approach in order to secure enduring commitment from participating families. Therefore, the processes were first presented to the village chief, the VDC, and to the community in meetings at the *Kgotla*, and project staff took on board the views of the communities on how the project should be implemented. A project evaluation in 2004, however, noted that more efforts were needed in involving district and municipal authorities. Developing the above linkages with the communities, community mobilisation, and awareness-raising were part of the preparatory steps in project implementation.

The pilot project was implemented with a set of selected households; however, other interested community members were involved during demonstrations and awareness-raising activities. The selection of the initial participating families (**5 in each of the Hanahais and 11 in Paje**) was mainly a community and individual household decision.

In 2004 it was estimated that the average household size is six people. During the evaluation tour in Sept 2009, Stefanie Lorenz asked most of the families how many people are actually using the toilet. The numbers varied from 5 up to 15 people (usually 3-5 adults, and up to 10 teenagers or children). In general it is mainly woman, children and old people living in the villages. The young adult Motswana are usually working in the City and only come home during their holidays.

In order to promote sustainability, the major requirement was that households must contribute to the cost of developing a urine diversion toilet (UDDT) system for their yards: project funds would be allocated for the purchase of the toilet pedestal and building of the structure up to the slab at the ground level; **households would be responsible for the expenses and the work for the super-structure**. With this in view, interested families registered for the project. The selection of the final participants was then done using a raffle system in the Hanahai communities and through a vote in the Paje community.

Construction of the UDDTs began in April 2002 and the first UDDTs were being used by December 2002.

During the course of project implementation, the number of households participating in the project increased to 32 in Paje Village; but not all of these new participants constructed a toilet. With each successive group, the level of input assistance to the families was reduced and more emphasis was placed on self-contribution. In contrast, in Hanahai, no additional households joined the project. The apparent reasons were that people could not afford a household toilet within their limited economic resources, and that the community had a relatively higher dependency attitude, expecting the same input support for all project activities as was given to the initially selected participants.

The project worked with the communities on ecosan and other project activities using training workshops, individual household visits and on-site demonstrations. The project notably focused on a 'learning by seeing' approach. For example, project staff and community representatives were taken on an ecosan study tour to South Africa in April 2002 to see working examples of UDDTs. The enthusiasm level rose considerably after the tour, and people began work on the toilets immediately.

The project evaluation in 2004 however noted that while the demonstration activities had been effective, one-off training events needed to be followed up so that households would be able to apply the knowledge and skills they had gained better. The communities in particular desired more training in urine application in the gardens, and Paje community wanted more training on garden management. This feedback was also noted during the follow-up visit in 2009, where people in Paje were asking for more training because they did not feel in the position to maintain a UDDT without training.

An important step taken in making the ecosan technology accessible was a training workshop on producing urine diverting concrete pedestals locally, so that the expensive plastic pedestals would not be needed. The training had an immediate effect in Paje, and it was reported that soon after the training, pedestals were being made and sold in the community. In Hanahai, local production did not catch on and the number of households adopting UDDTs did not increase.

There were some difficulties during project implementation. Notably, there were delays in making the super-structures of the toilets, mainly due to financial reasons and involvement of households in drought relief projects. Also, acceptance of the concept of using waste for composting purposes was a challenge. Fencing and proper protection of the backyard gardens was often neglected.

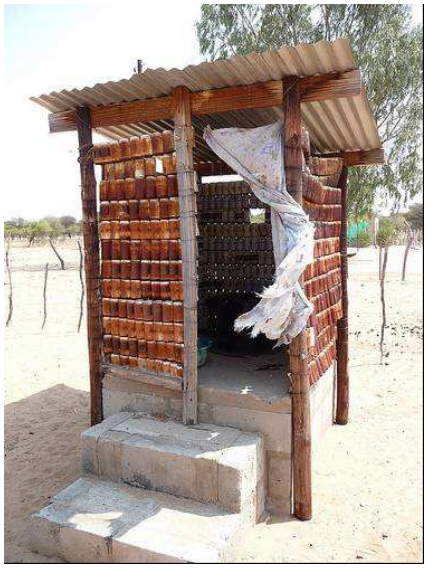

Fig. 5: Ecosan UDD toilet built out of beer cans in Hanahai. The most creative superstructure in the region!

In spite of the efforts made in ensuring ownership and sustainability during project implementation, the follow-up visit in September 2009 to the initial participating households showed that approx. half of the UDDTs had been abandoned. But the other half was still working well. Out of 21 UDDTs visited, 13 were still in use (6 out of 11 in Paje and 7 out of 10 in Hanahai). Encouragingly, however, **those UDDTs that were still in use (about 60%, 6-7 years after they were built) were being well maintained and worked properly**. Section 11 discusses reasons for abandonment of UDDTs at the three locations.

No assessment was done during the 2009 follow-up of the households that had joined the project in Paje at a later stage or of the households that had bought toilet pedestals from their own initiative, which would have been useful in gauging any demonstration effect more thoroughly.

5 Technologies applied

The communities were informed about three different types of "ecosan toilets", namely urine diversion dehydration toilet (UDDT), Arborloo, and composting toilet. The households chose the UDDT to be the most feasible solution. An initial design was taken from a South African model and then adapted over the course of implementation. Essentially a single vault UDDT was used with a container inside of the faeces vault.

The urine was collected in a container situated within the vault or outside and was available for reuse. The system was complemented by a composting unit for processing and hygienising the faecal matter that was emptied out from the collection chamber. The faecal matter was composted together with other household organic waste and animal refuse. Urine was added regularly to the compost heap.

Greywater (used household wastewater) is often collected and applied directly to the trees etc. This practice was further supported by the project. The greywater was also used to keep the compost heaps moist.

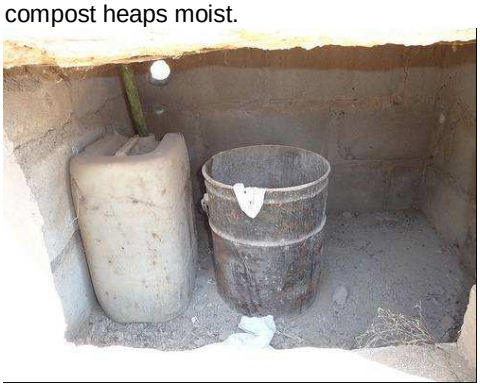

Fig. 6: Collection chamber under a properly working ecosan UDD toilet (left: urine container, right: faeces bucket) in Paje.

Fig. 7: Left: UDD toilet working properly in West Hanahai. Right: This UDDT was well maintained, ash standing next to the toilet and composting unit filled (in Paje).

6 Design information

The first eight UDDTs were constructed according to a toilet design seen during a study visit of the project staff and community leaders in South Africa (in April 2002). The faeces collection chamber of that model was built half or totally below ground and it was approximately 1 – 1.5 m deep. Two-thirds of the sub-structure was covered with a concrete slab which supported the super-structure; one-third was covered by a removable slab which could be lifted for emptying the chamber from the outside.

This "below ground design" had some major drawbacks and is thus *no longer recommended*: some families had difficulty in moving the heavy slab, especially those without male support; the depth of the chamber was inconvenient even for routine maintenance; and the joints of the slab were often not water tight, and therefore rain entering from the outside increased the humidity of the faecal chamber and intensified odours.

In the Hanahai settlements, the design was changed upon requests and ideas from the households, and this design was then transferred to Paje using local builders. The final adapted model included a ground structure built entirely above ground with an access door at the back or at the side for better handling and maintenance and a ground and top slab made of concrete.

The urine diversion toilet pedestals, initially purchased as plastic pedestals from South Africa, were later locally produced from cement using a mould acquired from South Africa. The project organised a moulding workshop to train the toilet builders for the new structure. The cement pedestals were reworked with crack filler and painted with water resistant floor paint for hygienic and maintenance purposes (to minimise the risk of bacteria surviving on a rough surface). In comparison, a standard ceramic pedestal (without urine diversion) available in local shops was approximately 30% more expensive.

Households were responsible for constructing the super-structure and they used different materials, such as stone, wood, shade nets, even beer cans (see photo below).

During the visit in 2009, it was observed that the UDDTs with above ground chambers were working well. In two cases in East Hanahai, the below ground structure was still in use, but the removable concrete slab had been permanently removed to facilitate maintenance. UDDTs which were later abandoned included however both those with below ground structures and those built entirely above ground.

Composting boxes

The production and use of compost is culturally unknown in Botswana. It is also difficult to carry out composting successfully in the prevailing dry climate because the compost heap must be maintained with sufficient moisture. In Paje Village, brick-built composting boxes, as had been seen during the study tour in South Africa, were provided in order to set boundaries against children and animals during the composting process. The simple structure was approximately 1 m³ in size with openings for aeration. The faecal matter was mixed with earth, organic waste and chicken dung.

The evaluation visit in 2009 revealed that all households visited in Paje (i.e. the initial 11 households) were using these brick-built composters. It is not known why these composters were not introduced in the Hanahai settlements. There, households were using pits dug into the sand for composting and these pits were generally not protected from children and animals.

The recommended time to achieve good quality compost and hygienisation was 1-2 years. In the follow-up visit in 2009, it was seen that households that used compost were letting it mature for 3-4 years to be absolutely safe.

7 Type and level of reuse

On the one hand, gardening was a major motivation for families in all three communities to join the project; on the other hand, the inherent revulsion to any form of excreta posed challenges in harnessing its nutrient value for gardening. A break-through occurred in Paje Village after a demonstration of 16 vegetable trials in 2003. Each field trial comprised three comparative plots fertilised with (a) urine, (b) urine and compost or (c) nothing. Fertilisation with urine and compost achieved a 40–50% higher production than the unfertilised plots. The plants were stronger and more resistant against pests.

This "learning by seeing" motivated people to use their collected urine. Moreover, participating households that did not have a UDDT, also started collecting urine separately to reuse it. In the Hanahai settlements, PTB also promoted reuse activities.

By the time of project evaluation in 2004, it was reported that approx. 75% of all households visited were applying urine on their vegetable gardens and several households had planted trees on their compost pits or were reusing it. Importantly, 5 households in the Hanahai settlements and 4 households in Paje were selling surplus vegetables (though it was not reported how many of these were using urine/compost as fertiliser). The only problem then appeared to be a lower production of human fertiliser than was the potential from the toilets since children did not use the UDDTs and men often urinated outside, which reduced the impact on gardening.

During the visit in 2009, it was observed that **the situation had regressed in terms of reuse**. Half of the initial participants in Paje no longer had a garden; apparently no one in the three communities was selling surplus vegetables; and from the 13 households still using UDDTs, only 5 were applying urine (2 in Paje, 3 in the Hanahai settlements) and 4 were applying compost (2 in Paje, 2 in Hanahai) in their gardens.

This could be attributed to a need for further trainings and follow-up as expressed by the communities (see Section 4). Here it was noted that the support by PTB for gardens in Hanahai was much stronger than in Paje where the PTB was going through an institutional transition period and people complained about the lack of support.

Households that had been reusing excreta in Hanahai reported during the visit in 2009 that the vegetables were larger with the urine/compost applications, and this had also attracted interest from neighbours and other people. However, this interest had not translated into self-initiative. Here it was noted again that the amount of human fertiliser produced by one household was not enough for the backyard garden of that household. Surprisingly, in Paje, where the vegetable trials had been very successful with the participating households during the project implementation phase, the majority of villagers remained skeptical and still considered reuse of excreta a taboo.

Fig. 8: The garden of Gome Petros where the urine is used to fertilise the plants.

8 Further project components

The ecosan project was interlinked with other activities on small-scale rainwater harvesting, co-composting of faecal matter with household organic waste and animal manure, using compost and urine as fertiliser to increase yield from the backyard gardens, and using greywater for moisturising the compost heaps.

Since the existing method of rainwater harvesting simply consisted of collecting the roof runoff with pots and other such vessels, the construction of small rainwater harvesting systems, for example with a shaded, plastic sealed pit for the roof runoff, was introduced to interested households. These simple constructions were suitable since fly breeding did not occur and malaria did not exist in the area. Furthermore, water reticulation systems were designed to direct rainwater to the plants and reduce soil erosion.

9 Costs and economics

As this ecosan project was just one small component in a much larger program, the budget for this ecosan project is not known.

In 2003, a survey was done with participating and non-participating households in Paje to understand the willingness to pay for toilet services and existing prices of structures. Paje provides an example of a relatively central location close to a major village and along a main road. These prices are given in Table 1.

The cost of construction of the sanitation facilities was also calculated for the toilets built in Paje (in 2003). The ground structure was estimated at 705 BWP (141 EUR; see Table 2), the urine diversion toilet pedestal (painted concrete pedestal, made locally in Paje) at 73.5 BWP (15 EUR), and the composter at 310 BWP (62 EUR).

Table 1: Acceptable prices and market prices for sanitation related structures (prices converted from Botswana Pula, BWP; 1 BWP = approx. 0.2 EUR).

Item	Price (in EUR)
Acceptable price for use of public toilet	0.14
Average price of existing toilet	91
Acceptable toilet price at time of survey	**160**
Market price for pit latrine	300
Setswana house (20m²) relevant for super-structure	450
Brick house (15-25m²)	1360

Table 2: Cost of construction of the UDDT ground structure in 2003 (still to be added: UD pedestal and super-structure).

Item	Cost (in EUR)
Bricks, big (44*22.5*11)	18.2
Bricks, small	4.2
Cement (slabs, brickwork, plastering)	25
Riversand (wheelbarrow)	12
Plaster sand	4
Mashwire	10
Brickreinforce	5
Timber for frame (10% of total costs)	1.4
Timber for evacuation door	7.2
Joints, nails, screws etc.	6
Labour	48
Total	**141**

The cost of toilet ground structure plus urine diversion pedestal equals EUR 156 which is close to the quoted "acceptable" price of EUR 160 (but still excludes the super-structure). Therefore, the complete UDDT structure may not be within the economic means of the households. Enhanced sales from backyard gardening could theoretically off-set some of the expenses; however, this means of income was unfortunately not sustained.

10 Operation and maintenance

The participants were trained in the necessary operation and maintenance measures, which were as follows:

Faeces collection chamber: Faeces were collected in 50 L buckets or as heaps. It was recommended to add one cup from a mixture of ash and sand after every defecation to reduce the humidity of the faeces, flies and odour. A family of two adults and four children needed 2 - 3 months to fill a 50 L bucket, and this was then emptied onto the compost unit. Some families started using smaller 20 L buckets that needed to be emptied more often (once a month), but were lighter and thus easier to handle even by one person alone.

Urine collection: Urine was 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 was filled by the "average family" mentioned above in about three weeks; however, the filling

time depended on the habits of the users. Men and children often urinated in the bushes, around trees or on the hedge fences, and in some cases, overnight urine was collected separately and either emptied into the toilet or used directly on the compost, around the trees, and on the hedge fences.

Compost: Household organic matter, livestock dung if available, and faeces were co-composted together. Regular moisturisation of the compost heap with greywater and overnight urine was indispensable in the local climate and the project recommended a composting time of one to two years for hygienisation purposes.

Toilet structure: The pedestal had to be cleaned for hygienic reasons and fly and odour prevention, and during this process it was important that the collected excrements in the chamber beneath were not diluted by the cleaning water or substances. The urine pipe also had to be cleaned every 14 days with some hot water.

Follow-up in September 2009:
For the UDDTs still in use, the maintenance of the toilets was adequate in all cases. The toilets appeared to be clean and almost odourless. All households had a bowl of sand or ash standing next to the toilet. In most cases, a small 20 L bucket was being used for collecting the faeces, and plastic bags were used as gloves when emptying the buckets. Families reported that it took 1½ to 3 months to fill the bucket, depending on the number of people and the size of the bucket.

11 Practical experience and lessons learnt

The results of the ecosan project in Paje and East and West Hanahai Villages have been mixed. The project worked hard at developing a participatory grass-roots programme and at incorporating sustainability-oriented mechanisms such as community contribution and ownership. However, it also faced the difficult challenges of poverty, an ingrained dependency syndrome on external aid, and taboos on reuse of excreta.

During the project life, the 21 initially participating households from all three communities and many of the additional 21 households from Paje were active in establishing a UDDT toilet system with a composting mechanism and reusing at least the urine in backyard gardens. A follow-up of the initial 21 households in September 2009, however, showed that only 13 households were still using their UDDT and a third of these were reusing the excreta. Moreover, several households in Paje Village no longer had gardens, even though it had been one of the motivating factors for joining the project.

The reasons given (in Sept. 2009) for not using the UDDTs were as follows:
In Paje*:* the collection chamber was too deep for maintenance (bucket too heavy); the man responsible for maintenance of the toilet had left the household in 2007, and the women preferred the pit latrine which did not need any maintenance; the woman responsible for maintenance said she "felt like vomiting" when looking at the bucket; a blockage of the urine pipe that had not been repaired. One toilet had been destroyed because of border issues with a neighbour.

In West and East Hanahai*:* one family reported that the toilet was not used properly by people staying in the house while the family was outside on the farm (most likely used it as a pit latrine), and the other two families could not be asked for reasons because they were on the cattle post.

While the reasons for disuse of the UDDTs varied and also point towards lack of follow-up and maintenance issues, it can be said that the most important contributing factor was **need**. In Paje, 4 of the 5 households that no longer used the UDDT were using a pit latrine instead. One of these households converted the UDDT into a pit latrine - since the sub-structure was partly below ground - while the other three already had a pit latrine (i.e. there had been two toilets on the same plot). Moreover, the super-structure was dismantled and reused and hence presumably there was little loss of investment. Neighbours also often had pit latrines and were sceptic of the UDDTs.

In Hanahai, on the other hand, a UDDT was a better option than a no-toilet option, and neighbours also often used the UDDTs. They also desired such sanitation themselves, but, as before, they were looking for support with the construction of the ground structure and training.

Long-term follow-up after project implementation, continuous support for productive benefits from gardens, and the basic need for sanitation, played an important role for households to continue using UDDTs. A larger percentage of the initially selected households were still active in the Hanahai than in Paje and this could partly be attributed to the continuing support of PTB in encouraging people to build-up their gardens and using the UDDTs, whereas in Paje the support structure during the last few years had basically been non-existent.

Even though the participants of Paje were reported to be convinced about the benefits of reuse after visually seeing the results from vegetable trials with urine and compost fertiliser in 2003, it appears that further training and follow-up in garden maintenance and application of human fertiliser were needed for people to benefit from productive reuse and hence prefer a UDDT over a pit latrine.

In contrast to the awareness reported in Paje at the start of the project about groundwater pollution caused by pit latrines and the strong support of the village leadership for ecosan in protecting groundwater, the pollution risk did not seem to be a strong enough motivation for households to abandon pit latrines. Moreover, the taboos against excreta could not be overcome sufficiently, especially given an existing alternative sanitation option. Also, it appeared that the concrete urine-diverting pedestals were no longer being made locally in Paje.

In Paje, those families that already had pit latrines were not motivated to maintain a UDDT in the long-run. In all cases where two toilets were found on the same plot, the pit latrine was used and family members said that they either did not know how to handle the faeces and/or considered it to be 'yucky'. The parallel structures seem to account for an unwillingness to maintain the UDDT, in some cases because the decision to make a new toilet had not been taken by the woman who usually maintained the UDDT.

Fig. 9: UDDT (on the left) next to a pit latrine on the right (in Paje). The UDDT was never used since its installation in 2004 (as the main female of the household objects to having to empty the faeces container. The pre-existing pit latrine is used instead (when it is full, a new pit will be dug).

In Hanahai, the option to use a pit latrine often did not exist and people seemed to have less objections of handling the faeces. Neighbours were often using the toilets as well and (not trained) close relatives were in some cases taking care of the toilet while the family was on the cattle post.

During project life, an additional 21 households from Paje participated in some part of the project activities. No new households joined the project in the Hanahai settlements. However, after the end of the project, it appears that there has been no self-replication of UDDTs as a sanitation option. This lack of a demonstration effect can be attributed to the high cost of the toilets without sufficient benefits from productive reuse; the high dependency of people on external aid; and in Paje, because the wider society was not convinced of the usefulness of the toilets enough to overcome their taboos and fears of excreta handling and reuse.

In conclusion, it can be said that the UDDTs were successful where people were convinced of their benefits, where they had the need for sanitation, where they had been given financial support, and/or where they had been given long-term technical follow-up (for the toilets and for reuse activities).

12 Sustainability assessment and long-term impacts

A basic assessment (Table 1) was carried out to indicate in which of the five sustainability criteria for sanitation (according to the SuSanA Vision Document 1) this project has its strengths and which aspects were not emphasised (weaknesses). The qualitative assessment was done for the overall project (both project sites) and also took into account the abandoned and destroyed UDDTs.

The project can be considered sustainable in the health and hygiene and environmental parameters; however, these aspects did not seem to hold much value for the communities. The technology worked well and was easy to operate except for those households that preferred the "no-maintenance" scenario with the pit latrines. The project was not financially sustainable since people could not afford to adopt it or were

not willing to pay for it. The sustainability indicator for socio-cultural and institutional aspects was also weak as shown by the reluctance towards handling and reuse of the excreta.

Table 4: Qualitative indication of sustainability of system. A cross in the respective column shows assessment of the relative sustainability of project (+ means: strong point of project; o means: average strength for this aspect and – means: no emphasis on this aspect for this project).

	collection and transport			treatment			transport and reuse		
Sustainability criteria	+	o	-	+	o	-	+	o	-
• health and hygiene	X				X		X		
• environmental and natural resources	X			X				X	
• technology and operation		X		X			X		
• finance and economics			X		X			X	
• socio-cultural and institutional		X				X			X

Sustainability criteria for sanitation:

Health and hygiene include the risk of exposure to pathogens and hazardous substances and improvement of livelihood achieved by the application of a certain sanitation system.

Environment and natural resources involve the resources needed in the project as well as the degree of recycling and reuse practiced and the effects of these.

Technology and operation relate to the functionality and ease of constructing, operating and monitoring the entire system as well as its robustness and adaptability to existing systems.

Financial and economic issues include the capacity of households and communities to cover the costs for sanitation as well as the benefit, e.g. from fertilizer and the external impact on the economy.

Socio-cultural and institutional aspects refer to the socio-cultural acceptance and appropriateness of the system, perceptions, gender issues and compliance with legal and institutional frameworks.

For details on these criteria, please see the SuSanA Vision document "Towards more sustainable solutions" (www.susana.org).

Regarding long-term impacts the following statements apply:

1. The local NGO Permaculture Trust Botswana has gained experience with building and operating UDDTs.
2. Around 252 people (42 households) were directly reached by the project and benefited in one way or another.
3. About 60% of these 252 people still see a benefit 6-7 years after toilet construction to continue to use their UDDTs and a certain fraction of these still value the fertiliser properties of urine and compost.
4. This demonstration project has not led to copying of UDDTs in the region (to our knowledge) and was in that regard not successful.

13 Available documents and references

A set of **photos** from September 2009 is available here: http://www.flickr.com/photos/gtzecosan/sets/72157622233387657/

- Hanke, T. (2004) Experiencing Ecological Sanitation in Paje, Botswana, Internship Report, 11.09-31.12.03. CBNRM Missing Link Project, IUCN Botswana. http://www2.gtz.de/Dokumente/oe44/ecosan/en-ecosan-experiencing-ecological-sanitation-paje-2004.pdf
- IUCN (2004) Final Evaluation of the CBNRM Missing Link Project. IUCN Botswana. http://www2.gtz.de/Dokumente/oe44/ecosan/en-evaluation-of-the-CBNRM-missing-link-project-2004.pdf
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- Wirbelauer, C. (2003) 'CBNRM-Missing Link: Piloting Ecological Sanitation in Botswana. Powerpoint presentation. IUCN. http://www2.gtz.de/dokumente/oe44/ecosan/cb/en-piloting-ecological-sanitation-botswana-2004.pdf

14 Institutions, organisations and contact persons

Note: IUCN office in Botswana no longer exists.

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Case study of SuSanA projects

Rural urine diversion dehydration toilets (after 6 years) Hanahai and Paje villages, Botswana - draft

SuSanA 2010

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This document is available from:
www.susana.org