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40,000 Eco-toilets in Ethiopia in 4 years: What makes it work?

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Between 2005 and 2008, Catholic Relief Services in Ethiopia facilitated the construction of 40,000 ecological toilets (the Arborloo design) in impoverished rural areas of Ethiopia where coverage had been less than 1%. In many communities coverage reached 100% within a few weeks or months. The keys to success were very low cost of slabs (US$5), ease of building and its modest contribution to food security in a country with chronic food shortages. Promotion techniques included demonstration and crop trials through model farmers, use of PHAST methodology for education and empowerment, and provision of tree seedlings. This paper discusses the factors leading to success and concludes that the Arborloo is well suited to Ethiopian culture.

Introduction and background

More than 80% of Ethiopia's 70 million people live in rural areas and depend on rain-fed agriculture. Between 15 and 20% of the population experiences chronic food deficiency each year and 47% of children are stunted. Access to basic social services such as health, education, safe drinking water and sanitation is low, contributing to high rates of water-borne and fecal-borne diseases throughout the country. Sixty percent of all reported disease in Ethiopia is related to poor water and sanitation, and 20% of the under-5 child mortality (123/1000) is related to diarrheal disease. Women and children are the most negatively affected by diarrhea and parasitic worm infections, which impact not only their well-being but also their productivity.

Water and sanitation coverage in Ethiopia is among the lowest in the world: 31% for water 18% for sanitation. Most sanitation coverage is in urban areas and many rural areas have 1% coverage or less. Reasons for low sanitation coverage are many and include: a) the health benefit of improved sanitation and hygiene is generally unknown among the rural population and b) the poor reputation of latrines (their apparent lack of stability, privacy, and safety) and c) shortage of available, durable construction material.

While large numbers of latrines have been and are still constructed by campaigns during endemic diarrhea outbreaks, these latrines are not used beyond emergency time nor replicated by any communities.

Almost all regions in Ethiopia have been the victims of Acute Watery Diarrhea. Open defecation is the major source of water contamination. Water quality monitoring conducted by CRS and its partners (2002-2005) documented that most shallow ground water and surface water sources contain nitrates higher than 45 mg/liter and feacal coliform bacteria 23-50 per 100 mg/liter, all higher than the recommended limit. A nitrate concentration of more than 45mg/l can result in "blue baby" syndrome, as the nitrates interfere with the ability of red blood cells to carry oxygen. Parasite infections are also common in Ethiopia, due to open defecation. A lack of toilets in schools is a contributing factor to girls not attending school, especially after puberty.

CRS experience in ecological sanitation

In response to the sanitation challenge and little progress achieved through past CRS approaches, in 2005 CRS/Ethiopia and its partners began to pilot the Arborloo, the Fossa Alterna and urine harvesting for fertilizer (see text box below for descriptions) for cultural acceptability and to conduct crop trials with urine

in partner compounds, among households and in schools in several different culture areas. Ecological sanitation, especially the Arborloo, was found to be culture- friendly and is suitable for all types of communities including pastoralists, agro-pastoralists and farmers, Muslims and Christians. In 2006 CRS began promoting the Arborloo in all project areas (see map), while still educating about the Fossa Alterna and urine harvesting, and by the end of 2008, nearly 40,000 rural households had chosen to construct Arborloos and about 75% of these are among Muslims. Many communities achieved 100% sanitation coverage in areas that had 1% or less before the project. This paper explains in greater detail how this sanitation success occurred.

Ethiopia's farmers are very practical people, especially in the face of chronic food insecurity, and thus in 2005 CRS asked 30 farmers in food insecure communities to try an Arborloo, Fossa Alterna and/or urine harvesting as fertilizers for growing crops as well as for sanitation. At the same time, CRS partner organizations, mainly Catholic dioceses, were trying these toilet designs and doing crop trials with human urine inside their own compounds. Diocesan staff and priests were using these toilets on a regular basis. It was thought that field staff and priests could not promote a toilet they themselves did not use and could not promote urine and compost as fertilizers unless they had conducted crop trials themselves. In addition, a school in a project area decided to conduct crop trials using urine on a large school market garden.

Within a few months the results of all these trials began making an impact. Farmers and diocesan staff planted fruit tree seedlings provided by the project on Arborloos and used urine for fertilizer and, comparing with control crops, quickly saw the advantages of composted human excreta and urine as fertilizer. Crops were coming double and triple to those grown on plain soils, and as farmers have little money to buy fertilizer, they quickly realized the advantages. These farmers and outreach staff shared their findings with their communities and demand grew for the new toilet design. By the end of 2005 these 30 demonstration Arborloos had multiplied to nearly 3,500 units, without any other promotion than by model farmers. By the end of 2006 over 12,000 Arborloos had been constructed in these and new project areas.

The Fossa Alterna did not prove to be as popular as the Arborloo, perhaps because of the time it takes (2 years) to have compost ready for fertilizer and only about 30 were constructed. With the Arborloo a benefit can be realized in less than one year. The urine harvesting and application has been less well understood by partners and farmers but is slowly being taken up and shows promise. One school in particular has amplified a large market garden, doubling and tripling production of crops for sale, with the collection and use of children's urine. Several farmers have reported that their crops are more resistant to insects when urine is applied, but these claims have not undergone scientific trials to date.

In 2007 CRS decided to pilot the Arborloo among pastoralists, who normally do not grow crops or fruit trees. The Arborloo proved to be popular among them as well, as women in particular appreciated the privacy and the ease of construction. Over 20,000 were constructed among pastoralists, many of whom are now gradually settling and beginning to grow some crops and trees. The Arborloo can be used to grow any food plant, such as pumpkins, tomatoes, spinach, bananas or papayas.

At about the same time that ecological sanitation was introduced, CRS began using the PHAST (Participatory Hygiene and Sanitation Transformation) methodology with communities to strengthen sanitation and hygiene promotion. Drawings and discussions of the Arborloo, the Fossa Alterna and urine harvesting were added to activities. PHAST is both an educational and a planning tool that empowers communities and individuals to learn about the relationship between good hygiene, sanitation and health and to plan for community sanitation and hygiene changes. Through PHAST, groups are indirectly encouraged to achieve 100% sanitation coverage through activities such as understanding the fecal-oral route of diarrhea transmission and exposing participants to the pros and cons of different latrine options through an activity called the *sanitation ladder*. Staff feel there is little doubt that PHAST was a good tool for helping communities select the Arborloo, for promoting related hygiene behaviors such as hand washing, and committing to 100% sanitation coverage.

The Government of Ethiopia does not endorse subsidies for sanitation and therefore households must purchase slabs and pay other building costs. Many private artisans have been trained to make the small slabs for the Arborloo, but materials are often hard to come by. Project partner organizations still have to assist in getting materials, and often have to cover the cost of slabs for the poorest families. Slowly, however, the Arborloo is becoming a part of Ethiopian rural culture by providing a payback for efforts made. Families are also teaching children to no longer waste their excreta through open defecation, as use of the Arborloo is now seen as a family asset.

In addition to working directly with communities, CRS collaborates closely with government officials through training, planning and implementation. Civil servants receive rewards through the government

system when sanitation coverage increases, creating an incentive for them to consider the Arborloo as a sanitation option in their areas.

Promisingly, in October 2006, the Government of Ethiopia endorsed ecological sanitation as a good option for the country as it strives to reach its Millennium Development Goals. In addition to the Arborloo, other ecological toilet designs for rural and urban areas are being adapted by other organizations for use in Ethiopia. Through teamwork and community mobilization, Ethiopia might just reach its Millennium Development Goal of 100% sanitation coverage. Regardless, the Arborloo has shown itself to be an excellent sanitation solution for Ethiopia and holds promise for the rest of Africa.

Lessons learned

1. The most prominent lesson learned from the experience of piloting the Arborloo among Ethiopia's poorest rural communities is that the toilet design suits the various cultures in Ethiopia, Christian and Muslim. The main reasons for this are low cost, ease of construction and food security advantages to households. While CRS Ethiopia does not yet have economic data on the food security impact of ecological sanitation, the cost data are available. In 2000 CRS was still promoting the VIP toilet, largely on a demonstration basis that was unreplicable by rural households. Its cost at nearly US$100 was not affordable to families whose annual income was not much more than that. In 2001 CRS reverted to promoting simple pit latrines, halving the cost, and continued to bring down costs. The table below shows that demand increased among those who could afford these lower costs. Poorer households were still left out. However, with the introduction of the Arborloo in 2005-2006, demand again increased with affordability, a slab costing only about US$5 at that time.

Table 1. Relation between unit cost of toilet and number built per year in CRS Ethiopia project areas

Year	# built	Unit cost US$	Toilet type	Totals
2000	111	96	**Ventilated Improved Pit latrine (VIP)**	**Total VIP =111**
2001	989	47	**Conventional Pit Toilet (CPT)**	**Total CPT= 6303**
2002	1,634	33		
2003	1,808	18		
2004	1,872	12		
2005	3,433	5	**Ecological Sanitation (Arborloo)**	**Total Arborloo =39,968**
2006	12,360	5		
2007	10,459	5		
2008	13,716	5-12		

The table above and the graphs below show that simplifying the latrines and making them cheaper has increased replication.

2. **The demand for eco-toilets is growing.** Since our goal for health is rapid 100% coverage, we now for the first time see the light at the end of the tunnel. If this level of acceptance and demand remains steady, the communities we serve will soon have full coverage and many fruit tree seedlings. Already we see that parents are encouraging their children to consistently use the eco-toilets in order to fill the Arborloo pit quickly and more quickly plant a tree seedling. Also, households with Arborloos are inviting households without latrines to come and use theirs for the same reason. This has resulted in almost no open defecation in project areas.
3. CRS experience suggests that continued promotion of the VIP latrine and conventional pit latrines in poor areas of rural Ethiopia is not cost effective for achieving rapid and widespread sanitation.

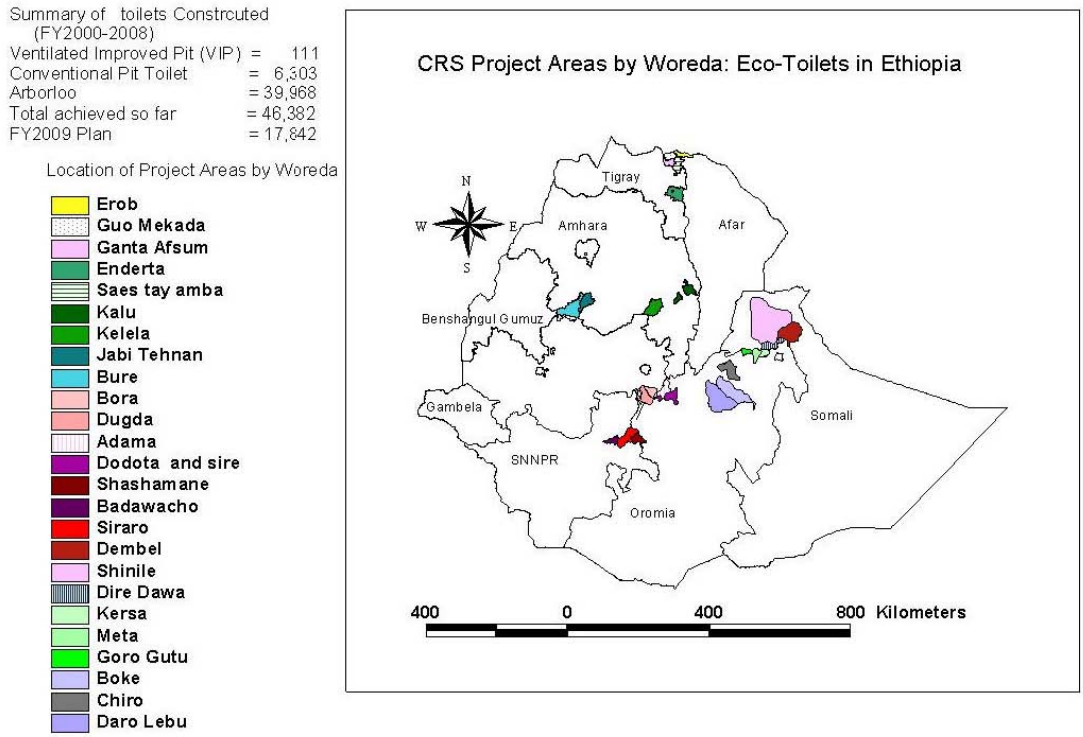

Figure 1. CRS project areas by Woreda with eco-toilets (Arborloos)

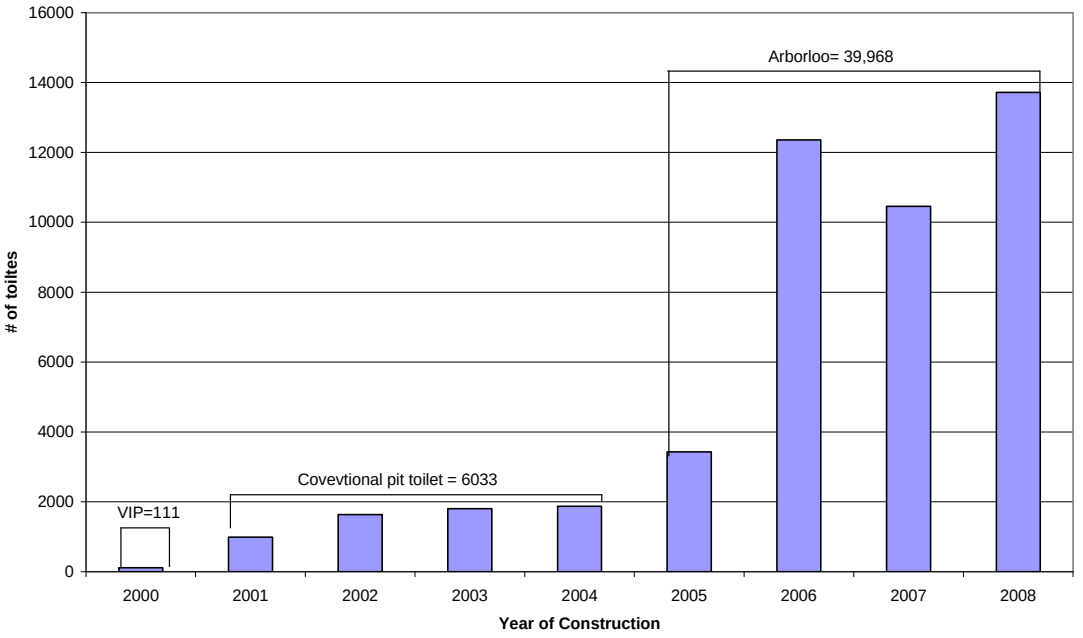

Figure 2. Toilet construction per year in CRS Ethiopia project areas 2000-2008. In 2005, the Arborloo was introduced and resulted in rapid increase in construction

Ecological sanitation options offered by CRS Ethiopia

The Arborloo

The Arborloo is a very shallow pit that is designed to be, eventually, a home for a fruit tree. Designed by Peter Morgan of Zimbabwe especially for African conditions, the latrine is the simplest of all eco-latrines. A pit about 80-100 centimeters deep and 60 centimeters in circumference is dug, the top is reinforced with bricks, and dry leaves are added to the bottom. A simple slab is placed over the opening. After each use, a cup of a soil/wood ash mixture is added to encourage soil composting, to reduce smell and to discourage insect breeding. A very simple superstructure can be added for privacy. This latrine is used by a household until the pit is filled (usually about 1 year for this size pit and a family of 5) and then the slab is removed, the pit is topped up with good topsoil and a fruit tree seedling is planted in the topsoil. (Any other food plant can be grown as well). As the roots grow downward into the pit, the seedling takes up rich nutrients which result in a very healthy fruit tree that produces in abundance.

The cost of the Arborloo is mainly in the slab, currently about $5-$12. Households can dig their own shallow pits and construct their own simple privacy structures, so there is no further cost to the latrine. Arborloo has proved extremely popular due to its simplicity for digging and its multi-benefits within short periods of time.

The CRS Ethiopia Arborloo has been scaled down from that designed by Peter Morgan. Local farmers have elected to make the pits smaller for uses of about 4-6 months, so that they can speed up the planting of tree seedlings. The pit diameter is 40 cm and the depth varies from 50 cm to 1 meter, depending upon the wishes of the household and the soil conditions. Many households who adopted Arborloos have now as many as 4 or 5 tree seedlings growing in their compounds. The reinforced concrete ring at the top of the pit has been eliminated without negative consequences. The slab is 70 cm square or round and 5 cm thick. The ratio of the mortar is 1:2:3 – 1 part cement, 2 parts sand, 3 parts gravel (.1 to .2 mm). In some project areas the diocesan partners have painted slabs bright colors. This has proved very attractive, especially to children, and women report that painted slabs have a slick surface that is easy to clean.

In CRS project areas, communities often name their Arborloos “Tree seedling latrines” or “baby tree toilets”.

Fossa Alterna

Fossa Alterna means “alternating hole or pit”. Also designed by Peter Morgan, it is constructed in the same way as the Arborloo. The only difference is that there are two pits which are alternately used for one year each, composted for a year each and then emptied. The removed humus is mixed 50:50 with top soil. The amended soil is laid in furrows and the crops are planted in the improved soil. Over time, in 2-3 years, FA humus can greatly improve backyard garden soils. Not much is produced per pit per year, less than one square meter, but when mixed 50:50 with soil and carefully laid in furrows for planting, the improvement in crops can be substantial.

Urine harvesting

CRS Ethiopia is currently experimenting with urine harvesting and using the urine for fertilizer on small gardens. Household members merely urinate into a jerry can or jar to collect urine. Urine is applied directly to soil before planting or added to crops through watering, diluting it with 3 parts water to 1 part urine. Early trials indicate an increase in crop production of two to four times, as compared with unfertilized control plots. Once enough experience is gained on ideal uses of urine for crop production in Ethiopian conditions, CRS and partners will be educating farmers on its use.

- 1.5 liters of urine is sufficient to fertilize one square meter of land for one year.
- The average adult produces about 1.5 liters of urine per day.
- Therefore, one adult can produce enough urine in one year to fertilize 365 m^2 of land.
- A family of 3 adults can fertilize about $1/10^{th}$ hectare of land (350 m^2 X 3) per year.
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This is not a great deal of land, but it is enough for a substantial backyard garden.

Photograph 1. Urine crop trial maize on 6.5 cubic meter plot: left with water only, 6 kilogram; right with urine and water, 12.5 kilogram

Source: CRS Ethiopia

Photograph 2. The Arborloo moves on a never ending journey:
left: newly dug pit;
middle: same pit with hand washing facility and in use for excreta disposal;
right: same pit planted with fruit tree seedling (avocado)

Source: CRS Ethiopia

References

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