Greywater reuse interventions: keyhole and vertical gardens

Case studies of multiple use of water in Ethiopia (MUStRAIN case 5)

As part of the MUStRAIN project in Ethiopia, various approaches to water harvesting, multiple use of water and ecological sanitation have been studied. Here two methods of greywater reuse are presented.

Greywater reuse in Ethiopia at a glance: keyhole gardens and vertical gardens

Technical features:

- *A keyhole garden* is a waist height garden bed surrounded by rocks and stones, with a walkway ('keyhole') to allow easy access. The bed is comprised of layers of various organic materials that add nutrients and retain moisture.
- *A vertical garden* is made from a bag or other vessel, filled with a mixture of soil, ash and compost. Leafy greens are cultivated in holes, cut in the side of the bag, and on top. Some designs include a gravel column at the centre of the bag to allow filtration of greywater.
- *Greywater* is household wastewater from kitchen and washing, normally not polluted with faecal material.

Implementation:
Various organizations have promoted the use of greywater for gardening and enhanced nutrition, such as ENDA-Ethiopia, USAID and the ROSA and CLARA projects of Arba Minch University. Catholic Relief Services (CRS) promotes vegetable gardens with partner organizations in East Arsi, Eastern Hararghe and in Addis Ababa.

Main advantages:
Vegetable gardens at the homestead help improve nutrition, while surplus may be an important source of income. Greywater is a valuable source of water in (semi) arid areas and helps reduce pollution of the compound.

Challenges for uptake:
The keyhole garden is more suitable for rural areas because of the required materials, whereas the space-efficient vertical garden is better suited to urban environments. Perceptions on the effect of soap and actual contamination with faecal matter hamper the wider application of greywater in Ethiopia.

Introduction

In Ethiopia, most households are not connected to a sewerage system and collect their greywater (household wastewater that is not polluted with faecal matter) in jerry cans or buckets) to dispose of either on their own compound premises, or outside, to avoid "unsightly conditions"[1]. In urban areas, greywater is often disposed through informal hand-dug sewerage connections or by emptying jerry cans on the streets, or into the municipal open storm water drains or streams and rivers flowing through the city. This water may then be used for productive purposes downstream (off-site). Wastewater reuse for irrigation is common practice in and around Addis Ababa, where wastewater (greywater, black sewage and surface runoff from rain) drains into rivers that are used downstream for vegetable crops, including those consumed raw.

Alternatively, greywater can be used for productive purposes on site, at household level. This is another dimension of the closed-loop-concept of ecological sanitation (eco-san), where the focus lies at utilizing the nutrients in human excreta and urine[a]. The focus of this case study is on household-level interventions for the reuse of greywater, such

[a] See also MUStRAIN case study 4 on reuse of faecal sludge.

as of vegetable bags or greywater towers and keyhole gardens.

Implementation

The Catholic Relief Services (CRS), an international NGO that has been operating on humanitarian issues in Ethiopia since 1968[b], promotes productive vegetable gardens under its nutrition programme, for enhanced nutritional intake for those infected and affected by HIV. Under the umbrella of CRS' homestead gardening programme, keyhole gardens and vegetable bags are promoted as easily managed production units that retain water and moisture through the use of stones[1]. Keyhole gardens are a major success in Lesotho. In Ethiopia CRS has introduced these in East Arsi in 2011, implemented by the Wonji Catholic Consortium (WCC) and in Eastern Hararghe, with the Hararghe Catholic Secretariat (HCS). Similarly, vegetable bags have been promoted in Addis Ababa between 2007 and 2012 by PICDO amongst Productive Safety Net households, to improve their nutritional status. PICDO promotes the bags as alternative vegetable gardens for households living on small plots in dense areas, such as in the Kechene sub-city of Addis Ababa.

In the town of Arba Minch (100,000 residents) in the Southern Nations, Nationalities and Peoples Region, an EU-funded project '*Resource-Oriented Sanitation concepts for the peri-urban areas in Africa'* (ROSA, 2006-2010)[1] and its follow-up CLARA piloted the local uptake of decentralized sustainable eco-san technologies, including urine diverting dehydration toilets (UDDTs), Arborloos, Fossa Alternas, greywater towers, biogas units, aerobic wetlands, and septic tank sludge disposal. Nine greywater reuse towers were tested at household level[2]. Though these are somewhat different from vegetable bags, because of their elaborate documentation the ROSA pilots are an excellent reference for comparative analysis.

ENDA[c] - Ethiopia ran an urban agriculture programme between 2006 and 2010, which focused on enhancing the nutritional status of those infected and affected by HIV, by providing training on poultry production, vegetable production, business development and nutrition. The program promoted different ways of vegetable gardening using water from communal boreholes, municipal water connections or reusing greywater. ENDA worked directly with HIV associations or through district health workers. The programme led to the following lessons learned on urban agriculture[3]: it positively contributes to nutritional status; it allows HIV affected persons to be integrated into the community; it is a self-employment opportunity; it can help a family sustain a dignified life; and it positively contributes to the environment, through the reuse of greywater and composting (with waste separation at the source). However, it is unclear whether ENDA projects have applied and evaluated greywater, as it is not mentioned in their reports[4,5].

Several more projects and initiatives have promoted the reuse of greywater in Ethiopia, such as USAID (urban gardening program for communities, including composting component), as well as many individual examples but these are not the focus of this case study.

[b] All dates are noted using the international (Gregorian) calendar.

[c] International NGO, ENDA stands for Environnement et développement du Tiers Monde (environmental development action in the third world).

Greywater reuse

Greywater is wastewater that is not polluted with faeces, such as water from bathroom and kitchen sinks, showers, and clothes washing. It "may contain traces of dirt, food, grease, hair, and certain household cleaning products. While greywater may look 'dirty', it is a safe and even beneficial source of irrigation water in a yard. There are many simple, economical ways to reuse greywater in the landscape"[6] .

Even in the most water scarce areas of Ethiopia, the majority of garden crops are rainfed and irrigation with greywater is not frequently applied. Incidental cases can be found though, of households repurposing greywater.

Greywater reuse in Lege Dini

Lege Dini is a drought prone district in Eastern Hararghe, part of the Dire Dawa Administrative Council. The Hararghe Catholic Secretariat and other emergency relief and aid organisations have implemented many interventions in this food insecure area. Nevertheless, farmers in Lege Dini still can cultivate only about 30% of their required food intake and aid organizations donate the rest[7].

In Lege Dini village, irrigation is practised only where there is good access to a reliable water source, usually a high-yield water supply point. Wells and ponds are rarely used for irrigation. Households that live close to water points, tend to have higher water consumption and hence produce more greywater, 60% of which is then used productively for irrigation; 33% for livestock and the remaining 7% for cleaning[7].

Irrigation with greywater is commonly done either by diverting excess water from the drinking water points or laundry basins, via a narrow canal to the field, or household washing water is poured into discarded tin cans, punctured and hung from a tree branch[7]. Papaya is promoted in Lege Dini for its nutritional value and high yields. With its high beta-carotene content, is reduces the risk of blindness caused by a Vitamin A deficiency.

Figure 1. Papaya trees drip-irrigated with greywater in Lege Dini[7].

Keyhole gardens

Keyhole gardens, originally designed for use by the chronically ill, is a raised (waist height) garden bed surrounded by rocks and stones, with a walkway to allow a person to sit or squat while working in the garden around them. The bed is comprised of layers of various organic materials that add nutrients whilst retaining moisture, thereby making the keyhole gardens productive even in arid areas[8]. Keyhole gardening is especially effective in areas where good soil is scarce, creating an enabling environment for improved nutritional intake[9].

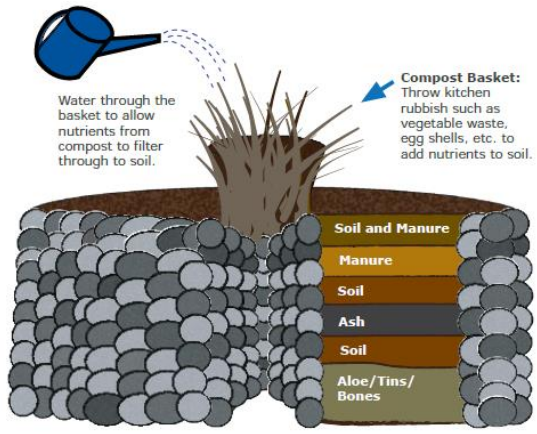

Figure 2. Keyhole garden design[8].

The keyhole gardens are designed to be watered with greywater from washing or bathing, both to conserve water and reduce the labour burden of collecting additional water for irrigation. Water can be applied to the top of the bed or through the basket at the centre, thereby watering the layer beneath. The basket is woven of reeds or thatching grass, which should help filter out some of the chemicals from soap and detergents[8].

Figure 3. Newly constructed and planted keyhole garden with watering basket[6].

Kitchen scraps and manure can be laced inside the basket to help renew the nutrients in the soil. In addition, CRS recommends adding manure or compost to the topsoil when it is no longer visible within the top layer. As the garden will sink over time because of decomposition of the layers of organic material, some soil should be added regularly to maintain the level of the garden[8].

In Lesotho, where CRS provides training on keyhole gardens, they are fertile gardens, highly productive within a short time period[10]. Keyhole gardeners are encouraged to grow multiple vegetables for a diverse nutritional input, such as lettuce, carrots, tomatoes and pumpkin. The latter two can have their roots in the raised bed but may grow alongside or in the ground (along the sticks in Figure 3). Households here are encouraged to add dust from sweeping the house and ash from the fire into the basket. Furthermore, participants get training on food preservation and sun-drying of produce to encourage stocking of vegetable produce instead of sale[10].

The intended benefits of the keyhole gardens include[8]:

- *Soil enrichment* - layers of organic materials break down over time, adding nutrients to the soil. The use of natural fertilisers, such as manure and compost, will provide additional nutrients to the plants.
- *Moisture retention* - the layers of organic material soak up and retain moisture, especially when constructed to waist-height. Greater retention means that the garden requires water less frequently and in smaller quantities. During periods of extreme drought, water can be retained by covering the entire system in plastic.
- *Labour saving* - Keyhole gardens are relatively light to cultivate and thus reduce the labour required to produce food for households. This is especially important for those affected by chronic illness and HIV or households headed by

children or the elderly. Additional labour saving comes from the central basket that allows the use of convenient greywater.

- *Year-round vegetable production* - the stone lining retains heat from the sun and keeps the soil from freezing during winter months. A warmer soil encourages root growth and, when combined with a nightly cover at night, will help prevent frost damage.

Keyhole gardens in East Arsi

The Wonji Catholic Consortium operates in 12 wards, and at each Farmers' Training Centre a demonstration keyhole garden was constructed. One of the participants in the training built one in his ward, seemingly the only one. Uptake has been extremely low.

Figure 4. Demonstration keyhole garden at the Farmers' Training Center in the ward of Lodesharbe, Dodota district, during the 2013 dry season.

The keyhole garden at the training facility seems to have been constructed somewhat haphazardly and looks unused. Several reasons can be given for this failure at the demonstration level, such as lack of a responsible person at the training centre, lack of greywater, lack of follow-up and drought issues. The last reason is interesting as keyhole gardens are designed to be drought resistant. Moreover, a nearby water facility was not used for the keyhole garden.

Figure 5. The same keyhole garden as in Figure 4 during the 2013 long rainy season – unused.

Figure 6. Water supply point directly behind the Farmers' Training Centre, sharing a common wall.

The keyhole garden constructed by the training participant looked neater, built with stone and clay. Recently various vegetables, including onions, kale and tomatoes were harvested. Kitchen scraps were added to the basket, together with kitchen water.

Figure 7. Keyhole garden duplicated by participant of training at FTC with some stubble, evidence of vegetables grown.

In the Meta district (East Arsi), a number of keyhole gardens were constructed at a height much below the recommended waist-height, and as a result these gardens needed to be watered more frequently with fresh water[10]. Poor construction may be among the reasons why in East Arsi the uptake of keyhole gardens is so much lower than in Eastern Hararghe. Other reasons could include the scattered and remote plots of land in the sub-region. Evapotranspiration may also be very high in East Arsi, but gardeners could cover their keyholes in grass or plastic to retain moisture and thus make them successful[10].

Keyhole gardens in Eastern Hararghe

In Eastern Hararghe, government development agents participated in the training on keyhole gardens. Since these participants are very keen to duplicate, there is some government backing, contributing to a more widespread and successful uptake with many healthy keyhole gardens around. Around 10 out of 40 households with keyhole gardens maintain them very well. They treat them with case by slowly adding water to the basket to minimize the loss of nutrients. The keyhole gardens constructed at the local primary school in the ward of Yeabata Lencha in the Kersa district survived the school holidays, providing evidence that demonstrations at institutional level can be successful.

In addition to broader institutional support, and promotion of keyhole gardens at the household level, there are cultural differences between East Arsi and Eastern Hararghe, which could explain the understanding and success of the keyhole gardens. Communities in Eastern Hararghe are known for their open-mindedness and willingness to uptake new interventions[10]. Also, people in Eastern Hararghe have more experience growing vegetables (and *qat*) in the backyard, and they are generally more used to the application of wastewater on non-food crops and may have a better understanding of the nutrients in it.

Figure 8. Keyhole gardens at household level in Lange town (Kersa district). Non-soapy wash water is poured into the basket and water from the standpipe is applied directly onto the spinach leaves. Harvest is for household consumption only.

Vertical gardens

Vertical gardening systems enable the production of vegetables in areas or compounds where space is scarce. Both the vegetable bags, promoted by PICDO in Addis Ababa, and greywater reuse towers, promoted by ROSA in Arba Minch, are vertical gardens. Usually a bag, supported by poles, is filled with a mixture of soil, ash and compost. Holes are cut into the sides of the bag, and leafy greens, like spinach and Swiss chard, are planted in the holes. The key difference between the two is that the vertical garden of the ROSA project is designed with a gravel column at the centre of the bag. Greywater is then poured through the gravel column that removes some of the soap and other components[11]. Often a piece of cloth is stretched over the plants to protect them from direct sunlight.

Figure 9. Preparation of greywater tower in three steps: mixing soil, ash and compost (top left), filling the bag (top right) and watering the vegetables with greywater (left) [11].

Vertical gardens in Addis Ababa

The vegetable bags, promoted by PICDO amongst urban poor households, are used for the cultivation of leafy vegetables such as lettuce, kale and Swiss chard. As some of these are consumed raw, PICDO decided to reduce the risk of contamination by eliminating the reuse of kitchen water. This reinforced perceptions of users who fear that 'contaminants in soapy water may hurt the plants.'

Figure 10. Vegetable bags are efficient space users.

Users water their crops twice per day with water from the municipal standpoint in their compounds. In some cases non-soapy wash water, collected under the standpipe from hand washing without soap, may be applied.

Figure 11. Vegetable bag as pot.

Some households use leafy materials and dry grass, or apply cow manure, bought from neighbours, as sources of nutrients.

Sometimes homemade pesticides are applied, prepared from onion, garlic and chili.

Costs and benefits

The keyhole gardening system can be constructed from locally available materials[8]. However, it is not that simple and labour-intensive as it requires quite some preparation time to collect the various resources. Particularly collection and chiselling of stone is considered time consuming. Once the required materials are there, a keyhole garden can be constructed within a day with some help from neighbours and family[8]. Under the current programs implemented by the Wonji Catholic Consortium, no financial capital investment is required from the vulnerable households and seeds are donated.

In urban areas a keyhole garden may be a larger investment, with many materials not freely available. Stones may cost ~€ 0.09 – € 0.22 each[d]. Here mud bricks covered in plastic sheeting (to prevent drying out and breakage) or the reuse of car tyres, might be more convenient[8].

Table 1. Materials required for construction of a keyhole garden[8].

Item	HCS practical experience	Costs
Stones: medium (not smaller than a fist) to large in size	Households collect stone, using borrowed wheelbarrow	Time + labour, no extra cost
Thatching grass for a central basket		No extra cost
Small tree branches	Or stalks of sorghum and maize	No extra cost
Manure: 10 to 20 wheel barrows (more manure gives higher productivity)	Manure is readily available on farms	No extra cost
Wood ash: 3-4 wheelbarrows	Fire ash is always available as fire wood still is most common cooking method	No extra cost
Soil: 10-20 wheelbarrows	May be difficult in rocky and/or sandy areas but could be replaced by compost	No extra cost
String/rope: 10m	Can by borrowed	No extra cost
Space to build: 2x2m	Usually not a problem in rural areas	Free
Seedlings	Often provided by HCS as household, sometimes supported by district	Free

Wheelbarrows are no commonly-used tool in Ethiopia, but are provided by the implementing organization and then shared among the community to collect and transport materials over short distances. Transportation by truck would be far too costly, so CRS tends to promote keyhole gardens only in areas where stones are part of the landscape.

[d] Currency conversion according to www.xe.com (March 2013): EUR 1 ≈ ETB 24.0

The vegetable bags are especially designed for small plots in an urban setting. Most of the beneficiary households in Addis Ababa are part of the Productive Safety Net Programme (PSNP), which meant that they received seeds and seedlings as a donation from PICDO. Subsequently, PICDO does train households in multiplication so that they can provide for their own replanting. Households not part of the PSNP will incur some costs for seeds and seedlings, for instance at government nurseries that are located across the country and provide low-cost seedlings and seeds.

Hence, the main cost for the vertical gardens is water. PICDO's vegetable bags are currently designed (without a filtration column) for watering by rainwater or from municipal water. The ROSA-project greywater towers are designed for use of greywater. On average, households in Arba Minch produce 45.7 litres of greywater per day. Depending on the number of greywater towers, this may not be sufficient for watering the vegetables. In such cases, additional fresh water may be required, at an incurred cost[11].

The ROSA-project recommends placing a wire mesh on top of the gravel column to filter out any bigger particles in the greywater. ROSA also suggests using half the size eucalyptus sticks as poles to uphold the bag, which reduces the costs. The pilot households found that the shade cloth rapidly disintegrates and begins to tear after one-year, and suggest to stretch the shade cloth over a mesh wire[11]. Together these design alterations bring the cost of a new greywater tower up to € 10.20.

Table 2. Cost comparison between PICDO vegetable bags and ROSA greywater reuse towers, with average costing for an adapted design[10,11]. All costs are in Euros.

Item	PICDO vegetable bag	ROSA greywater tower	Combination: vertical garden with central gravel column
Vessel	Ideally vessels that need not be purchased, such as broken buckets, plastic bags etc. Woven (fertilizer) bag: 0.45	Bucket: 1.62	Woven fertilizer bag: 0.45 Bucket: 1.62 Total: 2.07
Gravel column	n/a	0.83	0.83
Soil and Ash	1.25	0.00	1.25
Compost	1.25	10.81	1.25
Seedlings	0.45	0.45	0.45
Water	Difficult to measure		
Mesh Wire	n/a	4.73	kitchen sieve: 2.70
Eucalyptus poles	n/a	1.62	half size: 0.85
Total (€)	**3.40**	**20.06**	**9.40**

The benefits include improved nutrition and a healthier and active life, as well as acceptance in the community of persons infected and affected by HIV. Those households that sell the excess vegetable produce benefit from some income generation. This can be an important building stone for women-headed households. Increased income can be used to buy necessities such as school books and soap. Most households also participate in women's saving groups (SILC), contributing € 0.21 every week to a revolving fund; € 0.42 as private saving, and € 0.02 for social activities.

Comparison keyhole - vertical gardens

Both systems use a similar principal of applying (grey)water to a central column or basket for sub-surface irrigation. In keyhole gardens this is complemented by the addition of food scraps to the bucket, thereby adding nutrients to the soil. It is not clear however, how much composting actually takes place, without any stirring, in the baskets made of thatched reeds and filled with stones.

The vertical gardens are an option in urban areas, where there is scarcity of space. The keyhole gardens are more suitable for the rural areas, also because of the stones and other materials required. If all local materials are available, the only costs for keyhole gardens are labour -actually a main constraint. Vertical gardens with a gravel column may cost up to € 10.20 and the availability of soil, compost and other materials may be a limiting factor. Key benefits of keyhole gardens are high moisture retention that makes them suitable for water scarce, arid areas; for vertical gardens these are greywater reuse and reduced purchasing costs of vegetables.

Soapy water

Overall, people in Ethiopia seem reluctant to using 'dirty water' for watering backyard crops. Soapy water is said to 'burn the leaves'[7] or 'hurt the plants', but there may be other perceptions of applying a waste product on something that is cared for and consumed later. An early adopter in the Meta district in Eastern conducted his own experiment and poured extremely soapy water through the basket. After discovering that his plants were unhurt, he is now convinced of the benefits of greywater.

In poor rural areas, such as those under the Product Safety Net Programme, greywater is not soapy as soap may be a luxury item to these households. For example, in East Arsi, ash is commonly used for hand washing. In such cases, it may be easier to promote the productive reuse of greywater. In urban areas, even households under the PSNP regularly buy soap: blue bars for dishes and white bars for clothes. Quite large proportion of the monthly income is spent on soap, between € 1.92 and € 3.13, depending on the size and income of the family.

Challenges for upscaling

Both types of vegetable gardening could be promoted in the rural, peri-urban and urban areas of Ethiopia. In the urban areas, the costs of stone will raise the cost of keyhole gardens, but these could possibly be replaced by mud bricks or car tyres covered in plastic sheeting (to prevent crackling of mud brick) or the reuse of car tyres[8].

Households of gardening interventions usually receive seedlings at no extra costs. If these gardening technologies are promoted at a larger scale, there could be opportunities for the development of seedling enterprises. This would fit within a market-chain approach and the government's no-subsidy strategy for sanitation.

Keyhole gardens might be better demonstrated at household level than at Farmers' Training Centres. Households have direct access to greywater and scraps for compost. It is recommended to have the opening of the keyhole point towards the kitchen, for increased accessibility of the greywater/compost basket[8]. Such household-based examples might also demonstrate the potential of vegetable production in the moisture-retaining keyhole gardens during the dry season.

PICDO's vegetable bags, contrary to the vertical gardens in the ROSA project, miss the opportunity for the reuse of greywater. This may have to do with the perception of many urban people in Addis Ababa that soapy water is dirty and will harm the plants. However, with a simple alteration to the design of the vegetable bags, greywater could be poured into a gravel or sand column at the centre of the bag. This column will also act as a filtration system to filter out some of the contaminants and may be more acceptable to the users than sprinkling 'dirty' water directly onto the soil and plants. Where households grow vegetables that are not consumed raw, such as false banana (enset), greywater could even be used in a vegetable bag without further adaptations.

Conclusion

Greywater can be used in vegetable gardens throughout Ethiopia. The keyhole garden is specifically designed for increasing retention in water scarce areas, whereas the vertical garden with central gravel column is a space-efficient technology particularly suitable for designed especially for the denser urban areas. Both gardening options provide improved nutrition to households and for this reason alone the technologies should be promoted across the country.

In some cases, greywater may be contaminated with faecal matter. In the ROSA project "the faecal coliform concentrations in greywater were very high thus indicating a considerable contamination of greywater by human faeces"[1]. The source of this contamination is not clear, but could come from e.g. water used to wash children's diapers. Little is known about how households dispose of their water and whether such washing water is mixed with kitchen water or 'thrown out' separately. More research needs to be done on this, before proceeding to nation-wide promotion of greywater reuse. Even if it contains some faecal matter, the reuse of greywater should not be much of a problem for the keyhole and vertical gardens, as the water is applied to the central column for sub-surface irrigation. Moreover, gravel and other materials in the column may serve as filter. However, in the vegetable bags this contamination presents a potential health risk, as the water may be sprinkled or poured over the plants.

In terms of the multiple uses of water, our findings suggest that reuse of greywater, from kitchen or washing, is a largely untapped resource. As this is linked to perceptions and attitudes, a closer look into hand washing, soap use and faecal matter content of various types of wastewater may provide valuable input and insights to overcome local hesitancy that may exist around greywater reuse.

The MUStRAIN project

The goal of the MUStRAIN project is "to address the critical water problems in water scarce rural areas of Ethiopia by collaboration, implementation of innovative and alternative solutions and exchange of knowledge and mutual learning". Scalable approaches to rainwater harvesting (RWH) and shallow groundwater development (Self-supply) for multiple use services (MUS) have been the focus.

MUStRAIN brings together the strengths and builds partnerships of a consortium of Dutch-based organisations (IRC International Water and Sanitation Centre, RAIN Foundation, Quest and Water Health) and Ethiopian partners and experts with complementary interests in the sustainable development of approaches to MUS. MUStRAIN is led by IRC

and funded by the Partners for Water (PvW) programme.

MUStRAIN aims to promote uptake of Multiple Use Services in different contexts within Ethiopia, by documenting replicable water access/MUS models. In eight case studies cost-benefit relations are analysed, as well as opportunities and challenges for implementation.

The MUStRAIN case studies are:

1. MUS from sand rivers
2. MUS and Self Supply
3. Mechanized pumping and MUS
4. Ecological sanitation for MUS
5. Greywater reuse for MUS
6. MUS and livestock
7. MUS and the Community Managed Project (CMP) approach
8. MUS and manual drilling

The methodology for the current case study includes a review of documented greywater reuse projects and pilots in Ethiopia, the exploration of initiatives within the NGO and CBO community, and the exploration of initiatives and projects through the Susana Forum. In March 2013, keyhole gardens were visited in the wards of Lodescharbe and Debiso, both in the Dodota district in East Arsi. Households using vegetable bags were visited in the Kechene sub-city of Addis Ababa, on 11 March and 22 April 2013. Keyhole gardens in Eastern Hararghe were visited in July 2013.

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The IRC International Water and Sanitation Centre is a knowledge-focused NGO working with a worldwide network of partner organisations to achieve universal access to equitable and sustainable water, sanitation and hygiene (WASH) services. IRC's roots are in advocacy, knowledge management and capacity building. IRC was set up in 1968 by the Dutch government on request of the World Health Organization as a WHO Collaborating Centre. Currently, IRC is established as an autonomous, independent, not-for-profit NGO with its Headquarters in The Netherlands, and local representation in the countries where IRC implements programmes. IRC has profiled itself over the years with innovation and action research to achieve equitable and sustainable WASH services.

In collaboration with:

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