Making links between traditional, conventional and ecological sanitation.

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Development projects in the Third World gain much from having been built upon methods which have their roots embedded in the traditional culture. Such practices evolve because they are simple, logical and bring a tangible and valuable end result to daily life. Some techniques may have been borrowed from elsewhere in the past and been adapted over time to suit local conditions. Methods which fall short of the basic ideals usually fade away in time. Those that make good sense are retained. Throughout the world there are many examples.

One good Zimbabwean example is linked to rural water supplies - the upgraded family well. This technique evolved from a simple water hole into a unit which now combines a lined well chamber, hygienic well head and an adapted miners' windlass to form a long lasting and sustainable solution for providing water of improved quality in the rural areas. Yet a knowledge and acceptance of this elegant technique took years to materialise in the minds of policy makers. It was cast aside as being just too simple to warrant attention. There were endless debates on water quality and safety. And yet in time it has been accepted by officialdom and now forms the basis of a National Family Well Upgrading Programme, which currently serves about half a million people in Zimbabwe. Whilst water quality falls short of that delivered from sealed wells fitted with a hand pump, such upgraded wells pose no known health threat and they are infinitely more reliable. Also they provide water close at hand which can also be used, not only for domestic purposes but also for providing food and for earning a living - in the vegetable garden. The method also blends in with traditional life. All that was required was a little tidying up and an appreciation of its elegance by those who were in a position to make its true value well known.

A traditional method of recycling

I intend to use just one example of a traditional African method of recycling human waste to establish the same principle. It is the method of planting valuable trees in old abandoned latrine pits - a method which is established in countries as wide apart as Rwanda (Beatrice Winberg pers.comm.), Kenya (Obiero Ong'ang'a pers.comm), Malawi (Mbachi Msomphora pers.comm) and India (Jon Lane pers.comm). Many more example will come to our attention. It is a method often hidden from view under an intricate curtain of cover. But where this technique has been established, the growth of trees is known to be spectacular and the fruits large and delicious. Local wisdom has proven that after a period of time the digested excreta does indeed form a suitable medium in which trees can grow. It is an elegant and simple method in which nutrients available in human waste can be recycled to form new fruit which is eaten and then recycled again. The concept of closing the loop is established. It is a method which is easily observed and has a direct benefit for those in the homestead who use it. And yet the method has, until recently, been largely ignored by those looking from outside. Perhaps as a technique, it is seen to be just too simple, like the

family well. Perhaps the association of bearing fruit from human excreta is seen, on the surface, as being unacceptable. Perhaps the influence of Western gardening books has also had an influence. Planting trees on manure is simply not recommended - it cannot possibly work! But the method is simple, works well for those who know how, and is “deeply rooted” in many cultures around the world!

Definitions for eco-san

How does this well established traditional method fit into the more recently evolving concept of ecological sanitation?

In a perfect world a good definition for ecological sanitation might be read as *a system that makes use of human excreta and turns it into a valuable resource which can be introduced into agriculture with no pollution of the environment and in a way which poses no threat to human health.* However, almost no sanitary system known to man can attain this ideal. Many well managed water borne systems lead to some contamination of the environment - those which are poorly managed can lead to gross contamination of rivers, lakes and even seas. However, studies have also shown that even with highly evolved eco-sanitation systems using urine diversion, some pathogens may remain in the end product, albeit in greatly reduced numbers (Moe et al. 2001). The safety of the end product may be linked to the extent to which recommended management techniques are followed. Thus even with this method, the risks of pollution are not necessarily reduced to zero. Simply put - no system is perfect.

This applies to water borne systems, pit latrine systems and also to eco-sanitation systems. Clearly the aim should be to reduce pollution potential as much as is practically possible. In terms of health benefit this may be more closely allied to an individual’s personal hygienic habit than the design of a toilet or toilet system. Pathogens which cause health problems are often carried on the hands or in water or food. If hand washing facilities are not available near to the toilet, soiled hands can easily contaminate such objects as door or cover plate handles, towels and other objects. In this way freshly released pathogens can pass very rapidly from one person to another. Soiled hands can also pass on pathogens to food or to other people by direct contact. So the toilet itself may not necessarily be directly implicated. Health improvements are more closely related to improvements in personal hygiene made possible by the availability of water and washing facilities.

So perhaps a more realistic definition for ecological sanitation might be read as *a system that makes use of human excreta and turns it into a valuable resource which can be introduced into agriculture in such a way that both the health risks and risks of polluting the environment are reduced to a minimum.* If this slight loosening of the definition is accepted, then a wider range of technical options becomes available to the eco-sanitarian. In practice this means the inclusion, not only of urine diverting devices, but also shallow pit concepts where useful trees may be grown or where humus can be formed for later introduction into agriculture.

Urine diversion methods

At the present time most existing latrine systems used in eco-sanitation projects throughout the world are based on the method of separating the urine and faeces

with specialised urine diverting pedestals. This method makes the faeces far easier to handle and sanitise (Stenstrom, 1999). Also the separated urine, having a high content of valuable nutrients, once diluted with water, can be applied to plants as a good liquid feed. It is a well established system which works extremely well (Esrey et al. 1998; 1999; 2001; Esrey and Andersson 1999). However, for many developing countries, including much of Africa, where millions of people do not have access to the most basic form of pit sanitation, it may be an ideal which may only be practical for the minority. The method is costly compared to simpler forms of pit sanitation and does require quite strict management procedures to be successful. Like all methods, it certainly has its place. The writer has used one successfully for three years with less problems encountered than the in-house waterborne system. All excreta has been recycled to produce food.

Links between the pit latrine and eco-sanitation

If simpler shallow pit methods can be introduced as an acceptable alternative to urine diversion under the eco-san umbrella in Africa, then several important links can be made. The strengthening of links between traditional, conventional and ecological sanitation can form a bold front which will take the state-of-the-art forward as a whole. The first vital link to establish is the one between pit sanitation (drop and store) and eco-sanitation.

With the advent of ecological sanitation there has been a tendency in the literature to dismiss the “drop and store” method as being wasteful of the end product and also a source of underground water pollution. The problems of odour and fly breeding are also cited as disadvantages of the “drop and store” method, despite the development of the VIP Latrine which evolved to overcome these twin problems. The problems of underground water pollution can certainly occur, especially where pit latrines are used in high density areas where the water table is high or where the soil formation is fractured. But the great bulk of pit latrines do not really pose an important threat of underground water pollution. There are many other ways in which domestic water can be contaminated. In any case it has now been established that improved health results more from access to improved sanitation coupled with improved personal hygiene rather than the benefits resulting from improvements in drinking water quality alone (Pete Kolsky, 2001). The issues surrounding the implication of pit latrines as a source of underground water contamination have been debated in various papers presented in *Waterlines* (Vol.17.No.4. 1999) and elsewhere.

The fact remains that ecological sanitation has enough strengths and merits of its own without the need to dismiss other simpler forms of sanitation. Likewise the pit latrine and its variants have many great strengths of their own. It is simple and easily managed - that is why countless millions have been built throughout the African continent. Nothing on earth will stop this trend of logic.

Also it is not entirely true to say that the nutrients held in full latrine pits are never recycled and are lost for ever. As we have already seen, fruit trees are deliberately planted in old abandoned latrine pits in many cultures. This is done for a very good reason. Many reports reveal that such trees show phenomenal growth with above average production of fruit. Such observations have been made in many cultures both on the African and Indian continents and also elsewhere. Certainly once a latrine pit is full it must be abandoned, but even where a tree is not planted the

composted material still lies in the ground and the natural germination of seeds may occur in the upper part of the pit. Tomatoes for instance will often form at the head of abandoned pits as well as paw paw, guava and mango. Kitchen scraps may also be thrown on the pile as the pit contents contract and leave a suitable hollow which turns into a compost heap. The germination of all sorts of plants, including trees is inevitable. It is very possible that the observation of this natural process by progressive rural folk led to the practice of deliberately planting trees in old pits.

That nutrients available in the composted excreta are recycled must surely be an accepted fact. Also the human excreta formed in pits and left to compost is never touched by human hands, which is also a benefit. It is true that *Ascaris* eggs may mature, but the excreta is normally buried under layers of soil or garden compost. One argument is that with deeper pits, the potential still exists for underground water contamination. However, by slight adjustments in pit design (reducing depth) and by introducing a small change in the management technique (adding soil/ash regularly to promote the formation of humus), even the potential threat of underground water contamination may be reduced. These concepts are brought together in a latrine system called an *"Arborloo"* - a toilet that becomes a tree! Thus it would appear that all the basic requirements of ecological sanitation are met, even in this simplest of systems.

An example - traditional tree planting culture in Malawi

An excellent account of the traditional method of recycling nutrients in old pits in Malawi has been made by Mbachi Msomphora, formerly of WaterAid, who started an ecological sanitation project in Salima close to Lake Malawi. I include parts of her illuminating text.

.....*The project realised the fact that in promoting ecological sanitation it is important to start from the understanding of local cultural and traditional practices and build upon them in order to make it more attractive and effective. As the merchants would say, you have to speak the language of your customer to sell your products (Sida 1998). It is from reconnaissance surveys that experiences have been drawn from cultural and traditional practices of rural communities amounting to what is accepted formally as ecological sanitation.....*

.....*The planting of bananas on old full pit latrines is commonly practised in Malawi, both in the rural areas and also in peri-urban and urban areas where pit latrines are used. Some farmers have also successfully grown other horticultural crops like paw paws, granadillas, tomatoes, pumpkins and a variety of leaf vegetables. Some farmers practising urban agriculture in Lilongwe and Blantyre have been collecting sewage from the disposal site for fertilisation of their plants or gardens. Since consumption of fruits and other crops grown from human waste is seemingly widely accepted in Malawi, the promotion of the arborloo, where old pits are used as planting grounds for crops is seen as a good exercise which will be effective....*

....*Certain tree species known as "Cham'mwamba" and "Mtumbi" were also shown to grow well on abandoned full pit latrines. The trees are used for various household purposes such as shelter and making poles for fencing and roofing. Besides, leaves from Cham'mwamba trees are used for food ie okra and leaves from "Mtumbu" trees are used for making dyes for dyeing woven baskets. Timber can also be made from*

"Mtumbu" trees. A farmer demonstrating this had several stands of these tree species around his homestead. He had future plans of planting fruit trees.... (From Ecological Sanitation in Malawi by Mbachi Msomphora, WaterAid, Salima. 2001).

In its simplest form, the life of the pit in many traditional pit latrines may be similar to the life of the structure. This will be true where structures are simple and made of grass and wood. After 2 or 3 years or so, a simple structure made of grass and wood will begin to perish. It will be eaten up by termites, moulds and fungi. The timber will rot. It will revert back to the soil. A new structure must be built. At the same time the used pit can be topped up with soil and a tree planted. A new pit is excavated and a new structure is built at the same time. The simple process of recycling starts yet again. Everything has been recycled as in nature.

Recycling in single shallow pits - the *Arborloo*

The introduction of the *"arborloo"* (the name given to a portable latrine that moves on a never ending journey through the lands and where trees are planted in the full pits that are left behind) has taken root easily in Malawi simply because the concept is well established in the traditional culture.

In fact, the method of construction and management of the *Arborloo* is very slightly modified from that of the standard pit latrine. *Arborloo* pits are normally shallower than conventional pit latrines- between one and one and a half metres deep rather than three metres. The superstructures are designed to be more portable. Also soil and ash are added regularly to promote the formation of humus in the pit. The addition of rags, plastic and bottles etc is discouraged. By doing this the pit contents change their form into humus far more rapidly and offer tree roots a much improved environment in which to grow throughout the entire depth of the pit. The shallower pit formation also distances the excreta from the water table and together with the more rapid humus formation, the potential for water table pollution is reduced.

Conversion in deeper pits

Observations made in South Africa by the writer (Maputaland Project of *Partners in Development,* Pietermaritzberg.) reveal that with standard deep pit latrines filled only with excreta (together with rags, plastic, bottles etc which are the standard contents of a deep pit), conversion into humus can be a very slow process indeed. One 2.5m deep pit (lined with concrete rings) was easily excavated down to a depth of 1.5m below which almost raw excreta was observed which had been deposited about 8 years earlier. The material in the upper parts of the pit were more humus like and more suitable for tree growth or use on the garden, but the deeper central core of the pit contents, where a distinctly anaerobic environment existed, had led to little change in the excreta. A sample of this foul material was placed in a bucket and surrounded by fertile soil. It changed into a sweet smelling humus within three months. The soil, in allowing beneficial microbes and air to come near the excreta had effected a change in just a few weeks, that years of anaerobic digestion in the base of the pit had not accomplished. Such observations are very convincing.

Soil testing

In a recent trial, raw faeces (from a urine diverting unit) were placed within a bag of shade cloth (to identify it as being just raw faeces and nothing else), and surrounded by fertile soil in a bucket. Shade cloth is a woven plastic material with air spaces. The faeces within the bag changed into “soil” within a period of 4 months. This “soil” was taken for analysis to the Soil Testing Laboratory in Harare. It was identified as having a medium grained sandy loam texture with a minimum Nitrogen content of 118 ppm (before incubation) and 230 ppm (after incubation). Phosphorus: 272 ppm, Potassium 4.40 me/100gm; Calcium: 46.71 me/100gm; and Magnesium 30.30/100gm. A rich healthy “soil” in fact, quite suitable for mixing with other less fertile soils. Intense biological activity undertaken by beneficial soil bacteria, fungi, insects, worms and other animal life had taken place across the shade cloth barrier to effect the change. The temperature of the bucket contents was around ambient - around 16 degrees centrigrade. This process is best described as “ambient temperature composting.”

Root invasion into pits

These observations and others suggest that where trees grow in old abandoned latrine pits, the roots may invade only the upper part of the pit initially, which will normally be sufficient for their growth. There is a curious relation between the roots of plants and their invasion into converting excreta. The roots carry oxygen into the mass and thus promote humus formation. But the roots will only move into the mass once there has been a conversion of excreta into humus. Some trees are more tolerant than others. There is intense biological activity around the root zone. The plants are sensitive to, and move forward or hold back according to the state of the excreta. Trees hold back for a period if the soil/excreta mix is not yet suitable for root invasion, a process I call “hesitancy.” Sometimes the tree may die. More often, once the tree is on the move, it grows with great vigour. Trees are best planted in a layer of topsoil placed above the converting excreta, so that the young roots enter pure soil first before tackling the more organic environment below.

Area of soil contact

The argument that the presence of soil assists in the conversion of excreta into humus can be taken further. The conversion of excreta into humus will take longer in pits lined with bricks or cement rings compared to simpler pits which are only partly lined with bricks (eg ring beam) and where a large area of soil is in contact with the excreta to form an active biological interface between soil and excreta. For the same reason the regular addition of meaningful quantities of fertile soil into the body of excreta deposited in a pit will promote the more rapid formation of humus. There are more pockets or layers of air and beneficial microbes present in the mix of ingredients.

Recycling in twin pits

Mbachi Msomphora also describes how some rural farmers in Malawi preferred to excavate their *Arborloo* pits rather than plant trees, and therefore practice the alternate use of two or more shallow pits to make humus. The shallowness of the pit (up to 1.5m) and the more rapid formation of humus (after about 2 - 3 months in Salima, which has a warm climate) resulting from the additions of soil to the excreta in well drained pits, meant that pits could be excavated easily and the extracted material (humus) was pleasant to handle. Such humus can be directly applied to the

lands and used for vegetable growing. Tree planting is not directly involved in this process, but the humus can be mixed with other soils to form a planting medium for trees and other plants including vegetables.

Here we have the seeds of the *Fossa alterna* concept which has been described (like the *Arborloo* and other eco-sanitary methods) in *Ecological Sanitation in Zimbabwe* Vols. I, II, and III *(*Morgan 1999, 2001a, 2001b). The *Fossa alterna* is a latrine system designed to promote the formation of humus in two alternating shallow pits. Like the *arborloo,* the pits are shallow (1 – 1.5 metres), and both the concrete cover slab and the latrine structure are portable (a variant in Mozambique has a single portable slab but the twin pits are housed within in a single structure - Breslin, 2001). The twin pits are used alternately. Soil and wood ash are added regularly into the shallow pit together with excreta (urine and faeces). The addition of vegetable matter like leaves and kitchen scraps also helps the conversion. Formation of humus is thus encouraged. The rapidity of humus formation depends on many factors which includes ambient temperature, proportion of soil/ash/leaves etc added and its distribution within the pit and also the drainage characteristics of the pit (influenced by pit lining and soil type). Conversions in well drained pits in which a good mix of ingredients has been added may be as little as 2 - 3 months in a warm climate (Salima, Malawi) or about 4 - 6 months (Hatcliffe, near Harare, Zimbabwe). Humus formation takes longer (9 - 12 months) in less well drained pits with poor management (lower proportion and distribution of soil). As we have seen, the formation of humus from human excreta may take many years in conventional latrine pits where excreta alone is added to a pit. Normally one year is an adequate changeover period for the *Fossa alterna* if soil has been added in meaningful quantities. The *Fossa alterna* method is now being used and evaluated in Zimbabwe by the Mvuramanzi Trust and other organisations. Experiences are also building up in Malawi, Kenya and Mozambique. The exciting Mozambican experience was debated in Stockholm earlier this year (Breslin, 2001). The *Fossa alterna* concept is still evolving.

Long cycle - short cycle?

The concept of encouraging the formation of humus in alternating pits is adaptable. The cycle of change can be short (6 - 12 months) but can also be long (5 - 10 years). Where the frequency of change is short, the pits can be shallower, but the structures must be more portable. Where the frequency of change is longer, the pits must be deeper but the structure can be more permanent and even made of bricks. There is the possibility of infinite variation. Variants of the Blair (VIP) latrine have now been designed in which everything is recyclable from the excreta below ground to the bricks, pipe and roof used to build the structure above ground level. Three metre deep Blair pit latrines are known to last a family up to ten years. Filling time depends on the volume of the pit, number of users and what extra ingredients enter the pit (rags etc). By taking the same number of bricks and making two shallower pits (each 1.5 deep) and building a structure which can be moved back and forwards, one has built the equivalent of a humus making factory in which human excreta together with soil goes in at one end and humus comes out at the other. Each pit may be used for 3 - 5 years and then moved to the second pit which allows for several years of composting within the pit. Even brick structures can be designed so they can easily be taken apart and rebuilt within a single day. The end result in all these cases is a humus material which is not only suitable for growing trees (in situ) but also suitable

for excavation and reuse on the lands. In essence these are no more that pit latrines. But the twin pits are shallower and the management is slightly changed to encourage humus formation.

All these simpler “alternative” eco-san methods based on the shallow pit do require a greater level of management skill than is required by the simple pit and VIP latrine. Structures must be moved from time to time and trees planted, protected and watered. Humus must be excavated and judgements made when the material is ready. However the benefits may well exceed expectations. Decisions have already been taken in many different parts of the world to plant trees on old pits even although it may not be a conscious act of recycling nutrients held in human excreta. It is more likely a decision made because trees often grow better in old latrine pits than in the barren soils surrounding them. These facts perhaps offer the most compelling evidence that this simplest form of ecological sanitation can work in practice. The aim should be to build on it.

Such elementary methods may act as “*entry points*” into the world of ecological sanitation as we see it today in Africa. Whilst the jump from simple pit latrine to urine diversion maybe too large a stride to make in one go, the same journey can be made in a series of steps on a ladder on which the user can stop on the rung most suitable for the family at the time of construction.

Conclusions

The sanitary journey can be made from the simplest of latrines through a wide range of technical options. Rather than separating the various sanitary methods into isolated clusters, they can all be linked in one way or another on a “sanitary tree” or “ladder.” Traditional techniques can be linked to conventional techniques and both of these can form logical connections to the newly evolving concept of ecological sanitation. And there are additional benefits - the worlds of sanitation, agriculture and forestry can also become linked - adding new “colour” to rather a drab discipline. The potential for improving soil fertility and tree production becomes a reality. And these are important considerations in a world made up of ever increasing barren landscapes devoid of tree cover. It is simple and logical. Only simplicity and logic can take the sanitary world into a new era of enlightenment.

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