

1. An Introduction: understanding the concept of ecological sanitation

For most people sanitation means sitting on a toilet and flushing away the excreta to waste or simply sitting or squatting on a pit toilet and letting the waste matter build up in a pit. In both cases the excreta is disposed of and forgotten in the quickest and most convenient way. To be frank, this is an entirely logical view - there are far more important things to concern us all. But in a world which is becoming increasingly polluted from excreta, and where many of the world's population do not have access to a decent toilet at all, it does make sense to look at excreta in another way. The fact is that excreta can easily be made safe and contains valuable nutrients which can be used for enhancing the growth of food. And the methods of achieving this are not complex or expensive. On the contrary, they can be undertaken very cheaply, with great benefit to those who try.

Ecological Sanitation concerns the recycling of human excreta to form products which are useful in agriculture. Those who believe in ecological sanitation see the human excreta, not as a waste but as a valuable resource. And a resource which is renewed every day! To put it simply... *ecological sanitation is a system that makes use of human excreta and turns it into something useful, where the available nutrients can be recycled in agriculture to enhance food production, with minimal risk of pollution of the environment and with minimal threat to human health.*

In fact processed faeces can turn into excellent humus. This humus contains a well balanced mix of nutrients, such as nitrogen, phosphorus and potassium, which are easily taken up by plants. Urine also contains a similar range of nutrients, being particularly rich in nitrogen, which makes it useful for feeding green vegetables and maize. Even a combination of urine and faeces, when allowed to compost together in a shallow pit, with soil, wood ash and leaves, can turn into a sweet smelling and fertile humus. This humus is quite unlike the original matter from which it was formed, and when mixed with poor soil can greatly enhance vegetable production. Such a conversion is nothing short of a miracle of Nature.

But there are problems. Raw excreta is reviled, odorous and unpleasant in the extreme. The excreted products, particularly the faeces, are known to carry a multitude of pathogenic organisms which carry disease. For most people they are best disposed of and forgotten as quickly and as effortlessly as possible. That means the use of a flush toilet or a pit latrine - out of sight and out of mind. And for much of the world's population the flush toilet and the pit latrine must continue to form the basic form of excreta disposal for a long time to come.

But there is a growing concern about the use of ever depleting fresh water supplies to flush away such wastes, which can often lead to greater pollution "down the line." Where there is a lack of space, even the ubiquitous pit latrine cannot easily be emptied to form space for another. And even deep pit latrines eventually fill up and must be abandoned. The problems faced in high-density urban areas are the most pressing and also the hardest to solve. And for much of Africa, the cost of an improved latrine may also be prohibitive.

Perhaps the answer may lie in applying the principles of ecological sanitation. Now there is an extended range of options that can suit a wide range of users - from the very poor to those who are well off. Slowly but surely the concept of ecological sanitation is broadening and rising to help solve these serious problems.

There is also a concern that valuable nutrients are being lost, in vast quantities, every minute of the day by the disposal of excreta in conventional ways. The nutrients available in processed excreta are ideal for use on the lands and in vegetable gardens – and yet these valuable resources rarely come anywhere near our gardens in most parts of the world. Where flush systems are used they fertilise our lakes and seas instead of our fields, with dire consequences.

Shallow pit systems

Two of the three main toilet systems described in this book process the excreta in shallow pits. The third system separates urine from faeces and these two products are processed separately. The methods using shallow pits are simple and relatively cheap to construct, and are thus more suited for uptake in the poorer countries of the world, where pit sanitation may already be the standard method of excreta disposal.

This approach has been undertaken for several reasons. The world of ecological sanitation has been broadened to include very simple and forgiving methods which are similar (if not identical) in their use to the standard pit latrine – the most commonly used excreta disposal system in the world. These systems have been given names – the *Arborloo* (a simple pit - toilet in which a tree is later planted) and the *Fossa alterna* (a twin pit toilet which forms humus). Such methods are, in this account, seen as introductory or entry points into the world of ecological sanitation and the recycling of human excreta. They are particularly useful and appropriate for use in parts of Southern and Eastern Africa. The urine diverting system is seen as an excellent but more sensitive concept – its success depending greatly on meticulous use and regular maintenance. Thus the range of options is expanded to include methods which are more forgiving and thus less sensitive to misuse. Also there is a problem of cost to consider. Urine diverting systems are more complex and costly to build and may be beyond the scope of the less well off, which on a continent like Africa, may be most. However, there are many ways of collecting the valuable urine other than separating it in a pedestal or squat plate. Urine can be collected in containers, bottles, potties and stored and later mixed with water for application to the soil. There is much flexibility.

Urine diversion

There are many ways of putting ecological sanitation into practice – and it starts off with the use of an appropriate toilet. A huge range of ecological toilet designs exist from the very simplest to the most complex. Most ecological sanitation programmes throughout the world use a concept known as ‘urine diversion’ to separate the urine from the faeces. The faeces accumulate in one place and the urine in another. A specialised urine diverting pedestal or squat plate is used for this purpose. Most of these are designed for sitting, but an excellent squatting type has emerged from China. Both faeces and urine are much more easily handled when they are separated. The smell is much reduced, as is the potential for fly breeding, common to most pit latrines. The urine can be contained, and then later:

- a. Diluted with water to make a plant food particularly rich in nitrogen, or
- b. Applied undiluted to the soil and watered in, or
- c. Applied to the land without dilution, and then left, before planting, for soil bacteria to convert the urea into nitrate nitrogen for later uptake by plant roots.

In most urine diverting toilets, attempts are made to desiccate and sanitise the faeces. Lime or wood ash (and often dry soil or sawdust) are used for this purpose, being added regularly to the faeces which accumulate in vaults or containers. The combination of desiccated faeces

and ash or lime turns into an alkaline, sterile product which in countries like Guatemala is known as “abono.” This inert and inoffensive material can be stored in bags and is often applied to the land as a soil conditioner. Being very alkaline it is good for acid soils. When it contains much ash, this will help to increase the potassium level of the soil. In its dry state it is certainly quite a safe material.

Most practitioners of ecological sanitation feel the greatest value of excreta lies in the urine, which contains most of the nutrients, and a very high proportion of nitrogen. They see the dried faeces as a secondary product of much reduced value. Some advocate digging it into shallow pits or burning it. But this book promotes the view that humus derived from composted (as opposed to desiccated) human faeces is far too valuable to burn or to dig into holes which are then abandoned. In fact this humus has a far better overall balance of nitrogen, phosphorus and potassium than urine. Also the faeces, once processed, provides humus, a vital material for the healthy growth of all plants.

The ideal is to use a combination of both humus and urine in our gardens, taking advantage of the best qualities of each. Much has been written on the subject of urine diversion and reference should be made to the bibliography at the end of this book. This book deals mainly with the almost unknown range of non urine diverting methods, since they have been little researched and written about before. One chapter in this book is devoted to urine diversion and another to urine and its use.

Upgradeability

The concept of being able to upgrade from one system to another is also embraced here. It is for instance possible to start in the simplest possible way with an *Arborloo*, and then upgrade to a *Fossa alterna*. This too can be upgraded later to achieve a fully urine diverting system, when the concepts of recycling are fully understood and appreciated. Thus urine diversion is a system to aim for in a step-by-step upgrading process. In all cases the primary aim of ecological sanitation is to recycle human excreta in a simple, safe and effective way. Whichever method is used, the results should be obvious to the users and useful to them. For without a true value being perceived from the user’s point of view, the ultimate aim of ecological sanitation can never be realised. To form a convincing appreciation, the humus formed in the eco-toilet must be seen to enhance the condition of the soil and actually lead to greater production of vegetables, food crops and trees. The urine must be seen to make plants grow larger and provide more food. Without such evidence, people will not be convinced.

The management of ecological toilets must also be simple enough to be achievable. The extra effort involved in managing eco-latrines must be repaid many times over in the end result – and in most cases this simply means more food to eat. Without this return, in the eyes of the user, ecological sanitation can never attain the position it deserves.

Recycling – the central issue

Ecological sanitation embraces far more than building eco-toilets. The toilet is important but it is only part of the system. The toilet fits into a concept of recycling compostable materials within the homestead as a whole and plays its part in recycling biological wastes from the kitchen as well as the garden. Obviously the “eco-toilet” is a central component, but the system also includes the processing of human excreta into products which are safe and valuable in agriculture. The aim is to show that the nutrients held in processed human waste can be recycled in a simple, safe and effective way to increase the production of food (both vegetables and fruit). This is known as “**closing the loop.**” That means that food is

consumed, excreta formed, excreta converted into humus and that humus (and urine) is used to grow more food which is consumed again. That is closing the loop!

The **practical demonstration** of the usefulness of the by-products of human excreta in agriculture is seen as an important component of all ecological sanitation programmes. Consequently the crucial step of linking toilets with a method of producing humus or urine for use in agriculture (or forestry) must be emphasised. It is this very important management procedure which is vital to the success of ecological sanitation. In ecological sanitation, success depends on proper management, and thus depends on user participation to a far greater extent than conventional sanitation systems. It is no longer a case of sit and flush or squat and deposit. Ecological sanitation embraces a philosophy which the users must believe in and practice daily. Such an understanding and practice takes time to fulfil.

Forming links with agriculture

Ecological sanitation has come at a most important time, not least because it is able, unlike most other forms of sanitation promoted before it, to form direct links with other important disciplines. The need to improve top-soils in a world where most soils are poor and unable to generate good crops is an important consideration. On a small scale, ecological sanitation can greatly assist this problem. The humus resulting from composted human faeces makes an excellent humus-like soil conditioner, admittedly not in huge quantities at the family level, but certainly sufficient to enhance vegetable production in the back yard. The aim is to mix the humus formed in toilets with infertile and worked-out soil, thus making a “new soil” in which plants can grow far better. The urine can also be used to enrich the soil further, particularly for growing green vegetables. Those practising ecological sanitation should also be familiar with the methods of making garden and leaf compost so that all these fertile materials can be mixed to form an enriched soil suitable for planting vegetables. Such humus, when properly used in agriculture, helps to improve food yields considerably and hence provides more food security and improves the nutritional status of the beneficiaries.

It is accepted that gardening and home based vegetable production may not be important to all potential users of ecological sanitation. But in the context in which this book has been written, which is for use in the urban, peri-urban and rural areas of Southern and Eastern Africa, food production in the home can be an important issue, and is taken seriously by most families. However, as we shall see, eco-toilets can solve other problems related to conventional sanitation, not least the saving of water or ease of excavation of shallow pits.

Thus important links can be made between sanitation and the worlds of agriculture and forestry. And also of importance is the link to permaculture where methods associated with the best organic farming are emphasised. Permaculture emphasises the use of natural methods, where organic materials of all types are used to make valuable humus. The miraculous change of human excreta into humus is one of Nature’s marvels. Without this natural process of “building up” and “breaking down” no animal or plant life could exist on Earth.

The living soil – humus is important.

The message contained in this book sees the converted faeces as a product of considerable value and no less important than the urine. The soil is placed at centre stage as a converter of excreta into humus. The ideal is a mix of excreta, soil, ash and leaves, which, within a year turns into a valuable humus within a shallow pit. Even with urine diversion, the separated faeces, initially mixed with some wood ash and soil in the latrine, can be moved to a

“secondary composting site” where additional soil and leaves are added. The end result is also a nutrient-rich humus, not a sterile dust. The converter is the “living soil,” greatly assisted by the presence of leaves and ash.

Global considerations

Perhaps there are broader objectives too. Turning a renewable waste product like excreta into humus in which plants of all types can thrive has considerable merit in its own right. Even more so, in a world overlain by depleted soils and barren landscapes. Saving valuable phosphorus, a vital nutrient in plant formation, is also vital – for world supplies are being depleted at an alarming rate. Human excreta is a most valuable source of phosphorus, and also of nitrogen and potassium – all vital elements to food production.

Letting Nature work so effectively for Man has supreme merit. *Nature at work* lies at the heart of the message provided by this book. The conversions are natural - the growth of plants a natural response to the fertile soil. The soil organisms of all types, beneficial bacteria, fungi, worms and insects, are seen to be at work throughout the entire process. The nutrients available in eco-humus and urine can work for the benefit of Man. Whilst these processes of Nature take place, for the most part out of sight and out of mind, in combination they represent a great movement towards improving the fertility of the Land - something of supreme importance for the survival of Mankind on a planet which is fast being depleted of its natural resources.



Fine tomatoes growing on humus derived from excreta