



# Exploring and Implementing Agricultural Opportunities in Monwabisi Park, South Africa

An Interactive Qualifying Project submitted to the faculty of Worcester Polytechnic Institute in partial fulfillment of the requirements for the Degree of Bachelor of Science

Submitted by:

Alex Madden

Jasmine Pitts

Gina Roffo

Bridget Stevens

Submitted to:

Project Advisors:

Professor Scott Jiusto

Professor Joseph Petrucci

Project Liaison:

Zero Emissions Research and Initiatives Southern Africa (ZERI)

Soil for Life

December 16<sup>th</sup>, 2009

## *Abstract*

The mission of the Gardens Team was to collaborate with the residents of Monwabisi Park to research and implement sustainable agricultural systems that could provide nutritional and aesthetic benefits. The team planted gardens and created educational materials to develop the community's agricultural capabilities. We proposed composting procedures that will be utilized in the Indlovu Water and Sanitation Facility. Through our achievements, we hope to provide a sustainable gardening plan and a base for future teams to build upon.

*This project report is part of an ongoing research program by students of the WPI CTPC to explore and develop options for sustainable community development in the informal settlements of South Africa. For more information, please go to:*

<http://www.wpi-capetown.org/>

*The following is an executive summary of a full project report that has been implemented as a website available at:*

<http://www.wpi-capetown.org/projects/2009/gardens/>

## ***Problem Statement***

Informal settlements, such as Monwabisi Park, South Africa, are built by groups of people looking for a temporary place to live while seeking employment in nearby economic centres. When the economy of these cities provides inadequate job opportunities, the settlements become permanent because the residents cannot earn the means to relocate or significantly improve living conditions. Unemployment in these settlements can be upwards of fifty percent with many residents lacking necessities such as electricity, running water, or toilets (Strategic, 2001). Following this pattern, resources for the residents of Monwabisi Park are often minimal and not readily available. Foods, in particular fruits and vegetables, are expensive and may require residents to travel long distances to purchase them at markets. With the existing agricultural conditions, many families are already spending large portions of their income on food (Envisioning Endlovini, 2008), yet fresh fruits and vegetables do not make up a large portion of residents' diets and malnutrition is commonplace (Dannhauser, 2000). Although some residents have gardens, little food is self-produced. For most residents, there is not enough space, time, money, soil amendments, knowledge nor social support for residents struggling to provide food and shelter for their families. The lack of necessary resources therefore limits the prevalence of gardening in Monwabisi Park.

In addition to nutritional and economic hardships, the people of Monwabisi Park also face the challenge of obtaining the proper supplies to deal with the physical conditions of their community. The soil in Monwabisi Park is arid, sandy, and due to the location of the park on an old landfill. The VPUU did a base line survey of Monwabisi Park and discovered that out of the 546 residents surveyed, 150 had a garden area and only four people in the survey population were actually growing a vegetable garden in their household. This general lack of gardening within the community can be accounted for by the difficulty and length of time it takes in the Monwabisi conditions to produce a worthwhile harvest (VPUU, 2009). We learned through our own experience that gardening in Monwabisi Park without the use of proper composting techniques is inefficient and ineffective. Without modification, the landscape is extremely intolerant to growing most plants and vegetables. The heavy winds of the Cape Flats also pose problems; if not properly shielded, plants will be stunted in growth. In Monwabisi Park, gardening is not commonplace due to limited access to proper supplies, poor soil conditions, and a lack of motivation for the gardening process.

## ***Background***

Currently, the agricultural activities in Monwabisi Park that do exist consist mainly of a small number of residents who have planted gardens around their homes. Some of these residents have completed a course on sustainability and gardening with the Soil for Life organization, and have a good understanding of gardening techniques and sustainability. However, based on field research which turned up only a handful of gardens in the community, it is apparent that interest has not spread beyond the small number of residents who have already established gardens. There have been some solutions proposed and implemented by the Shaster Foundation and by local residents of Monwabisi Park. In the past few years, the Shaster Foundation has offered a biannual gardening competition, where the winner receives a cash prize (Womersley, 2008). The foundation has also planted a few organic gardens around the community buildings in Monwabisi Park; most specifically, the crèche building (Womersley, 2008).

An extensive program is needed in order to bring sustainability and agricultural activities to Monwabisi Park. One organization that provides such a program in the area around Monwabisi is Abalimi Bezekhava. This non-governmental organization's (NGO) goal is to counteract poverty in the informal settlements by establishing programs that bring together and train the community while providing residents continual support and access to resources. Subsidized supplies like seedlings, manure and compost are provided at different program garden centres located within the community. Economic outputs are also included through the hosting of organic markets where local gardeners can sell excess produce. Much of the work is done in collaboration with other organizations and groups to create extensive and sustainable support (Abalimi).

Soil for Life is another non-profit organization based in Cape Town that focuses on creating sustainable agriculture through education. They hold workshops that cover many aspects of sustainable gardening, such as

composting, container gardening, and water wise gardening (Soil for Life, 2009). Soil for Life also has their own permaculture garden where they raise seedlings, maintain a vermiculture system, and experiment with different sustainable gardening techniques. One unique feature of Soil for Life's garden is the dry-composting system they have established for their toilet facility. The point of the system is that by setting up three bins and filling them one at a time, you should be able to safely use the compost from the first bin in their gardens once the last bin is full. This is a unique system of pasteurizing human waste that has the potential for implementation in the Indlovu Centre's Sanitation Facility.

If treated and pasteurized correctly, human waste compost can be used as fertilizer for gardens around the community. The concept of pasteurizing waste is that, given a certain amount of time, heat will kill off all the pathogens in the waste. The simplest form of pasteurization is solar pasteurization. This system uses the energy of the sun to 'hot box' the compost (Lachapelle, 1997). At any temperature, with enough time allotted, the heat will remove harmful pathogens while leaving beneficial micro-bacteria intact (Sutcliffe, 2000). This method of treating waste has been successfully employed in Yosemite National Park and, due to the ease at which it could be replicated, we have created a plan for its implementation in the Indlovu Project's Water and Sanitation Facility.

If the waste compost is to be treated nearby to the toilet facilities as well as homes, odor control becomes a major issue. One possible way of controlling odors is the use of effective microorganisms. Effective microorganisms are specific phototrophic bacteria that serve a variety of purposes by simply performing naturally in their microbial colonies (Abalimi, 2009). These types of microorganisms could be used to accelerate the decomposition of waste in the Indlovu Centre's proposed Sanitation Facility. The bacteria feed upon the very organic compounds that cause odor (hydrogen sulfide, methane, etc), therefore eliminating most odors inherent in a dry composting system. This works especially well when the waste is taken from the system and put into an external composter, such as a solar pasteurizer. The elimination of odors also eliminates the problem of flies around the toilets. The phototropic bacteria also have detoxifying properties and can turn harmful bacteria into beneficial ones (Efficient Microbs SA). EM has the potential to significantly improve the quality and functionality of a dry compost toilet system.

### ***Mission & Methodology***

The mission of the Gardens Team was to work with the residents of Monwabisi Park to research and implement a sustainable agricultural system that could help provide nutritional and aesthetic benefits to the community. The goal of this project was to analyze the feasibility and benefits of creating a community-based gardening system in Monwabisi Park. As part of this effort, the team researched methods of removing pathogens from the potentially harmful byproduct of the proposed dry composting toilet, so that soil amendment might be more widely available for gardening.

### **Objectives**

1. Characterize the Key Aspects of the Local Environment
2. Develop Community-Based Educational Materials
3. Research and Implement Different Types of Example Gardens
4. Research and Propose Methods of Removing Pathogens from Compost and Integrate Byproducts in Community Gardening Efforts



**Household Garden**

## Characterizing the Monwabisi Environment

In conjunction with members of the Monwabisi community, we explored the current agricultural conditions in the area. By physically seeing the surroundings, we obtained a clear understanding of how our project needed to be focused in order to bring about the most significant change for the residents. The soil in the community is infertile, dry, and lacking many nutrients. We created a listing of what types of vegetables community members could grow and what methods could be used to ensure success. We supplemented our field observations with interviews of current community gardeners and others with no gardening experience. We also conducted interviews with our co-researchers (community members hired by the WPI Cape Town Project Centre to aid us in our research), where we asked questions geared toward understanding why the majority of community members do not have their own food gardens.

## Agro-Educational Informational Materials

Our team recognized that the best way to begin achieving sustainability in the community was to certify that there would be educational supplements in place, which community members could easily utilize. To achieve this goal we first invited one of our sponsors, Pat Featherstone from the organization Soil for Life, to give a tutorial on water-wise gardening practices and how to grow the most nutritional foods in the smallest amount of space. Any interested community members were encouraged to attend this seminar. Eight residents came to the workshop and those present were very interested and gained a large amount of useful knowledge. Our second procedure in ensuring sustainable educational practices was designing pamphlets detailing the processes taught at Soil for Life's seminar. Our community co-researchers translated the pamphlets into Xhosa, the language spoken most frequently in Monwabisi Park, in order to make the information more widely accessible. Our final stage of the education piece of our project was to set up demonstration gardens enlisting various permaculture techniques (working with the existing environment to create the most efficient agricultural system) around the community centre and crèche of the Indlovu Project. By working with community members in installing these gardens, we were able to determine the most efficient practices collectively.

## Researching and Implementing Gardening Practices

Around the Indlovu Centre, we worked with interested community members to create demonstration gardens to display the most useful gardening techniques we came across in our research. We used easily accessible materials from the area, the most common being tires from the dump at the back of Monwabisi Park. We combined the ground soil with donated compost to create a more fertile environment inside the containers. We researched methods for planting herb and vegetable seedlings to ensure each seedling was paired with its most suitable companion for optimal growth. In addition to the many vegetable and herb container gardens, we designed and planted a medicinal garden for use by the crèche at the Indlovu Centre.



Demonstration Garden behind the Crèche

We also planted aqua-trap gardens around the Indlovu Centre modeled after Pat Featherstone's workshop. Aqua-traps are meant to catch water and compost while allowing the soil to be more water-efficient and nutrient-enriched. To create an aqua-trap we cut off the front side of a tire and super glued a section of black tarp over the hole in the middle. After creating the aqua-traps themselves, we worked with Xolani, the community gardener, to dig a hole large enough to place two traps in the bottom. We filled the hole with a mixture of compost and ground soil. In the bed, we planted a variety of seedlings and built a short wall around the garden to protect the seedlings from wind and pests. The aqua-trap method is an inexpensive, uncomplicated, and effective way to create gardens



View of the Interior of the Earthworm Farm

in areas where resources, such as water and compost, are not always available (Featherstone, 2009).

While creating our demonstration gardens, all of the compost had to be donated from an outside source. In order to eliminate the need for a constant donation of compost, we designed and implemented a worm garden for the community centre. Vermiculture is an excellent way to compost common organic waste and it requires little maintenance. To create the worm garden, we bought a bathtub from a vendor in Monwabisi Park and designed a platform for it to rest on behind the community crèche building. We filled the tub with bedding material consisting of damp newspaper, potting soil, and organic waste. The worms were added in a layer on top of the bedding and covered with a thick layer of damp newspaper and woodchips. The tub was then covered with wood and pieces of the metal siding used on the shacks. This was meant as a barrier to keep predators and sun away from the worms. A pail was placed under the drain to collect drippings that, when mixed with water, will create a “worm tea” that works as a rich fertilizer for use in food gardens.

### **Composting as Part of the Proposed Water and Sanitation Facility**

WPI and the University of Cape Town are proposing a new Indlovu Project water and sanitation facility containing water taps, a laundry station, and a dry composting toilet system. The composting toilets will produce a byproduct with potentially harmful pathogens. For this reason, the compost cannot be directly applied in gardening for food. We researched different methods for dealing with ‘unsafe’ human compost. The hope is that by treating the waste produced by the toilets, the compost can be used to enrich the soil of the park and allow residents to grow their own food more easily. Dependent on the implementation of a new toilet system in Monwabisi Park, our research could be a starting point for further research and development.

We compiled our research into a proposal that includes two options for pasteurizing compost and a supplementary option for removing pathogens using effective microorganisms. It contains a brief summary of each option as well as a short plan for implementation. The team also included suggestions as to which system would provide the most benefits and be the most sustainable in Monwabisi Park.

### ***Results and Analysis***

Through the course of our project, we successfully installed example container gardens around the Indlovu Centre, and in a yard near the crèche building. Gardening in the current conditions of Monwabisi Park is complicated due to the inadequate soil. The sustainability of our gardens and the ability for our plants to produce a harvest is uncertain but we are hopeful. Xolani showed great initiative with the demonstration gardens and cared for them on the days that we did not go to the community. This enthusiasm suggested that the gardens we planted are going to be well maintained beyond the period of our project, which should allow them the time they need to grow. There are also a few people in the community of the Indlovu Project willing to continue gardening and working on bringing the concept of urban greening to the community.

In order to add essential compost to the soil, we created an earthworm farm behind the crèche building. The downside to this system is the fact that the start-up cost is relatively high, which makes the option unfeasible for use in household gardening systems. Earthworm farming is, however, a viable option for implementation in a community garden situation, such as the Indlovu Project, because of the fact that there is a caretaker who focuses on the maintenance of the agricultural systems.

We researched and designed step-by-step ‘how to’ pamphlets in Xhosa and English, meant to educate the community and raise awareness of useful gardening techniques. These pamphlets were printed and are now located at the Indlovu Centre to allow interested community members easy access to the resource. From the understanding we have gained of the current interest toward gardening in Monwabisi Park, these gardening pamphlets are going to be the best way to boost household gardening and bring the community closer to agricultural sustainability.

Along with the gardening pamphlets, we constructed “Feed a Family” gardening kits, designed with the hope of increasing gardening activity within the community. By giving a family everything they need to start a garden in their own household, we hope to eliminate the start up cost and give them a concrete reason to begin their own food garden. This donation program will be available through the Shaster Foundation following the

implementation of the WPI Economy Team's Sustainability Plan, which will set up the method through which donation money will be utilized.

Aside from gardening and greening, heavy focus was placed on researching composting options for the waste by-product of the sanitation facility. We compiled the most feasible options for implementation into a plan submitted to the University of Cape Town as part of our collaboration to design a functioning, experimental facility. This proposal will be used in the final design of the water and sanitation facility and its systems. We hope that this will help accomplish a big step toward sustainability in Monwabisi Park because the sanitation facility is one of the corner stones of the Indlovu Project.

### ***Conclusions and Recommendations***

The gardens team designed and planted numerous demonstration gardens around the Indlovu Project Centre and created a worm garden that can generate compost to help support them. These gardens serve to encourage similar practices from others in the community by providing an example to follow. Some residents who already garden have shown increased interest in their own gardens and have applied the techniques demonstrated in Pat Featherstone's presentation. However, there is still a general lack of interest from most of the people in the community. Through the interviews with the co-researchers, we learned that many community members would not find it practical to use gardening as a source of food because of start up costs and the amount of time required for maintenance. We networked with the local urban gardening and greening NGO, Abalimi Bezekhaya, to try to gain the involvement of an established and experienced gardening and support group. This proved unfeasible due to the monetary investment they require for their gardening programs.

In addition to gardening and greenery, we worked with the WPI Water and Sanitation team to determine a means of dealing with and treating the waste compost from the proposed dry composting toilets. We found that effective microorganisms (EM) were a viable option for treating the waste compost. While the waste is still in the initial compost chamber, the addition of EM is a promising technique that will be experimented with to determine its effectiveness in accelerating the composting process and controlling harmful bacteria and odors. We also researched different methods of outdoor solar compost pasteurization. High heats can destroy all the harmful pathogens and bacteria that prevent human waste compost from being used agriculturally. We proposed a design similar to existing solar compost pasteurizers. It could be constructed relatively inexpensively and work effectively while requiring little maintenance.

When the toilet system is eventually implemented along with the proposed solar pasteurizing system, the safe compost will need to be distributed. A system could be designed in which the caretakers bag the compost and distribute it among community gardeners, or the compost could be sold at low cost or given away throughout the community.

The future of the gardens project needs to focus on community involvement. Educating residents about the benefits of gardening will hopefully increase their interest level and influence them to start their own household food gardens. Widespread gardening cannot exist without widespread interest. There are local gardening programs that have resources and years of experience operating in different parts of the community. Rather than start a program from scratch without the necessary knowledge and connections, the existing programs should be utilized in a collaborative effort. A pre-existing gardening NGO, such as Abalimi, could provide the sustainable support of inexpensive compost, seedlings, expert information, and training (Abalimi, 2009).

## References

- "Abalimi Bezekhaya." *Abalimi Bezekhaya*. © 2009. <http://www.abalimi.org.za/>
- Dannhauser, D (2000) Nutritional status of preschool children in informal settlement areas near Bloemfontein, South Africa. [Electronic Version] *Public Health Nutrition*, 3, 303-312
- "EM technology." *Efficient Microbes*. Web. 09 Dec. 2009. <http://www.efficientmicrobes.co.za/ViewProduct.aspx?tID=132> .
- *Envisioning Endlovini: Options for Redevelopment in Monwabisi Park Cape Town, South Africa*. December 18<sup>th</sup>, 2008. "Water and Sanitation" Section (pgs 98-134)
- Featherstone, Pat. *Grow to Live*. Auckland Park: Jacana, 2009. Print
- Lachapelle, Paul R.; Land, Brenda L.; Clark, John C.; *Mountain Research and Development*, Vol. 17, No. 2 (May, 1997), pp.177-180; Published by "International Mountain Society"; 2003 <http://www.jstor.org/stable/3673833>
- "SOIL FOR LIFE." *SOIL FOR LIFE* . N.p.(c) 2009. <http://www.soilforlife.co.za>
- Strategic Development Information, GIS. "City of Cape Town Census- 2001- Khayelitsha". Statistics South Africa. 2001. <http://www.capetown.gov.za/en/stats/2001census/Documents/Khayelitsha.htm>
- Sutcliffe, Ron; "Composting Toilets, Pasteurization and Permits"; 2004 <http://www.networkearth.org/naturalbuilding/toilets.html>
- Violence Prevention through Urban Upgrading; "Monwabisi Park In-situ Upgrade Baseline Survey"; September, 2009; Cape Town, South Africa; print
- Womersely, D. (2008). The Shaster Foundation for Community Development. Retrieved September 26, 2009, from <http://www.shaster.org.za/>