MANGWENDE ORPHAN CARE TRUST

Concept Design Proposal

"*The future of all people is linked with the condition of the land. If the people enrich the land the land will enrich them in return. Permaculture gives a way of redesigning our communities, cities and habitats in a way that enhances nature our local economies and a healthy lifestyle. If applied correctly, permaculture design can be used to solve many if not all our planets and species current problems*."
Evans Mangwende

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EXECUTIVE SUMMARY

Economic, social and environmental issues are interlinked and so require a common worldview to tackle them in an integrated way in order to address the questions of climate change and sustainability so that the needs of individuals, communities and the planet are met without compromising the conditions of survival for present and future life. While there is a pressing call to reduce worldwide consumerism, energy consumption, carbon emissions, and wastage of water and other natural resources, there are also a number of issues associated with rural disadvantaged communities in Zimbabwe with regards to the financial burden and the lack of access to appropriate education on sustainable practices. The mechanistic, reductionist and linear economic system destroyed the ecosystem and social integrity. Moving away from this dysfunctional pattern incentivises the emergence of an alternative mode of thinking and behaving, respectful of the intrinsic environmental and human rights. This way, nature and people can coexist to mutually profit from a thriving livelihood and long term viability.

The **Mangwende Orphan Care Trust**, a grass root initiative, originally took on the task to look after vulnerable members of society and wishes now to expand this responsibility beyond the locality and most importantly to the environment. The key drivers are the development of a vibrant trade-based economy through the development of environmental services together with the revival of the Zunde traditional culture encouraging social cohesion and caring for the needy. Indeed, economy and ecology mutually strengthen the foundations for life and happiness for all. This project presents an opportunity for innovating skills and personal empowerment. The initiative's goals are to minimize the need for resources consumption (mainly water and energy), prevent waste leakage (economic, energy, pollution, recycling) and maximize the use of locally available natural resources while enhancing community social development (skills, services, network) and bioregional biodiversity. Change needs to be ingrained in daily practices for sustainability and love to become once again communal wisdom to share at a larger scale.

One way to achieve this is by focusing on **food**. Land degradation, biodiversity loss and air and water pollution can all be resolved by the implementation of permaculture farms. A restored soil requires fewer inputs to produce higher yields, which translate into higher profit. Feeding the orphans was the trigger behind the creation of the Trust but step by step, the founders are hoping to build the foundations for a more resilient local food economy that can be both climate and income resilient in the face of global fluctuating challenges. The local population knows that the virtue of wealth resides in the soil, not money, and needs to regain lost knowledge. Soil and its ecosystem are valuable to life. Its health is determinant to our wellbeing, yet soil has no official intrinsic value. The current worldviews and policies favour an economic system that emphasizes on the generation of monetary profit while disconnecting with the true essence of our existence, health and happiness, namely what cannot be bought: peace, love, meaning and above all Nature as a source of water, food and shelter.

Most of Zimbabwe's agro-economy is based on smallholder farming. Small farms play an important role in supporting rural households, their community and the local economies. Unlike large monoculture fields, which yields high amount of one particular crop (a significant portion of which is wasted), small subsistence diversified farms produce more food and more kinds of food per surface area, despite the smaller scale, and so are more efficient at fighting against hunger. The right to food production is determinant to the future resilience of the rural community and embraces sovereignty and freedom. Throughout human history, food has always been at the centre of community life, culture, traditions, cooperation, spirituality and celebrations. Its diversity is also the basis for health and survival of individuals, communities, whole ecosystems, and life on Earth. Its stability and success are highly dependent on the holistic understanding and respect for Nature.

Growing one's own food offers self-reliance, it is the essence of freedom. Regenerative agriculture and permaculture can be considered as a mode of thinking and living, beyond farming, that lead towards sustainability for the whole community. By making smaller farms profitable, it attracts people back to the land and thereby boost the economy. **Education** here is the weapon against scarcity. The plan for the Trust includes adding value by developing its two sites: an orphanage school and an agricultural hub. Both consist of educating and practicing farming and environmental protection while engaging in socio-economic activities honouring the local traditional identity. This pilot study serves as a demonstration model, via peer to peer training and exchange, to show a successful starting point for weaving a larger scale transition network and spreading the seeds of transformation. By creating abundance through collaboration and by reinstating local cultural wisdom for collective healing, the current story of separation is reversed so that the new narrative passed across the borders of land and time empowers the values of hope and care.

Source: https://treeyopermaculturereedu.com/

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1. GENERAL INTRODUCTION

Evans Mangwende with wife Maud Tonha, founders of the Mangwende Orphan Care Trust

1.1 Background

«*We need to consider the fact that many people who are now "poor" are often descendant from cultures that were brutally abused and suppressed by the ancestors of those who are now wealthy. This is not because it is advisable to seek to blame or retaliate for ancient crimes but to promote truth and reconciliation and to close that chapter in history. We need to honor the knowledge these cultures had and that was ignored as the colonizing powers choose to spread materialistic market economics that has led humanity to mass desertification, biodiversity loss and climate change.*
When we recognize that the cultures that were conquered were actually higher civilizations than the conquerors we also have to realize that the reason they were superior is that they protected their landscapes in ecologically functional ways that did not lead to the calamities that are now befalling us. This recognition reveals a truth that has been forgotten. Namely, that ecological function is more valuable than things. If we put this concept at the center of our thinking now we can move from a materialist economy to an ecological economy. This has numerous benefits. We can correct historical mistakes. We can evolve human consciousness. We can shift from a corrupt and destructive economy of consumption to a fair and abundant economy based on ecological health benefiting all living things and ensuring a safe future for generations to come. » - John Dennis Liu (Ecosystem Restoration Camps)

a- Site information

Zimbabwe is a landlocked country in South-East Africa, with its capital city, Harare, situated in the north-eastern part of the country, neighbouring Mozambique. The country is a recent republic since its independence in 1980. Being a previous British colony (Rhodesia), a number of languages are officially spoken with a predominance of English and Shona (the largest ethnic group). Christianity dominates the faith of a large part of the population and is often mixed with traditional beliefs and culture.
Zimbabwe holds the highest literacy rate in Africa, where teachers are highly respected, and the education system is comparable to current British levels. The country, however, currently suffers from serious economic and energy crises. Mining and agriculture are the major national economic activities since the recent decline of tourism due to the extinction of wildlife as a result of poaching and deforestation. With a life expectancy not exceeding 60 years, most rural communities rely on subsistence farming and are poorly connected to services and infrastructure. Most basic and traditional (agriculture and culture) knowledge is being lost, with the exception of a few elders, who hold the key to educating land stewardship as a means to transformation and empowerment in the hope to reverse the reliance on the dysfunctional first world's commodities.

The proposed project refers to the development of two areas of land, a smaller (4.8 ha) and a larger plot (18ha), both located in the rural district of Murehwa (or Murewa), a casino township, which is 80km to the East of Harare and 52 km North from the provincial capital of Marondera (see figure 1.1). The Murewa district totals 336 of villages, each with an average of 250 to 300 households, usually comprising of four to six people per household.

Coordinates:
Casino township: 17°53'06.7"S 31°38'34.2"E
Mangwende Orphan Care Centre: 17°52'43.8"S 31°38'54.2"E
Mangwende Permaculture Centre: 17°48'47.30"S 31°39'27.79"E
Main road: 17°53'29.0"S 31°37'55.4"E

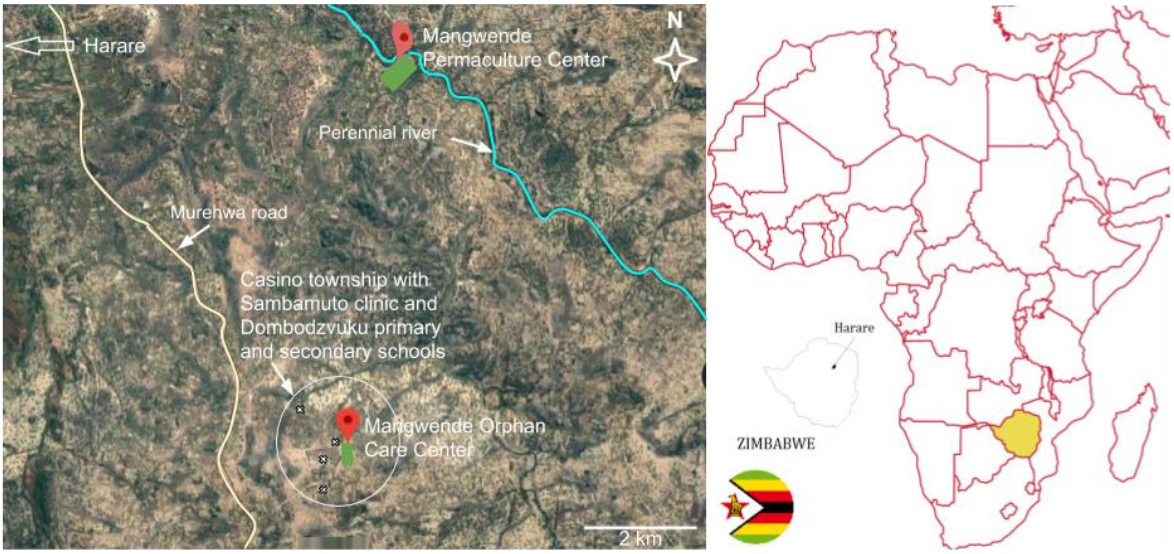
The primary site, the smaller plot, is in the middle of Muzembe village, situated between the local primary and secondary schools, and in the vicinity to the main township and facilities such as the clinic and the main road (with limited access to public transport nor electricity grid). It currently holds a non-residential orphanage, with a brick house in progress due to

accommodate up to 50 persons, for visitors' purpose. A solar system is installed for lighting, but the storage has expired and was replaced by kerosene lamps or open fire wood. Similarly, the diesel water pump for drinking water is no longer in use due to the fuel shortage in Zimbabwe and most of the four deep wells have run dry because of increased droughts in recent years.

The secondary site, the larger plot is located 8 km north, closer to another village but in the same Ward. There are no built structures on this land which is not fenced yet but which is to be used for a proposed permaculture centre. It is connected to the small site (the main road and all the other amenities) with a narrow path. The main advantage being its proximity to a natural water source, 30m to the perennial river, which borders about a third of the site. The river is not safe for drinking without purification, and with a depth of only 3m, it is too shallow for navigation and is at high risk of flooding during the rainy season (December to February). The absence of a bridge forces villages to travel an extra 30 km in order to cross safely.

Generally, the land is relatively flat and the natural vegetation of the area is open woodland with granitic sandy soil. However, this part of the country is now becoming a semi-desert, with erosion taking place along the river and the disappearance of wild animals from the landscape. The land still hosts a few indigenous plant species and so offers excellent grounds for restoration.

Figure 1.1: Map of Murewa district showing the location of the two sites and the local township



Although the climate in Murehwa is temperate and generally mild, with an average temperature of 18°C, the dry season is usually very sunny and relatively warm (21.5°C in October). The annual rainfall of 866mm is unevenly distributed. Precipitation is lowest in winter with only 2 mm of rain in July which is the coldest month averaging 13.5°C, whereas it reaches its peak in January with an average of 215mm. The rainy season typically lasts three to four months with some short (+/- 3 weeks) periods of dry spells. This seasonal pattern is no longer reliable since the region now experiences erratic torrential rainfall, tropical cyclones and flash flooding but also much longer and intense dry periods from October to March, creating a semi-arid zone which affects the crop production and increases the risks of migration (see figure 1.2).

Figure 1.2: Sector analysis for both MOCT sites

b- Mangwende Trust

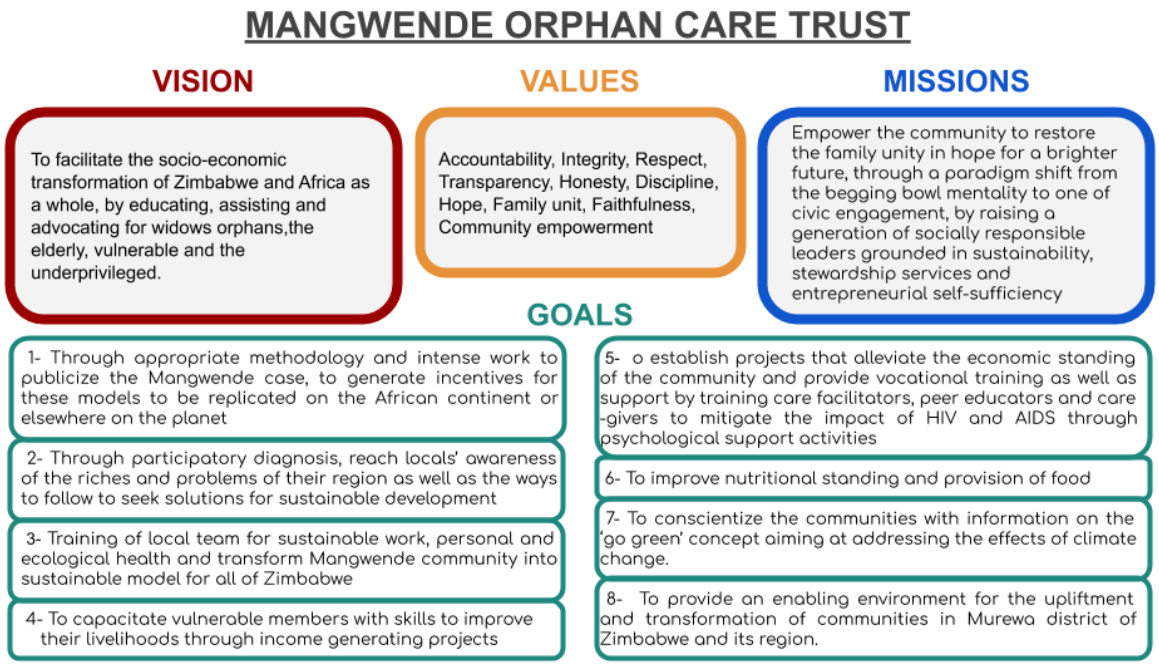
The **Mangwende Orphan Care Trust** (MOCT) was founded in 2015 by Evans Mangwende and other family members with the intention of addressing the plight of the underprivileged and marginalised communities in the Murewa district (one of the largest districts representing 336 villages) and the extended region. Their father, the late Jonathan Mangwende, acting as president of all chiefs in Zimbabwe, inspired this idea to assist the needy through the Zunde raMambo concept.

The Mangwende Orphan Care Trust is a holistic, community based, community centred and community driven charitable organisation, funded by a family and run by volunteers to cater for the local community. It primarily aims to provide food, clean water, shelter, clothing, safety, medicines and support with school uniforms, fees and books to orphans and vulnerable children, widows, the sick and the disabled. Working together with teachers, health professionals and community leaders to identify and create a healthy environment for vulnerable young people in need of financial, medical and emotional support, the Trust is facing financial challenges due to the current economic situation in Zimbabwe.

Agriculture is the backbone of the MOCT's mission to feed its growing number of users as a result of years of over tillage, irresponsible chemical usage, poor farming methods, droughts and soil erosion, the land is no longer productive, the population is malnourished, unemployed, disconnected and susceptible to various infectious diseases. For this, MOCT plans to implement a permaculture farm featuring an education and demonstration centre. Near the village, it is the main point of contact, information, and everyday activities, serving as the main headquarters and administration hub. A permanent team is on site whilst events, training, trials, projects and support activities take place regularly for community groups, volunteers, supporters and sponsors. Each activity of this grass root non-profit organisation is to be run independently but following a central management that provides efficient communication within the site and to optimise the development of various sustainable training programs as well as the opportunities for income generation and external partnerships.

This way, the centre serves to boost and benefit individuals, the community and local economy whilst at the same time creating community independence, global participation and sustainability. The work is adapted to the transition in local and bioregional context but through a weaving network of peer training, collaboration and knowledge exchange it will serve the global interest (as per the concept of glocalization).

Table 1.1: MOCT statements



c- Statement of needs

Like other African countries, Zimbabwe was repeatedly hit by economic, political, energy, infrastructure and climate crises, among other social and health issues (HIV, food deficiency). This resulted in an influx of vulnerable and stigmatized individuals in need of care (widows, orphans, elders, sick and disabled). Rural communities are most vulnerable to climate change and variability on account of its socio-economic and physical characteristics.
The Mangwende Orphan Care Trust is no longer able to support the growing number of orphans with basic needs for safety, food and education. Due to the shortage from governmental assistance, there is a need for a swift response to address the provision of food. The first response is to revive the local culture, Zunde RaMambo, based on the philosophy of sharing and redistribution. This mission is now extended to the whole community of Murewa. The intended organisation of MOCT is to encourage the empowerment and personal development of all members of the community without discrimination. At its centre, lies a holistic worldview with the understanding of the interconnection of all forms of life and their mutual support. All members have the opportunity to participate on a voluntary basis in the different aspects of the project. Their decisions and actions ought to be consciously driven accordingly to their shared vision and missions.

As knowledge represents power, the focus is on educating useful sustainable skills and care for each other and for Nature while respecting the traditional Zunde social structure. The awareness of environmental connection and the notion of interbeing, laying at the heart of a

paradigm shift and change of behaviour, offers the keys to unlocking the long-term enhancement and wellbeing of orphans and other vulnerable groups.
However, ecosystem and sustainable community management needs to be rooted in local leadership, adapted to local planning, involving participation of stakeholders and local implementation. The project is therefore to be performed by the local farmers and villagers (including women and the youth) to serve the whole community through education and a collaborative embrace of permaculture ethics. Here, permaculture becomes the precursor to the development of bioregional livelihood via hands on experience and peer to peer training accessible to all, including the poor and illiterate with no access to sustainable education. Permaculture permits an increase in food production and quality through training of sustainable (mainly agriculture) practices; and subsequently, the evolution of the local population's cultural, social and economic harmony. Indeed, scarcity is resolved not only by managing demand through reduction but also by keeping resources (water, currency, waste) in active circulation and usage. The switch can then take place from the current short-sighted paradigm of financial gain towards a long-term security of thriving natural capitals, via the restoration of habitat, rebalance of ecosystems and capacity building of society.

"The test of our progress is not whether we add more to the abundance of those who have much; it is whether we provide enough for those who have little." - Franklin D. Roosevelt

To respond to the various concerns and achieve the major goals, the activities of the project are mapped onto the United Nations SDGs (see Economic Dimension 4.2.1 for more details).
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Figure 1.: The 17 Sustainable Development Goals

1- No poverty:
- better community cohesion and redistribution through Zunde method
- appreciation of existing values and sharing of assets and facilities

2- Zero hunger:
- securing local food production, processing and storage

3- Good health and well-being:
- abundance of organic and nutritious diet and supporting social structure for better physical and mental health and reduction in socio-economic conflicts

4- Quality education:

- extracurricular school teaching and activities relating to permaculture and sustainable living
- training of trainers programs demonstration gardens and peer to peer learning for adults

5- Gender equality:
- all children with safe and equal access to schools and education
- women empowerment through key positions in community and business issues
- restoring demographic balance by offering work to men in the villages/farmland
- family planning programs on health, sanitation and teenage pregnancy

6- Clean water and sanitation:
- sustainable water management and preservation of resources
- reduction of polluting behaviour and adoption of hygienic habits and purification systems

7- Affordable and clean energy:
- favour local resources and production
- recycling of waste

8- Decent work and economic growth:
- transferable skills for development of new local activities
- value the knowledge of women and elders (grandmas converted as social workers)

9- Industry, innovation and infrastructure:
- strengthening social and bioregional networks
- eagerness for change and paradigm shift
- efficient transportation

10- Reduced inequalities:
- taking care of the basic needs for the poorest (and vulnerable members)
- bursary programs for the underprivileged

11- Sustainable cities and communities:
- permaculture settlement
- adhesion to national permaculture and global ecovillage networks

12- Responsible Consumption and Production:
- conscious behaviour towards resource conservation and waste management
- increased awareness about values of ecosystem services

13- Climate action:
- afforestation and restoration of ecosystem health (soil, nutrient and hydrological cycles) for better resilience and creation of micro-climates

14- Life below water:
- farming, cleaning and bathing activities non-polluting nor exploitative of the watercourse
- rehabilitation of the natural riparian habitat

15- Life on land:
- strengthen the respect for environment time spent observing and celebrating natural biodiversity and dynamic complexity
- minimise human impact and attempt to regenerate ecosystems

16- Peace and justice strong institutions:
- stability through the governance and family structure and the Zunde approach
- Regular meetings and support groups to express concerns and offer community help

17- Partnerships for goals:
- networks with local and international partners
- trade with other villages
- improve accessibility and visibility

1.2 Case Study

a- SWOT analysis

A SWOT analysis is a strategic planning technique determining the assets that are either helpful or harmful in achieving the objectives, and whether these have an internal origin to the organisation or external to the environment. Strengths are internally monitored and relate to positive qualities, resources and uniqueness, while weaknesses implies areas of improvements. Dependent on external factors, are threats of damage or competition, and opportunities which could be advantageous.

Table 1.2: SWOT analysis of MOCT

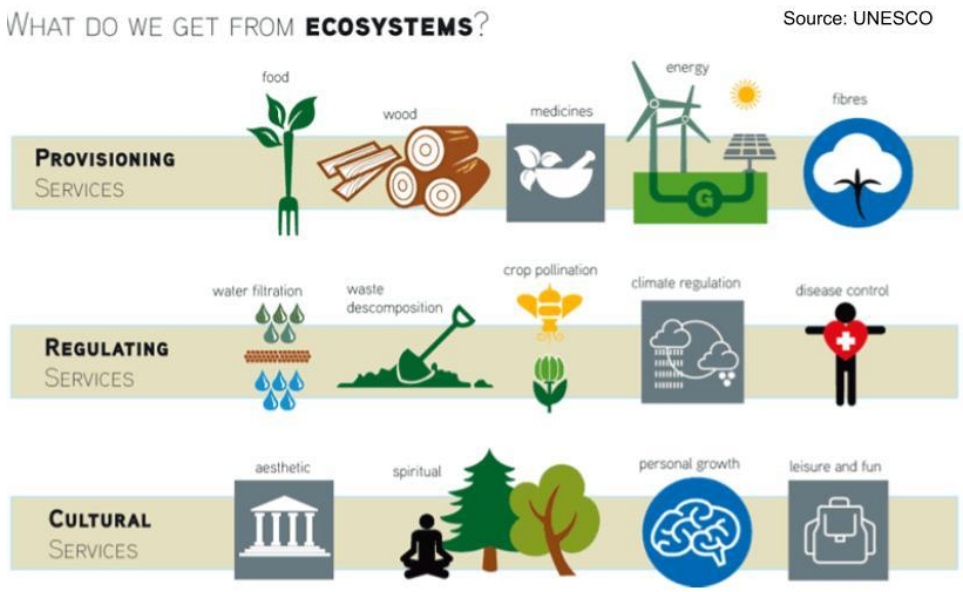
Strengths:	**Weaknesses**:
Internal: • Realistic project • Enthusiastic leader (good in involving the community and in networking) • Land space available • Holistic and regenerative design approach *External:* • Expert and student volunteers to help with the project • Located near the capital city (Harare) • Visibility on social media • Credibility (acquired permaculture certification and Gaia Education case study)	*Internal:* • Sole leader cannot do everything, more people need to be included • Food and water shortage • Lack of finance • Land degradation and biodiversity loss • Poor agricultural practices *External:* • No funding had been secured • Import/buy knowledge, processed food, commodities and services • Difficulty to sensitise and attract partners, trainers, investors and donations • Poor infrastructure • National economic and energy crisis
Opportunities:	**Threats**:
Internal: • Education, self sufficiency, resilience for community • Localisation of activities, resources, and skills • Social livelihood and personal wellbeing • Scale networking and raise in awareness • Audit for improvement *External:* • Living capital supporting local economy • Increase in biodiversity and food production act as demonstration for educating sustainability across bioregion • Restoration of ecosystem health • Redynamisation of bioregion	*Internal:* • Greed, competition, selfishness *External:* • Climate change (flood, drought) • Land security (no long term ownership guarantee) • National and global instability and policies • Infectious diseases • Genetically modified seed • Corporate chemical and seed market

b- Concepts

An **ecosystem** is defined as a biological community of interacting organisms and their physical environment. Ecosystems are complex dynamic systems of interconnected life forms constantly adapting to their surroundings. Their resilience is highly dependent on biodiversity. Increasing the variety of organisms, not necessarily the total number of each one, allows to recover after disturbance. Diversity (of methods, members, output, subsistence, income and food) is key to resilience, such as if one part of the system fails, others will thrive.

Although most parts of the ecosystem functioning remain invisible and of no monetary value to most humans, they still provide a multitude of services essential to life (see figure 1.4). Provisioning services are the most recognizable and quantified economically. These include food (such as livestock and crops), wood, fibre and energy (such as fuel). Non negligible are the supporting services ensuring long-term primary production via soil formation and nutrient cycling. Regulating services ensure a constant equilibrium such as climate, erosion, flood, disease and natural hazard regulations, water purification, pollination and waste treatment. Less apparent, are cultural services such as spiritual, inspirational, recreational, aesthetic, and educational enhancement.

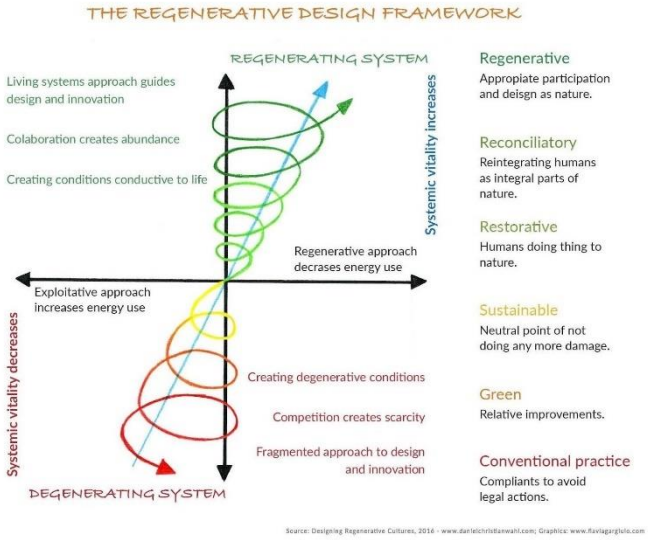
Figure 1.4: Examples of ecosystem services



An ecosystem approach would consider the interdependence of ecosystem services and human needs. It is the basis of a green economy, where growth and development are not restricted but combined with better management of resources and assets forming the four capitals (natural, built, human and social). A systemic integration of land and society consolidates the rehabilitation and sustainability of these services on which we all depend. The proposed activities have no negative environmental impact, they aim to mitigate these negative impacts while minimising further degradation. To turn the tide on worldwide threats, including effects on the Murewa community, **sustainability** ought to become the norm and not the exception. In essence, sustainability is the ability to sustain quality over time. However sustainability is no longer enough, hence the design for regenerative systems that restore the whole ecosystem (see figure 1.5).

Regeneration aims at building the capacity of humans to improve the health of the whole ecosystem by adding value to their community and bioregion. Regeneration stimulates revival, restoration, renewal and smart growth. A regenerative design emphasises on the transition from a fragmented worldview to a holistic thinking integrating the active participation and interconnectedness of mutually beneficial diverse relationships. This process takes place at several levels from physical, biological dynamics to complex economies and societies, where a regenerative environment enables the coevolution of human systems with nature for better resilience, inclusivity and wellbeing.

Figure 1.5: Regenerative design framework



Permaculture is a form of regenerative system for stable habitats and settlements following the observation of nature's patterns and without depleting earth's natural resources. It is ethically designed to build on human's vitality that is rooted in ecological health by integrating all life forms into ecologically respectful agricultural systems of abundance for a just, productive, interconnected and regenerative socio-economic system. The primary focus is the harmony of the relationships between all the elements so that the whole becomes greater than the sum of its parts.

Permaculture and **Zunde ReMambo** are fundamental for the Mangwende Trust to help rebuilding its community. The Zunde philosophy is a traditional social structure, which entails the values of collaboration, solidarity, relationships, belonging, oneness. It aims to foster food security for everyone and mostly for unprivileged people by a system of redistribution and sharing especially in times of shortage.

c- Project statements

The purpose being to create a strategic vision for a sustainable society that would engage the community as it builds on their traditions, skills and opportunities in order to give them back power. The unfolding of shared dreams, especially when they are big, difficult or complex to attain, is based on the co-operation of each individual for the greater communal good. For a vision to be successful it requires clarity, coherence, consistency, community power and flexibility. Above all, it needs to represent the interests of all the community members with no exclusion of the underprivileged groups (children, orphans, elderly, people with disabilities, women, widows, nature etc).

The design of this project is therefore inspired by the following guidelines.

- The vision is to create an educational farm cooperative acting as a model for food sovereignty and sustainable society and which empowers the participation and collaboration of all its members and inspires the holistic transition of other communities towards climate resilience and economic independence while respecting all forms of life.

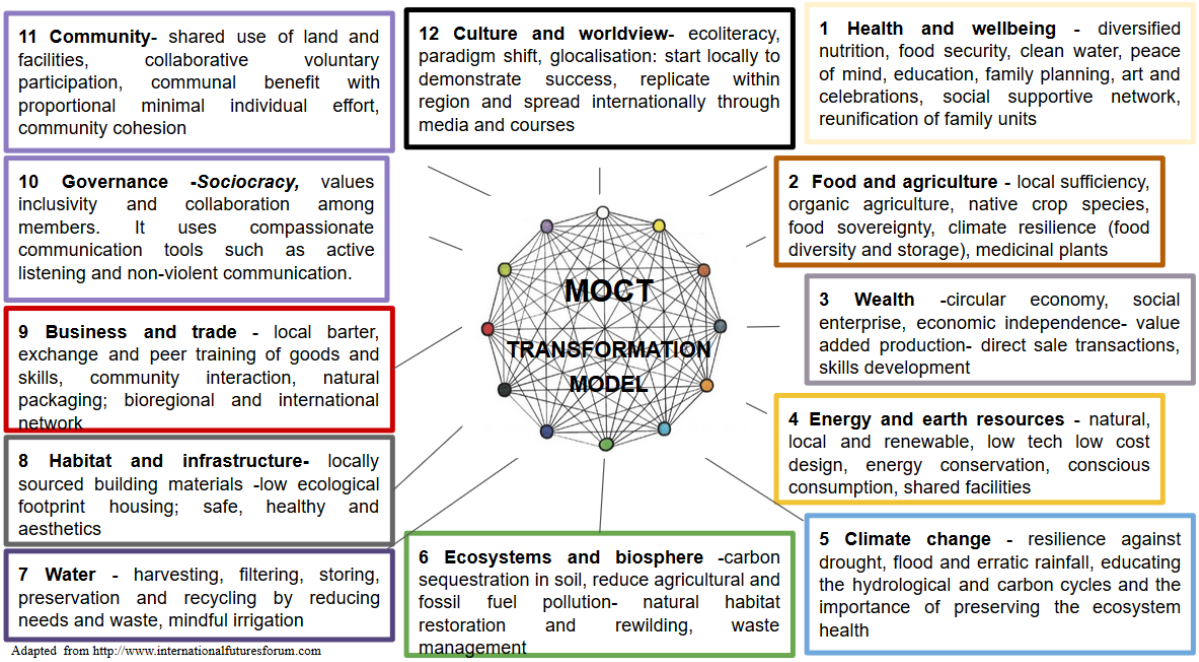
- The primary mission is to support the implementation of a stable social structure (educational centre) enabling self-sufficiency (food and water sovereignty, health and facilities) and a regenerative empowered rural community (economic productivity and ecological resilience) integrative of social diversity and in harmony with the local ecosystem and traditional culture, based on the revival of the Zunde social system and the newly learnt permaculture design.

- The core values are: inclusivity, diversity, safety, empowerment of underprivileged population, equality, interbeing, elders wisdom, cooperation, regeneration, sustainability, voluntary participation, trust, empathy, collaboration, traditions, peace, exchange, fair share, wellbeing, hope, transition, future heritage, model of influence and glocalization.

- The above can be accomplished by achieving the main objectives of this project, as stated below (following the 12 nodes of transformation - see figure 1.6) :

- Revival of Zunde social structure and traditional culture
- Development of sustainable best practices and learning programs
- Design of framework and infrastructure to build ecologically sound and supportive community
- Restoration of hydrological cycle, bioregional ecosystem health for individual wellbeing and community development
- Climate change mitigation and long-term resilience
- Organic agriculture for improved health, food sovereignty and financial viability
- Relocalisation of food consumption, economy, skills and services
- Optimisation of existing infrastructure (building and transportation)
- Focus on circular and responsible economy and alternative local trading system to decrease external financial dependency
- Diversification of income from organic produce, ecosystem services and local craft products
- Economic and employment opportunities to counter gender imbalance, strengthen social structure, sense of purpose and local identity
- Demonstration site for local inspiration and worldview influence
- Environmental sensibilisation for holistic and sustainable land and resources management
- Improved access for social exchange, educational programs and external partnerships
- Bioregional and global networking (farmers, similar organisations, connected services, volunteers, experts)
- Celebrations of both human and environment diversity and re-connection

Figure 1.6: IFF (International Futures Forum) World System Model: 12 nodes of transformation



d-Integration design

Because most rural communities are subsistence farmers, they cannot thrive through abundance. This approach of the MOCT initiative towards self-sufficiency is offered as a model to alleviate poverty. It aims to increase both income and food security, while also improving general health, education, ecological resilience and bioregional solidarity. Indeed, a healthy community is defined by its systemic dynamic, complex and symbiotic relationships connecting biodiversity, cultural diversity and economic diversity. Long term happiness and wellbeing relies on the growth, distribution, and sustainability of four interdependent capitals.

The natural capital refers to the resources and management of the natural environment needed to support life and human activity. The social capital describes the norms and values that underpin society focusing on the relationship between people. The human capital encompasses people's skills, knowledge and health, where worldview refers to the evolving understanding and perception of life, its purpose and the spiritual connection between living beings and Earth. And the built capital includes financial and physical assets which have direct roles in supporting incomes and material living conditions.

Each chapter of this report relates to one of these four capitals. The four dimensions (worldview, ecological, economic and social) are not only intertwined such as one can negatively impact on the other, but each dimension plays an important role in the positive transformation and healing process and one cannot occur without the other (see figure 1.7).

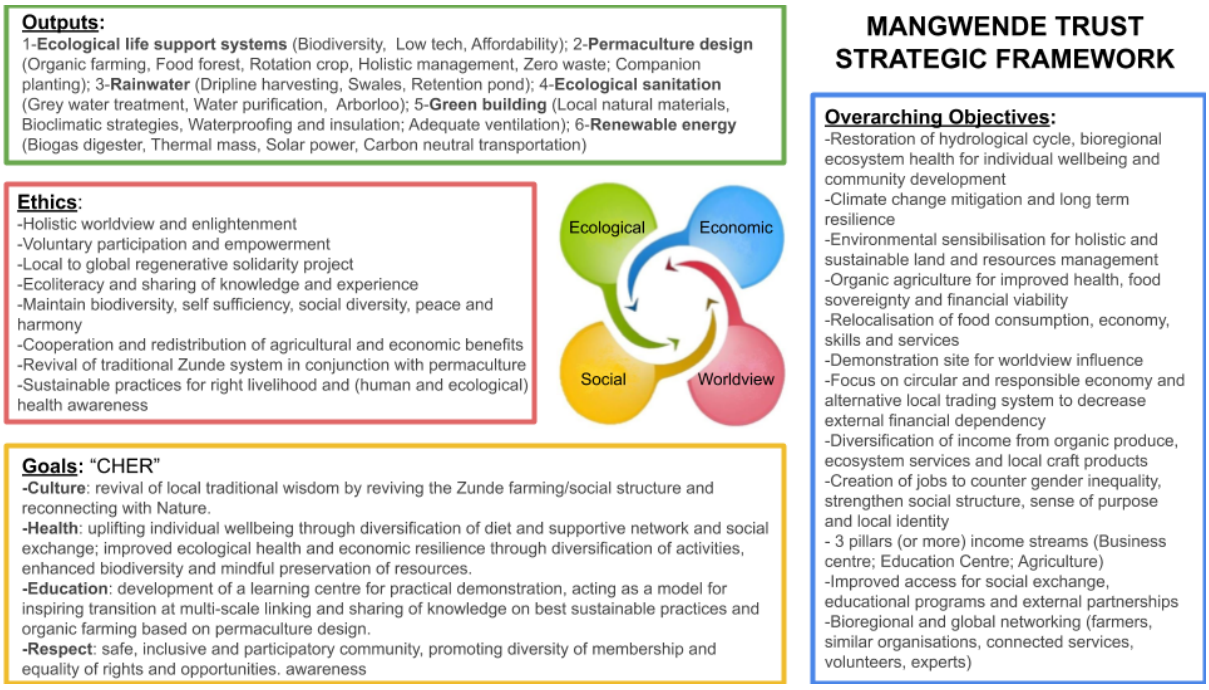
"*You cannot get through a single day without having an impact on the world around you. What you do makes a difference, and you have to decide what kind of difference you want to make.*" - Jane Goodall

Ecosystems are the foundation of food security, health, shelter, culture, geology, economies, livelihood, peace and overall quality of life. They regulate climate by maintaining air, water and soil quality. Reversely, climate disruptions damage ecosystem's health and therefore harms this equilibrium affecting species survival and harmony at a planetary scale including humans. As soil degradation is costing the economy and livelihood, there is an urgent need to adopt a responsible management of the soil in order to start working in harmony with nature and also for the greater benefit to both wildlife and future generations in addition to the community subsistence. Restorative agriculture and rewilding regenerate landscapes with biodiversity and abundance providing services and opportunities for humans to thrive physically, socially, economically and spiritually. Thereby agroecology allows to feed the population in a socio-economically, morally and environmentally just manner. Indeed, the food system, via self-sufficiency, embraces the whole environment and empowerment of a community: nourishment, employment, production, soil, health, culture, interactions, economics, infrastructure. All of which are highly dependent on community cohesion. The proposed development can be integrated and not in conflict with nature: human, economic and industrial activities are living systems participating in the Earth's natural systems.

- Approach:

This project aims to empower farmers and their whole community with a whole systems ecological design approach to become independent and climate resilient by educating sustainable practices, regenerative agriculture, and circular economies and to influence this strategy across the bioregion and beyond. The objective of this report is to provide basic knowledge and practical approaches on ecosystem management in the context of overall community development by answering the following questions: 1- why (worldview), and the reasons behind the need and motivations for this project, 2- what (ecological and economic), and the realistic actions for change and stability, and 3- how (social), the backbone structure ensuring the success of its implementation.

Figure 1.7: Strategic framework for MOCT



-Worldview dimension: A worldview relates to one's culture and the perspective from which we see and interpret the world. Diverging worldviews raise important questions common to the other three dimensions but primarily questions within oneself about our personal and communal vision for the planet, our purpose in life and our role as key players in the project, community, and the web of life. The clarity and integrity of the long term visioning shapes each step along the design process, with equity and health at its core, acting as a bridge between modern and traditional knowledge as well as linking the local and planetary scales (such as social structure, crowdfunding communication, model for change). The current difficulties faced are a direct consequence of westerners abuses of privilege. Likewise, local restoration of ecosystem services resulting from a shift in consciousness can cause rippling effects in distant societies. Humans across the world are interconnected with each other and share their dependence on nature. The project looks at the revival of the traditional Zunde method, the spirit of place rituals, stories, elders' wisdoms and the non-financial wealth such as ecology and relationships.

-Ecological dimension: The solution to ecosystem degradation and the adverse effects of climate change lies in the restoration of the hydrological cycle by recharging the aquifers instead of constantly digging new wells in desperate search for water. The focus is therefore on using what is naturally available in abundance, such as harvesting rainwater by adding value to the farmland on site even though it appears unproductive, instead of clearing more forest land. As soil becomes healthier, and with the establishment of a food forest system, biodiversity is increased, and so are food production and human wellbeing. Such sustainable adjustments empower the local population with economic prosperity. Their awareness of interbeing and the importance of respecting and preserving the natural life cycles also serve as a demonstration for influencing the shift in consciousness at a larger scale. Therefore, the project puts a big emphasis on education to develop good agricultural practices through the permaculture infused Zunde philosophy by creating a training centre and Agri-Hub.

-Economic dimension: The primary aim is self-sufficiency in order to reduce the need to rely on scarce and sources of financial income to be used for external purchases. Food security impacts on mental and physical health of individuals but also social wellbeing. Excess production of food and the storage of other processed commodities as well as the trading of skills, and services provide additional prospects for economic independence, resilience and development. This concept spreads to the wider community by strengthening ties with surrounding villages and other likeminded ecovillage initiatives subject to similar conditions elsewhere. The weaving of a network into an African alliance relies heavily on the security of land ownership and protection of resources particularly against governmental grabbing and foreign investment.
The project highlights the importance of the multifold income stream model that could offer a solution for employment, men's delocalisation, bringing back agricultural and crafting skills, while increasing the health of the community through locally purchased organic produce.

-Social dimension: Sustainability has a long-term goal. But to become conscious actors of transformation towards a healthier life for all, education is mandatory, for understanding the complex structure of the world and our actions, or simply teaching others and weaving a web of transition. By teaching interconnectedness, sustainability, food production and also trade or other business skills, individuals and community can regain pride, independence and lead towards a sustainably flourishing livelihood. Relocalising the activities and knowledge offers the tools to thrive within a regenerative ecosystem in dignity without need of further burdening the already scarce external aid.
A suitable governance system for managing the Permaculture Centre and enthusiastic vision, with the support of celebrations and rituals (e.g. harvest, seasons), community building increases the interaction between community members. This helps aligning core values of equality, diversity, tolerance with deep ecology.

2. WORLDVIEW DIMENSION

Children dancing harvest dance in traditional costume; river as source of life; caring for all beings including non-humans

"We must become the stewards of the biosphere and rediscover in nature the source of meaning" - Ian McHarg

2.1 Current Worldview Situation

a - Worldview background summary

In Zimbabwe, there are currently more than 1.8 million orphans and vulnerable children. Many communities are vulnerable to drought and, hence, experience hunger and malnutrition from time to time. This scenario raises many questions about what went wrong with the agricultural revolution technologies such as the use of fertiliser, improved seed, irrigation schemes from the government and donor investments in agricultural research. The project aims to overcome these difficulties by reincorporating the ancient wisdom of the Zunde philosophy that is described in more detail in the following section.

There is a need to go back to the ancient wisdom philosophy in order to ensure better food security for the whole community, which is what this project aims for.
Here is a description of the Zunde philosophy:

"Zunde is a Shona word that may mean a large gathering of people taking part in a common activity or may refer to plenty of grain stored for future use by people in a particular community. However, Zunde normally means an informal, in-built social, economic and political mechanism. Its primary aim was to ensure that a particular community had adequate food reserves that could be used in times of food shortage. The Zunde practice ensured that ***food security*** *for a village or villages was guaranteed at all times"* (Mararike, 2001, p.54).

The Zunde also played important religious, economic, social and political functions. Members of the society would take turns to participate in planting and harvesting of crops. Harvesting was normally done by both men and women. People would collectively come together and do the work. Participation in the Zunde raMambo was an expression of ***oneness****,* ***belonging****, reinforced* ***collaboration****,* ***solidarity****,* ***relationships*** *and loyalty to the king* (Mararike, 1999).

The Zunde philosophy is particularly relevant in the context of helping orphans and vulnerable children as well as other unprivileged people. This is the reason why there is lots of meaning to revive this philosophy inside this project.

There are three Zunde raMambo Pillars in the community which are:

1. Zunde Community centre
2. Zunde RaMambo plots
3. Master Farmer/Hurudza

Zunde itself stands for "regenerative," which reference the intention to use the outputs of one system as the inputs of another system.
Zunde agriculture is similar to Ubuntu from South Africa and aims to rekindle the old ways of looking after the land and boost the value of the land to attract back those men to work on the land.
The return of the Zunde ReMambo system provides a social structure so that each village can care for its most vulnerable members.

"In Africa there is a concept known as 'UBUNTU' – the profound sense that we are human only through the humanity of others; that if we are to accomplish anything in this life it will in equal measure be due to the work and achievements of others."
Nelson Mandela

Zunde is a social security system providing protection against food shortages to vulnerable families and is coordinated by the chiefs. Although the concept is as old as the Zimbabwean culture, it had been abandoned as communities became urbanised.
Mambos are communal leaders or Chiefs and Zunde is the chiefs granary or chiefs land. Traditional custom requires the chief in any given locality to designate land for growing food crops/staple cereals as protection against food insecurity in the community. Members of the community take turns to participate in the entire production process from ploughing and sowing to weeding and harvesting voluntarily. The harvest is stored in granaries at the chief's or village headman's homestead as food reserves, which will be distributed to chief's subjects in the event of food shortages or during normal times. Priority is given to older persons, orphans, widows, vulnerable and persons with disabilities.
This voluntary participation helps to sharpen the community's sense of belonging and identity. Mangwende orphan care trust is the organisation working with communities promoting Zunde raMambo using Permaculture design principles.
For the volunteers, fulfilment comes from meeting the food requirements of orphans, widows and older persons in the community. They know that one day they will also be old and will thus rely on the community for support. They are also mindful of the fact that they may die leaving their children without care and support, and in this context participating in Zunde raMambo is akin to purchasing a pension annuity. The Zunde Practice is consistent with many communities in Zimbabwe. It has withstood the test of time and is not outdated regardless of the socio-economic and cultural changes that Zimbabwe has undergone. It has been handed down from one generation to another through oral communication.

Zunde was abandoned during the 1950s because of:

- Adoption of Western culture
- Resettlement of rural households during colonisation
- Poor storage facilities and management significantly reduced the yield from the harvest.
- Heavy losses incurred due to insects and rodents
- Lack of inputs (fertilisers seeds and land) and community mobilisation
- Corrupt elders using the harvested grain for their personal benefit.
- Poor methods of farming
- Poor harvests leading people to lose faith in participating in the communally owned plots

b- Worldview analysis and statements

The SWOT analysis reviews the strengths, weaknesses, opportunities and threats of the worldview dimension from an internal and external viewpoint.

Table 2.1: Worldview SWOT analysis for MOCT

Strengths: *Internal:* • Zunde philosophy restored • Elders' wisdom is still present; • Respect for teachers and chiefs • Uniqueness of traditions and celebrations of community identity *External:*	**Weaknesses:** *Internal:* • Current mindset of separation from nature • Poor health care (poor nutrition/water/sanitation/drinking behaviours) • Loss of traditional culture and elder's wisdom *External:* • Consumerism: aspiration for Western/city life style

• Permacultural to enhance links to nature and within the community • Ecological/spiritual connection	• Communication: inadequate accessibility to distant/global network • Marketing skills: language, IT skills, administration
Opportunities: *Internal:* • Permaculture education on holistic systems • Revival of rituals and salutogenic approach (earth care + people care) • Stewardship and value of the inner collective wisdom. • Holistic meaning of one's purpose and life cycles • Education on holistic and personal (mental/physical) health and family planning • Right livelihood and conscious behaviour *External:* • Environmental and cultural integration and celebrations • Eagerness for bioregional opportunities, education and exchange • More respect for diverse human / nature experiences • Positively influencing shift in consciousness to wider network	**Threats:** *Internal:* • Aspiration for Western lifestyle lacking holistic view *External:* • Possible negative influences from exposure to external non eco responsible visitors • Lack of governmental support • Low engagement from the international community

The following statements were derived from the above SWOT analysis as a guideline for the proposed worldview solutions.

Worldview vision:
The vision here would be to restore the Zunde philosophy through permaculture principles and reharmonize human community within its natural surroundings, while celebrating diversity, creativity and freedom.

Worldview mission:
The mission in this dimension is to revive the traditions and celebrations that enhance natural, spiritual and social connectedness and to see nature and the ecosystem as "life support system" to take care of it for future survival.

Core worldview values:
It is important to develop a holistic vision for the community including shared values.
Here are some core values and ethics mapped out by the spiral dynamics map of human bio-psycho-social development that make sure that the project enables healthy development:

- Care for the environment
- Fair society (cooperation, sharing, diversity)
- Social justice and equality
- Honouring local land and traditions

- Sense of belonging and purpose
- Holistic worldview and future vision
- Humility, simple living
- Empowerment (socially, economical, health of people and land)
- Abundance in terms of quality of healthy relationships

Other important worldview values include respect of the diversity of spiritual practices, honouring ancient wisdom, celebrations, deep ecology, interbeing, compassion, dignity, responsibility, deep listening, transformation, inspiration, cultural and educational experience sharing, spiritual ecology and glocalization.

Worldview goals:
The main goal here is to reconnect with ancient wisdom (Zunde philosophy), natural and cultural knowledge.

2.2. Worldview Solutions

2.2.1 Worldview perspectives

In order to take part fully in the project, it is important to question our worldview perspectives first. Indeed, it is important to reconnect to **a story of interbeing** in order to foster a sense of true care and respect for nature and one another. If we think we are part of nature, then there is no sense anymore in wanting to destroy it. The current world has long been tending towards a story of separation and it is now time to reconnect to who we really are: organisms of the same being, which is our planet.
This new vision also **celebrates the diversity** in all its forms. By including the voices of all members of the community (youth, women, people with disabilities, elderlies, etc.), we make sure to include a diversity of worldviews and value systems. Reintegrating the Zunde philosophy at the centre of the project also ensures that this beautiful ancient wisdom is also integrated into the diversity of worldviews fostering collaboration, solidarity, relationship among others.
By using voting or sociocracy as well as focus groups (see social module), one can make sure that the diversity of people and voices can be integrated and heard.

Holistic thinking is also key in managing a successful project. In order to foster this holistic vision, it is important to stay away from these **five traps**:

1. **Materialistic and mechanistic worldview:** Perceiving all elements of nature as inert things won't allow people to honour life and take care of nature as deeply.
2. **Reductionist methodology of analysis*:*** Isolation and Separation of living beings vs non-living matter reinforces the one sided view as it lacks the inter-relation synthesis. However, each element of the system and every of our actions play a crucial role to keep the equilibrium.
3. **The cult of the expert*:*** To stay outside of this so called *cult of the expert* where only one person as the wisdom and everyone else is intended to listen and be passive, it is important to give voice to the community (through questionnaires) as well as by asking people that have special knowledge such as Evans, the chief of community, etc. This is then assumed that everyone has a part of expertise which needs to be shared. Through the implication of all these expertise will help everyone feel more concerned

and motivated by the project. The cult of the expert values highly trained specialists over broadly educated generalists, however when taking a holistic approach to redesigning a community within its natural ecosystem, several different problems interact and interdisciplinary cross fertilisation is much needed. Also, often in post-colonial countries, “experts” refer to the supposedly more educated or wealthy (according to Western standards). This attitude is the reason for the current food shortage and health issue in Zimbabwe as non-sustainable practices have been imposed by such “experts” devaluing the traditional holistic understanding of the connection between humans and nature.

4. **Short-term thinking*:*** This project aims at thinking long-term, thinking about recreating a healthy ecosystem that would provide food and education in the long run and help regenerate nature that has been destroyed by short-term thinking (cutting trees without replanting them for example). The short term thinking also prevents the understanding of a whole system unfolding over different time scales because of the mutual interaction and coevolution between natural and cultural processes. Short term thinking is common to most modern lifestyle where personal comfort and financial benefit prevail despite the consequences to others and the environment. The thirst for profit encouraged the deforestation for intensification of agriculture and the adoption of monoculture with the use of synthetic chemicals polluting the land, water and food, thus damaging the health of both the ecosystem and humans in the long term.
5. **Non-holistic nature of modern education:** permaculture education given to students and the community will help get this more holistic perception that will allow people to consider human as part of nature, wanting to take care of it instead of wanting to destroy it.

a- Guide to anticipate future issues

As there are often issues arising in a project within the community, here a few advices by Briggs and Peat (1999) to go beyond those:

- **Be Creative:** engage with chaos to find imaginative new solutions and live more dynamically
- **Use Butterfly Power:** let chaos grow local efforts into global results
- **Go with the Flow:** use chaos to work collectively with others
- **Explore What’s Between:** discover life’s rich subtitles and avoid the traps of stereotypes
- **See the Art of the World:** appreciate the beauty of life’s chaos
- **Live Within Time:** utilize time’s hidden depths
- **Rejoin the Whole:** realize fractal connectedness to each other and the world.
- **Mediation sessions:** have one or two persons (good with relationships) responsible for helping people go through their common conflicts
- **Focus on collaboration rather than competition:** this will help you find solutions more easily.

b- Human rights

It is important to include human rights in order to respect every human being. Important human rights are for example the right to live, to be healthy, to have an education, freedom of speech and thoughts, and to have equal rights.

2.2.2 Respecting nature's resources

Currently, people cut down trees or burn them to grow tobacco near the nearby farms. Women had a knowledge of growing plants, but government scheme encouraged them to buy goods instead of growing plants. Women are thus not planting any longer and the knowledge is starting to get lost. There is the need to revitalise eldership by involving older people who know the old way of life. Women can also transfer gardening knowledge to children as they represent the backbone of community (they plant, cook, provide food and care for family).
There is no program to plant trees and a great opportunity of this project would be to teach about permaculture and the importance of restoring nature's ecosystems to local population. People would thus understand local trees and species and appreciate the long-term value of the forest belt. Planting native trees and woodlots would add value to the environment.

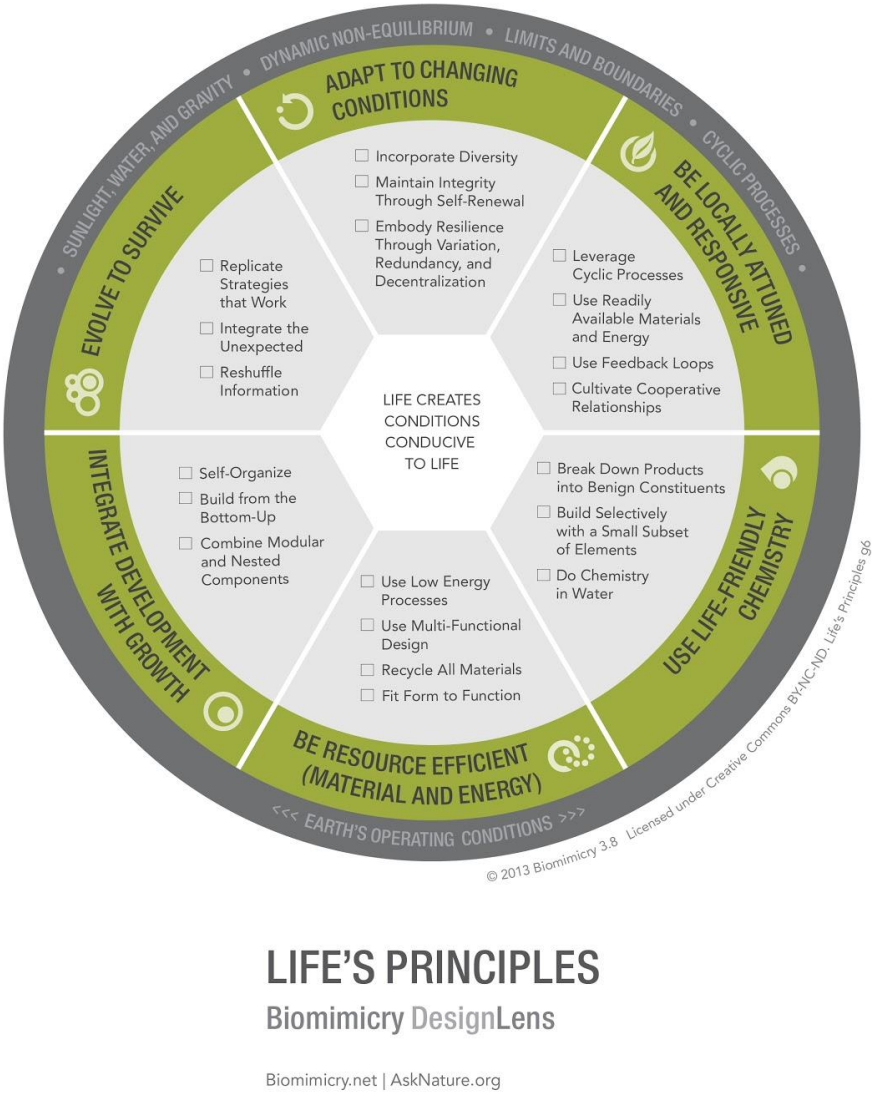
The Deep Ecology Platform

Here are presented the principles of deep ecology platform that aim to create a worldview that respect nature's resources at its best (from Arne Naess and George Sessions, 1984):

- The well-being and flourishing of human and nonhuman life on Earth have value in themselves (synonyms: inherent worth, intrinsic value, inherent value). These values are independent of the usefulness of the nonhuman world for human purposes.
- Richness and diversity of life forms contribute to the realization of these values and are also values in themselves.
- Humans have no right to reduce this richness and diversity except to satisfy vital needs.
- Present human interference with the nonhuman world is excessive, and the situation is rapidly worsening.
- The flourishing of human life and cultures is compatible with a substantial decrease of the human population. The flourishing of nonhuman life requires such a decrease.
- Policies must therefore be changed. The changes in policies affect basic economic, technological, and ideological structures. The resulting state of affairs will be deeply different from the present.
- The ideological change is mainly that of appreciating life quality (dwelling in situations of inherent worth) rather than adhering to an increasingly higher standard of living. There will be a profound awareness of the difference between big and great.
- Those who subscribe to the foregoing points have an obligation directly or indirectly to participate in the attempt to implement the necessary changes.

Also, in order to make sure to follow nature's operating instructions and 'Life's Principles', it is important to consider the individual elements and the whole system of the project such as demonstrated in the following graphic:

Figure 2.1: Diagram of Life's principles



Also, in order to raise awareness about the existence of the project, organising a **pilgrimage from Harare to Victoria Falls** could be a powerful action.

Figure 2.2: Illustrating a pilgrimage walk

Other **collective practices** such as 'the work that reconnects' from Joanna Macy would also help people connect with each other and nature more deeply. This would also help to develop more empathy, trust and understanding towards each other. Also, there is a strong collective intelligence that emerges from these collectives' practices that is deeply valuable and which will increase positive energy in the project.

Finally**, individual practices** such as meditation, council circles or solo time in nature, would greatly help people maintain focus and energy and get more peace and clarity of mind regarding what needs to be done in line with the project for the best benefit of nature and human beings.

2.2.3 Stories of transformation

Transforming agriculture and coming back to native practices is one great way to transform the community worldview and transform back society for more sustainable living practices.

a- Body, mind and spiritual health

Health and consciousness depend on the integration of all aspects of being: heart (emotional), mind (mental), body (physical) and spirit (spiritual wellbeing).
Although the focus of the project is to establish sustainable practices as the default behaviour and reasoning in order to regenerate the bioregional ecosystem and livelihood, each participant will be engaged in multiple aspects such as solidarity economy, food sovereignty, education and permaculture across generations and gender.
Activities require but also help developing further inter- and intra- personal and social skills integral to individual wellbeing and leading to a healthy community.
Connection to nature, food and economic security, future empowerment, social cohesion, communal festivities, shared hardship and prosperity, improve emotional, physical and intellectual abilities.

Encouraging communication and mutual support between members but also raising awareness of one's own impact helps in the process of transformation of consciousness and extend its influence to the rest of the region. The realisation that the collective effort and respect for nature is key to survival and emancipation gradually leads to changes in social practices for the greater good of the community, a healthier ecosystem and in return a happier personal life.
Personal, community and ecological health are interrelated where improved diet, care for the environment and connection to nature increase personal physical and mental health, but also improved social relations increase personal wellbeing- and in return happier members and a better ecosystem also improve a community's health and resilience.

b- Healthy lifestyle

It is important to consider a healthy lifestyle while building up the project for individual, community, ecosystem, bioregion and planetary health in a scale-linking way.

Here are a few of these elements:

- **Connecting with spirit**: through dance, meditation, prayer, observation, retreats, deep listening, transformation of motivation from despair to compassion, love and purpose
- **Exercise**: sport, dance, children sports games, etc.
- **Food**: healthy local and organic food grown from permaculture garden which decreases food deficiency and increases immunity resilience
- **Work**: inspiring and fulfilling jobs giving meaning and financial security to people (e.g. teachers, people working at the shop, garden, at the mill, etc). These jobs will help create meaningful relationships between individuals from the community.
- **Leisure**: Arts and crafts will be part of the skills taught to children and the community, not only to create income, but to express creativity and have fun. Volunteering at different parts of the project can also be part of the leisure time of people from the community.
- **Governance**: Although there is a very clear hierarchy in the village with a few people taking the decisions, through the implementation of the project, women and youth (and other unprivileged people) will become empowered, and thus will also be given a voice. Also, despite the already existing hierarchical decision-making system, at the field level and as part of permaculture education, a more horizontal decision making system can be implemented.

2.2.4 Engaged spirituality

About 85% of the population in Zimbabwe follows one form of Christianity and church is often the only main institution in rural communities. The Mangwende Trust is an example of faith-based organisation.
Farming God's Way (FGW) is frequently used in similar faith based rural organisations in order to promote more sustainable agricultural practices (mulching, crop rotation, no tillage) for increased household food security but with a strong religion motive. Similar vocational teaching (literally biblical interpretation) have previously taken place in Zimbabwe but the priority was production intensification for short term profitability thus its true benefits remain

contestable: not fulfilling the equal claims of long-term environmental sustainability while creating gender inequality in labour.
Although this method proves to be successful in the initial stage of changing mindset and convincing reluctant members to adopt and participate in a « purer » agriculture, it is not suitable for this project which primarily aims to rely on tolerance and diversity for an inclusive and voluntary participation. In order to include and appeal to all members, the fundamental principles cannot be based on a specific faith but rather follow a general philosophy and a shared vision for all. The community rather choses to focus on Zunde and permaculture as its core guidelines instead of following a theological approach to agriculture and faithful living. Spirituality (at a more ecological and philosophical level) can still take place communally if embedded within the culture and daily activities while religion practices are permitted (in privacy) with no judgement as long as they do not interfere with the unity and wellbeing of the community.
Each individual is free to adopt spiritual beliefs and practice religion of their choice as long as it does not impose a choice on others other than respecting each other's spirituality and most important the common grounds to the community: respecting each other as individuals and respecting nature and all other forms of life.

Spirituality relates to one's active engagement with reality and personal exploration to find guidance to live a meaningful life in service to a greater whole. Spirituality is different from religion and everyone has their own way to live spirituality. .
Its most powerful expression is not by preaching or trying to convert others but by setting an inspiring example through our daily actions, the way we relate to other people and living beings, and our social and ecological engagement.
People ought to be conscious of the impact of their presence on earth and the effect of their decisions and actions.
Engaged spirituality has a fundamental basis for social change, enlightened decision making and actions to heal policies, economies and the environment. Socially and ecologically engaged spirituality calls for responsible living, co-creating and co-designing a more sustainable and fair future for all, for a healthier world.
The spiritual practices therefore reinforce the shared values and efforts of the community for social change towards a common vision. Daily practices become integral of daily activities such as sustainable practices, respect for the environment or care for the elders and other vulnerables.

2.3 Worldview Conclusions

Worldview review:

Every decision and action, no matter how small or unimportant they may appear in daily life, has significant consequences. The worldview of a person or a community affects personal and collective interpretation and awareness of reality, the sense of purpose to one's life and so the intentions and meaning translated into behaviour.

Therefore, it is important to understand the perceptions and roles of every actor in the community in order to grab the whole vision of the project and the worldview dimension. The Zunde philosophy, but also the mindset in which the young people, elders and women stand in the present moment is important to consider in order to foster and encourage a worldview that helps the whole community to stand in a salutogenic approach, not divided with nature that helps not only to regenerate nature itself, but also ancient rituals and sense of belonging. The goal is to transition into the notion of inter-being (interconnection of everything) and spiritual well-being based on "love" for all living and non-living organisms of the whole community.

This "new" worldview that is in fact a restored worldview that has been forgotten over time is what the community needs to help restore a new equilibrium and healthier links between all community members to each other as well as their collective connection with nature.

Rituals (described in the social dimension) as one way of creating collective interconnection represent continuity, and act as a source for inspiration and connection between individuals, groups and nature as well as an expression of gratitude.

The Zunde tradition serves as a very good foundation for spreading wisdom within respected hierarchic ownership and distribution patterns. It can therefore be extended with permaculture principles in order to distribute knowledge respectfully on a bigger scale to surrounding villages and farmers.

Table 2.2: Synthesis of MOCT worldview aspect

<table>
<tr>
<td>IDENTITY
- Zunde tradition (oneness, belonging, reinforced collaboration, solidarity, relationships)
- regeneration of forgotten values</td>
<td>CELEBRATIONS
Rituals:
- create collective interconnection between individuals, groups and nature
- represent continuity
- express gratitude</td>
<td rowspan="2">WORLDVIEW VALUE
- holistic vision for the community
- right livelihood
- conscious behaviour</td>
<td>CULTURE
- collective and individual practices
- encouraging communication and mutual support</td>
<td rowspan="2">VISION
- permaculture education to restore holistic knowledge and behaviour
- revival of rituals and salutogenic approach</td>
</tr>
<tr>
<td></td>
<td>HEALTH
- education on holistic and personal (mental and physical health and family planning)
- connection with spirit</td>
<td>PURPOSE
- enhancing the bond to nature within the community</td>
</tr>
<tr>
<td colspan="3">WORLDVIEW IMPACTS
- Restoring Zunde philosophy
- Diversity of worldviews and value systems by including all voices of the community
- Revitalize wisdom of planting from the elderly
- More respect towards nature</td>
<td colspan="3">WORLDVIEW BENEFITS
- Regenerating the bioregional ecosystem and livelihood
- Raising awareness of one's own impact</td>
</tr>
</table>

Worldview objectives:

- restoring connection between community members and their surrounding nature surroundings while respecting local Zunde traditions
- enhancing creativity by collective or individual art projects at school
- strengthen the sense of pride and belonging within the whole community
- make use of Zunde's chain of authority for ownership and knowledge distribution to respectfully spread permaculture knowledge and methods to other villages, communities and farmers in the region

Future worldview recommendations:

- School and curriculum activities: for special events and festivities, to promote ecoliteracy: celebrate harvest, create a nature diary
- Other creativity/rituals: new songs to be sung when performing different tasks (when planting, when carrying water etc.)
- Instruction/reminder notices on black boards (instead of us/foreigners) such as how to use the toilet, not to throw trash in the river etc.
- Promote the feeling of pride and belonging and strengthen the sense of unity of the whole community
- Zunde training: trainers will train others back home in their own villages and train others on Zunde plots as learning grounds (recruiting visitors)
- Planning and implementation is undertaken using local structures, processes and procedures under the chiefs guidance, thereby ensuring high community participation and organisation, thus feeding into programme efficiency
- Platform for interaction among farmers, local leaders, and service providers (provided by Zunde initiative)

- Form of insurance or food bank for villagers in need (communities can work as partners with joint) ownership
- Practice activities and games from the *work that reconnects* from Joanna Macy to reconnect with oneself, with each other and with nature : (https://workthatreconnects.org/practices)

3. ECOLOGICAL DIMENSION

From top: digging a well in the dried fields; clay hut with pot shaped bricks; Evans observing the crops in the permaculture garden

"What we most need to do is to hear within us the sound of the Earth crying"
Thich Nhat Hanh

3.1 Current Ecological Situation

a- Ecological background summary

In the Zimbabwean area of the Murewa district livelihood is currently precarious due to chronic poverty and food insecurity. Prior to colonisation, most of the rural population was knowledgeable and respectful of the values of nature, indigenous food plants, cultural identity and various practical skills. The majority of the people in the communal areas are smallholder farmers whose survival solely depends on subsistence rain-fed agriculture and grazing. Despite access to ample land and relatively high level of academic education, Eco literacy is non-existent and ancient wisdom is lost (together with its Zunde reMambo organisation) and food is no longer produced, shared or consumed directly.

Modernisation of agriculture favoured the planting of a single crop within a designated area for ease of sowing, treatment and harvesting. Monoculture is frequently used in large scale agriculture and was implemented in Zimbabwe as a result of colonisation to replace traditional farming methods for the sole purpose of short-term profit.
The compaction that takes place with this type of agriculture squeezes the life from soil (air and water) whilst the synthetic fertilizers wipes out micro-organisms (web of life). Furthermore, such agriculture is not only unsustainable, it causes multiple irreversible damages as it uses more water and fossil fuel than traditional farming, depleting natural reserves and depriving small scale farmers, local people and other species access to safely viable resources. Soil quality, landscape functions and farm productivity are consequently all negatively impacted by the lack of biological diversity and the usage of non-natural “cides”- herbicides, pesticides, insecticides and fungicides, released into soil, water and air and thereby polluting food and environment.
This extractive method, referred to as conventional agriculture, has impoverished the local population’s socio-economic structure as well as the soil from its nutrient density, carbon cycle and overall ecological equilibrium, resulting in a decline in crop resilience which forces into a spiral of purchasing industrial seeds and agro-chemicals.

Industrial seeds, confusingly labelled as “high quality seed”, are only suited to feed the poisonous loop caused by the market-oriented monoculture, requiring the constant use of chemicals to be somehow viable, making the system profitable to those few in power.
Corporations are imposing themselves over the seed system, pushing farmers to abandon their cultural and natural heritage. This relatively new seed monopoly eradicated the ancient network of sharing and distribution, breaking down social cohesion no longer able to fulfil basic needs of local communities. The abundance of indigenous nutritious food varieties has been replaced with few species of certified hybrid or genetically modified crop. The uniformity of this modern commercial food industry presents a direct threat to farmer’s freedom and infers a dependence on cash. Lack of cash translates into lack of food and often leads to malnutrition, dependence on insufficient food relief, and leading to the marginalisation of the disadvantaged part of the population, whom the MOCT cares for.

“*To let people arrange their own food, energy and shelter is to lose economic and political control over them. We should cease to look to power structures, hierarchical systems or governments to help us, and devise ways to help ourselves*.” - Bill Mollison

Due to changes in global climate and local seasonal rainfall patterns, the region is also vulnerable to severe periods of drought. Resulting harvest failures and livestock death cause food and income insecurity which consequently lead to a lack of seed material for upcoming planting and the rising risk of conflict. The area is also experiencing more extreme and erratic weather cycles, notably with intense downpours and extreme flash floods, but excess water is not being optimised for usage. These fluctuations have become unpredictable and may even occur within one season. Poor agricultural practices also exacerbated flooding, and coupled with unsustainable waste and sanitation habits, the land is now covered with impervious surfaces where rain water runs off at a faster rate into the streams and rivers gathering various pollutants, creating bank erosion and decline in water life and quality (and source of food).

Deforestation and overgrazing also cause serious environmental issues. The perception of the natural wild habitat (forests) surrounding Marondera as unwanted land led to the uncontrolled cutting down of trees and animals grazing freely over young trees and pasture, breaking down the regenerative process. However, the removal of vegetation cover impacts on the local nutrient and hydrological cycles, thus contributing to factors leading to drought and loss of wildlife and ecosystem services. And the shortage of household energy is responsible for the pressure on natural biomass, resulting in the collection of fuelwood. The burning of firewood for cooking and candles or kerosene for lighting constitute serious health and safety hazards.

A combination of the above factors has led to the current disruption of livelihood. Follows an urgent need to enforce an adaptive capacity for a resilient weatherproof system. Individual and communal actions involving renewable energy, green building, rain harvesting, decentralisation and relocalisation of resources, skills and activities, wilderness restoration and organic food production, strengthen adaptation and reinforce mitigation by minimising or preventing negative impacts. Agroforestry, in particular, has the ability to mitigate climate change while contributing to adaptation, offering empowerment to villagers by acting on sequestration simply via tree “growing”. Unlike the heavily publicised one-off events of tree “planting”, growing plants is a slow process with sustained engagement with little visible returns on investments in the early years. The long-term shared vision must therefore constantly guide and motivate the action plan suggested in this dimension.

b- Ecological analysis and statements

The SWOT analysis reviews the strengths, weaknesses, opportunities and threats of the ecological dimension from an internal and external viewpoint.

Table 3.1: Ecological SWOT analysis of MOCT

Strengths: *Internal:* • Availability of land with remains of indigenous plants Abundant solar energy • Labour • Permaculture certificate and eagerness to learn *External:* • Collaboration with similar organisations and expert volunteers	**Weaknesses**: *Internal:* • Limited skills and equipment • Lack of awareness or understanding of the need to care for the environment *External:* • Minimal availability of quality seeds • Unreliable climate • Arable land degradation • Deforestation • Water scarcity

	• Poor infrastructures, limited facilities
Opportunities: *Internal:* • Model for inspiring transition • Protection of wild natural areas • Social and economic implications • Land management for long term viability • Soil, water, crop productivity and overall community improvement *External:* • Micro-climate • Bioregional exchange and partnership • Global network	**Threats**: *Internal:* • No visible immediate benefit • Theft of goods and resources *External:* • Climate fluctuations • Disrespect of values and sustainable practices (from visitors) • GMO and chemical corporations

The following statements were derived from the above SWOT analysis as a guideline for the proposed ecological solutions.

Ecological vision:
A healthy and flourishing ecosystem that nurtures the basic immediate needs of society (abundance and prosperity) as well as for the benefit of regenerating the four capitals for present and future generations of life on Earth.

Ecological missions:
To create a leading live classroom for stewardship, climate resilience, environmental and social wellness, integrative of the local technical and economic limitations, in order to become a weaver for a regenerative culture inspiring the transition towards a peaceful, responsible and sustainable lifestyle while remaining within the planetary boundaries.

Core ecological values:
Organic, resources regeneration, ecological restoration, carbon farming, resource and energy conservation, carbon neutral, permaculture, zero waste, recycling, Eco literacy, diversification of crop, responsible consumption, biodiversity, localisation

Ecological goals:
- Paradigm shift towards nature, sustainable agriculture and land management
- Training centre for permaculture (demonstration site)
- Clean water and organic food security (closed loop system)
- Diversity of diet, climate resilience and biodiversity
- Improved soil quality, natural cycles and ecosystem services
- Sustainable waste and resource management (recycling, composting)
- Alternative energies (local, renewable, zero carbon)

3.2 Ecological Solutions

3.2.1 Permaculture design

Ecology, on which is based permaculture, is a whole system scientific study the interrelationship and interdependence of living organisms within their environment. The realisation of this project is heavily based on understanding this complex dynamic as the basis for agriculture. The primary objective being to achieve food reliability and self-sufficiency since government subsidies to feed school children have stopped, the Mangwende Trust cannot sustain feeding enough members from its current limited farmland.
Weather and mainly poor agricultural practices (non-native, monoculture, chemicals) have deteriorated the health of the soil leading to reduced yield and lower crop quality (both in terms of resilience as a plant and in terms of nutritional values as food). It is imperative for food production to become organic and diverse (ideally incorporating indigenous species and traditional nutritious vegetables) in order to regenerate the local ecosystems on which depend the community. This implies the prohibition of chemicals polluting food, water, air and the reduced dependency on import of external food with incurring costs, to be replaced by the local processing and storage of food produces and by-products on site (for redistribution according to the Zunde principles or for added market value).
Agricultural systems host a number of dynamic interactions of human and natural ecosystems. Currently, agriculture is extractive and damaging as it exploits the resources for profit and immediate needs. Although a more conservative or restorative management would minimise degradation and attempts to bring back its natural state, a truly regenerative agriculture is more nurturing of the whole system. This infers using the smallest already available practical land combined with traditional wisdom and modern scientific knowledge to produce economically viable life supporting systems based on the natural characteristics of landscape and the symbiotic relationships of its living organisms (both the human family and the family of life as a whole).
The emphasis is on: 1- local: reducing transport also means reduction of waste from perishable goods, with storage facilities offering food during shortage; and 2- organic: ban of chemical fertilisers in favour of natural manure and other plant compost towards a reduction in greenhouse gas emissions and the runoff of nitrogen into the soil and local waters. Based on permaculture, this model for food production is to be implemented at both locations: school and orphanage allotments (small primary site) with the aim to be replicated by villagers as home gardens and the larger educational centre (secondary development site) for the future establishment of a woodlot and wilder food forest, following agroforestry principles to provide food as well as other plant derived materials for other practical and commercial uses to the community.

a- Permaculture ethics

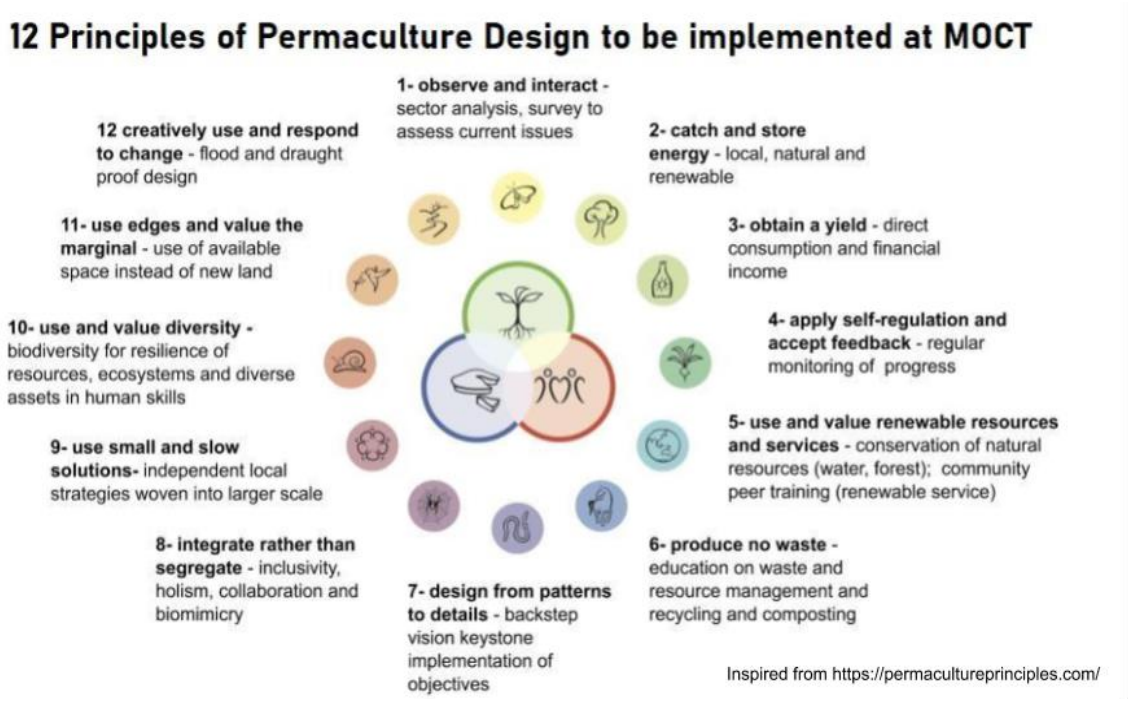
Organic agriculture is part of the regenerative agriculture movement in that it does not deplete the soil. Instead, organic farming views soil, plants, animals and humans as interconnected where each element of the system is necessary for the others to thrive. The main ethic is to stop poisoning the earth by working with nature to develop healthier environments. By replacing toxic substances, the benefits extend to the surrounding wildlife habitat in adjacent ponds, grasslands, streams, hedgerows and riverbanks; which in return enhance plant-animal interactions and so improve crop resilience and productivity. It is a win-win strategy where plants are grown without pesticides and fertilisers and follow the six criteria:

- Cultivate a healthy ecosystem to maintain soil life.
- Encourage biodiversity (plants, insects, birds, mammals and aquatic life).
- Use resources responsibly to minimise waste.
- Do no harm and avoid using harmful chemicals.
- Feed regularly with organic fertiliser (compost).
- Keep close observations and records.

One step beyond, **permaculture** (Bill Mollison and David Holmgren) consciously integrates land design to create a viable and regenerative holistic, diverse and stable socio-ecological and agricultural settlement based on connection to Nature and caring for Earth and cooperation with people without environmental damage.
The concept of permaculture equals that of a sustainable culture with, at its centre the people, the infrastructure and the organisation of a community designed to mimic the patterns and relationships as those found in nature. This way, humans cohabit with nature in a sustainable and economically viable manner, while their needs are satisfied without damage or exploitation to the environment but by regenerating the resources and maximising the use of every part of the system, including waste.

A key element to permaculture is good observation permitting to collect initial information about the site, which will form the baseline to compare progress in future monitoring, such as changes in weather, exposure, water flow, soil quality, infrastructure, natural and financial resources, accessibility, wellbeing, plants and wildlife, and how each piece of the landscape is integrated in relation to each other and cared for, including humans.
There are twelve main principles guiding a permaculture design (see figure 3.1). These include considering the problem as the solution (such as recycling), making the least change (using pre-existing components), valuing diversity, services and renewability (for better resilience to change), producing abundance instead of waste (regeneration), maximising the edge effect (value of marginals and vulnerables) and applying self-regulation and integration (feedback loop).

Figure 3.1: Principles of permaculture design for MOCT



Permaculture is further guided by three fundamental values which inform the sustainable actions in each of the three spheres so that decisions in one consider and enhance the others:

- **Earth care**: recognition of Earth as a living entity and source of life to be respected by revitalising complex soil and food webs, strengthening hydrological cycles, enhancing biodiversity and ecosystems, mitigating climate change. Local, organic and diverse food production and seed security revives the connection with nature (preservation of natural habitat) and helps with the regeneration of a healthy ecosystem (no pollution, better water cycle, restoration of wildlife).

- **Fair share**: limitation of consumption by equitable use of all four capitals to build a green, local and circular economy focusing on low footprint development, capitalisation of waste, redistribution of all forms of wealth and employment opportunities that are fair, safe and respectful of the environment with an inclusive social structure for collective benefit.

- **People care**: embracing culture that reinforces cooperation over competition, promotes diversity, help and support for each other, all as part of the Earth. Honour the elders, educating traditional knowledge with stories of transformation and celebration of the place, love, equality, joy, health and oneness.

b- Zero waste

Following on permaculture's long-term aim to leave the planet in a better condition by involving localisation and regeneration of ecosystem health, waste management becomes considerably valuable and profitable. Reduce, reuse and recycle (3Rs) are three ways to minimise impact on the environment. Following the cradle to cradle (C2C) approach, circular and renewable flows of energy and materials (and economies) are promoted by a switch towards conscious

consumption and the application of recycling, or even better the upcycling of materials normally destined to trash. Here, everything, even death (dead matter, old or broken apparently useless goods) can be reused for the creation of new objects and services as a constant cycle of regeneration, where one end of life leads to the birth of another. In line with holistic views and permaculture, this principle values every part of the life cycle with limited usage according to one's needs and no more than what can viably be replaced with no damage (naturally or financially).

Composting is an efficient environmentally and economically friendly way to handle organic agricultural debris and household waste. It guarantees the return of nutrients to the fields for increased yield on the farmland, while providing a solution to the waste which is typically either burnt or left to deteriorate causing considerable damage to the environment and human wellbeing among the MOCT community.
The nutrient cycle is the process by which important elements like nitrogen, carbon or phosphorus are transported and converted by organisms. The waste from one organism becomes food for another. In this way, carbon sequestration is the process by which carbon is fixed into the soil consequently reducing greenhouse gas and atmospheric carbon responsible for global climate change. Returning compost obtained from waste into the ground not only completes the cycle but is beneficial to crops as a soil amendment (For compost making see Appendix E1 - Making compost and E2- Liquid manure). Charcoal may be added to the system to create biochar, a more performant version of composting that complements the recycling of residue from eventual wood burning.

Generally, compost offers many virtues, it:

- Enriches soil, helping retain moisture and suppress plant diseases and pests.
- Reduces the need for toxic and expensive chemical fertilizers.
- Encourages the production of beneficial bacteria and fungi that break down organic matter to create a nutrient rich humus layer.
- Reduces emissions from landfills and lowers carbon footprint.

In addition, composting can create business opportunities by offering the possibility of making a profit from trading or selling excess compost.

Plastic and more importantly its amount, is causing a non negligible ecological disaster both at local and planetary levels. Starting with its production which necessitates the extraction of fossil fuels leading to a long chain of processes with high ecological footprints. Its use and most importantly its waste are sources of harmful contamination to both human and ecosystem health. This is because plastic is non-biodegradable and its natural decomposition is extremely slow and is released into the various natural systems in the form of dangerous microplastic.
Policies could be introduced that incentivise towards more conscious behaviour, trending towards sharing, swapping, lending, recycling, re-using and upcycling. The first aim is to limit non sustainable consumption by reducing the need for acquiring goods contained in plastic. This is done by providing better alternatives such as relocalisation of production, processing, services and improved storage while favouring biodegradable options for packaging, containers and natural materials for tools and furniture (glass, leaves, leather).
However, plastic is currently already present on site in large quantities due to lack of waste management. There is no collection service nor much understanding of both the threats and values it holds within the Murewa district. It is currently considered as worthless litter and remains either unused or worse it is often incinerated in the open. The burning releases toxins into the air, adding to the negative effects of pollution. There is a need for better measures in tackling the plastic among other waste issues.
One particular usage of the abundant plastic bottles lies in its multi functionality as building material. When assembled together or cut longitudinally, they can form gutters, pipes or even roof tiles. If flattened, they can be used as draft insulation on windows and leak protection or

splash proof on walls and roof covers (while allowing light through). Creativity can take place and greenhouses of various shapes may be constructed where the bottles double act as green walls, for growing (internally or externally) fragile plants demanding special attention and enhancing the harmony within the living space.

c- Zone planning

The primary objective of applying permaculture design is to add value to the existing area of the primary site around the school (by creating gardens) instead of exploiting more unused natural land. This will serve as a pilot study prior to replicating at the larger secondary site for the development of an educational agri-hub centre. Its success will demonstrate the multifunctionality of permaculture farming to the community to become self-reliant, generate an income, produce healthy food, and become a source of inspiration and belonging.

Based on the whole system approach from Declan and Margrit Kennedy's "Vision for Ecological Statement", MOCT may propose the following charter for a healthy and sustainable community:

- **A settlement on a human scale**: easily manageable at community level.
- **A settlement of short distances**: locally sourced or produced materials and services, relocalisation of family unit. Zoning design to increase accessibility based on time and frequency of visit.
- **A settlement which uses as little space as possible:** communal infrastructure and shared facilities, use of pre-existing buildings and land, maximising the edges.
- **A settlement of occupant responsibility**: promotes pride and stewardship towards community culture and surrounding environment.
- **A settlement which values water**: conservation, minimising waste and pollution-rituals and celebrating the rainy season and harvests.
- **A predominantly waste-free settlement**: recycling; upcycling; compost and natural alternatives.
- **An emission-free settlement:** zero carbon transport and energy, implementation of offsetting programs
- **An energy-efficient settlement**: use of natural availability (sun, biogas), passive light and thermal energy (building orientation).
- **A settlement of healthy buildings**: low carbon footprint, clean air/sanitation, ecosystem (natural materials and green walls).
- **A quiet and beautiful settlement**: beauty in nature, life, art and garden designs.
- **A settlement of human values**: diversity, tolerance, cooperation, respect for humans and nature.
- **A settlement of creative conflict solving**: traditional governing structure enhanced with sociocracy elements
- **A settlement of diversity:** development of various skills, resources and services, energy sources, biodiversity and food supply and inclusion of all social status.
- **A settlement of native species and productive plants**: forest garden, seed bank, reforestation, tree nurseries.

As per the charter above, settlement for short distances implies the optimisation of the layout of the site according to the permaculture zoning strategy. Each zone is defined depending on its frequency of visit and its need of attention, so that the most demanding and popular areas are located at proximity in order to reduce duration for travel, use of transport and infrastructure associated with distance.

- **Zone 0**: safe and harmonious living space for residence in efficient buildings and central activity such as dormitory, communal kitchen, school or family housing.
- **Zone 1**: most frequently accessed area surrounding the central building with regular visits and management, such as kitchen garden and composting, greenhouses, shading plants, clean water access.
- **Zone 2**: combination of allotment guilds and interface with future buildings: workshop, storage and recreational areas, outdoor assembly, visitor centre, clinic, but also small animals (fishpond, beehives), energy generation, waste recycling and trees.
- **Zone 3**: agricultural land with swales, forest belts and raised beds.
- **Zone 4**: mostly passive open space with rotational grazing area, mob grazing with pigs, sheep and chickens.
- **Zone 5**: food forests with ponds (with possible extension to wild zone for restoration of natural environment, pasture and riparian area).

Fencing of the site and the plantation is important to protect crops and livestock from theft, protect vegetation from unmanaged grazing, and also for general protection around the buildings. A living fence is the most cost-effective solution as it maximises the use of the edges by doubling the purpose of the barrier with a row of useful plants. **Living fences** and hedges offer excellent protection against winds too which dry and erode the soil. Tall plants act as a screen around the crop and can be planted at closer proximity or further away depending on whether there is a need for creating shade or letting light through.
Aloe plants are particularly suitable for drier areas such as above top swales whereas acacia bush and prickly pear (with additional potential for food consumption) deter any passing because of their thorns. Jatrophas, planted in double line also create a thick barrier with no risk of grazing by goats and cattle due to its poisonous leaves, while its berries attract pollinators.

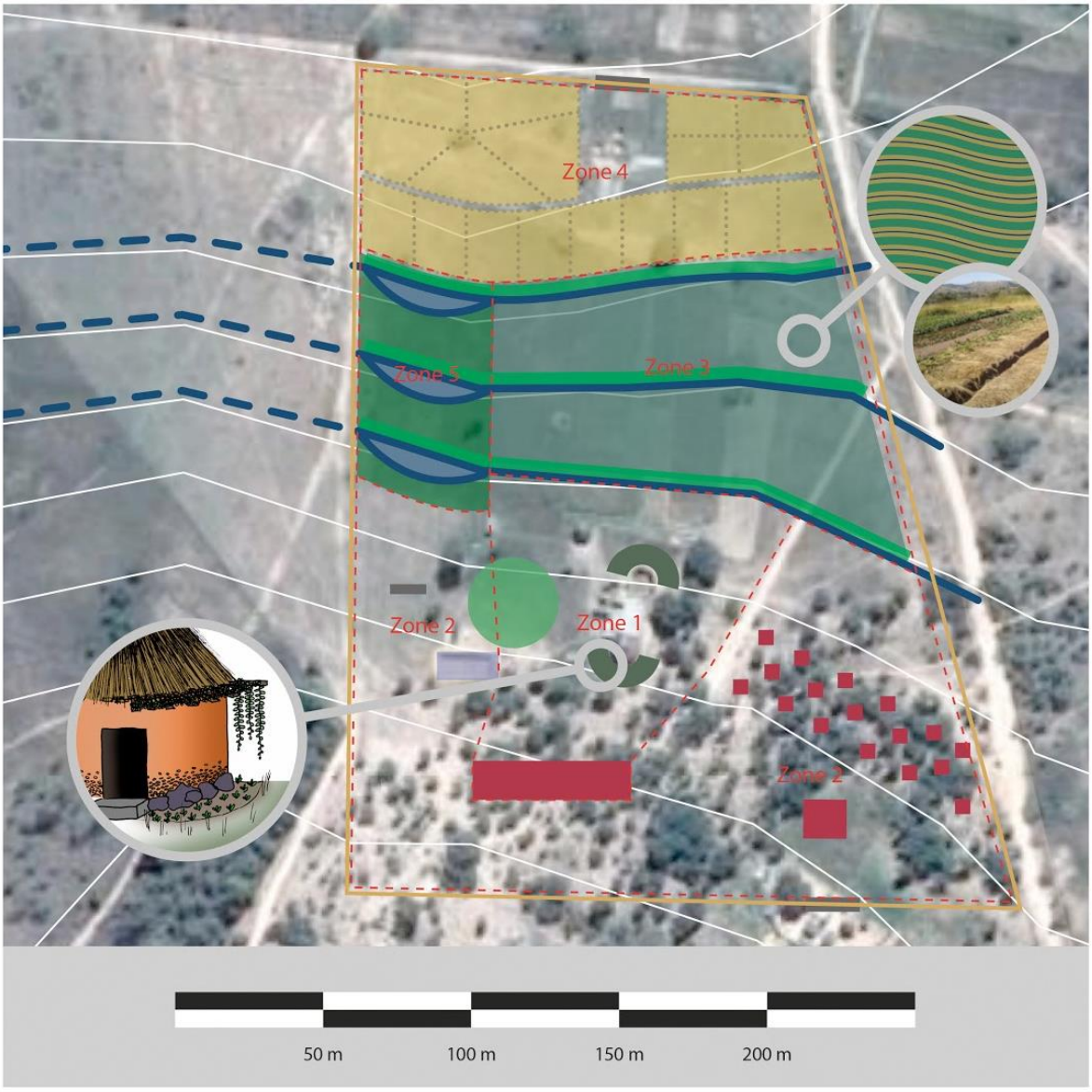
- <u>Permaculture concept</u>:

The keyline process (J. MacDonald Holmes, 1960) is an agricultural process that is based on the natural topography of the land and is designed to increase the fertility of the soil. The position of the edges, paths and water irrigation follow the natural shape of the terrain. The keyline system uses rainwater harvesting points as dominant landscape features to draw the contour lines to separate the forest, transport, building and agricultural zones. Keyline farming and water management was further elaborated by Yeoman, by allowing water into the ground, and integrating agroforestry and tree crop into the system together with rotational grazing. The concept is to dig contour ridges with swales acting as infiltration pits, and planting trees to stabilise the soil and prevent erosion. The general layout of a keyline pattern helps optimising rainfall distribution across the landscape in order to reduce the damaging habit of pumping from aquifers. Following this theory, the built environment also constitutes part of the landscape. In this way, roads play an important part in the water harvesting system. Due to their compacted and impervious nature, they accelerate water runoff, and are a key feature for water collection and drainage.

The terrain around orphanage school has a gentle evenly slope rending it suitable for designing a permaculture concept based on contour lines and keyline process (see figure 3.2). The **permaculture concept plan** for the primary development area in the small site (Mangwende Centre) focuses on the most effective use of water by installing a storm water drain along the Eastern road. Instead of the accumulation of runoff from the road downhill, the water captured by the stormwater drain will be channelled into the fields via the creation of swales (starting from the road).

- The swales follow the contour lines but slowly run downhill approximately for a drop of 1m per 300 or 400m. The three suggested swales are 30-40m apart and lead each to a detention pond where the excess water is gathered to create a moist area.
- Along and just below the swale, a forest belt is planted. The swales will progressively revitalise the soil and create humus for the sandy ground. The forest belts will provide wind barrier and support the micro-climate.
- The detention ponds are relatively shallow (approximately 1m deep). They create a small swamp which can be filled with wetland plants to naturally enhance animal life and biodiversity. The edge of the detention ponds should be planted with bananas whilst the pond area should be filled with cut and drop mulch from shrubs and trees. Vetiver grass should be planted extensively along the allotment boundaries.
- A food forest is planted between the various detention ponds.
- The northern part of the site (zone further away from buildings) is reserved for potential mob grazing of pigs or sheep. The pond at the bottom of the site can therefore be left for use by pigs or cattle as a mud bath.
- The area between the swales is filled with raised beds where annual crops are planted. These raised beds form lines parallel to the swales. Additional water channels run between the raised beds for irrigation.
- The circular brick buildings could be surrounded by half-circular vegetable and herb gardens, using the rainwater coming from the roof most efficiently.

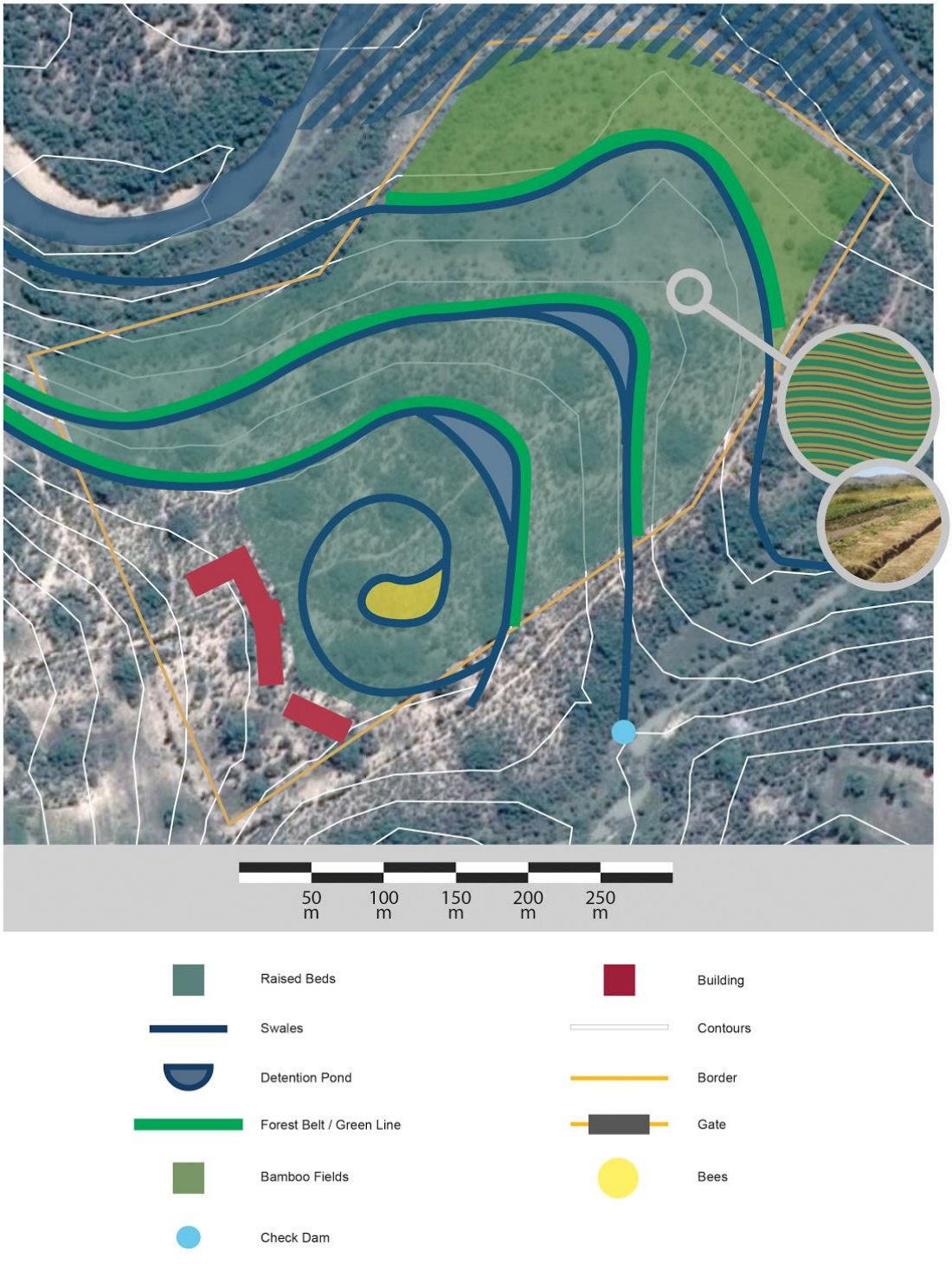
Figure 3.2: Permaculture concept plan for MOCT (small plot)



The development of the secondary MOCT site (large plot for proposed agri-hub and educational centre) can be designed in a similar way with the creation of swales, forest belts, raised beds, detention ponds and food forests (see figure 3.3). In the upper area, where land

is relatively flat, a circular swale can be designed. In addition, beehives can be set up, preferably in the southern area closer to the buildings, away from the footpath. The flooded zone is used as a woodlot for a bamboo plantation.

Figure 3.3: Permaculture concept plan for MOCT (large plot)



3.2.2 Food production

Mangwende Orphan Care Trust's original aim was to encourage the community to take control of its local food supply. Unlike past and current unsustainable industrial practices, the local agriculture system ought to be primarily a natural food system. Healthy, biologically active soils do not exhibit compromised levels of nutrients affecting both crop productivity and human health. Such capacity is drastically improved through the use of diversified cover crops, animal integration, multispecies pastures, and strategic grazing. Plant cover and diversity, replacing bare damaged ground, display advantages in terms of food security, economic prosperity and climate resilience particularly evident during rainfall, by improving infiltration and water retention too.
Soil restoration can be achieved via regenerative farming simply by working with nature. The natural process of photosynthesis captures carbon by the plants from the atmosphere to return it into the soil, thus promoting its capacity to store water. This is boosted further with the higher biodiversity and biomass grown in gardens, farms and forests, as more plants sequester atmospheric carbon and nitrogen, the more organic matter is available therefore reversing the trends by reducing both emissions and air pollution. In this context, biodiversity is a key solution to hunger and climate fluctuations.

a- Farming techniques

- Agroecology:

Agroecology is a sustainable farming method of growing and processing food, by shifting the control of the land, seeds, markets and labour out of the remote corporates and into the hands of small-scale farmers. **Agroforestry** in particular, aims to mimic the natural ecosystem by combining forestry and agriculture. It is becoming a newly accepted alternative for cultivating crops following various more specific methods such as riparian buffers, forest farming or silvopasture. Agroforestry allows, via a farmers-managed natural regeneration, for the integration of tree covers with crops and livestock as a way to increase ecosystem and agricultural resilience. Adding star multipurpose species of trees brings a wealth of benefits. In agroforestry systems, fruit trees and trees providing timber and or fuel may be grown in between crops in a scattered way. Although benefits from the coexistence of crop and trees on farmland may not be visible immediately, depending on the growth of the plants, trees do represent a secure long-term investment as they add ecological potential to the land, thereby bringing valuable economic returns.

Repeated tillage increases the susceptibility of the soil to erosion. Although benefits may be apparent in the short term, the long-term depletion is highly detrimental. The increased oxidation of organic matter in bare soil from tillage, coupled with reduced photosynthetic capacity, also becomes an additional source of carbon emissions. On the other hand, no-dig beds is a gardening method (also called **no-till**) that does not require ploughing the soil as is done conventionally. Instead, they are constructed by adding soil and organic matter on top of the ground to create a humus layer. This reduced soil disruption preserves the life and functioning of the microorganisms (bacteria, fungi, earthworms) which are responsible for aerating, fertilising, and processing organic matter, keeping the earth rich and textured. A healthy soil not only rehabilitates biodiversity, nutrients and water cycles, it also rebalances the ecology of the farmland and surrounding environment while increasing productivity.

Planting annuals such as cereals leaves the ground bare much of the year. Bare soil is vulnerable to erosion by wind and water. **Mulching** is a process to achieve no dig gardens. This method includes stacking several layers of organic materials, generally alternating between high nitrogen material (manure, grass clippings, coffee grounds, compost) and high

carbon material (cardboard boxes, straw, leaves, wood shaving). As these mulching layers decompose, they form rich and fertile raised beds. Maize stalks are commonly used for mulching and composting and so are banana leaves. Layers can be regularly added on a yearly basis to continually regenerate the soil. The principle behind mulching is to mimic a forest floor with fallen leaves and rotting timbers.

One of the characteristics of a truly sustainable garden is its capacity to generate at least some of its own seed. Traditionally, seeds are open-pollinated and ideally non hybrid variants are farmed, maintained and administered at small scale level. They are handed over from generations and are sacred as a foundation of life and food security. This is an informal family or community-based form of seed production practice. Encouraging a community **seed bank** would revive this lost heritage in an effort to counteract the loss of diversity commercially available for food crop. Seeds can be stored either in large quantity to ensure that planting material is available, or in small samples to ensure that genetic material is available, should varieties become endangered. The objective is to protect the quality of plants varieties by redistributing viable seeds to community members to improve the diversity of plants and food security.

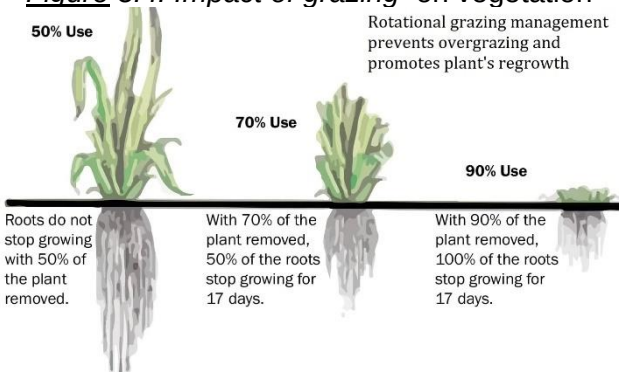
> "*Seed diversity and its preservation lies largely in the hands of us women - from seed selection to storage to deciding which varieties to plant and how much*." - Ms. E. Kaunda, Shashe, Zimbabwe

The seed library is a circular system: free seeds are offered to farmers who become breeders as they start growing food. The seeds obtained from allowing some of the crop to mature are reinvested into the seed bank, in turn to be planted by other community members. As for most of the crop, the seeds harvested will be divided such as 50% is allocated to the seed bank for future seasonal production, and 50% is used for direct consumption or trade. By sharing locally and swapping seeds through gift markets across the bioregion, the grown plants become better adapted and resistant, minimising the need for expensive industrial fertilisers. Crops become more resilient to diseases and natural disasters and the preservation of crop diversity eliminates risks of extinction. Educational and economic activities are therefore taking place via workshop, trade or sale so that seeds represent more than food for survival but become the heart of social exchange. These are centred around community values of selecting, self provisioning, exchanging seed, and sharing knowledge about planting, cultivating, harvesting, processing and preserving the crop. In this manner, food sovereignty is achieved with seed banks by re-localising the food systems and securing farmers' rights, thereby freeing them from the need for financial resources to constantly buy seeds, chemicals or simply food.

- <u>Animal husbandry</u>:

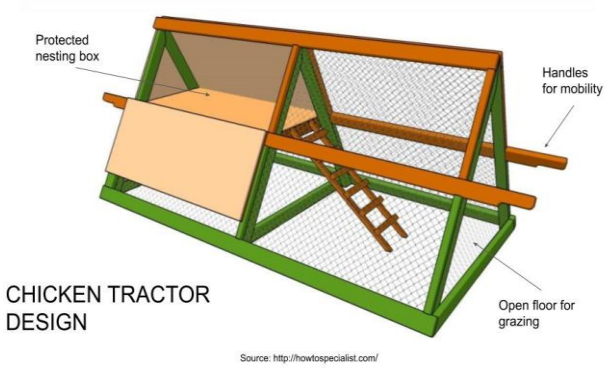
Holistic agriculture (Alan Savory 1960s) is based on monitoring techniques of the whole farm planning system by mimicking nature models. Holistic grazing, also called holistic management or planned grazing, is a method for animal management. It functions to reinvigorate grasslands by creating a rotational pattern of livestock and mixed agriculture so grazing animals do not over graze on the same area of land for too long. Overgrazing indeed occurs when animals are allowed to graze freely, often at the risk of removing the whole vegetation before it has time to regenerate itself, thus causing land degradation. Holistic management not only offers time for the plants to regrow between grazing while the animals are moved to another location, but it also prevents the plants from being eaten to the roots since animals are only allowed for a short period of time, thus leaving some vegetation able to regrow afterwards (see figure 3.4).

Figure 3.4: Impact of grazing on vegetation



Silvopasture or carbon farming, allows grazing livestock or chicken among a plantation. It is ideal for land that is inappropriate for growing annual vegetable crops as it integrates trees into pasture thus creating better habitats for animals and grasses. Animals are regularly moved, on a daily basis to avoid compacting or eroding the soil, damaging the roots and trees or overeating the grass. This allows time for plants to regrow. The rotational system mimics the natural movement of wild herds, fertilising the soil during their passage. The animals benefit from the diversity of pasture to forage on or keep cool under (trees, grass and other plants).

Figure 3.5: Mobile enclosure: chicken tractor



Raising **chicken** presents with the ideal animal size for low management. They offer a regular food. As the egg production falls after two years, they become a source of meat. In addition, feathers and bones waste can be recycled for insulation, pillows, tools or decoration. Chicken not only feed on garden weed and aerate the soil as they slightly till the soil, they are also often used as pest control (against maggots and snails), and as organic fertilisers. If located above the ponds, the manure slowly nourishes an aquaculture system by releasing nitrogen, potassium and phosphorous which breaks down in water promoting algae and phytoplankton for fish.

The different types of Brown breeds, Hyline and H&N, are the main egg producers in Zimbabwe, for both small- and large-scale producers and the Boschevelds are disease and climate resilient. For ease of rotational grazing, they are kept in mobile enclosures (called chicken tractors, see figure 3.5). These are small portable A-frame bottomless houses that can be moved around regularly to avoid damage to the ground. They consist of a nesting area, water (and food) dispenser and a roof to protect against heat and rain. The principle of a mobile animal tractor can also be applied to rotate other animals like goats or pigs.

Chickens and pigs are good options as they are easy to contain and help digging out vegetable beds. The exchange of meat and eggs form an integral part of income in rural areas (in addition

to producing derived goods such as leather/feathers) and the management flock is easier for women than herding larger cattle.

Goats are considered as “poor man’s cow”. Goat farming indeed only requires a low capital investment but offers quick returns with relatively low maintenance compared to other livestock businesses. Goats tend to graze on weeds and unwanted plants. They help trimming hedges and controlling against forest fires while naturally replanting vegetation by dropping the seeds. Goats can be raised with other livestock animals, without the need for a separate enclosure as long as a shed is available to them. Boer goat species are common for meat production in South Africa, but Angora goats are quite popular for producing wool in addition to meat and milk.

Apiculture is also a viable source of additional income. Honey is known for its antiseptic properties and beeswax can be used for making candles and soaps for trade.

Aquaponics is a closed-loop system consisting of fish farming (**aquaculture**) where fish are kept in tanks, and the wastewater produced in the fish tanks is used to provide nutrients for the growth of vegetation. Plants, in return, provide clean water for the fish. As a result, aquaponics requires less water than conventional fish farming and produces less waste. Although a fish tank is currently available on the primary development area around the orphanage, fish or other aquatic species can also be kept in the second area to be developed by the river, especially in the zone prone to flooding. Artificial basins (finger ponds) can be dug in the ground to be filled naturally during floods catching aquatic species (see Appendix E3-Flooding Zone and Finger Ponds) .

- <u>Integrated Pest Management (IPM):</u>

Pests are defined as organisms that cause damage to health, plants, homes or other structures. A pest can be a plant (weed), vertebrate (bird, rodent, or other mammal), invertebrate (insect, tick, mite, or snail), nematode, pathogen (bacteria, virus, or fungus) that causes disease, or other unwanted organisms that may cause nuisance, or harm water quality, animal life, or other parts of the ecosystem. The central point of IPM is to provide a combination of environmentally sensitive strategies aiming at long term pest prevention to eradicate the need of relying on the regular application and exposure to inorganic pesticides. It is based on the rigorous monitoring of the ecosystem and the factors affecting the health of the plants and the occurrence of nuisance. The purpose is to understand the factors triggering the emergence of pests instead of simply eradicating the visible problems. Education and management focus on basic hygienic rules such as isolating infested areas, protecting stagnant waters, maintaining clean dry and hard to access storage. This approach is smart because it creates a safer and healthier environment, sensible since practical strategies are used to reduce sources of food, water and shelter for pests, and sustainable because the emphasis is on prevention, which makes it economically advantageous while minimising the risks to people and the environment.

Certain man-made natural remedies can be put in place. Slugs and snails can be trapped into a bowl at ground level filled with water, yeast and sugar. Spraying water with bicarbonate of soda on leaves prone to mildew. Meanwhile chicken and poultry help to control termites.
However, many insects actually help to control pests too like predatory beetles, praying mantis, parasitic wasps and ladybugs. These natural enemies form the **biological control** of pest management. Fungi are beneficial for the soil and roots, removing them makes the plant more susceptible to diseases and pests. The diversity of habitat such as rocks, log piles and ponds attract different flora and fauna. The rehabilitation of wild predatory species such as amphibians and small reptiles or dragonflies also deters pests and insect herbivores (like caterpillars and beetles).

Farming design and social activities should therefore prioritise the incorporation of beneficial wildlife that help suppress pests such as insectivorous bird and bat nesting boxes. Sufficient opportunities need to be integrated such as bathing space in shrubs or trees to create refuges for beneficial insects, together with indigenous fruits and seeds. By working with nature, garden pests can easily be controlled naturally by creating habitat for predators, avoiding insecticides harmful to predatory insects, planting perennials and polycultures. Native flowers are not negligible. They are most adapted to the environment, resistant to pests and disease and attract insect pollinators, needed for crops. Certain plant families too -Asteraceae (daisies), Apiaceae (or Umbelliferae, carrots), and Lamiaceae (mints)- can help support various predator insects which feed on garden pests.

Natural enemies protect crops without causing damage to beneficial insects, the environment or humans. Ladybugs larvae feed on small aphids and the adults feed on mites. They are attracted to dill, fennel, angelica and yarrow. Angelica also attract lacewings which larvae also eat moth eggs, small caterpillars, hornworms and thrips. Parasitic wasps help control flies and leaf miners. Bees are usually attracted by aromatic plants like thyme, rosemary or lavender.

There are numerous auxiliary plants that can be helpful, too. For example, wormwood, pennyroyal and catnip help to ward off mites, aphids and fungal diseases. Lucerne is a typical insectary plant (which also doubles as animal feed), it should be planted near infested plants as it attracts parasitic insects away. Basil attracts pollinators while repelling flies and mosquitos, it is commonly planted together with tomatoes. Mint has numerous beneficial health properties, and helps fighting against rodents, cabbage moths, ants and aphids. However, it can be an invasive plant which spreads rapidly if not monitored correctly. Garlic is another healthy addition to diet and garden and repels beetles, spider mites and aphids; while mammoth dill attracts most of the beneficial insects. Dragonflies are also effective at controlling mosquitoes and they are keen on flowers and aquatic species such as swamp milkweed, meadow sage, white yarrow, wild celery, water horsetail and cattails.

The ideal for a naturally pest free plantation is to use a combination of the above along with rotating crops.

Table 3.2: List of beneficial garden species

BIOLOGICAL CONTROLS		**PESTS**
Beneficial plants	Beneficial insects	
Dill, dandelion, basket of gold, fern leaf yellow	Ladybug	Aphids, whiteflies, potato beetles, chinch bugs
Evening primrose, amarathum, clover	Ground beetle	Slugs, caterpillars, cutworms, potato beetles
Alfalfa, caraway, spearmint, fennel	Minute pirate bug	Spider mites, aphids, caterpillars, thrips
Dill, angelia, coriander, golden marguerite	Green lacewing	Aphids, whiteflies, mealybugs, leafhoppers
Dill and nectar/pollen rich plants	Aphid midge	Aphids

Peter and goldenrod, fennel, caraway, spearmint	Damsel bug	Caterpillars, mites, aphids, cabbage worms
Lemon balm, parsley, common and fern leaf yarrows	Braconid wasp	Tomato and tobacco hornworms, caterpillars, aphids

b- Edible landscape

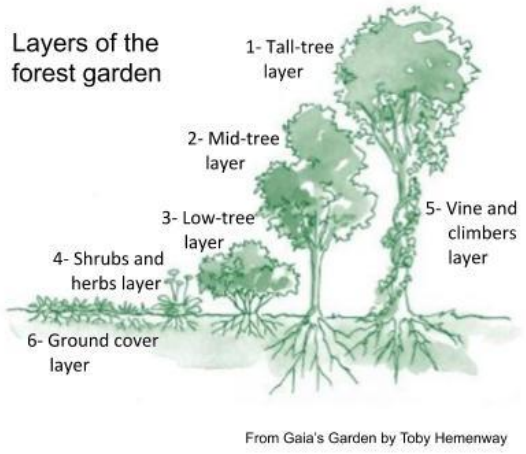
In **polyculture**, diversity is favoured, by growing two or more plants interacting with each other. The increased biodiversity provides resilience against crop failure within the whole plantation. Polyculture of perennials also includes non-edible yet highly valuable multi-functional plants forming fences and hedgerows which provide natural windbreak, shade and food for livestock, habitat for wildlife (pollinators and insect predators), medicine and timber for humans.

- Forest gardening:

Natural forests are self-sustaining, and require no maintenance, weeding, fertilising or watering. Each plant species occupies a specific space and various animals and micro-organisms interact within specific niches. This diversity leads to fertility and abundant productivity throughout the years. A **food forest** emulates this natural living system. As leaves fall, they provide nutrients and substance to the soil. Plants with deep roots protect soil from erosion and move nutrients upwards towards the soil surface for other plants. The canopy of trees creates a shelter protecting against temperature fluctuations while the high humus content of the soil acts as a sponge absorbing water to replenish groundwater tables. Besides food, plants also provide with useful produce such as fibres (for clothes, rope or paper), oils (as a lubricant, fuel, waterproofing, paint) and building materials of various forms, just to name a few.

Figure 3.6: Configuration of a food forest

The particularity of food forests is that they are cultivated with productive food producing plants, which interact at several levels allowing for low maintenance. As trees and crop occupy different levels above and below ground, they do not compete but rather benefit from each other (see figure 3.6). The varying heights of the vegetation from annuals such as beans, vines such as wisteria, shrubs such as peas, or trees as acacia, all contribute to the nutrient cycle system, but each acting on a different layer and maximising exposure to light, water and wind. The top layer consists of the tall overstorey trees (1) growing vertically above the rest. Just below the canopy is the understory layer (2) filled with smaller trees, and the vines (3) growing up the trees. Underneath are the shrubs (4) and climbers and other tall herbaceous plants (5). Open areas of the forest floor is populated with bulbous and tuberous plants while the soil is concealed with groundcover plants (6). Depending on the moisture level, mushrooms may also grow and occasionally, small animals are allowed to roam.

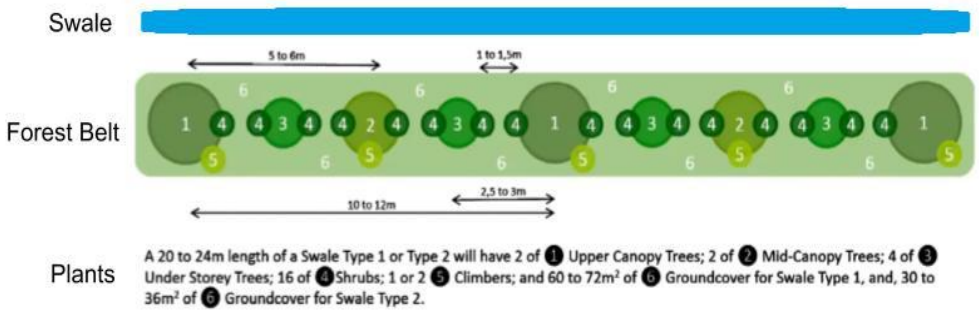


From Gaia's Garden by Toby Hemenway

Legumes and pulses, tend to capture nitrogen from the air and exchange it with bacteria in the soil, increasing nitrogen levels. This process creates a natural source of fertiliser for other plants that need nitrogen to grow. Following this principle, food forests are initially cultivated with nitrogen-fixing plants (types 5 and 6) to support the productive plants which will eventually yield into the food forest. The chop-and-drop technique consists of regularly trimming down these nitrogen-fixing plants so that their biomass is left on the ground to help revitalise the health of the soil. Progressively, as the productive plants grow and reach maturity and nitrogen deposits are no longer necessary, these types of plants are reduced to minimal.
Perennial plants such as comfrey or stinging nettle can be used as an alternative to the chop and drop cover cropping. Comfrey can be constantly cut but continues to grow rapidly providing constant supply of biomass for compost, bio-fertilizer or mulching.

While food forests can cover large areas, **forest belts** can also occur along the swales, slightly off the contour lines, thus doubling as wind breakers. Windbreaks are obtained by planting lines of trees capable of withstanding the wind, perpendicular to the prevailing direction of the wind. This juxtaposition highlights the advantages of tree planting (mitigating against soil erosion and evapotranspiration, creating biomass, improving soil nutrients and carbon sequestration, while improving biodiversity, favouring pollination and acting against climate change). It also mutually reinforces the properties of the swales to promote rainwater harvesting and recharge the water tables, thus reducing the need for irrigation (see figure 3.7).

Figure 3.7: Configuration of a forest belt



Layout of plant types along forest belt

Table 3.3: List of plant species according to the forest layers

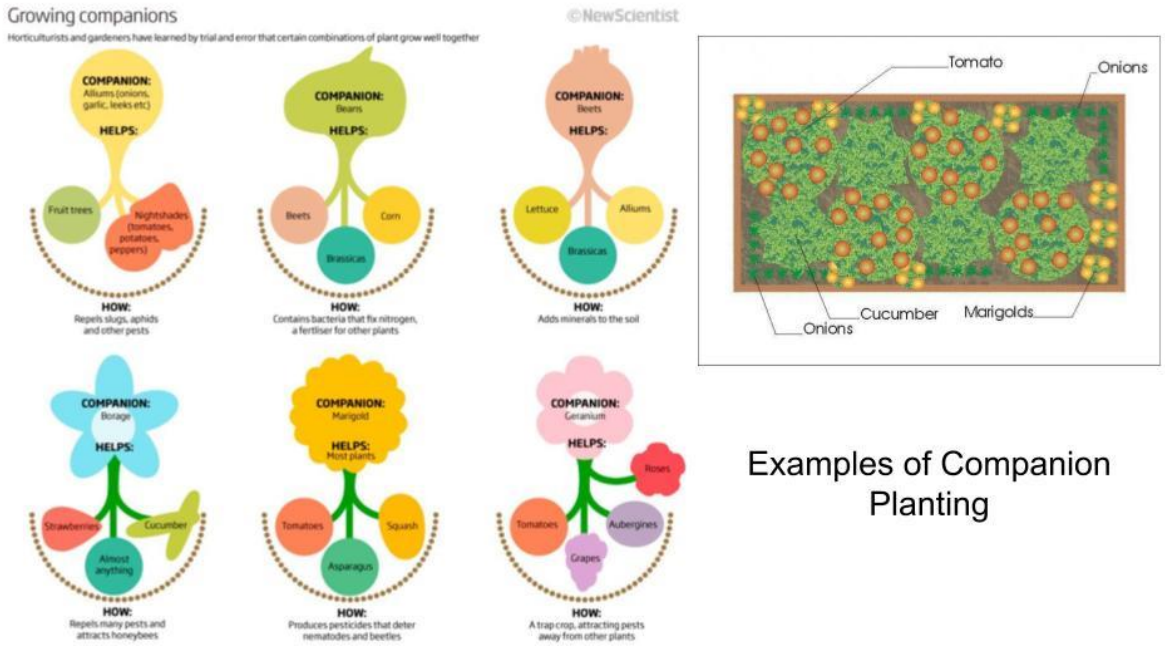
Layer Type	**Plants**
1- Upper Canopy Trees:	Acacia albida, Jackfruit, Mango, Papaya, Julbernardia globiflora, Peltophorum Africanum (weeping wattle), Baoba, Yellowwood, Marula, Syzyguim cordatum, Milletia grandis
2- Mid-Canopy Trees:	Carob, Orange, Moringa, Faidherbia Albida, Jacaranda, Matohwe (Azanza garckeana), Chechete (Mimusops Zeyheri), Matamba (Strychnos spinosa), Nut trees, Lychee chirindensis
3- Understory Trees:	Fruit trees: Lemon, fig trees, Grapefruit Pomegranate, Sour plum, Shambahuro, Masekesa (Piliostigma thonningii) or monkey bread, Persimmon, Sesbania sesbans, Indigofera jucunda
4- Shrubs:	Coffee, Lavender, Prickly pear, Rosemary, Jatropha, Euphorbia, Hubva (Vitex payos), Cassava, Sunflower, Sunhemp, Bauhinia, Buddleja, Shellbush, Pigeon pea
5- Climbers:	Grapes, Granadilla, Vines, Luffa gourd plant
6- Groundcover:	Soya bean, Bushbean, Calendula, Marigold, Calendula, Vetiver grass, Edamame, Cowpeas, Field pea, Lupin, Fenugreek, Clover

- Raised beds:

Raised beds form lines or clusters of earth slightly elevated compared to ground level. They are usually laid parallel to the swales, creating irrigation lines, that channel the rain water or which can be used with a drip irrigation system. Often, leguminous shrubs are planted on the raised beds between the tree crops, whilst cover crops use the space between the beds. The

raised disposition of a planting bed offers considerable advantages, such as it favours drainage from excessive stormwater, while reducing soil compaction (and the need for tilling) and promoting soil humus and so water retention (reducing the need for irrigation). Just like food forests, raised beds also gain from **companion** planting, where companion plants not only improve soil functions, but benefit from the reduced need for pesticides and fertilisers (see also Appendix E4 - Companion planting).

Figure 3.8: Companion planting

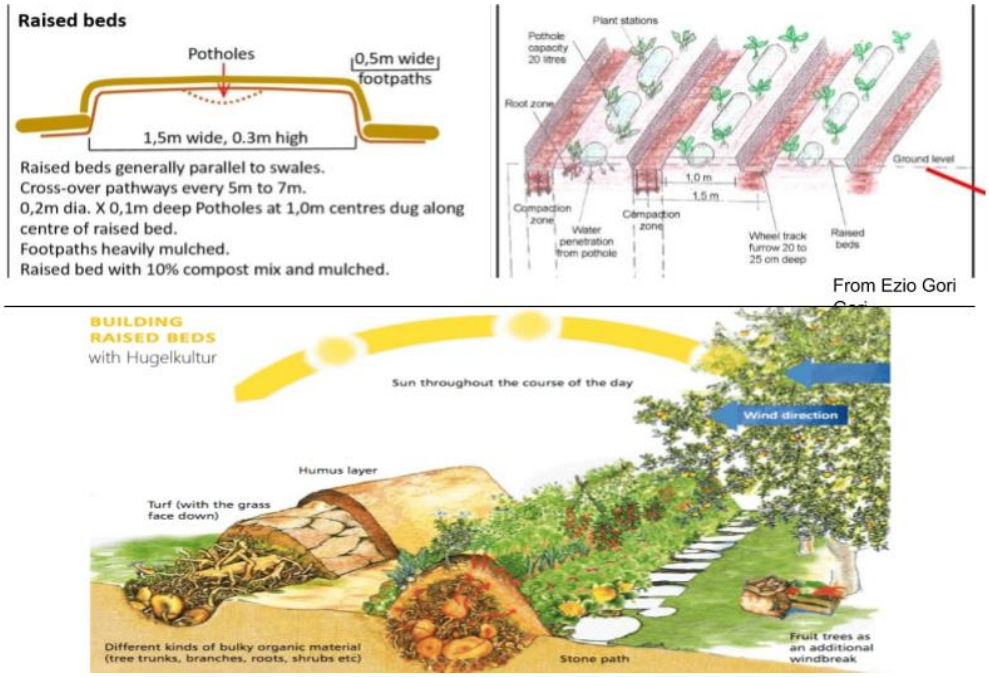


The **three sisters** consist of three types of plants, which could be comparable to three types of community members, where each role contributes to supporting and protecting one another. This symbiotic relationship is the essence of food sovereignty, as it allows for individuals not only to feed themselves but also to care for each other and feed the whole community. Farming, in that respect, represents more than a provision of food or connection to ancestral land and nature. It brings a sense of belonging, dignity and spiritual relationship with fellow farmers, the community, the living organisms and Earth as a whole where individuals and every being is a key part of the puzzle.

For example, sage, comfrey and chamomile are great companion plants that boost general nutrient absorption and plant health. The common combination of vegetable trio growing together provides a balanced diet too: legumes and pulses (bean/soy/pea), cucurbitae (squash/pumpkin/gourd/courgette/cucumber) and cereals (corn/sunflower/sorghum). For the three plants to benefit from each other, it requires first the planting of an upright element (corn or even sugar cane) providing a structure and shade for the climbing of legumes. Corn is highly demanding on water and nitrogen, which is balanced by the beans and peas providing some additional nitrogen (from the second year onwards). Later, are planted squash or pumpkins on the outer edge as they need maximum sunlight. Their large leaves create a living mulch by shading the ground, retaining moisture and preventing weeds, therefore creating the optimum ground cover for both the corn and beans. Often these plants are chopped back onto the soil to keep fertility levels high and forming a moisture retention mulch. Ground cover not only suppress weeds but also act as a deterrent against insects and pests.

Allotments: Vegetable and herb gardens can be planted in clusters such as small circular patches (1m diameter). These can be arranged in an aesthetic manner for better visual and mental harmony around the household. The shapes form a basin which channels the water to sink into the ground thus preventing runoff. At the centre of the circle, a pothole to catches rainwater or a drip irrigation system can be placed (see Water irrigation chapter). This system (compost in the soil and mulch cover to prevent evaporation) prevents waste by watering deep into the ground directly at roots level. By creating a compost layer at the base of the garden and keeping it moist via the perforated bottle, roots are encouraged to grow downwards instead of being dried and weakened by the surface sun and weeds.

Figure 3.9: Raised beds, potholes and Hugelkultur



The **Hügelkultur** is a German term meaning hill cultivation. It is a type of vertical planting where the raised bed is filled with rotting wood and covered by compost and soil. It is based on self-composting and self-heating principles so that a raised bed can be built on a base composed of wood which acts as both composting via natural slow decomposition process of organic matter and as moisture trap where naturally occurring microorganisms (and bacteria/fungi) convert the humus layer into a highly nutrient rich organic substrate which builds fertility over time and that is suitable for plant growth. As the wood breaks down, the resulting rich soil is suitable for plants intolerant to flooding and water saturation. The air pockets allow for drainage and root penetration for the plants growing on the mound. This suppresses the need for fertilisation or regular irrigation. However, addition of compost may be necessary over time as the mounds collapse slightly. As soil may be nitrogen deficient over the first two years, annual vegetables are best planted after that period once the mounds are properly established (see figure 3.9).

Hügelkultur is an excellent integration of permaculture (where no waste is wasted but recycled) and biomimicry (where the raised beds replicate the natural cycles of forest decomposition layers with leaves, wood and seeds accumulating in the ground to regenerate into life).
A hügelkultur may be constructed into a trench or over ground. The latter offers more surface area to plant on, the ability to harvest food without having to bend down too much and further protection against flood:

- Bottom layer: logs and thick twigs
- Second layer: a thick pile of dead leaves or dry straw
- Middle layer: green leaves and other fresh plant residue
- Next layer: mature compost
- Top layer: topsoil

c- Ecosystem restoration

- Biodiversity:

The regeneration of vital local ecosystem functions is not limited to afforestation programs, but can start with reviving carbon sinks within the crop land and the riverbank. Drought-tolerant varieties of crops are favoured for staple food production or for their added economic value (like lavender distillation for essential oils or antibacterial soap production). However, there are a number of key plant species which must be integrated to the farmland.

Vetiver (*Chrysopogon zizanioides*) is a perennial bush grass with multiple uses mainly due to its deep extensive rooting system and its tolerance to both drought and submergence. It helps in soil erosion and flooding control, invigorating soil structure and purification of polluted water and waste management, acts as windbreak (stiff stems forming hedges) and can be used in construction (roof thatching, adobe bricks and ash used as mortar instead of cement), handicrafts (baskets, hats) and for medicinal purposes. It is also a source of feed for livestock and wildlife, and an ingredient for the production of cosmetics and pest control (intercropping, bio-pesticide).

Jatropha *curcas* (purgeerboontjie) is not only drought resistant but is not grazed by goats. It is mainly used to create living fences (for protection and wind barrier). Hedges reduces erosion, and due to its widespread lateral root system, it can be planted around dams, or as filtering systems near ponds, often in association with lemon grass or vetiver grass. Jatrophas are easily planted directly from seeds or by propagation from cuttings. The seeds can be processed for oil extraction or pressed cakes (with insecticide properties). Soap production from oil is a simple process and creates a business niche. Oil is also a biofuel as a substitute for energy in lamps, cookers and as diesel substitute for modified engines. Besides the economic advantages, the fruits are used for mulch and composting, and various parts of the plant are used for medicinal purposes (leaves as antiseptic, sap as antimicrobial and coagulant).

Similarly, although nonindigenous, the large ***Moringa*** *oleifera* (horseradish or drumstick tree) is often planted as a companion shrub along raised beds and forest belts. Only a few specimens are recommended to be left to grow at full height for seed collection. It is a resilient, adaptable deciduous crop tree growing on drained sandy soil. The leaves have high nutrient value and therapeutic properties. They are usually dried and milled to make powder or tea. Oil extracted from the seeds is high in antioxidants presenting with several health and cosmetic benefits. Due to their rich nutrient content both seeds and oil can be used in cooking, or in the production of derivatives such as soap and medicine (anti-microbial, anti-inflammatory), or lubricant and anticoagulant for water purification; all potential sources of income. Most of the plant is edible and, except for the roots, can be used as animal feed, in addition to creating shade, fencing, or ropes.

Another star multipurpose species, the **Acacia** tree (*Faidherbia albia*- mutsangu), is indigenous across Africa, tall, thorny, deciduous and fast growing on sandy soils and riverbanks. It is favoured in agroforestry in dry regions because of its water retention capacity

and the thick leaf cover in the shape of a protective crown. The canopy provides shade and the leaves and pods serve as nutritious livestock fodder during periods of droughts, while the seeds are edible to humans. The tree also offers advantages in apiculture and medicine (bark used as toothbrush, and with the roots, against various respiratory infections, digestive disorders and malaria). The association with crops like sorghum or millet directly planted underneath the tree has demonstrated an increase of yield. It is also ideal for pergolas due to the shedding of leaves during the wet season, allowing sunlight into the adjacent building and the crop below. Like vetiver, its spreading roots conserve the soil from wind and water erosion (suitable for protecting watercourses) but also fix atmospheric nitrogen which then passed through to the leaves, fertilize the topsoil when they fall.

Bamboo species are not currently present in the area despite their multifunctionality. There are two types of bamboo, the clumping which does not spread and the running bamboo, which is highly invasive and needs rigorous monitoring, and ideally should be avoided especially near wild areas. There is only one indigenous species to South Africa, the berg clump bamboo (*Thamnocalamus tessellatus*) but *Bambusa balcooa* is now widely spread as well as Oreobambos *buchwaldii, Oxytenanthera abyssinica and Yushania alpina*. A bamboo plantation is recommended in the lower part of the secondary site, prone to flooding. Bamboos are fast growing grass that regrow very quickly (renewable resources), and the clump species present no risk to the natural habitat. They hold soils (reduce erosion), take part in carbon sequestration (decrease environmental footprint), use less water (maintain water supply) and have multi-functional applications (source of income and employment).
One hectare can yield up to 20 tons of bamboo which can be economically viable within five years of planting. It offers potential for economic development and trade without harming the natural forest. Bamboo shoots for weaving can be harvested after two years but for hardwood such as furniture, they need to mature more than 5 years. They are usually cut down at the base, without removing the roots from the soil. They are an excellent source of renewable biomass supporting sustainable livelihoods, as the production of bamboo charcoal burns with less residue.
Bamboo sticks are also strong and usually insect resistant, they are a good alternative to timber and plastic, thus mitigating the pressing issue of deforestation. It can complement building and housing material. The bamboo industry has the potential to reduce poverty as it provides the opportunity to develop new skills for local and domestic craft markets. In the same manner as from palm trees and reed, and with relatively low level of skills, leaves can be woven into baskets, mats or used on the roof. Adding to the list of advantages, bamboo shoots can also be prepared for human food consumption and used as water containers because of their hollow tubes.

Other useful plants (see Appendix D2 - Recommended plants list for further information):
The ***Julbernardia*** *globiflora* is an African tree with multiple usages. Although not suitable for timber, the reddish bark is astringent, and the extracted tannin is commonly used as dyes. The inner bark can form various ropes. The leaves are fed to livestock and the flowers are a good source of nectar. The roots can be used as infusions or decoctions for medical treatments against dysentery, diarrhoea or as an eyewash against conjunctivitis.
Marula trees (*Sclerocarya birrea* – mupfura, umganu) flourish in the driest and least productive agricultural areas of Zimbabwe, yet they offer abundant, reliable harvest and edible fruits from which beverages can add to the market value. The oil, extracted from the kernels also has a good export potential and is used in cooking and cosmetics, while the edible nuts can be roasted for long term conservation.
Although not a coffee plant, the **coffee bauhinia** (*Bauhinia petersiana*) is an indigenous tree that grows on sandy soil. It possesses seeds that can be roasted and ground to produce a coffee substitute. In addition, the seeds can be pounded into a substantial porridge meal to feed the population. Both leaves and roots have medicinal purposes too while the bark can also be made into rope.

Raffia palm trees (*Raphia farinifera*) are mainly used for furniture, roofing and building (leaves and stalks), but not for direct consumption. It is most commonly known for its extracted fibre that makes a strong string used in gardening. Fibres can also be used for manufacturing textiles, mats and baskets, which represent a considerably profitable economic activity.
Luffa gourd plants are annuals vines of the cucumber family. The interest lies in the fruits they produce in the form of gourds. The skin of the gourds (or loofah) is peeled once dried to leave the inside that is used as a sponge or scrubber with added commercial potentials.
***Aloe** vera* is a succulent plant that grows primarily in hot and dry climates and so needs to be planted in a drained soil. It is cultivated because of its medicinal properties (superfood and topical benefits), but can also be used as a border to prevent animals from crossing.

- Rewilding:

In the absence of vegetation (due to deforestation, monoculture and weed control), dry landscapes absorb sunlight and radiate the energy as heat resulting in higher temperatures, depletion of aquifers and so drought and flood, which further impairs plant growth and crop productivity. Forests and managed plantations and grazing areas not only replenish the groundwater levels but also bring back rainfall. Thanks to agroforestry, the key role of trees aid in soil water infiltration and collection. The resulting increased biomass offers a better environment for healthier livestock with the availability of shade, food and shelter for farmed animals but also for wildlife who play a considerable part in closing the loop with pollination and waste recycling (see figure 3.10).
More specifically maintaining natural vegetation along streams, swales, ponds and riverbanks provide a wealth of additional benefits such as shade and cooling to the surface of the land but also by preventing dehydration from direct sun exposure of the wetland. A restorative environmental design highlights the importance of place and biophilia by minimising footprints and exploitation of organic resources and honouring the local traditions for a better quality of life for all. The optimisation of the whole system rather than some parts for the benefit of a few is the motto of the Mangwende Trust, with at its core value the interdependence and reciprocal relationships between all living beings. The best way to take care of oneself after all is to care for everyone.

Figure 3.10: Benefits of ecosystem restoration

Eco literacy and the importance of the wider environment are crucial to keep benefiting from ecosystem services. Activities must respect, maintain or enhance the sustained health of the ecosystem in terms of quality and quantity of services on which human communities depend. Indeed, protecting forests benefits water quality, due to their ability to capture, filter and retain water as well as air pollution. They purify the air by locking up carbon and thereby have the potential for reducing the global greenhouse effect. They also provide valuable socio-economic benefits including carbon sequestration, flood control, wildlife habitat and various forest products.

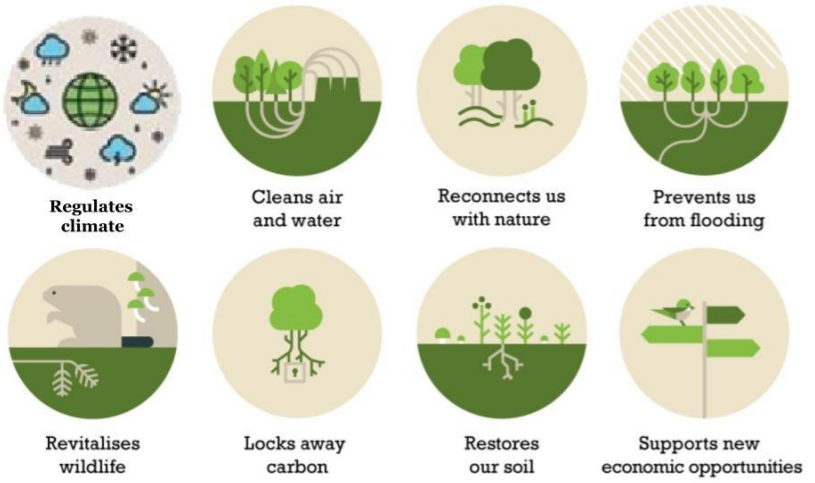
"*Socially and ecologically engaged spirituality is about taking our role as co-designers and co-creators of our common future seriously. If we do so, we will co-create the world we are hoping for*." - Daniel C. Wahl

Rewilding seeks to reinstate natural processes bringing life back in damaged ecosystems and providing hope for the future of struggling rural communities. It is a collective form of land management which acknowledges the role of occupants as stewards of ecosystem, giving a sense of meaning to the land. It draws the population to connect with nature, to find peace or energy, or explore the wonder and enchantment of wilderness. Experiencing wild nature helps reconnect people to the place, to themselves, to each other and with the living planet. This improves health and wellbeing, building a shared sense of humanity and alleviating a number of social and psychological issues encountered during youth development or conflict resolution. Rewilding can provide grounds for outdoor activities which further help revitalise communities through exchange of experience by attracting visitors. But above all, it is an opportunity to leave a positive legacy for future generations. Every action and decision one makes must tend towards nurturing the values and common vision, that is the regenerative connection between all elements of life.

The vision for the future is made possible by unlocking the rewilding process. The management primarily emphasises on minimising natural site disturbance and compaction but also to relegate disturbed areas using native species. The first part of ecological restoration

requires the reversal of processes that dewilded the land. It is primordial to maintain intact areas of natural vegetation to rehabilitate basic ecological functions and allowing trees to recover and recolonise. The second phase involves restoring some of the plants and animals that would originally have shaped the ecology to maximal benefit including the riparian system and by reimplementing the mangrove. Alien species density should be controlled so to facilitate recolonization by indigenous species. Native breed animal species such as local wild pigs and cattle can also exercise beneficial effect if in very small herd sizes, creating diverse vegetation structures and regenerating the soil structure. Finally, in the longer term, the aim for the introduction of indigenous keystone species which would control the balance of the forest ecosystem efficiently by reshaping the landscape naturally.

Figure 3.11: Environmental value of forests



3.2.3 Water supply

Water is the source of life. However, water scarcity is one of the world's leading problems affecting primarily vulnerable populations. To counterbalance this, it is important to adopt a systemic approach to water management. Hence, water is the first priority in permaculture design which works to harness the potential of rainwater with the aim to uplift livelihood. By harvesting water, retaining it and minimising loss, the goal is therefore to empower farmers to collect rainwater, by integrating sustainable agricultural practices into the design of land and water strategies. Sources vary from rainwater, underground (aquifers), surface (rivers and runoffs). Every drop of water counts and can be integrated into a holistic farm management where water conservation consists of either storing it in the soil or diverting it from the surface into ponds or tanks for future use.

The best option is to reticulate the water by capturing the rain, storing, and redistributing where/when necessary. Direct access to and regular availability of water saves time from frequent journeys walking to the nearest water sources (boreholes, streams). This reduces the risks of conflicts and the need to carry water buckets and herd livestock over long distances. It is worth noting that priority should first go to using naturally, freely and locally available resources (rain) before engaging with the building of a new well and so limit extraction from the aquifers. In this way, harvesting results from swales, drains or direct collection from gutters.

a- Water network (source)

- Rain harvesting:

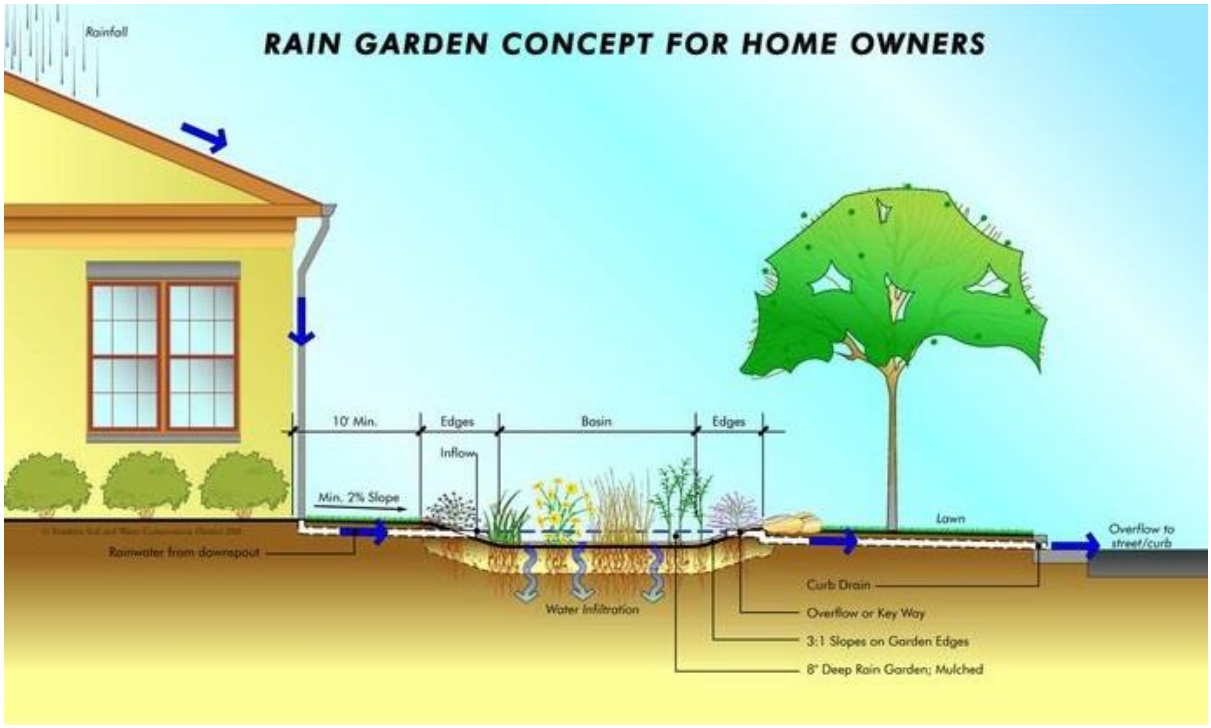
The community being settled in a semi-arid region, needs to make water conserving practices as a priority. The aim is to 1- retain water to slow down its flow, 2- recharge the water tables and create a buffer, and 3- reuse and recirculates water in the system and evenly across the landscape.

The hydrologic cycle corresponds to the process by which water circulates, through evaporation, transpiration, precipitation, flow, and percolation. Efficient water management needs to pay particular care to collecting, storing and distributing rainwater (gutters, wells, irrigation), replenishing aquifers (drains, swales, ponds), and reusing and recycling used water. Creating Watersheds and wet zones to filter and clean up the water naturally as well as providing a shelter for biodiversity is essential.
This is achieved by using swales located following the keyline contours to capture the water which slowly infiltrates and hydrates the landscape. Indeed, when land is bare and degraded, the rainwater runs off together with valuable topsoil organic material instead of infiltrating into the soil, resulting in erosion and drought. With the reintroduction of vegetation, the water is no longer wasted as it is absorbed into the ground through the plants and the organic material is captured to form a protective mulch further slowing and spreading runoff water thus constantly improving the humus layer.

One method for capturing water is the use of **fog catchers** which collect water from ambient air through big canvases (see Appendix E5 - Fog catcher assembly drawing). The process based on condensation. Air condenses on the cold surface into droplets of liquid known as dew. This is then collected under the canvas and can be channelled into a barrel or similar. There is typically 0.05 to 0.5 grams of liquid water in a m3 of fog.

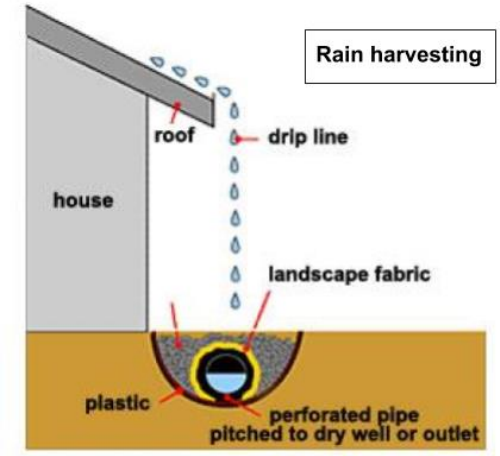
Water distribution systems safely release the water from storage or harvesting areas towards the desired location (reservoir, ponds, irrigation). The water from the outlet at higher location is directed downslope via a drain or a pipe network. The simplest is to use **diversion drains**, which are trenches with a slight gradient. They are comparable to earthen gutters built to flow the water. The ditches are ideally lined at the base and sides with clay to help water moving, unlike swales which are usually built on permeable soils.
Ground gutters are formed by digging a shallow ditch and tamping clay to channel rainwater (from runoff or collected from the drip line) into a drain or a dry well (filled with gravel). This allows for water to percolate into the ground and avoid localised overflowing. An alternative to a gravel drain is a **swale** populated with wetland plants such as irises, reed and tall grasses (e.g. vetiver) that also help the water to percolate into the ground (see figure 3.12). A third option is for water to be directed away from the building via the sloped trench into a **cistern** for future use such as drinking. For this, organic filter can be used to filter water before entering the container.

Figure 3.12: Configuration of a rain garden



Rain ought to be the primary source of water. Unlike the river which is polluted from bathing, washing, animal use and farmland chemicals runoffs, rain (that does not reach the ground) is clean and does not pressure the groundwater tables. It can simply be captured in jugs, but more efficiently, rainwater can be collected at roof level from gutters or off the drip line (see figure 3.13). This way, it serves to nourish the plants around the house and protect the building from excess moisture by creating an overflow route and managing that overflow water as a resource.

Figure 3.13: Rainwater harvesting from a building



Dig a trench in the earth around the building, by the edge of the walls and below the roof drip line, at the level where the water falls onto the ground,

1. Fill it with stones or clay to prevent erosion and splashback, this will divert away from the building into the adjacent garden. Cement or plastic based trenches can channel the water for longer distances.
2. Use the collected water:
   - to permeate straight into the herb garden, pergola or raised bed with a small permeable pipe perpendicular to the trench (see figure 3.12)
   - elsewhere on the land for irrigation with a non perforated pipe or a lined trench (both

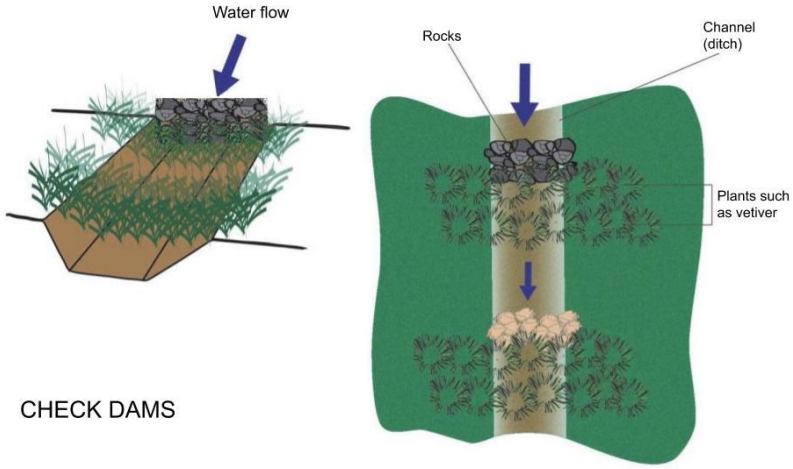
can be made of clay)
- to seep into the ground for recharging the aquifers via a pit filled with gravel
- for storage into a reservoir

- Runoff, erosion and flooding:

Burning pastures, overgrazing and deforestation are amongst the major human factors exposing land to torrential rains. Poor land and water management in conjunction with intense climatic events often leads to deep unwanted gullies. Severe erosion is characteristic of denuded landscape suffering from flash floods and leads to environmental pollution. Restoring degraded ecosystems can easily be controlled by starting with simple steps.

Small shallow dams serve to slow the velocity and movement of water running downhill allowing increased percolation into the soil. The most commonly applied engineering measure is the **check-dam.** They are positioned to form a series of successive dams along the gullies, usually at 5m intervals, and they are usually less than 2m deep and 3m wide. Small gullies can be simply filled with strips of vegetation, like vetiver, densely planted across the gully (see figure 3.14). Wooden check dams can be used for gullies with small catchment. They are constructed by inserting intertwining wooden poles into the ground and filling the upstream side with brushwood branches. Rocks and stones of large size can also be used alone or in conjunction with the above or reinforced with a wire mesh or post structure. Where flow of water is high, a stronger structure, a gabion, is necessary. It is a woven basket filled with stones to keep holding it in place. Over time, silt and sand gather behind each dam to refill the gully, as they are washed down from the watershed. This builds up organic matter which creates small terraces where vegetation can be planted to stabilise the soil moisture. The ecological succession of complexity and diversity following the installation of check dams offers the advantage of creating additional farmland areas.

Figure 3.14: Design of check dam using vegetation and stones

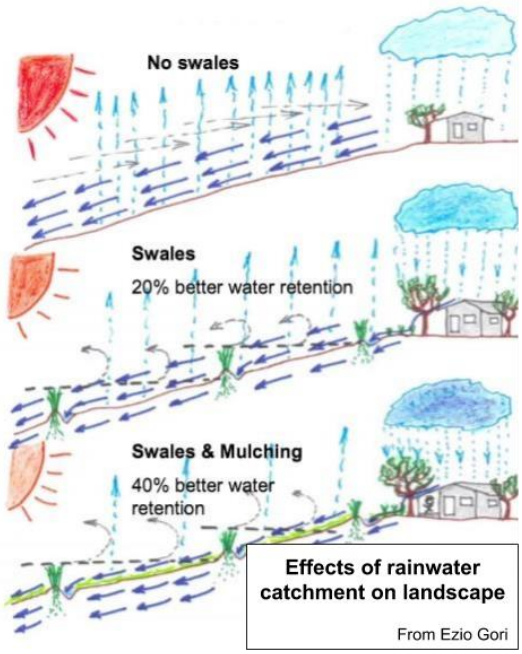


However, prevention is always favoured, and the best option is to control the water that falls onto the surface to slow down the runoff and disperse the flow to allow water to infiltrate into the ground. It prevents flooding and helps regenerating the natural water reservoirs and

hydrological cycle. This can be achieved simply by increasing the organic matter of the top-soil as it converts the soil into a sponge, thus facilitating its capacity to capture water.
Then, the cheapest way to store water is to follow the rule of “slow, spread and sink”. Digging trenches for example, to trap running rainwater does not require much elaborated skills nor technical or financial input. It is imperative to shape the landscape following both the keyline and contours.

The **keyline** concept (developed by P.A Yeoman) reverses the natural flow of water from ridges into the valleys by channelling it from where it is concentrated into drier areas and diffusing it across the land. This method uses a small plough to dig surface furrow lines parallel to the keylines, that help intercepting and draining the water. This in turn, promotes the formation of a fertile top soil.
The **contour** concept (described by T. Hamenway) is based on the creation of **swales**, by digging shallow trenches along the land's contour lines. This is most appropriate on terrains with slopes of 5% or less. The dimensions of the swales are variable but the key feature is that the earth dug out is piled along the downhill side of the swale to make a raised mound, which retains the excess moisture and adds to the benefit of creating a suitable space for growing plants. This prevents water overflow and runoff by intercepting it into the swale, which spreads it along its length, therefore slowly allowing it to percolate into the ground across the land (see figure 3.15). This way, swales also protect against erosion as they prevent the formation of unwanted stormwater gullies. In addition, swales help mitigate floods, drought (harvests rainwater, slow water release into raised beds, reduces needs for irrigation), they act as windbreaks and fire barriers, and also help stimulating the growth of plants. Combined with raised beds, swales enhance drainage from heavy storm with minimal maintenance (no till, improved soil quality), improve biomass and biodiversity, thus creating microclimates.

Figure 3.15: Effects of landscaping water catchment on micro-climate



- Pumping from the ground and river streams:

As a means to conserve the natural water resources and avoid drawing down the water table, the harvesting of rainwater is favoured over boreholes or wells extracting from the aquifers. However, rainwater may not always be sufficiently stored to provide for a yearly supply. In that

case, water from **wells** can be used as a supplement. Currently, continually digging new deep wells as they each dry out, constitutes the main source of clean water in the small site and for most parts of the local community. Although modern pumps are popular, they tend to demand fossil fuel energy, thereby incurring a financial and ecological cost, rending them inappropriate considering the actual national energy crisis (fuel and electricity). Instead, **manual pumps** are low-cost alternatives, requiring little maintenance and using easily accessible materials (rope, plastic bottles and car tyres).
Their design, above ground, can be adapted as playground instruments, where playing children activates the pumps. Their design can be adapted into playground instruments in the orphanage recreational area, where the energy of children playing together activate the pumps such as the merry-go-round or seesaw configurations. This also helps remediate against the timely chores children (especially girls) often endure when carrying water buckets instead of attending school or interacting joyfully with their peers (see Appendix E6 - Play pumps).

The **bush pump** design, originating from Zimbabwe, is regarded as a national treasure. It is based on the action of a lever mechanism on a hardwood structure with the use of pistons. It can draw water from depths between 20 and 100m. **Rope pumps** are another option, they simply rely on a force being applied to a wheel causing a rotating movement of a rope attached to that wheel, which in turn creates a change in pressure leading to water flowing upwards from the underground pipe. The rotating shaft is easily powered by hand, pedal, wind, solar or livestock. They are suitable for narrow boreholes as well as shallow and deep wells (from 1 to 100m depth), for supplying domestic usage up to communal irrigation. An improved variant of this model in place in Zimbabwe is called the Elephant Pump.

A viable option for pumping water in rural areas with access to a river is the **spiral pump**. Also known as water wheel pump, it is a hydraulic machine, simply installed, with low maintenance and functioning without fuel or electricity. A spiral pump is constituted of a pipe wrapped around a horizontal axle, generating a spiral tube that is fastened to a water wheel. The wheel is in flowing water, so that the water in the river provides the energy necessary for rotating the wheel. Water entering and moving inside the tube compresses air and achieves energy and velocity. This allows for water to be pumped at a higher elevation or at a certain distance from the water source. This is particularly interesting for irrigating the secondary plot that is located above the river.

Otherwise, the **ram pump**, or hydram, which is a cyclic water pump creating a pressure system, also allows for the water to be taken from a lower point towards an output at a higher elevation. The kinetic energy of flowing water does not require any energy input to function other than water flowing from a higher point to a lower point as it passes through the immersed system (with a minimal fall of 0.5m). The pump uses this momentum to capture water and then push it over great distances and even up an incline. A ram can raise water upwards 300m in height and 5 km in distance. It is an ideal option for rivers and streams with low flow rates, especially for remote areas, particularly where the need for water is located higher than its source. This would allow to irrigate the bottom half of the large field by the agrihub. Although the pump does not generate power, it is dependent on a steady water source; however unlike for a windmill, the flow does not need to be very important. To create a level difference in the river, guaranteeing constant functioning of the pump, small stone weir dams can be created where vegetation already exists, which will double act as bridges and flood prevention. Small canals can then channel the water from the pump into the swales of the site.

- Reservoirs:

Although water needs to be returned into the ground for long term soil health and hydrological cycle, it can also be captured and retained for direct consumption (human and animal drinking and plant irrigation).

Water **storage** can be constructed tanks for small quantity or in the form of ponds, dams or retention basins for larger amounts. Tanks can be made from various materials, but they need to be positioned at the highest practical gravity point if to be used as a source for downhill streams without the need for additional extraction pumps.
The first water tank, for example can be located higher than the buildings so that it can be used as a gravity-fed water source for the building area too. Other reservoirs can be located along the land for irrigating the fields below.
Alternatively, rain can be directed into underground tanks or into a pit to be used for both domestic practices and agriculture. However, such technologies come with some challenges, mainly construction costs, but although this initial investment is high, the long-term benefit is considerable.

Ponds, on the other hand, are made by digging embankments or excavated areas along the watercourse. The easiest storage option is the creation of a gully. It is the most economical way to dig a pond. Its main use is to store irrigation water that can then be directed via a pipe. Due to significant risk of evaporation in semi-arid climates, ponds need to be deep or surrounded by a protective vegetation.
Sealing the detention ponds creates a natural storage solution for offering drinking areas to livestock and wildlife. In time, allowing animals (pigs or cattle) to wallow and trample in the ponds, will pack the soil at the bottom, reducing permeability. Ponds can also be sealed manually with the application of a natural membrane, gley. **Gley** is a slurry of animal waste produced by temporarily (several weeks) tamping and covering a layer of fresh manure with plastic, cardboard or organic matter such as grass, leaves and soil. Careful attention must be given to avoid stagnant water. Aquatic plants not only keep the pond clean, but the shade also slows down evaporation.

b- Water distribution (usage)

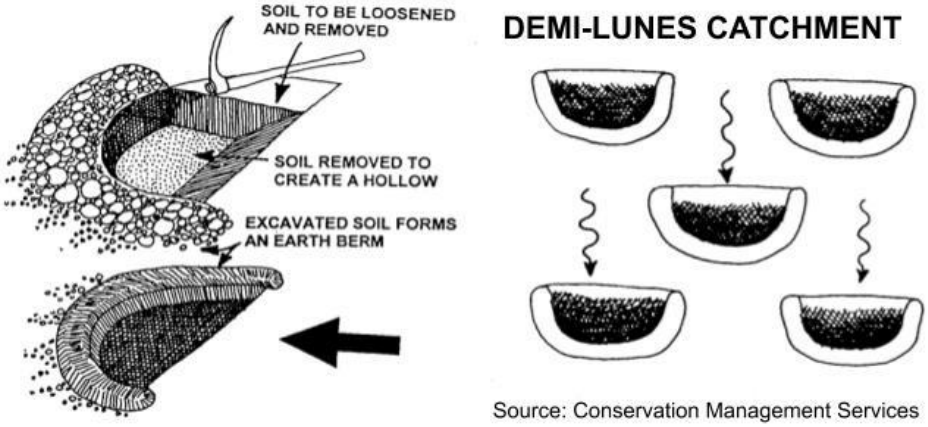
- Irrigation:

In order to reduce waste, every drop of rainwater can be captured directly when and where it is needed for agricultural purposes. Developed from African indigenous knowledge, **Zai pit** is a planting technique that helps with rainwater retention and is particularly suitable for flat dry fields (sorghum or millet for example). This involves digging small pits in the ground to accumulate water before subsequent planting. The holes are usually 20-14 cm wide and 10-20cm deep and are dug during the dry season and the excavated earth is ridged around.

A variant of the Zai pit is the demi-lune. Demi-lunes are larger earthen semi-circular furrows/bunds designed to capture water runoff as well as rainwater, thereby creating a suitable plantation zone (see figure 3.16). Pits and demi-lunes are surrounded by stones and filled with (non-raw) organic matter acting as natural fertilisers in the form of kitchen compost, farming residue or animal manure. After the first rainfall, seeds are placed in the planting pits which then are covered with soil. Following the harvest, the plant stalks should be left in the pits to increase the organic matter content. This develops the ground wildlife and bacterial activities progressively regenerating the ecosystem functions. The Zai technique could be linked to carbon offsetting programs where funds can be collected for each tree planted, in the

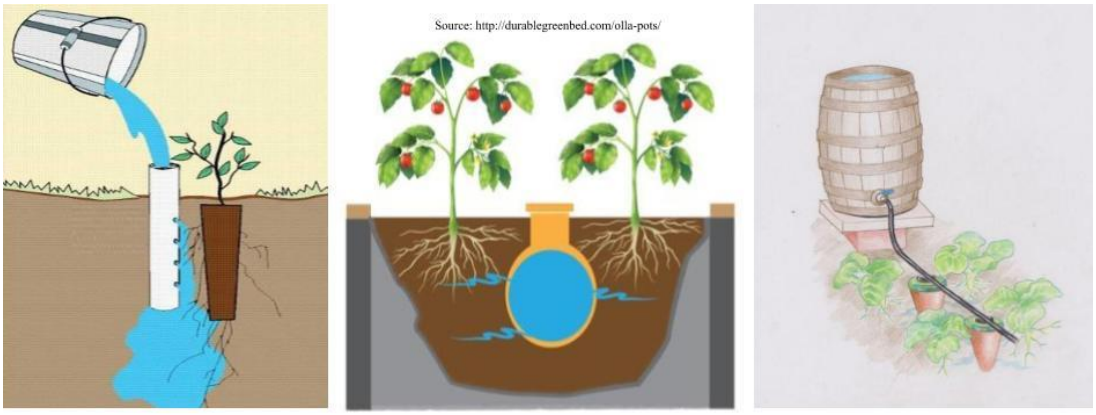
effort to encourage worldwide contribution towards afforestation (See also Appendix E7 - Alternative irrigation System).

Figure 3.16: Digging demi-lunes



As sandy soil does not hold water, the build-up of humus and micro-organisms is essential. Feeding the roots of plants without disturbing the top soil ensures optimal irrigation. Drip irrigation is the most efficient in terms of wise consumption and distribution of water since water goes directly to the plant the optimum is for the system to be solar powered, however this is expensive. Burying **clay pots** is an ancient method which delivers water to crop plants and trees in arid areas (see figure 3.17 and Appendix E8 - Pot irrigation). After firing unglazed clay pots retain their porous properties allowing water to seep out at a slow rate into the soil to feed the nearby plants according to their needs. This method is as highly efficient as drip irrigation and requires less water, labour or weeding than typical watering, since water is not poured on the soil, keeping the seedbed loose and aerated. An alternative is to use a perforated tube or bottle to guide the water below, but this configuration only works for immediate watering and not slow release as with clay pots. Ideally, the pots or tubes are protected by a lid and could be linked via a pipe to a rainwater catchment system or a cistern as water source.

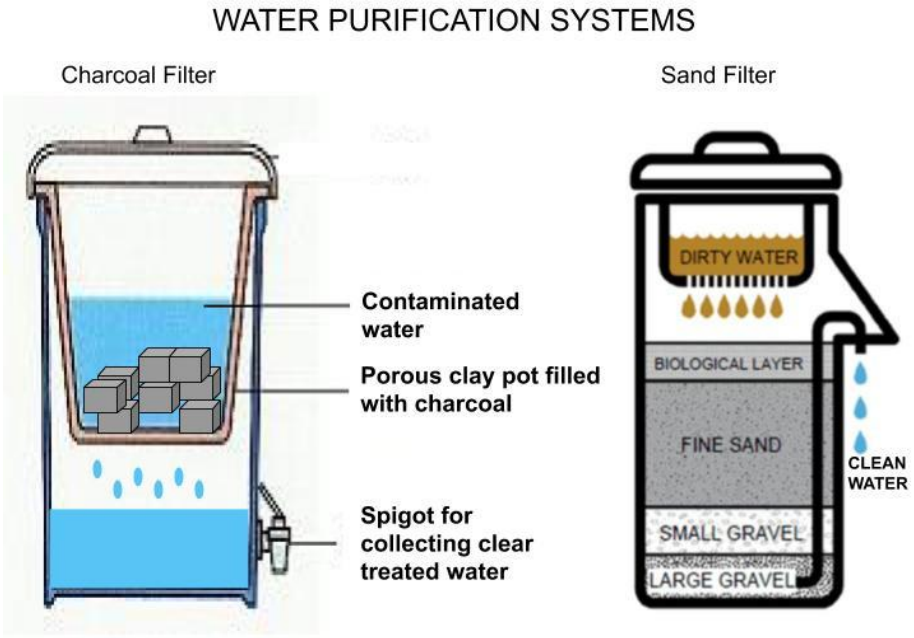
Figure 3.17: Alternative irrigation systems



- Clean drinking:

Rainwater for drinking purposes needs to be captured before it comes in contact with the ground, ideally directly from the roof with gutters or by catching it below the drip line. This ensures the cleanliness of the water, reducing the need for further complex purification.
Water purification system does not always entail expensive technologies nor the need for plastic materials. Large clay pots are made locally form perfectly adequate devices with low investment and footprint. Suitable for rainwater, one simply engineered system consists of two clay cylinders with the smaller one inserted above or inside the larger one and filled with activated **charcoal**. As water enters the small pot, it is being filtered by the charcoal and then released through the terracotta membrane.

Figure 3.18: Natural water filters



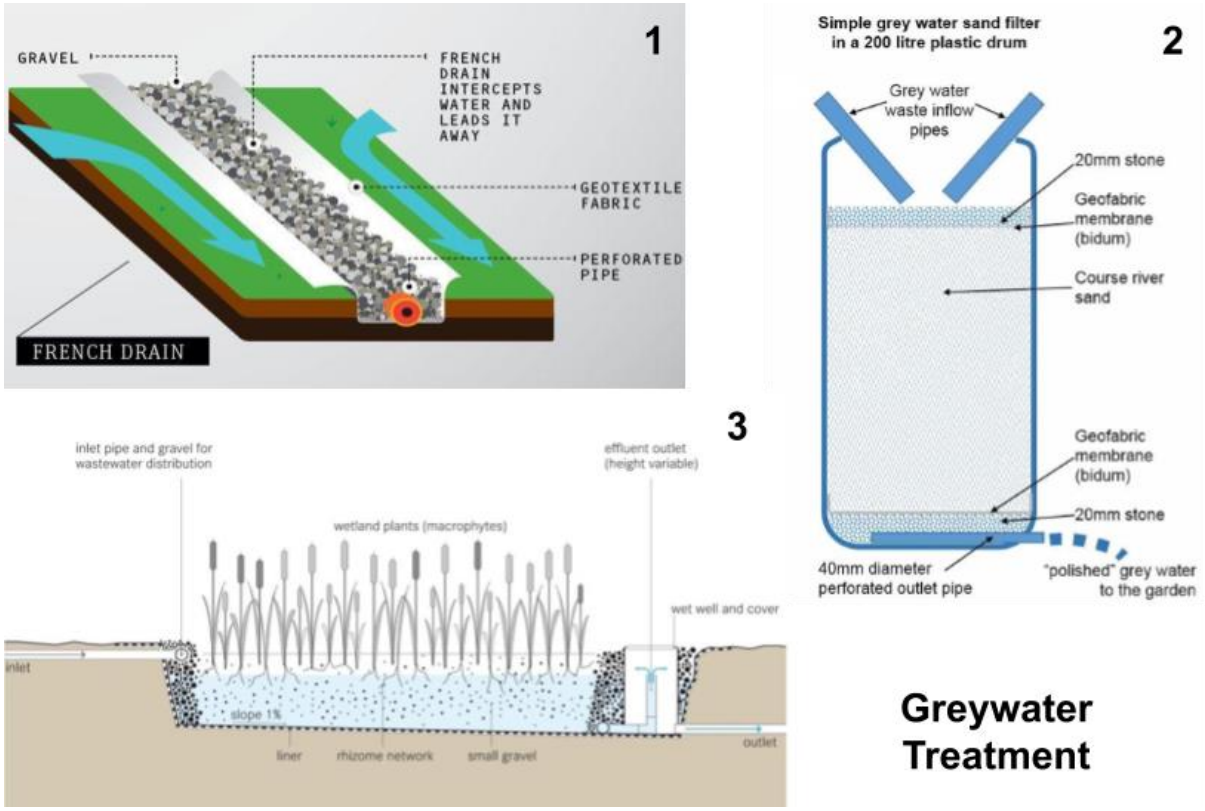
Water from potentially contaminated sources (dirty wells, rivers or tanks) must be disinfected before human consumption. Although boiling or chlorine filters are common options, **sand** filtering is a more effective remedy. Sand is locally available and is naturally unfavourable to the proliferation of bacteria. The process, which is inspired by the natural purification of water percolating through sandy riverbeds, is simple and can be adapted to any scale from small family size to larger communal units. Containers can be made from clay pots, bricks or even cement (see Appendix E9 - Emergency water filter from plastic bottle). Ideally the inside of the tank is lined with a protective plaster cover (such as taledakt). The bottom is filled with a draining layer of gravel (with an evacuation hole below), while the clean water is collected from an outlet levelled with the sand overlying the gravel and protected with a slab against erosion at the surface. Water is poured at the top of the bucket, which is covered with a lid. Since the sand needs to remain moist (to form a biofilm layer), and flow should ideally be slow and constant, a pre-treatment system is necessary to first remove sediments risking clogging the system, such as infiltration filters, upward flow gravel filters or reservoir settling tanks. A pre-filter reservoir as well as a storage tank for clean water may be added to larger community filters.

c- Wastewater management

- Grey water treatment:

The current use of the river for domestic usage causes considerable risk of contamination in addition to the pollution generated by the agricultural runoff. Instead, washing and cleaning activities are encouraged to take place within the residential area or at allocated facilities specifically designed with greywater evacuation.
Indeed, waste from bathroom and kitchen water cannot be recycled for human consumption (drinking or other domestic use) nor is it recommended for direct watering of vegetable gardens because of the risk of (soap) pollutants. Instead, a **wetland** zone can be created into the landscape surrounding the lavatory buildings. Sustaining a 2% slope, greywater is funnelled from its source through a coarse gravel bed into a reed bed. Gravel is used here like a thin barrier against soap and grease. Due to the soap content alkaline loving plants are recommended while for the pipes and drains, coarse grained gravel is preferred to still permeate the waste, but without clogging.

Figure 3.19: Design for greywater treatment system



The system is simple to construct, and grey water can be diverted first into a tank with sand filter for better purification. After being pre-filtered, water passes through a shallow trench with an irrigation pipe laid below (surrounded by gravel on top and (covered with geofabric membrane to filter small particles). The pipe is perforated on the sides to percolate the water poured from the soil above which also acts as a filter. Alternatively, wastewater can simply be collected into buckets and thrown onto the system.

The ditch can be planted with wetland specific plants (such as vetiver grass on top of sand and gravel), which act as an ecological engineering for naturally treating wastewater by creating an aerobic environment for microorganisms which filter detritus exchanged through the roots, ground and suspension, in return enabling plant growth. It is a low entropy system (with no fuel or electricity) with low embodied energy (no plastic, travel) requiring only the solar energy absorbed by the plants.

For larger communal use, a small **constructed wetland** (WET) can be constructed, where greywater is filtered through a series of basins, each with gravel and plants, into a final pond or storage tank for subsequent use in the garden.

- Sanitation:

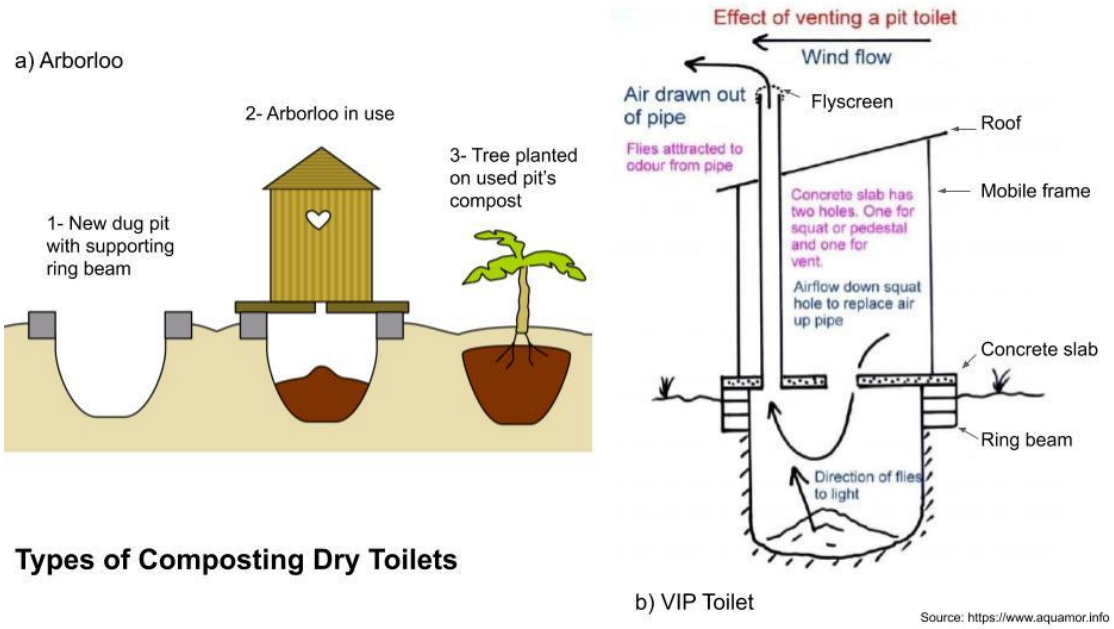
Blackwater refers to dirty water evacuated from toilet systems. It usually contains pathogens and present a risk of sanitary contamination due to the presence of faecal matter. Blackwater can be directed into a septic tank which separates human biological waste into layers of decomposition. Alternatively, all of household waste (including toilets or animals' excretions) can be disposed into a biogas digester where the tank is covered with a dome so that the chamber captures the released methane gases to produce energy (see chapter 3.2.5 Energy).
Waterless solutions also exist to be adapted for smaller personal scale. Dry toilets are a cheap and simple option in dry and warm weather conditions. They usually consist of a hole with a wooden cover for protection against insects. Faeces and urine are not separated, and they are covered with straw and sand to prevent door and helps with composting. Where these pit latrines are currently in place, in the orphanage, education on hygiene habits is fundamental and can be encouraged by locating a hand wash dispenser near the toilets.

For a more systemic concept, the **Arborloo** is a type of composting toilet born in Zimbabwe. It considers human faeces as resources (and not waste), helping with a new circle of vegetation life. It is simple and affordable. The design consists of a shallow (1m deep) circular or square pit, dug directly into the ground and covered with a concrete slab with a hole at its centre. The whole structure is hidden inside a small mobile frame for privacy. It is highly effective against odours and diseases which are controlled by regularly adding soil, ash and leaves into the pit (see figure 3.20). This dry toilet is only a temporary system at a given place. Once the pit is full, the slab and hut are transferred elsewhere. The pit is then covered by the earth dug from the building of the new pit. The deposited faeces together with the organic mixture form a compost, which can be used to fertilise another area, or directly in its original position where a tree can be planted at the site of the old pit. A more advanced version of this toilet is the Blair Ventilated Improved Pit (VIP) Latrine for more efficiency against flies and smell, rending the experience less unpleasant. The latrine is set up with a screened ventilation pipe creating a vacuum effect allowing for fresh air to enter while evacuating hot air.

Due to the disadvantages associated with having to displace the arborloo, a simpler alternative would be for the waste from a dry toilet at a fixed location is regularly collected from a container below and used to create a humanure compost mixture. This can be upgraded to vermicomposting toilet, where worms help to decompose organic matter.

Because of the lack of a sewage system, toilets should preferably be located downslope, away from the buildings, and near a wetland zone in case of leakage contaminating the soil and causing a sanitary hazard. The excess black water could then be mitigated by planting vetiver grass or trees such as Faidherbia Albida. The toilets can be placed near the detention ponds, in which case the ponds are acting as natural water treatment system. Ideally, toilets ought to be connected to a septic tank or a biogas digester (to be turned into energy).

Figure 3.20: Waterless toilets



3.2.4 Green building

Turning to Nature for inspiration requires connection and understanding of the local ecosystem. The Eastgate Centre in Harare is one example of construction derived from observing Nature. Its passive cooling system requires minimal energy compared to conventional architecture or unsustainable modern air conditioning systems. Its design is inspired from the African termite mounds which maintain constant temperature and humidity despite variable external temperatures. The cold air enters from below the ground, and the hot air is released at the top via a circulating ventilating system. In the same manner as settlement, water and agriculture which are influenced from permaculture designing with nature, buildings too can be considered as ecosystems. This is achieved by integrating the house within the local ecosystem such as surrounding it with indigenous plants for harmony. Such Earthship shelters predominantly integrate natural and upcycled materials with passive energy. The focus being on simple designs and affordable construction technologies taking advantage of local natural conditions and recycling of available resources such as low skill vernacular buildings, typical of rural Arica. In effect, natural buildings rely on materials and techniques which are ecologically sound, culturally sensitive, reliant on local resources and skills and are within economic reach of local inhabitants. Although they were the main type of shelter used in traditional communities, they have been abandoned for less adapted Western style buildings without proof of modern materials be better than the vernacular options. Conversely, they are now incorporated into the design of modern architecture newly concerned with environmental and structural integrity too. In this way, the architecture can serve as teaching, demonstration and practical practice to the pedagogic programs to take place at the agrihub (hoping to invite international participants).

a- Sustainable building design

Traditionally, within the community, the houses are sparsely populated (100-200 meters apart) and consist of an open living area in the centre. The vernacular design consists of round huts decorated with pride using colour. The toilets are separated from the main buildings. The kitchen is also located in a separate, round shape, building adjacent but not connected to the house. Kitchens are a central part of social life where members gather to sit around the open fire or metal stoves to cook. However, they usually lack chimneys causing fire and health risks from smoke. In essence, homes should provide a healthy and peaceful environment enhancing the wellbeing of its occupants.

There are seven foundations to a healthy and sustainable building design:

- **Conservation of energy**: the use of renewable energy for generating power implies using what is already available (sun, diversion of air flow) without waste (keeping the energy with good insulation), but with efficiency (orientation of the buildings for natural lighting and thermoregulation).
- **Conservation of resources**: the use of local green materials with low embodied energy for the construction of building (clay, vetiver grass) in conjunction with recycling of waste and by-product materials.
- **Carbon neutrality**: the combination of locally derived biodegradable materials and clean energy (manual labour) aims at lowering the overall ecological footprint in addition to reduced transport and the financial burden of external purchases.
- **Bioclimatic design**: complying with the local climate include floodproofing, safe storage, smart bio-architecture and redirection of air flow. Open spaces are also to be used for social activities.
- **Waste management**: recycling of grey water and plastic, composting from toilets, kitchen and agricultural residue, communal reward program to encourage collection.
- **Waste avoidance**: use of biodegradable materials packaging, rain harvesting with irrigation and education on disposal and recycling habits.
- **Communication infrastructure**: communal buildings and sharing of facilities reduce the need, cost and footprint associated with additional individual constructions, while increasing social cohesion.

The preference for natural and locally sourced materials with low footprint offers advantages beyond the ecological concerns. The **health** of buildings and their inhabitants is granted by the use of green materials that:

- are nontoxic, non-polluting, sustainable and renewable, display a low energetic production cost and can be reused and recycled on site.
- create a safe indoor climate by allowing the house to breathe while natural processes regulate temperature, airflow and quality.
- provide clean air and water, free from pollutants with possible pleasant fragrance from herbs and polishes.

Clay and mud present with the perfect synergy between human technology and nature. Clay is obtained from naturally occurring termite moulds on site and when fired, it is used for producing bricks for housing or pots which can then be occupied as beehives. In this way, the building process gives back to the environment, or at least attempts to neutralise the human impact on the land, in the same manner as previously discussed, water, humanure and food waste are captured and returned to the ground.

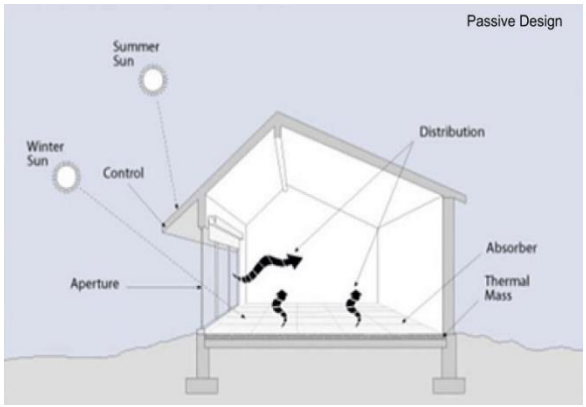
Besides allowing space for wildlife, the **aesthetic** aspect of building and landscape design is not to be neglected. Indeed, creativity and art are to be encouraged as a medium for communication. The inclusion of beauty in building design, adds to the health of the architecture in terms of resistance, and functionality in terms of purpose while not being polluting (to humans and environment), but it also provides health to the whole settlement in terms of individual and community wellbeing (artistic expression, visually pleasant, comfortable). This has potential for adding value to the tourism capital. Besides, wellbeing further encourages community pride and engagement. Communal festivities and reward programs also stimulate good practices. For instance, waste collection as a civil duty in exchange for another benefit, or a collaborative effort to collect and recycle being celebrated with the distribution of derived recycled goods. Waste materials can be reused in a number of ways for decoration purpose (such as beer bottle capsules framing on walls or attached together to create a curtain) or tins can be flattened and assembled to form larger containers. Similarly, plastic bottles act as insulators when combined into a greenhouse, or, if cut sideways, the bottles can form tiles allowing light through the roof while channelling the water into gutters and pipes (also made from reusing plastic containers).

Alongside harmony, practicality and intelligent cycles, conservation of energy and resources is determinant in the construction of low cost, low skill and low maintenance building designs. Simple rules in line with permaculture ethics are: 1- to use what nature provides in abundance and locally, 2- to harvest materials without harm to the ecosystem (nature and people care) and 3- to use efficiently derived materials, buildings and energy (that are produced and used for extraction). This entails the adoption of passive design strategies:

- Conservation of renewable resources by careful selection of situation, orientation and protection for the home.
- Maximal use of sun, wind and water for the energy needs to rely less on supplementary non-renewable energy.
- Intelligent house design for resources complemented by natural mechanisms if necessary, with efficient control systems for regulation, heating, cooling, water/air flow and lighting.
- Effective orientation to allow sunlight and daylight to penetrate thus relying less on fossil fuel for lighting.
- Thermal and acoustic insulation for a pleasant residential experience.

Figure 3.21: Passive building design

Passive design can contribute to the heating, cooling, and daylighting of a building. This can be achieved by passive solar design elements such as shading, implementing large sun-facing windows, and building materials that absorb and slowly release the sun's heat. Such passive systems have very low carbon footprints and result in fewer fluctuations in temperature for better thermal comfort. They involve the collection of solar (or earth) energy as heat through properly oriented windows (facing the sun exposure but, also located in the shade for cool air flow), followed by the natural distribution of this energy through the room. Buildings should avoid being overly exposed to winds and while they benefit from solar access, flexible protection against seasonal overheating is essential (see Figure 3.21).



Natural passive strategies not only capture and redistribute solar heat in winter, they also keep homes cool during the hot season with simple technologies:

- Light colour of external wall reflects light
- Extended overhead roof to protect wall from rain and sun
- Windows on all sides of the house for the fresh air circulation
- Vents or gaps at the top of the walls or roof, for evacuation of rising hot air (such as from cooking)
- Thatched roof are not air tight and allow for natural ventilation
- Mass earthen floors are in direct contact with the earth underneath thus absorbing the coolness of the earth, keeping cool inside regardless of outdoor temperature
- Earthen plaster on inside walls to keep inside temperature constant
- High ceilings give space for hot air to rise and escape
- Using vegetation to keep buildings cool on sun exposed sides of the house

Passive cooling naturally uses non mechanical methods to maintain a comfortable indoor temperature. The most effective method being to keep the heat from building up in the first place. Heat gain can be prevented by reflecting sunlight such as light-coloured surfaces effectively on the exterior facades. A radiant barrier can also be installed in front of the walls (made with reflecting aluminium foil for instance). Heat can also be blocked with effective insulation keeping both heat out during the hot season, while keeping the heat in during the cold season. Wood or reed shutters or clothes act as both windbreaker and sun shields. Draperies and curtains made of tightly woven, light-coloured, opaque fabrics reflect more of the sun's rays than they let through. The tighter the curtain is against the wall around the window, the better it will prevent air flow.
Although wall insulation is relatively achievable, insulating the roofs presents a challenge. Overhangs from the roof are an important component of building design. They act as both protectors against the summer sunshine and against the rain. Incorporating shading concepts into the landscape is a suitable design strategy. Effective shading can be provided externally by trees and other climbing vegetation. Ideally deciduous trees, but also vines, provide excellent shading protection and rain cover in the summer and permit the low winter sun light to penetrate and heat the building when needed most as the leaves fall. Besides providing shade, vegetation creates a cool microclimate that dramatically reduces the temperature in the surrounding area since water is evaporated from leaves, cooling the passing air. Trees and treillis therefore need to be planted at a suitable distance from the building, to allow the cool air to circulate in between. A windbreak of evergreen trees may also be useful to mitigate the constant winds throughout the year.

b- Materials

-Natural:

Working with and not against nature entails using what is already available. The emphasis is therefore on local materials (minerals and plants) and local production and processing.
Clay being naturally available locally, both rammed earth and adobe clay bricks are integral parts of traditional architecture. Thermal mass materials, made of solid, dense and heavy materials like rocks, rammed earth, cob and adobe, slowly absorb and release temperature making them suitable for hot and dry climates. They create a microclimate allowing the buildings to keep constant thermo-regulation. Indeed, a thermal wall or floor absorbs sunlight, heat or cold ground energy to progressively release it back over an extended period. This is often used in rocket mass heaters or ovens to keep warm for longer after the fire burnt.
Rammed earth has the advantage of thermal mass, strength, comfort and beauty. It is one of the simplest earth building techniques, as the material cures in the wall, and can be built in a variety of climates. The walls, made with clay, soil and sand, do not need to be plastered and have a multi-generational lifespan.

Adobes are sun-dried mud bricks made with a completely saturated mixture of clay and sand (and sometimes straw or manure). The adobes are laid on an appropriate foundation (usually stone or concrete) and assembled preferentially with a mud mortar and finished with a mud plaster. They are sensitive to excessive moisture and constructions must be protected from the rain.

Cob has similar mass thermal properties to adobe and rammed earth. It is a mixture of local subsoil with sand, clay soil and straw or other fibrous materials to create a stiff mud mashed onto the walls. One option is for the straw bale walls to be plastered with cob. Cob ensures breathability for optimal moisture exchange thus protecting the structure. Vetiver is frequently also used as straw input into cob or adobe, to provide tensile strength and holding the clay together.

Earthbags or superadobe, are soil-filled fabric sacks or tubes used to create walls and domes and are often used for flood control. The technique is relatively straightforward, with moistened soil placed into bags that are compressed and piled to form walls. Because of the risk of deterioration of the bag with the sun, the walls need to be plastered. One advantage is the ability to build in wet conditions and in areas prone to flooding. However the bags incur a financial and ecological cost.

Similarly, regenerative design for creating walls or furniture is the recycling of plastic bottles into building blocks as part of the Cradle-to-Cradle principle. **Ecobricks** are made from plastic bottles filled with earth. Bottles can actually be filled with sand or any other compressed inorganic waste materials. The advantage of standard round bottles is their modularity. Combined together they can form triangular or hexagonal shapes which are easily carried and assembled. If laid horizontally, they provide thickness to the wall, increasing the effectiveness of structural strength and thermal insulation properties. Just as for the earthen bags, the bottles can then be covered by plaster to protect them from solar damage and hold them in place (see Appendix E10 – Ecobrick preparation and use). Another way of recycling plastic bottles is for roofing (See Appendix E11 - Plastic bottle roof)

Earthen floors can provide an excellent source of thermal mass in passive solar designs. The technique involves pouring or tamping one or several layers of an earth mixture over a substrate of gravel or sand. Hardening agents such as blood, lime, cement or glue may be added. This mixture is allowed to dry and any cracks are filled with more mud mixture. When

the floor is entirely dry, it is sealed, most commonly with successive applications of oil such as linseed. The floor can be further coated with wax to protect the surface.

Typically, rural huts harbor **thatched** roofs which are made from locally sourced reed, grass or palm leaves. They are long lasting and breathable with a high insulating value. However, it is a highly skilled procedure and could be prone to leaks needing replacement if constructed inadequately. Smoking seems to lengthen the life of the roof.

Strawbale is a by-product from agricultural waste, obtained from the dry stalks of cereal crops or local grasses such as vetiver grass. It is lightweight and offers thermal and acoustic insulation properties to the rather thick but breathable walls and roofs.

Alternatives exist with the introduction of new plant species to the plantation. **Bamboo** is not commonly used as a building material in Zimbabwe, because of lack of knowledge despite its multifunctional potential. It may be employed to provide strong structures, create trusses, or as decorative elements and even in plumbing. **Hemp** is another source of fibre and oil with building potentials.

Table 3.4: Various functions of different building materials

Thermal mass materials				Insulation materials			
	Walls	*Floor*	*Roof*		*Walls*	*Floor*	*Roof*
Rammed earth	x	x		Straw	x		x
Adobe	x	x		Thatching grass/reed			x
Cob	x	x		Wool	x	x	x
Concrete	x	x		Clay	x	x	
Stones	x	x		Light earth	x	x	

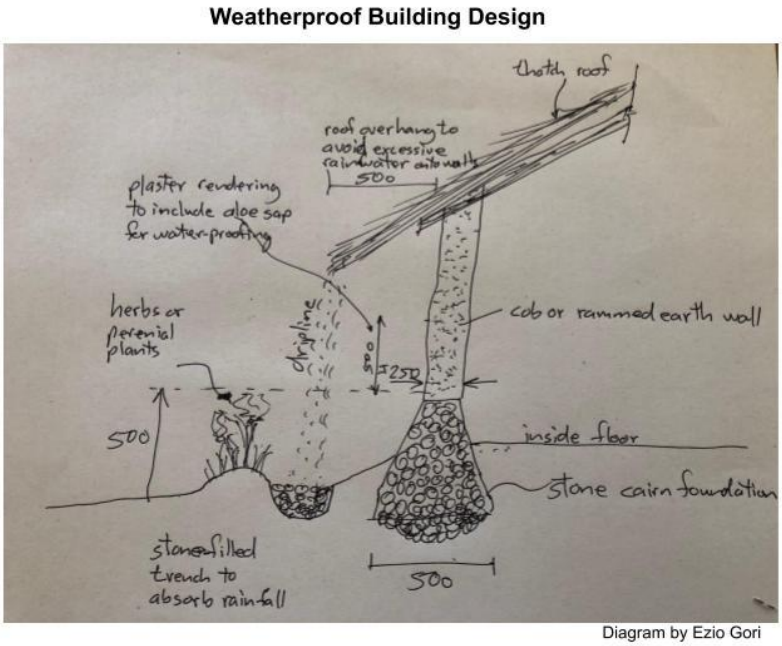
- Waterproofing:

Despite water scarcity, heavy rainfall can cause considerable damage to the buildings. Mud blocks offer excellent geothermal regulation, but are vulnerable to water and constructing in direct contact with the earth poses a risk of flooding.

Waterproofing the walls is determinant to tackle two major problems associated with earth walls.
Firstly, water pressure can increase against the exterior walls due to water build up in the ground, thus affecting the wall structure. Protecting the exterior of the walls against rain can be achieved by a variety of simple methods. The extended roof overhang (acting as a sunshield in summer), coupled with thick vegetation cover, is particularly efficient for the top part of the walls.
The foundations of the building, however, need further protection to prevent splashback from the ground. Drainage is crucial in order to prevent water from saturating the soil below and around the house. This can be achieved, for example, by creating a small drainage ditch, below the drip line, filled with gravel, and by placing a vertical protective layer of stones and

rubble against the base of the walls to avoid moisture penetration. Similarly, the area outside the entrance door can also be drained and since the house cannot be much elevated above ground level, the entrance can be blocked with a step to stop the incoming flow of water (see figure 3.22).

Figure 3.22: Weatherproof building design



Applying a render to the external structures exposed to the rain maximises waterproofing. **Taledakt** is an ancient technique used as a water repellent in wet rooms instead of tiles. It is a lime-based plaster impermeable to water but permeable to air, allowing the walls to breathe. It is versatile and suitable for internal and external earthen walls. The smooth finish resists dirt and mould and can covers earthen cisterns for the hygienic storage of drinking water.
More conveniently, a similar waxed resin liner can be obtained from the aloe plant sap by mixing aloe juice with clay.

- Plasters and Paint finishes

Structures are protected by mud or lime-based plasters for breathability, softness to the touch, aesthetic qualities, workability and easy reparability, as well as economy of materials. Because they can erode unacceptably in wet vicinities, exterior mud plasters are generally used in drier climates or with wide roof overhangs. Natural paints create a safe living environment free from hazardous products and non-renewable ingredients. They also allow the substrate underneath to breath, by preventing the accumulation of moisture, mould and rotting below the wall surface.

Clay is the best material for wall decoration, it can naturally come in various colours, or can be mixed with nontoxic pigments. The finely sifted clay soil is simply added to wheat paste (formed from boiling flour and water to obtain a glue acting as a binder between the clay, pigment and wall) and then layered onto the walls. Manure can be added to the clay plaster to improve the spreadability and impermeability of the plaster. There are a multitude of natural binders other than clay and flour including milk, beeswax, beer, natural oils, gum arabic from tree resin.

Eggs can also be used for making paint. Tempora, derived from egg yolk is opaque and durable. It is suitable for artwork to enlighten the aesthetic spirit of walls and furniture: only the yellow liquid inside of the yolk is to be stirred with pigment and possibly added to a little water and a bit of vinegar. On the other hand, white egg is more translucent and less sticky: after whisking the whites, a clear liquid slowly separates at the bottom of the froth, which can be mixed with pigment but needs to be used immediately before drying. Alternatively, milk paint also called casein paint, is made from the curds of milk, with the resulting paint having a slight sheen, that can be wiped down with a wet cloth.

Natural dyes are either plant or mineral based (like iron). For example, grey can be obtained with ash. Green can be derived from grass, spinach or mint leaves. Berries, roses and basil leaves can produce red coloured pigments. Dandelion flowers, marigolds and celery leaves are used for the yellow shades. While plants need to be crushed to form a juice, harder materials like charcoal (for black colour) need to be grinded to form a fine powder.

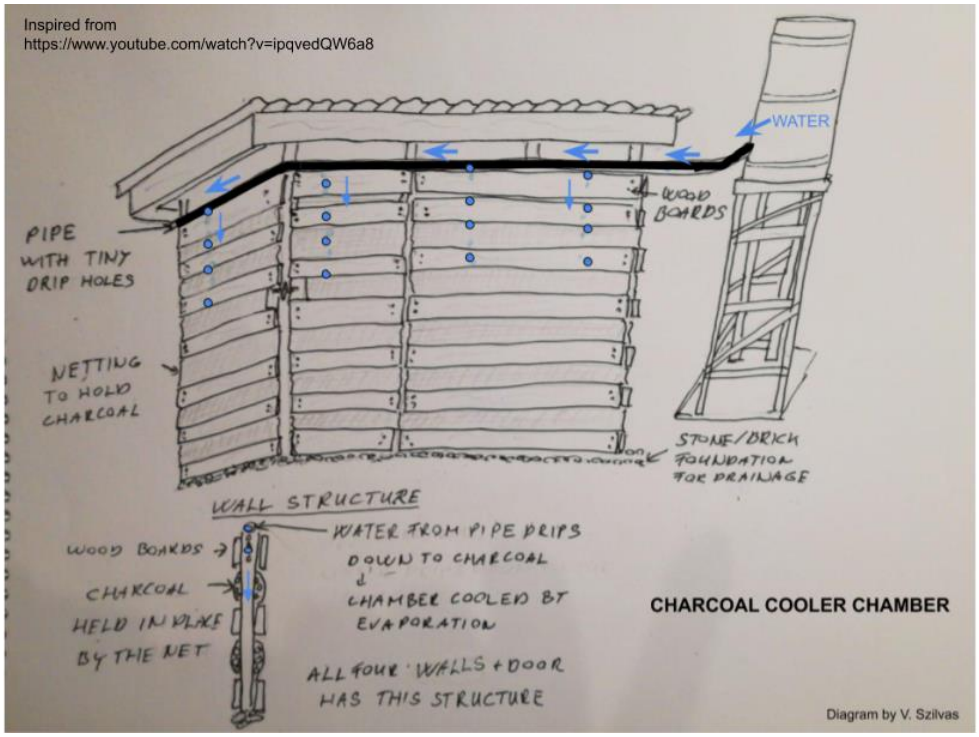
c- Storage

The storage of crops is vital for low income rural communities with no access to electricity. Storage allows to extend the shelf life and availability of food while tackling waste from post-harvest loss.
Harvested grains, and in particular seeds which can be saved for years, are usually stored in the kitchen to protect against moisture, pests, diseases and premature germination. Preserving above the cooking stove area or above the wood fire in the ceiling, allows for the smoke to act as a deterrent and drier. Certain seeds like pumpkin and sorghum, can be left to dry naturally by the sun on the rooftops, while ground nuts, round nuts and cowpeas, are often stored in their own shell for better protection. Dedicated space including sheds, huts or granaries are often raised off the ground where pest repellent plants are also located (such as finger millet residues, eucalyptus leaves, mint leaves, and ash, especially from burnt maize cobs).

Granaries vary in size and materials. Their purpose is to keep food dry and safe. They are typically small and simple shelters built from clay supported on rocks. The dome ceiling is made of clay and covered with straw thatch to protect against the rain. The whole structure can also be made of wood covered with cob but it must be raised off the ground to keep termites away. Granaries can also be constructed as a circular woven basket which rests on an elevated base and covered with a thatched roof (supported by a wooden frame). In either case, grains are traditionally dried before being stored in the granary to avoid accumulation of moisture and the growth of mold. For this, the grains are spread, turned and aerated in thin layers on the floor out in the sun before prior to storage.

On the other hand, for perishable keeping produce, **charcoal coolers** offer a low cost and low energy option (see figure 3.23). They mimic the natural transpiration process. The room or shelter can be made of any size and is built to create cold through evaporation. The walls have a wooden frame filled with charcoal. Water is stored at the top of the walls, under the roof. It drips down the side of the walls, cooling the inside.

Figure 3.23: Charcoal cooler



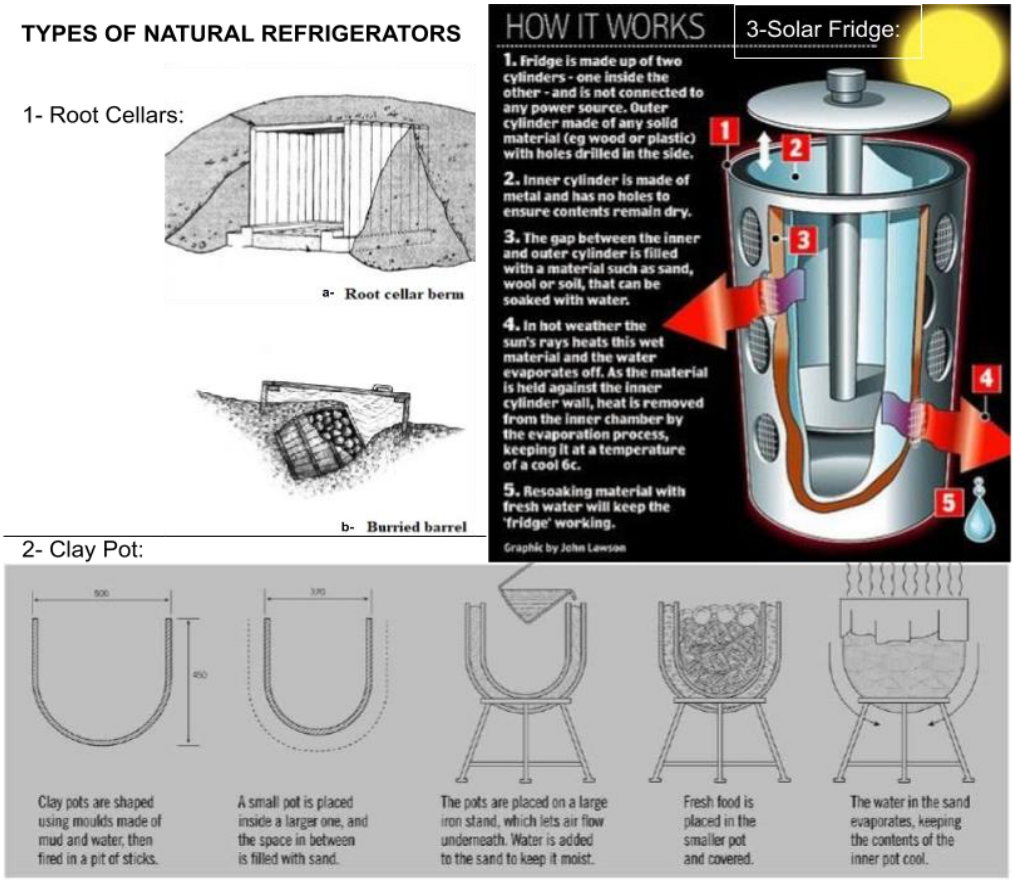
A **root cellar** is another variant of refrigerating device. It mainly consists of a partially buried (cool and humid) space mainly used for unprocessed food like fresh raw fruits and vegetables. A hole or a cave is dug underground in order to use the cool and moist conditions of the earth as a natural refrigerator (see figure 3.24a). Natural earthen or gravel floor helps keep these natural conditions. The walls may be covered by wood although not necessarily. Total darkness and good ventilation are essential to avoid mould formation. Air vents need to be located by the ceiling which is itself covered by a thick layer of soil. Food is often packed in materials that retain moisture, like dampened sawdust or sand, for better preservation.
A smaller version of this system can be made simply by burying a container like a wood barrel or a zeer pot, into the ground (see figure 3.24b). It must be covered by wood, dried leaves, straw or soil, to create an insulating air layer. The smaller size of the cooling unit, the shorter period it will be able to preserve its content and so would require regular monitoring. For best efficiency, root cellars need to be located in shady areas, away from heat and sun.

The **clay pot** refrigerator, also known as zeer pot or pot in pot cooler, was traditionally used across Arica and is the simplest alternative. The efficiency of this container lies in its reduced dimensions. It is easier to make but is more suitable for individual or family needs. It consists of two clay pots of different sizes, nested inside one another and covered by a wet cloth (see figure 3.24). The space between the two pots is filled with wet sand and pebbles. The sand creates an insulating chamber keeping the content inside the inner pot cool. The moisture is sucked through the pots and evaporated by the air flow around the device. It is important to keep this system away from heat and sunlight.
An improved version is the solar powered fridge, which can be built from household materials. It is also based on the simple principle that sun rays evaporate the water, keeping its content cool. This eco fridge is made of two cylinders inside each other with the inner cylinder made of metal while the outside one can be made of any solid sustainable or recycled material available, with holes drilled in the side. The space between the cylinders is packed with sand,

wool or soil, and then water is added. As the sun warms the mixture the water evaporates, cooling the perishable food or medicine content of the inner cylinder. Fresh water is regularly added to the mixture as needed.

Other options include the zero-emission fridge for rural Africa (ZEFRA) as a simple cooling design to preserve grains and seeds. It is an airtight cylindrical silo made from a tightly woven bamboo structure encased within a clay layer. Solar ovens can also be used as cooler devices. While the oven captures the sun's rays during the day to reflect it to create heat inside the oven, it can also capture cold temperatures during darkness to sink in the heat and cool down any food placed inside the oven.

Figure 3.24: Types of natural refrigerators



3.2.5 Clean energy

In general, the supply of electric energy in Zimbabwe is very limited and unreliable even in towns. Particularly so in rural areas, where there is no access to electricity at all. Currently electricity is available between 11pm and 4am due to low water level in the Kariba hydro dam (providing electricity to Zambia and Zimbabwe) and this is the time now, when businesses operate. Therefore, there is a need to design for independent and low consuming devices. Reducing the need to use energy and educating about how to adapt behaviour towards saving energy, are the starting points to a carbon neutral strategy.

The national grid from the smaller plot is 500m away and on the bigger plot it is 2.5 km away. Some shops and houses are connected to the national grid in the village, but it is also unreliable. There is a potential using smaller high capacity plants at the schools, clinic, orphanage centre and permaculture centre, but the distance between buildings and the low electricity consumption makes microgrid a non-viable option.
Currently, in the village, there are a few generators in operation (they should be better protected against risk of theft) and some buildings are connected to the national grid. Rather than the above, the main source of energy is timber, that is used for cooking in the form of open fire (sometimes also cow dung). Kerosene lamps and paraffin candles are used for lighting, none of them are good for the health.

Recycling waste and using more efficient cooking methods such as rocket stoves or alternative cooker like solar cooker and thermal bag, decreases carbon pollution. In addition to a regenerative design, increasing green areas and minimising tree cutting helps to increase carbon sequestration from the atmosphere.

The most reliable energy source in the region is the sun, with above 2800 sunny hours a year. The number of solar energy service providers are going in Zimbabwe taking advantage of the unreliable public energy supply from the national grid (ZESA). The price is not cheap, for instance 2kW package costs around $4,000). this amount of energy could power for example a washing machine), but smaller solar products (e.g. solar dynamo; solar cooker) are available for a more affordable price from e.g. ZimSOLAR.
Besides solar energy, there are very few other locally based feasible renewable energy solutions for Zimbabwe, such as wind, micro-hydro and biomass. However, a combination of renewable energy solutions can provide a holistic energy package for the facilities within the Mangwende project, such as; photovoltaic for low amperage electricity supply (lighting and electronic devices); solar water heater (hot water); biogas from a biogas digester (cooking); wood-efficient rocket stoves (cooking and heating); and thermo-compost (heating and hot water).

a- Ecological footprint

One must first identify the different footprints related to energy.
Ecological footprint: impact of human activities (mainly due to the release of carbon) that produce and consume resources and generate waste vs the rate nature can absorb our waste and generate new resources (biocapacity).
Carbon footprint: the measure of the emission impact of and activity on environment (particularly climate) expressed as carbon dioxide equivalent (CO2e).

NB: tCO2pa= Units of tons of carbon per year due to burning of fossil fuel for use in electricity, heating and transport = Primary footprint (direct personal control) + secondary footprint (public services).

Sources of emissions include the burning of (mainly plastic) waste and non-efficient burning of firewood in open fire in the kitchens. Renewable energy, meaning not fossil fuel (petrol; diesel; kerosene; gas) based generation may still consume/produce carbon footprint during manufacturing and transport process, particularly if using highly embodied energy materials such as concrete. These can be offset by example producing, using and exporting green energy such as from wind turbines or tree planting program/sustainable forest management. (Embodied energy is the energy used to manufacture construction materials, plus the energy consumed in the construction and transportation processes, it is calculated in total emission footprint).

Potential areas to reduce carbon emissions include: using more efficient stoves; alternative heating and electricity generating methods and recycling plastic waste. Using locally available materials with low carbon footprint and embodied energy, that are naturally occurring or produced onsite to reduce transport. Most of the technologies (construction; agriculture; transport etc.) are based on human or animal labour for machinery power, therefore the products considered to have low embodied energy. Using mechanical equipment rather than electrical makes them easier and cleaner to maintain and repair. Recommended equipment includes bike/pedalo washing machine and mobile dynamo charger bikes.
From agricultural prospects, by selectively planting native plants to restore natural forest cover will not only reverse degradation due to natural habitat (forest) loss, but also increases the carbon capacity through the respiratory process of the vegetation.

Table 3.5: Recommendations for heating, cooling and electricity generation

Energy use	**Current**	**Proposed**
Cooking	Open fire	Rocket stove
		Solar cooker
		Thermal bag
		Biogas from digesters
Cooling	Not used/food readily available	Charcoal coolers
		Root cellar
	Space cooling	Building shading/shutters
Heating	none/blankets	Passive solar building design
		Solar air/water heaters
		Thermal mass in walls/floors (also for cooling)
		Heat from compost
Electricity	none	Solar cells/PV
		Wind

		Hydro
Transport	animal/human based	Smaller trucks/community bus for children and community use
		Bicycle (e.g. from bamboo)

b- Energy sources

- Alternative energy:

Conservation of energy starts with conscious use of energy. This includes the reduction of waste of energy (and other resources) in order to reduce further need to generate/purchase (wise consumerism). With eco-conscious architecture, biomimicry (building orientation, materials selection, natural ventilation) the related energy needs (heating/cooling; lighting) can be significantly reduced. Increasing the efficiency of appliances or energy use (i.e.. mass heater instead of open fire or using natural chill rooms or similar for food preservation (see section 3.2.3 e - Storage) also contributes to the conservation of resources.
Although, day temperatures are pleasant with max. temperature at 33°C the winter evenings can be rather cool, around 12°C. Currently blankets are used to keep warm, but building thicker walls and using appropriate roof insulation, would benefit from the slow release of heat that accumulated in the walls during the day.

To reduce external dependency (decentralisation) and ecological footprint (localisation), alternative energy generation methods are preferred to using fossil fuels (that are also very expensive and difficult to purchase). Energy (heat and electricity) can be generated locally by technologies that:

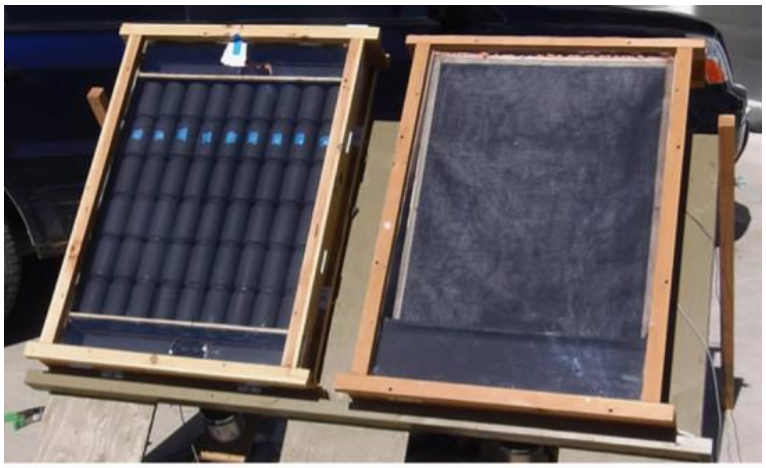
1. use natural forces and weather such as solar, wind, marine and tide:
    - Solar panels (photovoltaic)
    - Solar thermal panels
    - Solar cooker
    - Wind turbines
    - Water turbines in the river
2. are based on biological processes such as biomass, biofuels and anaerobic digestion:
    - Biogas digester
    - Heat from compost
    - Biomass burners (rocket stove)

Alternative energy is the energy gained from non-fossil (renewable) sources. By combining the available renewable sources, a more reliable energy system can be created. They also be derived to a single integrated system such as fuel cells that producing heat, electricity and hydrogen. Best option is to use the energy when it is readily available, as storing energy will still be a challenge. Most appropriate storage methods could be via batteries, fuel cells or hydrogen.
A **fuel cell** is based on converting chemical energy into electric energy from hydrogen gas (H_2) and oxygen gas (O_2) through a PEM (Proton Exchange Membrane) cell.
Energy can be stored in **hydrogen** as either a gas or a liquid and can be transported to other locations. Storage of hydrogen as a gas typically requires high-pressure tanks (350–700 bar tank pressure). Storage of hydrogen as a liquid requires very low temperature, because the boiling point of hydrogen at one atmosphere pressure is −252.8°C.

- Harvesting different renewable energy:

Solar is the most readily available, cost effective, sustainable and renewable type of energy, available most of the year. There are two types of solar panels: **Photovoltaic cells** (PV), which directly capture the sun's energy via solar cells and convert into electricity. Extra electricity can be stored in battery for night use. The other option is the **solar thermal panels**, where sunlight is absorbed by collectors. The absorbed heat is usually collected by circulating water in the absorber material (pipe), which is connected to a water tank to provide heat and hot water.

Figure 3.25: Solar air heater made from recycled cans (left) and using screens (right)



Source: https://www.builditsolar.com/Experimental/PopCanVsScreen/PopCanVsScreen.htm

Air can also be circulated in the collectors and used for space heating. The advantage of solar air heater is, the easiness to make it from recycled aluminium drink cans. An even simpler version is a screen absorber collector, but plastic bottles with a back tube could be used, too (for assembly drawings see Appendix E12 - Solar heater assembly).

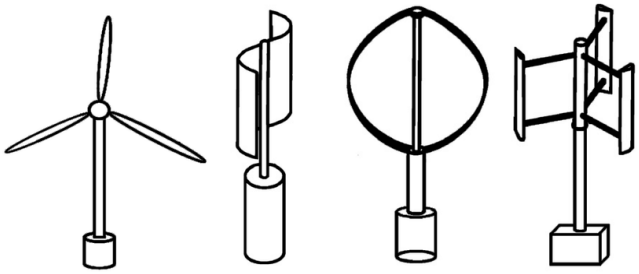
Standard solar PV panels represent an expensive initial cost; however, they are relatively affordable to run compared to fossil fuel power. They are therefore a better and cheaper long-term solution. They would work best in a high electricity usage area like at the centres; schools or clinics. At these places, they could also be installed onto the roof, although ground mounting could have additional benefits such as providing shade and easier to use for educational purposes and maintain it. This can be achieved in a later stage with the help of fundraising. Smaller and cheaper options could be solar powered lamps or portable PV panels that can charge phones, laptops or other smaller appliances.

Watermills and **windmills** are using mechanical energy to grain crops or pump water. Grain mills are rather complex mechanisms, but it could be an option in a very low-tech format. Pedalling based animal or human power can be considered for crop graining.

Wind turbines are generating electricity. The two main types of wind turbines are the horizontal axis wind turbines (HAWT) and vertical axial (VAWT) turbines. Figure 3.26 gives a brief overview of the different wind turbine types.

Figure 3.26: The major wind turbine types:

propeller-type horizontal axis wind turbine (HAWT), drag-based Savonius design, and the lift-based Darrieus and H-rotor vertical-axis wind turbines (VAWTs) - from Eriksson et al, 2008



The best methods of how they should be implemented, and materials availability require further research, but timber boards, tins, plastic or bamboo all could be used for blades.

Hydroelectricity: electricity is provided by generators that are pushed by movement of water. This can be horizontal flow (dams; tide or waterfall) or vertical (river current) e.g. floating river turbines (nano/micro hydro for small scales). Cheap and simple designs of hydraulic ram pumping system can be made with recycling plastic bottles, requires little skill, and material to create and repair.

Biomass heaters (boilers and stoves) are burning biological materials (e.g. wood or other plant or animal-based matter) to produce heat, power and other fuels. Biomass classed as carbon neutral resource because trees sequester the same amount of CO2 as it is emitted during burning (consider the age of trees and sustainably managed forests, replace the cut trees, otherwise biomass harvesting results in deforestation). Best to use waste from agricultural residue or wood logs from fast growing trees selected via Short Rotation Cropping (SRC), with consideration of their soil depletion effect.

Biofuels: from agri/aqua cultures used to power cars and machinery such as bioethanol and biodiesel. Derived from crops (rapeseed/canola, sugar cane & corn ethanol, palm oil), but they use of large areas of arable land that competes the soils for food and can deplete it. Not recommended. Alternative can be the use of recycled cooking oil used in modified diesel engines. Some biofuels use cellulosic ethanol (from grass such as switchgrass, trees, like jatropha and non-edible plants). They have low carbon emission and high energy return.

Algae: absorb a large amount of carbon-dioxide and transform into oxygen and in case of some species to hydrogen. The increased number of algae can be used as a soil fertiliser; animal feed; human feed; biomass for biomass digester; its hydrogen can be used in a fuel cell or in higher quantities it can be turned into electricity.

A **biogas digester** provides access to homemade source of renewable energy, in line with the zero-waste ethic of permaculture. Biodegradable organic matter is abundant on site from food and human waste, manure and agricultural plant residue.

c- Utilities

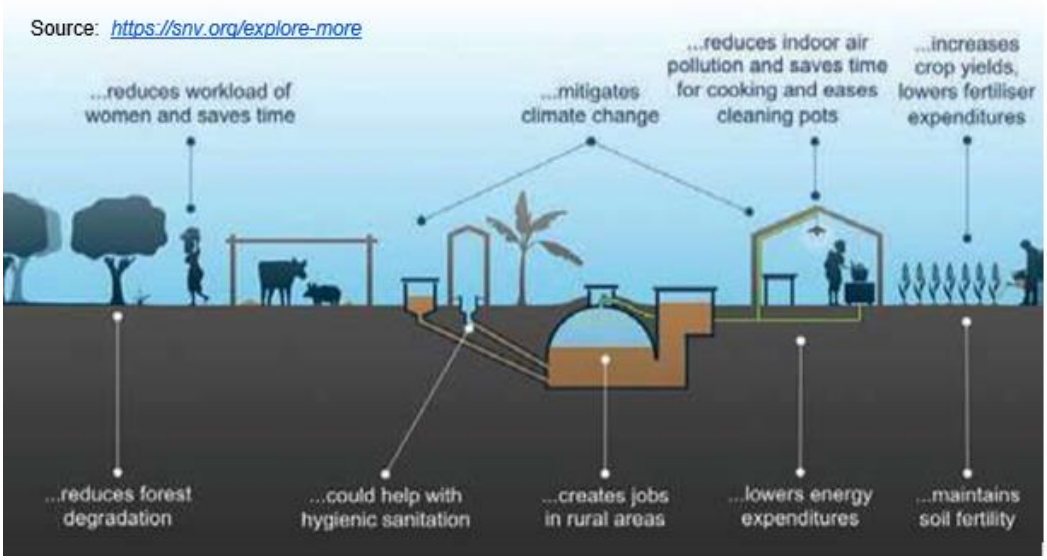
- Biogas digester:

Biogas is developed through anaerobic digestion (breakdown of organic matter in the absence of oxygen) in a sealed tank, where a mixture of gases (including methane (CH4) and carbon-dioxide (CO2)) is produced from the organic materials. The resulting biogas can be used as fuel for cooking; heating or drying.
If the digester is unused for longer periods (e.g. school holidays) it needs to be reactivated. This can be done by adding cow manure again.

The biogas digesters can be differentiated as:

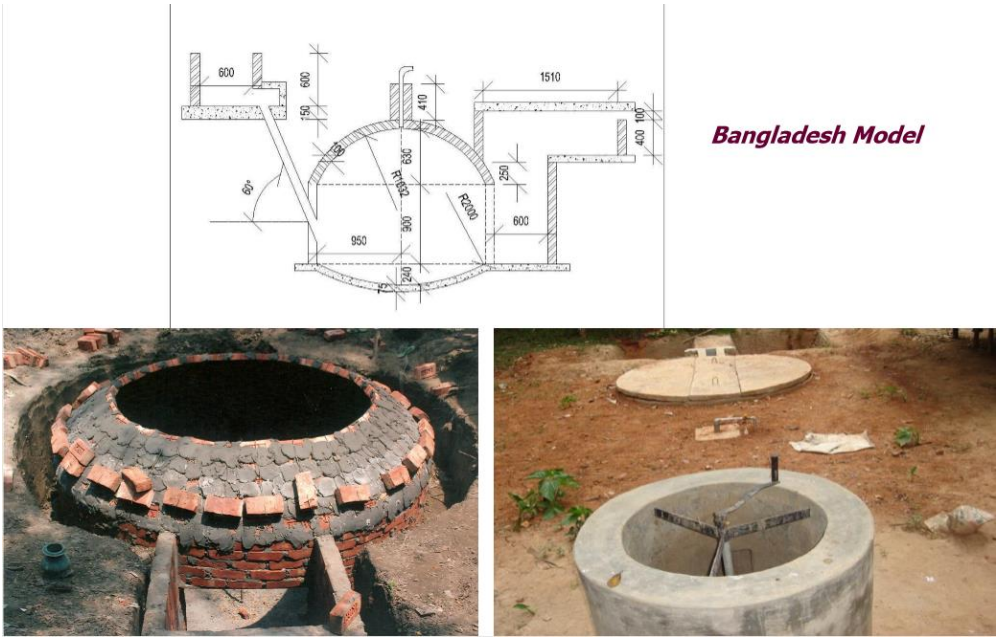
1. Based upon type of gas holder:
    - Floating gas holder
    - Fixed gas holder
2. Based upon the type of feeding:
    - Continuous feeding
    - Batch feeding
    - Semi-batch/continuous feeding

Figure 3.27: Multiple benefits of household biodigesters towards Sustainable Development Goals



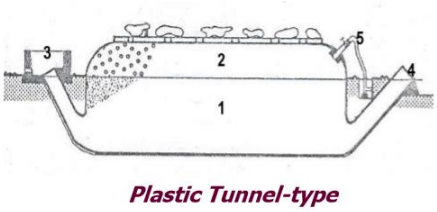
For the project in bigger scale the Bangladesh model and the Plastic Tunnel-type, while in domestic scale more the DIY solutions are most relevant.

Figure 3.28: Bangladesh Model, instead of concrete bricks can be used



According to SNV (https://snv.org) the most popular sizes are 4-6m3 and cost around $500-800 (June, 2019).

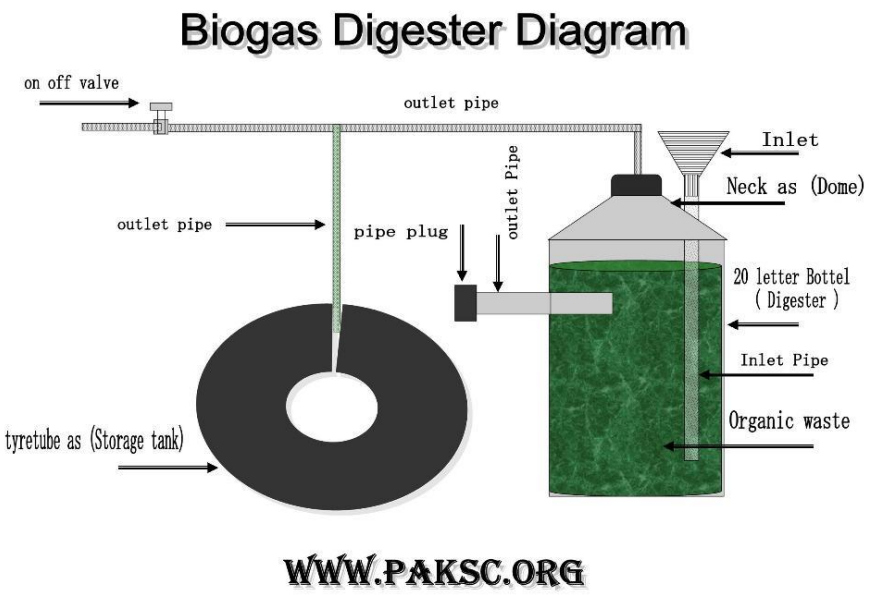
Figure 3.29: Plastic tunnel-type biodigester, instead of concrete bricks can be used



Itibetan.org (http://itibetan.org/biodigester.htm) recommends one **Tubular Polythene-type** digester (if there is 1 kg of kitchen waste everyday like in a family of 4 or more or school) or two tubes (if you own more than 1 or 2 cow or 5 pigs or chickens) with 20 meter length and 80 -100cm diameter. The source recommends 1:5 ratio of manure: water (see Appendix E13 – Tunnel-type biogas digester for installation).

Smaller scale versions are usually using plastic barrels, but clay pots or waterproofed adobe domes could also be trialled (see assembly instructions in Appendix E14 – Small scale DIY biogas digester).

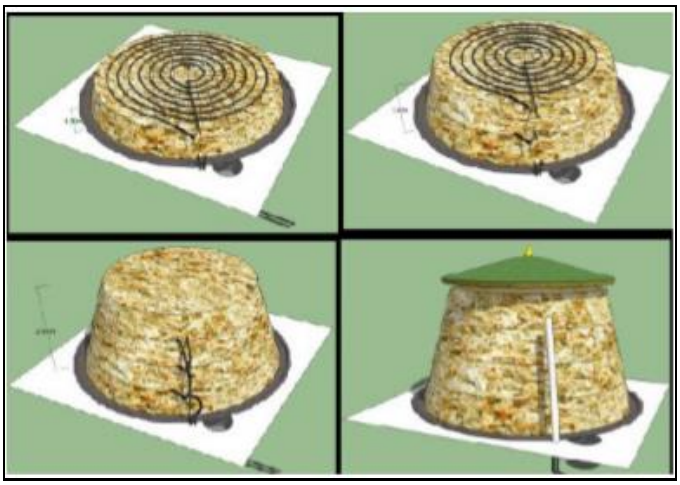
Figure 3.30: Home-made biogas digester schematics



- Heat from compost:

The idea of heat from compost is accredited to Jean Pain (1928 – 1981), who also developed a compost-based bioenergy system that produced 100% of his energy needs. He heated water to 60°C at a rate of 4 litres per minute, which he used for washing and heating. He also generated methane to run an electricity generator, cooking elements, and power his car. Creating usable energy from composting materials is called "Jean Pain Composting", or the "Jean Pain Method".
The method is simple, uses a tube laid in circles (sometimes in layers or wrapped around the compost from outside) to gain the warmth of the decomposition process. This can be done through several levels as shown in figure 3.30, this is called a biomeiler. According to Native-Power (www.native-power.de) a 2.8m high biomeiler with 6m base diameter using 15m heat exchanger over 3 layers, from 65m3 wood chips (~19t) can generate about 5.2kW (~44,000 kWh). The middle of the compost can accommodate a tank to collect the developing biogas.

Figure 3.31: Biomeiler schematic (Kimman, 2019)



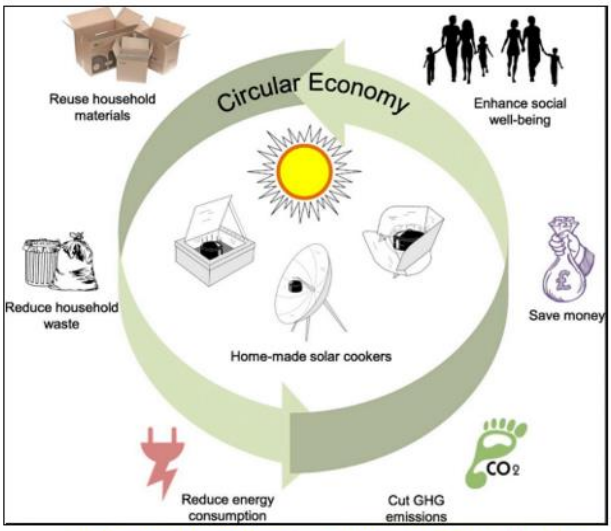
- Lights:

In the Philippines a campaign called 'A Liter of Light' was launched in 2012 by MyShelter Foundation, using plastic bottles to provide lighting for homes without electricity. The plastic bottles are filled with purified water and two caps of bleach, to prevent algae growth. They are then fixed to the roof with metal braces. If there is sunshine, the refraction of light provides about 55 watts electricity. The DIY bulbs estimated lifetime is 5 years. For guide see Appendix E15- Using plastic bottles for lighting.

- Cookers:

Solar cookers: The recently held Clean Cooking Forum in Nairobi, Kenya (5-7 November 2019), indicates the increasing interest towards simple, climate friendly cooking solutions in Africa. The current open fire way of cooking not only contributes to desertification by chopping down trees for firewood, but women spend a lot of time gathering wood and also resulting in a smoky kitchen due inefficient burning (air pollution).

Figure 3.32: Advantages of solar cookers to the environment, social well-being and finances



Source: https://www.sciencedirect.com/science/article/pii/S0048969718330894#f0040

Solar cookers are low-tech devices that have no operation cost and provide free energy. Working principles:

1. Concentrating sunlight through a mirrored surface (such as aluminium foil) achieving temperatures between 65°C-400°C
2. Converting light energy to heat energy onto the cooking pan (receiver). The cooking pan should be matte black in colour to maximise heat gain (absorption)
3. Trapping heat energy by insulating the air inside the cooker from the outside air. This can be done by a glass lid or similar.

The simplest solar cookers can be made from drink cans or card boxes with reflecting coating.

Figure 3.33: Box type solar cooker (left), and Easy Lid cooker (right)

The box type solar cooker uses timber for framing, card box sides (moisture proofed with latex paint or beeswax), metal inner box (can be substituted with another foil covered cardboard), spacers and glass cover. It heats up to 110°C over the summer and 80°C in winter (Johannesburg). The author uses it to bake cereals (millet, corn meal, sorghum), rice, potatoes, beans and sourdough bread. The average cooking time is 4hrs. Food is able to cook from 70°C upwards. The lower the cooking temperature, the longer it takes, the more nutrition the food will have. http://www.lowtech.co.za/solar-oven.

The Easy Lid cooker design uses only two cardboard boxes; aluminium foil; plastic sheet and black paint. Assembly drawing for the Easy Lid cooker and the box cooker is in Appendix E16 – Card box based solar cookers

Figure 3.34: Cooking with Wonderbags (left), and Rocket cook stoves (right)

Hay box cooker and wonderbags can be used when there is no sunshine – Large insulated box, or the insulating bag carries on the cooking once the food is brought up to boiling.

Rocket stoves based on burning fuel with high efficiently. They have an insulated combustion chamber and the thermal mass which surrounds the chamber continues upwards to absorb the heat of the exhaust gases forming a 'J'-shape. According to various reports a rocket mass heater can reduce fuel consumption by 80 - 90% compared to "conventional" stoves. The example rocket stove is made from bricks and clay based on the design by Africa Kitchen Revolution (Bafut, Cameron) . See Appendix E17 – Rocket stove building guide.

A whole-system approach can be achieved if waste treated through a biodigester and a reed bed to provide methane for cooking, solid fertiliser for trees, food garden fertiliser and irrigation. In permaculture, this is called Flow. The resources circulated in a closed loop system to maximise productivity, just like in nature, as part of the functional cycles, with microbial life recycling the waste to provide food to other species. Geoff Lawton, Permaculture Research Institute, Australia https://permaculturenews.org/ shows this concept for a small-scale permaculture, polyculture farm, illustrating by the whole-systems approach that ecological design, wastewater management, energy provision and farming are not separate. The system also produces biomass (from the reed bed) and, while, maintains the species in the ecosystem.

d- Transport

The local methods of transportation are low carbon options including mainly walking. Bicycles and ox-drawn carts are also available, but scarce. This means a lot of children have to walk long distances to school, sometimes in the dark hours or alone and this increases the risks of assaults and abuses. The principles of permaculture zoning allow to reduce the distance within the community/region to satisfy regular needs so that the most important areas are easily accessible by foot.

Figure 3.35: (From top left) Young people with bamboo bikes; community bus; leg powered S'cool Bus; repurposed barrels for transporting children (could be oxen driven)

To avoid the need of investing individual transport sharing these facilities is recommended:

- Individual transport for short distances or within the community the project team recommends the consideration of **bamboo bikes** or similar, that can be almost home-grown and also adjust to requirements, such as transporting children or shopping. Bamboo is extremely easy to grow, to cut and manipulate while staying strong.
  The construction of bamboo bikes could be an option to create workshop business.

Other bike-like constructions like tricycles, bike-trains (for the smallest children), tandems or rickshaws are feasible solutions as well.

- **Communal transport** long distances or outside community: purchasing a truck or boat (with the help of funds or grants), and organise a workshop by volunteers to adapt its power supply to a more accessible energy source- this could turn into a community/school art project and becomes a touristic asset too. Mediatisation is key, as these kinds of projects are popular for crowdfunding.

Figure 3.36: 'Rolling springs', a hoop-framed water tank, that rolls when pushed

Transporting goods can be done by wheelbarrows or there is a simple solution called **"Rolling springs"** to transport water, where water becomes the power to push the container, which can be crafted with any local recycled material.

3.3 Ecological Conclusions

Ecological review:

A holistic agroecological system integrating the education and practice of permaculture and Zunde reMambo values is a means to secure living and revive the economic viability of the rural Mwuera community. Thereby, the overall resilience of the community and its ecosystem is boosted by encouraging villagers to collaboratively design land, farms and buildings with respect for nature, starting with incorporating rainwater harvesting components.

First, storing water in the soil to rehydrate the landscape is done by building soil's organic matter, using swales and keyline cultivation pattern. Then the runoff rainfall is harvested through drains to fill up tanks and pond reservoirs for regular availability. Restoring soil health this way provides the basis for long term subsistence and saves farmers substantial input costs. Agriculture also offers grounds for live outdoor permanent classrooms, which increases connection and time spent on nature as a source of peace and enlightenment.

The rehabilitation of the orphanage school centre in the village and the development of the educational agrihub academy by the river is designed through educating and involving local participants and with minimal ecological footprint as a rule. The proposed regenerative agricultural system intends to satisfy the mission of MOCT, that is to offer all residents access to nutritious food, produced locally, in an environmentally conscious manner, while ensuring all members are treated fairly, gain in generating income and other non-financial wealth to be shared equitably within the community.

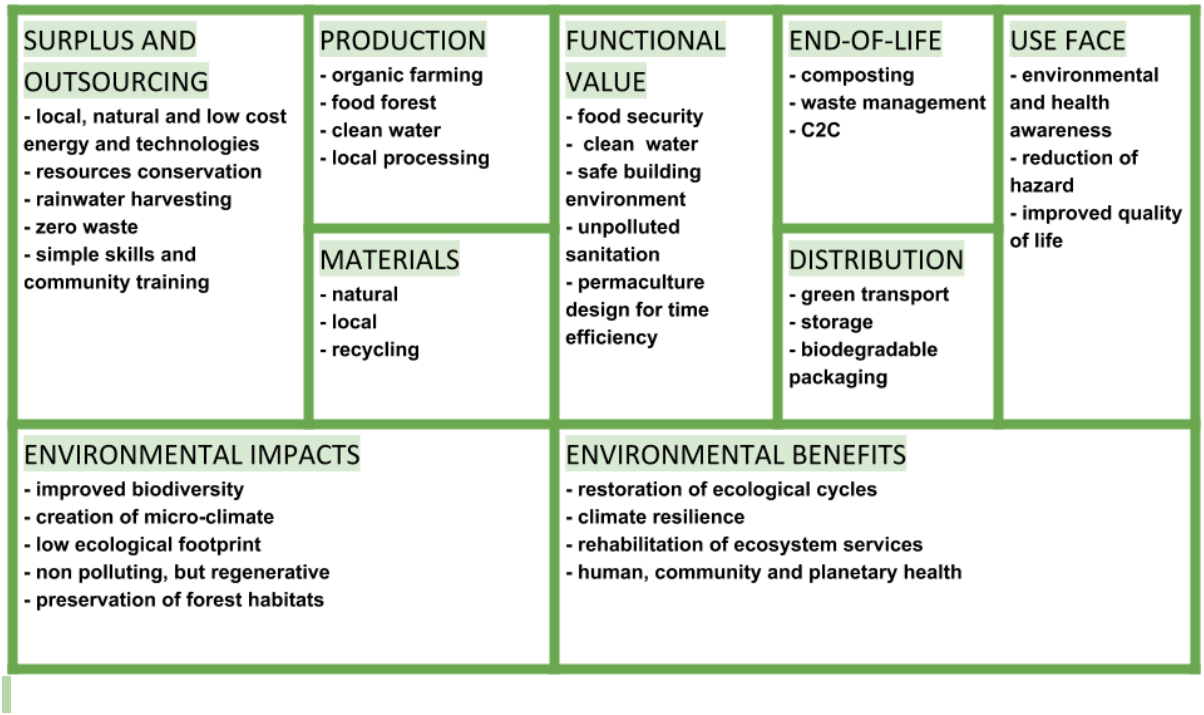
"Give a man a fish, he'll eat for a day; teach him how to fish, and he'll eat for a lifetime"
Anne Isabella Ritchie

Improving the ecological balance, with natural and low cost - low tech solutions, adds considerable value to the existing sites and bioregional livelihood without exploiting new land. The simple act of growing one's own organic food is a meaningful and worthwhile investment that immediately improves life by regaining control.

As a result, it :

- reduces dependence on the linear economic system
- decreases the polluting chain supply of corporate and industrial agribusinesses
- empowers individuals against political, climatic issues and food insecurities
- heals the community dynamics and builds a sense of belonging to a lively and healthy place
- repairs the damage to the environment, reengages connection and facilitates transition, collaboration and transformation at a larger scale

Table 3.6: Synthesis of MOCT ecological aspect



Ecological objectives:

Although self-sufficiency is the outcome of the future success of this project, the insufficient initial funding is a key challenge to kick start it. For this, the availability of manual labour is an asset. The first phase to be implemented is the digging of swales and the creation of ponds and catchment areas. Follows the gradual establishment of a food forest and the ongoing planting of food products through the creation of a seedling nursery and zero waste policy. Later, buildings and training for derived activities can start emerging.

Throughout this process, biodiversity ought to be monitored as a base reference for future progress. A vegetation inventory, coupled with a dataset of local wildlife and pollinators, facilitates individual awareness and communal action.

Future ecological recommendations:

There are some steps that could be considered next to optimise the ecological output:

- Secure funding, attract volunteers and teachers help with purchase and building technical facilities
- Attend training courses to acquire expertise
- Design education programs (such as PDC) and encourage peer training for local transition and scale-linking to a wider collaborative network
- Document optimal and failed methods
- Engage local population with reward programs, sharing, festivities
- Investigate paper recycling from agricultural plant reside and onsite sugar mill processing
- Create an arboretum of native species as school project
- Obtain officially recognised certifications (organic, fair trade)

- Record evolution of impacts on ecological health (biodiversity and rewilding, water, pollution), human health (nutrition, wellbeing) and socio-economic health (cohesion, wealth, lifestyle)
- Attempt to establish a zero waste and zero carbon policy and legislate a protected forest zone
- Fundraise for solar PV for energy generation and educational purposes

4. ECONOMIC DIMENSION

From top left: assembly meeting; beehives as economic activity; Evans evaluating site plans

"*Money has become a ring we wear through the nose, which allows us to be led around by those who control it*" - Mark Kinney

4.1 Current Economic Situation

a- Economic background summary

The country of Zimbabwe is suffering from an economic crisis with high inflation rates. The area located in the Sub-Sahara, recently became a semi-desert with little ground cover contributing to the loss of fertile topsoil during the rainy season. On the traditionally agricultural area, due to the frequent droughts and the loss of traditional farming knowledge, the intensive type of farming based on fertilisers and pesticides, is no longer yielding to satisfy local needs, as discussed in the previous Ecological dimension. Population growth and the low market value of traditional staple crops (maize, sorghum and millet), from which most households derive their income, have made subsistence agriculture unsustainable. Ninety percent of rural households in Zimbabwe earn less than the national average (GDP per capita was 1322.30 US dollars in 2018). Men left their families to find work elsewhere, creating a gender imbalance in the rural areas and social problems, such as loss of purpose among the youth, who escape to drugs and alcohol. The rising number of HIV/Aids infections is also concerning and calls for better family planning measures. The education is to a high standard, but remains academic with little practical and business skills, which learning materials are hard to access due to the lack of industries and infrastructure (including transport; electricity; internet). As not being able to self-sustain themselves, the external purchases are high, leading to leaks on the local economy.

For a society to be sustainable, its economy needs to be viewed as a means, not an end, so it serves the welfare of the environment, rather than the reverse. Growth is based on qualitative development rather than quantitative and physical expansion. The challenge is to shift from the current linear unlimited growth pattern towards the notion of regenerative growth that is ecologically sustainable and socially just, balancing processes of recycling (life and death) and development (learning). The focus on farming as being the centre of the project to create an agrarian based economy.

b- Economic analysis and statements

The SWOT analysis reviews the **S**trengths, **W**eaknesses, **O**pportunities and **T**hreats of the economic dimension from an internal and external viewpoint.

Table 4.1: Economic SWOT analysis of MOCT

Strengths: *Internal:* • Determination; labour • Multi-dimensional business plan • Investment in local skills development (long term training) • Community led *External:* • Regional networks • International contacts/volunteers • Crowdfunding	**Weaknesses:** *Internal:* • Lack of access to tools and electricity • No capital asset/collateral • Low financial investment • Inexperience, lack of knowledge • Irresponsible consumption/waste *External:* • Weak national currency • Corrupt government • Financial insecurity and lack of reliability of Zimbabwean accounts • No subsidies

	• Limited aid (charity) • Job scarcity, poverty • Cost of living: external purchase and dependence for subsistence
Opportunities: *Internal:* • Tradition; craft and agriculture-based entrepreneurship/cooperatives/alliances; selling permaculture and energy generation related know-how; peer-to-peer training; 'tool shed' a shared machinery and tool -hub; transport cooperative; selling goods and discuss business on markets; • Women's businesses; elders as social workers • Employment • Circular bioeconomy • Revitalising local activities and economic resilience *External:* • International trade and educational exchange • Tourism • Network and collaboration for donations in kindness; • Cut down intermediaries • Local focus with bioregional benefits	**Threats:** *Internal:* • Loss of enthusiasm if no visible results • Conflicts sharing costs/ benefits *External:* • Weather affecting the crops yield • Land taken back by the government; • Unstable economy-; unemployment • Debts: loan/credit repayment • Opportunistic abuse/misguidance

The following statements were derived from the above SWOT analysis as a guideline for the proposed economic solutions.

Economic vision:
To create a regenerative solidarity economy project that is based on permaculture principles benefitting at Trust and community levels and creating a business model that can be replicated elsewhere while restoring the ecosystem.

Economic missions:
Creating a social and economically dynamic community so that produces and by products derived from agriculture can provide work and income throughout the year. The community becomes less dependent on weather and economical influences with a decrease in gender inequality while being inclusive and supportive of vulnerable members.

Core economic values:
Organic produce, hand crafted goods, regenerative design, ancient environmental & agricultural wisdom, sharing, trading, co-operation, affordability, equity, partnership, welfare, conscious consumerism, diversification of income and currency, local and circular economy/

Economic goals:
- Provide a positive outlook for the youth, local jobs for men and empowering women
- Consume local produce and use local services through an alternative trading system
- Use renewable technology based and energy efficient systems
- Enhance infrastructure (water; electricity; communication; vehicles; roads)
- Create regenerative enterprises
- Add value to local products via food processing and development of various skills

4.2 Economic Solutions

4.2.1 Global-Local economic impact

The global tendency towards quantitative economic growth has many downsides including the exploitation of workforce and resources meanwhile generating unnecessary waste by fuelling the consumerist approach.
The project proposes alternatives that enhance qualitative regional economies instead, that would help to create long term resilience for the community and reset the demographic imbalance (shortage of men) caused by pursuing quantitative growth. This demographic imbalance affected the whole community, particularly the youth, who lost meaning and motivation in life and turned to alcohol and drugs.
Therefore, although the project and its participants cannot become totally independent of global and national financial markets (for example when purchasing goods or travelling for an abroad course), by applying alternative methods of exchange of goods such as bartering, local and regional livelihood can be improved. Alternative methods of trading reduce the financial aspect of transactions that are subject to inflation and devaluation, both of which particularly affecting Zimbabwe. A monthly salary is barely enough to fill up a car with petrol. While President Emmerson Mnangagwa acknowledged economic crisis, there is a need for reforms and pledges which take some time.
The project proposes to revive the local economy not by harming, but by regenerating the local and regional human, social and ecological capitals through collaborative advantage, organic food production and permaculture education primarily for orphaned and vulnerable children.

a- Dealing with inequalities and prevention of exploitation

In the light of the above, the project aims to facilitate the transition from a culture, driven by competitive advantage to a culture that co-creates abundance through collaborative advantage.
By shifting from providing individual earnings to family members only (influenced by my modern lifestyle and capitalism control of behaviour) to sharing facilities, resources, initial costs and harvest, would contribute to the revival of bioregional economy, culture and ecological habitats. It also produces less waste as well as allowing to co-own expensive or hard to get tools and machinery for example bicycle; computer; small tractor. This approach stimulates social interaction, strengthens social networks and care, offers opportunities for passing elders' wisdom and skills to youth and for peer to peer training. It also promotes inclusivity, increases collective production and promotes collaborative work with farmers and associated organisations.

Focusing on qualitative economic growth values people and resources without their exploitation in local and non-local context. Remote contribution to the project at this stage is mainly on voluntary basis, including time, knowledge, collaboration and donation. Gaia Education students being one of the examples. Knowledge exchange could happen through (international) volunteer activities. This needs to be planned so the participants, who give their time, labour and knowledge are valued and receive some compensation such as food and accommodation, while it is made sure they respect the local culture, traditions and project aims in return, too. External visitors could offer goods or services instead of paying a fee.
Activities such as courses or tourism brings much needed financial stability to the project, but economic activities need to be designed so that local resources are valued.

Inequalities are noticed on several levels: between towns and rural areas; gender inequality and due to the seasonality of agriculture.
In terms of town vs village, one of the main gaps is the infrastructure, including having dirt roads, electricity is very limited in terms of access and in terms of length of service (11pm-4am as of October 2019 due to low water level in Kariba hydro dam, which provides electricity to Zambia and Zimbabwe), water shortage for drinking and other uses. There are also low employment opportunities available leading to men going to work away far afield causing gender inequality.
Due to the lack of ownership of the land people cannot obtain mortgage (as the land cannot be taken as mortgage guarantee by the banks or lenders), thus otherwise would help securing initial funds to buy necessary materials, to start up or improve a business.
The seasonality of agriculture is mostly influenced by the droughts and heavy rains rather than seasons. Through permaculture practices the aim is to reduce the effect of weather by good water management, careful selection and companion planting of plants (see Ecological Dimension 3.2.3) to achieve a yield, therefore providing work and income throughout the year.

By creating an equal share model, for example a cooperative system that complements the Zunde culture, could reduce economic inequality for all members of the community including youth and women by sharing investment, labour and yield. Taking on specific roles according to the skills of the community members would also increase self-satisfaction and personal growth through further skills training. Creating jobs would attract men back to the villages and the demographic imbalance and dependency on uncertain external economic opportunities will be reduced. By offering jobs for the youth and women, men won't be the only bread earners.
By becoming self-sufficient in terms of resources and skills, leading to income generation by the community results in becoming more independent of the economic demands of the city, the influence of government and the global economic markets. The aim is to lift up the community from current deprived status to become rich in all forms of capital: human, social, ecological, infrastructure, cultural, health and creating a network of influence beyond the interest of the local community.

- Application of the eight principles of regenerative capitalism:

In 2015 the Capital Institute published a list of eight principles, which is based on a holistic understanding of whole system health (Capita Institute, 2015) that informs the way the project's business strategy is designed to create a more regenerative business model.

1. **Nurturing Right Relationships**: Through the Zunde philosophy and respect to all nature elements, animals, plants etc.

2. **Viewing Wealth Holistically**: This project is not only focuses on financial wealth or capital, but also on the 7 other types of capitals (intellectual, experiential, cultural, spiritual, social, material and living capitals), thus seeing wealth in a more holistic way, as a sign of peace, prosperity, health, stability, connection with nature, social cohesion and individual happiness - where most daily activities and interactions do not rely on monetary transactions nor on increasing unnecessary material possessions- wealth considered not only for humans but for all beings to flourish in harmony.

3. **Staying Innovative, Adaptive and Responsive:** Addressing the challenges, the community faces, for example, how to find a way to use clean energy or to protect girls from being assaulted, the solution could come from within.
Some suggestions:

- In order to increase bike numbers creation of bike repair workshop from old cheap bikes; or creation of bamboo bikes
- More focus on sexual education
- Use solar lights along footpaths
- Create social roles to value some excluded members, who are unable to participate much elsewhere in society/farm, such as elders to accompany children
- Give the young people a place to follow their interests: music, art, creativity of all sorts, political and philosophical discussions, innovation

4. **Empowering Participation:** Allowing women, youth, elders and all members from the community to participate in the project and share their wisdom. Also being conscious about what are the limitations of these different groups (ex: motivation for youth, safety for girls, etc.) in order to bring them the best conditions to fully participate in the project.

Embrace rules of peaceful communication, active listening, conflict management, include everyone, take time for decisions and seek consensus, set up rules for discussion hours

5. **Honouring Community and Place:**
   - Taking care of natural resources and members of the community.
   - Celebrating events (school; birth; harvest etc). Pride in local uniqueness
   - Respecting and celebrating Zunde traditions, choosing quotes, songs to sustain the vision

6. **Using the 'Edge Effect' (Collaborative Diversity) to create Abundance:**

By looking at the different edges of the project, we can find loads of diversity. For example:
   - at the edge of the river and the land
   - at the edge of the forest and the land
   - at the edge of the community and the land
   - at the edge of the economic system (towns vs rural areas)
   - At the edge of the social system (vulnerables vs valued status)

7. Establishing Robust Circular Flows (Regeneration):
   - *Ecological circularity:* Waste and water management allowing the ecosystem to regenerate itself and prevent additional production/consumption (examples: arborloo; composting green waste and limiting/recycling plastics),
   - *Economic circularity:* where organic local food can generate money that is reinvested in the community, trading system to exchange goods and services locally
   - *Social circularity:* where children and other members of the community are being taught permaculture principles (farming, social administration, conflict management, leadership/empowerment, traditional culture and dangers of modernism, conservation of energy and resources, waste/recycling) to be taught in return by themselves to their children and further community members (training of trainers) - community to serve as a model to be replicated to the larger region

8. Seeking balance between efficiency & resilience, collaboration & competition, diversity & coherence and between small, medium and large organisations and needs:

Starting small and local first is priority before slowly going larger. Collaborating with other organisations will be key to get some help, funds and expertise, however it is important to see what the needs in terms of food and other materials in order are to be

"competitive" and attract local and regional people. Focus on a few small projects at a time not trying to do everything at once.

- Effects of hidden externalities and hidden subsidies:

Currently low production (due to agriculture poorly adapted to ecosystem) and high costs (need to purchase most goods, food and energy including for agriculture purpose and basic subsistence) account for hidden externalities. The project proposes agricultural transformation focusing on localisation and self-sufficiency to reduce the risk of these hidden externalities and dependency. For example, planning for shortest supply chain i.e. local markets and trading, requires minimal storage, transport, transactions and middlemen.

Hidden subsidies include the ease of access to genetically modified (GMO) seeds, chemical pesticides and fertilisers through the Government's farmers education program. Thus, giving the farmers easy access to the above in the form of loan, that needs to be paid back and if they fail they will lose what they used as collateral. Therefore, even the microcredit loan is not recommended, best for villagers not to endure additional stress of whether they will be able to repay their loan- unless there is no other option for survival.
This practice not only deteriorated the health of the land, the environment and the people, but also the local economy. The proposed business model plans to substitute polluting (foreign) products by onsite generation; sourcing and processing using natural fertilisers and permaculture practices that eliminate the need for pesticides. This will reduce the external dependency and the number of middlemen along the supply chain, therefore reducing the final price which will not be determined externally.

b- Designing ecological growth to stay within the Nine Planetary Boundaries

Johannann Rocksröm, director of the Stockholm Resilience centre with a group of researchers illustrated the levels at which humans have reached beyond 'humanity's safe operating space' on Earth due to the ecological impact of the industrial growth of Western societies. It is called the Nine Planetary Boundaries. This project aims to stay within these boundaries as follows:

Table 4.2: Suggested actions for the project to stay within the nine planetary boundaries

Suggested actions to stay within the Nine Planetary Boundaries	
1. Climate change	The development follows the sustainable design guidelines, to minimise its negative impact on climate, by using regenerative solutions
2. Change in biosphere integrity	The project increases biodiversity mainly by increasing indigenous flora which itself will bring fauna through permaculture and keyline design
3. Stratospheric ozone depletion	Offsetting ozone depletion by implementing tree planting scheme
4. Ocean acidification	By eliminating the need of using chemical based pesticides and fertilisers and using plants to clean current soil/riverbank such as vetiver grass contribute to the improvement of (mainly local) watercourses

5. Biogeochemical flows (phosphorus and nitrogen cycles)	As above, through educating farmers to use less synthetic fertilizers and pesticides through agroecological farming methods and so revive the balance of phosphorus and nitrogen by increasing the microbiome in the ground (planting diversity on bare land)
6. Land-system change (for example deforestation)	The project aims to create replicable food forests that restore soil health and rehabilitate the natural hydrological cycle
7. Freshwater use	The wells dried out and the perennial river has multiple uses, to decrease dependency a water conservation and management system needs to be initiated. To make it cleaner people needs to be educated, particularly farmers. Plants can be used to increase the cleanness of the water (grey water recycling/filtering)
8. Atmospheric aerosol loading (microscopic particles in the atmosphere that affect climate and living organisms)	Reduction of polluting gases emitted from combustion of wood or incineration of plastic/other waste, by using more efficient technology and alternative energy generation
9. Introduction of novel entities (e.g. organic pollutants, radioactive materials, nanomaterials and microplastics)	The design aims to avoid the creation of these through organic agriculture in order to stop the use of GMO and recycling of plastic to prevent disintegration into micro-plastic

- Regeneration of healthy ecosystem functions:

To **regenerate** healthy ecosystem functions, the project's first objective is to create a permaculture farm with a food forest which will also stop the degradation of the soil, together with other practices such as the ban on fossil fuel, chemical farming or waste management which will reduce pollution and also help in the regeneration of healthy ecosystem functions. Once the ecosystem starts healing, ecological services will become interdependent with the social and economic dynamics of the local communities. Unlike in rich Western countries where the desire for ecosystem restoration is more an aim, in this case, a regenerative healthy ecosystem is a necessity for survival and a requirement for the future viability of a thriving community. A carbon offsetting program can also be introduced through Arborloo and Zai pit methods (see Ecological Dimension 3.2.3) and participating in campaigns such as EarthDeeds.org or joining The Red Soil Project https://www.redsoilproject.org/ an organisation promoting sustainable farming practices.
Other activities could include: raising environmental awareness; summer school holiday camps; forest school education curriculum; sharing resources (e.g. machinery); using renewable energies and energy efficient appliances. It also could be a school project to identify further options.

As visible from the above, regeneration is one of the foundation pillars of the project that will be expanded to regional level and beyond. Some examples:

- in the permaculture garden the plants will be continuously replaced; nourished;
- on-site energy generation from food, human waste and sun, also investigating the potential of water and wind
- the road infrastructure should be designed for minimal impact in terms of use of materials and in width and length
- efficient water and waste management systems to be designed
- using biodegradable packaging and tools made from natural materials whenever possible

- natural materials for buildings
- reusing materials whenever possible

- Addressing the project main activities and effects against the 17 SDGs:

"The concept of the circular economy is grounded in the study of non-linear, particular living systems. A major outcome of taking insights from living systems is the notion of optimising systems rather than components" - Ellen MacArthur Foundation

The project's main activities and effects against the 17 Sustainable Development Goals (SDGs) had been analysed as direct and indirect effects. The 17 SDGs address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity and peace and justice ratified in September 2015 by the United Nations.

Figure 4.1: Reflecting on the 17 Sustainable Development Goals on economic level

Primary/direct effects:

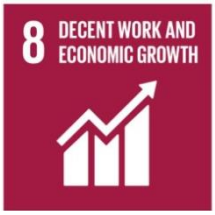
Poverty will be reduced or diminished by teaching the poorest on how to help themselves and become independent from external/expensive socio-economic activities; using alternative ways to exchange goods and services to monetary means

Climate resistant, local farming and healthy food production/processing; granaries and cold rooms for food storage

Including business skills into education like marketing and grant writing skills

Providing local jobs for men; leadership roles and education for women and youth; same wages for women as men

Different alternative energy solutions to complement each other: e.g. biogas; solar cookers; mass storage heaters, as a more efficient system implementation for cooking



Establishment of local economy growth: farmers, teachers, shop owners, cooperatives; farmers alliance. Independence from fluctuating global economies and national economic crisis.

Fair share of the products of the project; inclusive involvement in participating in project tasks; bursary programs to allow fair access to education for everyone;

Economical; ecological and social viability; regenerative solutions

Networks of local partners and suppliers, trade with other villages; search for funding and other support internationally with local, national and international NGOs, UN, and implying governments; partnering up with organisations for funding (some funds require cooperation) and knowledge exchange; making road links like pilgrim or organic farm trails; identify organisations and make contact in attempt for interest to secure future collaboration

Secondary/indirectly

Better food and education will lead to better physical and mental health, for example decrease in alcohol drinking, this lowers medical expenses. Improved welfare/health as a result of improved diet due to organic farming can be measured through university research. This could be extended to the improved quality of air/water (resulting from better waste management and agricultural practices) and improved well-being resulting in better social cohesion.

Sustainable water management, extended to but other villages and factories nearby to prevent dumping waste into the river, this could also be a proposal for study: the quality of water within the community compared to others not yet transitioned to sustainable practices; potential to sell low-tech water purifying systems

Focus on sustainable and local buildings and infrastructure, that are cheap to create and easy to maintain; improve road and communication infrastructure

Eating local, organic food which helps regenerate the earth, as well as using natural resources consciously; creation of educational diagrams for better understanding of the risks of irresponsible consumption of water, plastic and waste; implementing plastic recycling scheme; using biodegradable/reusable packaging

Addressing the major climate affected problems of the region: droughts, floods and desertification by designing activities to improve current land management; biodiversity for example through reintegration of food forests (increasing humidity and decreasing desertic surfaces, allows better water absorption during floods); tree planting scheme; for tourist include carbon offsetting into their travel costs, or ask them to contribute with activities that help to conserve/regenerate the environment

Using regenerative solutions to improve the quality of watercourses by planting mangrove trees to protect against floods and erosion along the riverbank but also improve the biodiversity. So underwater life can also become a source of food and income; use vetiver grass and floating plant islands to clean water (See 6)

Sustainable architecture to be fitted within the exosystemic framework e.g. building shelters from local, natural materials, reintegrating native plants and animals to regenerate ancient ecosystems including the increase of biodiversity; soil productivity; plant coverage;

With a common vision the ecological and economic aims are more easily achievable, easier to mobilise internal resources and handle conflicts

4.2.2 Economic resilience

Economic resilience relates to the ability of coping, recovering and avoiding the economic downturns. The report these opportunities by defining economic ethics and values, mapping up risks and opportunities (SWOT; Business canvas Model) looking at alternative trading systems, recommends strengthening the social and business networks and highlights the necessity for building transferable skills in the aid to build a resilient, vibrant community.

Figure 4.2: Alternative, community exchange system

a- Reviewing the potential of complementary currency systems

Apart from the current economic crisis in Zimbabwe, another difficulty is the lack of access to international payment systems. Global commerce is largely dominated by the US Dollar currency and it requires specialized systems for payments and receipts. This is often a challenge for many merchants in developing countries as they have no access to foreign exchange as well as the means to pay and receive money in foreign currency. Service providers that provide a digital wallet, such as mobile phone payments (see below), that allows users to receive Visa card payments could be a solution, but the internet infrastructure (and access to phones, laptops electricity remains a challenge).

Mobile payments: allows monetary transfers without the need of smartphones; cash; credit cards or bank accounts. No special device needed to accept payments; low transaction costs; can be used for online or in person, business-to-business or face-to-face. The cons include: mobile operators are competing with banks for the customers; regulations, fraud prevention and standards need to be developed. Mobile banking solutions, for example at OBOPAY can include: digital wallet (wallets can hold not only money but also coupons, loyalty points, stored value cards and membership cards); cardless ATM; airtime TopUp; Merchant payments; **group savings account**; contactless payments; transfers between family members (including money transfers from husband working abroad); person-to-person (P2P) payment; international payments; savings accounts.

The energy consumption and technical requirements make the **crypto currency** a non-viable option for our project, although further investigation is needed to see if it has a potential for international relations.

Microcredits could be an option, as they are considered a tool for entrepreneurship against poverty: very small loans without the need for collateral security (since no land ownership or steady employment/revenue), nor tedious paperwork. Ideally, for non-profit institution rather than typical for-profit banks or other private lenders. Lower cost if group lending (solidarity circle, where borrowers share responsibility and are therefore more motivated to help each other), but needs further investigation due to the low monetary savings. Microcredit available in Zimbabwe at ZMF: http://www.zmwft.co.zw/

Community shares: raising initial funds by issuing shares at community scale is a potential option to be considered by the stakeholders. The stakeholders meeting consists of village heads, Chief, School staff, Counsellor, District Administrator, 16 women, 16 men, M.O.C.T staff and staff from other organisations operating in the area.

Alternatives could be investigated, such as a **new local currency** (named “Zunde”) that could be linked to for example an hour of work (time banking) rather than being linked to the value of other currency e.g. dollar. The difficulty lies in producing (machinery; paper; ink) and recording the complementary currency. It also poses the question whether time is the most suitable value as opposed to other options, for example livestock herding vs well digging.

Investment through vouchers, where vouchers are sold for bakery products, vegetables or other goods that would be available throughout the following year at different times. This could allow the project to raise funds and spread the demand throughout the year. Similar to CSA (Community Supported Agriculture) system, where the community provides the funds in advance (that can be used on seeds; machinery; fertilizers) and shares the possible negative effects (such as low harvest yield). Disadvantages are the difficulty of printing and recording of vouchers. Instead of vouchers maybe just a member’s list required, and they can pay at a pay point receiving veg - box type weekly goods. There could be a few options offered e.g. just veg box; veg and bakery products; different size options (small; medium; large).

Local Exchange Trading Scheme (LETS), where people exchange all kinds of goods and services with one another, without the need for money, appears to be the most suitable option. Individuals earn LETS credits by providing a service and can then spend the credits on whatever is offered by others on the scheme: for example, childcare, transport, food, home repairs or the hire of tools and equipment. There is a need for a reliable tracking system, unless it can function efficiently on a trust-based system, where everyone counts their own credits (earned and spent). The LETS system can be complemented with bartering and gift economy, where bartering can be based on good quality organic seeds.

Payments for Ecosystem Services (PES): a scheme, where beneficiaries or users of nature’s services (such as: provision of food; water; timber and fibre; the regulation of air quality, climate and flood risk; opportunities for recreation, tourism and cultural development; soil formation and nutrient cycling) pay or fund the stewards, farmers or other providers of these services. It is similar to subsidies and taxes to encourage the conservation of natural resources (e.g. it could be in a form of eco-tax for tourists).

b- Funding Guidance

The aim is to create a Several Steps Funds guidance:

- Permaculture course (for example, initially with *Julious Piti*)
- Pilot demonstration: onsite example (including school gardens)
- Crowdfund for hosting permaculture design course in the area: through which start refining design for centre - need external experts to co-teach with the qualified Trust's members, feed & accommodate farmers coming from the region. The PDC, could spread across a longer time period to the usual 14 days one (so farmers and mothers could attend more easily), perhaps 2-3 days a week course over one month. In the meantime, international PDC students could do practical work, like: dig swales and work on plantations, to learn how to apply local technology with the resources available and visit the area
- Hire machinery, crowdfunding for earth works and volunteers (for agriculture, use as field work = free labour)

- Cooperative potentials:

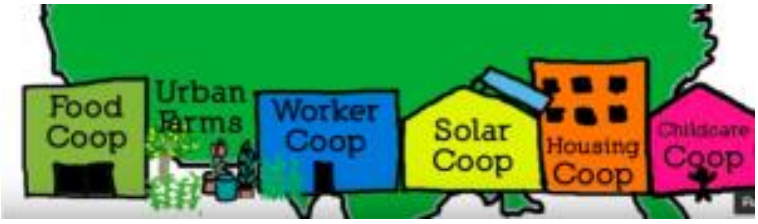
The land for the two sites of the Trust, and the community is generally owned by the government, but the chief of the district has the right of allocating the land. Everyone who is over 18 and is married (or has proven intention to marry) has access to land.

- Traditional leaders' structure:

1. Chief
2. Headman
3. village head
4. Individuals (homestead)

After the chief administers the people and allocates the land, he can give a 'permission to occupy', so people become custodians of their land.

Figure 4.3: Different forms of community coops



The agro-ecological works in the Permaculture Centre are designed to be educational including: designing raised beds; forest garden; water management; compost etc. and the aim is to replicate the method in every village in the ward and eventually expand it further. The project is community based, but since the land is not owned, a different kind of community framework recommended, where the benefits are allocated according to the members input, to motivate participation, increase the sense of responsibility, belonging and accountability.
By creating an Agri-Hub, it will offer a place for knowledge exchange, networking and meeting with the community. This can also include a machinery/tool hub, where equipment could be

borrowed. The Tool Shed could become a community asset, where people can go and fix their own equipment by using the tools or fixing the trust's machinery for benefits, he or she can use up elsewhere.
A Zunde based co-operative or Farmers' Alliance can be linked to the Hub, in which farmers can join together to produce organic plants. Some of them also could act as inspectors ensuring that all plants are organic. The communal participation would guarantee the viability of the system and ensuring the organic produce. It also ensures sharing best practices and help overcome difficulties.

Other types of cooperatives, such as local renewable cooperative can be based on biogas digesters built in the schools; Permaculture and Orphan Centres; shops and clinic. In a further phase, it can include solar electricity generation through PV panels, thus helping the project become carbon neutral and economically viable. Rocket stoves would use wood more efficiently in the households (see Appendix E17 – Rocket stove building guide).

c- Legal structures for the agrihub

The project initiated by MOCT, a non-profit organisation is aiming to become a community project. Based on the current status the following **organisational** structures can be considered:

- **cooperative society** (interests of members with one vote per member)
- **social enterprise** (for profit to be distributed or re-invested for common benefit)
- **charitable organisation** (non-profit with public benefit). The Trust is recommended to be registered as an international charity, so can attract additional donations and enjoy wider benefits.

There are two types of **legal** structure. **Company Limited by Guarantee** seems the most appropriate legal structure: private, non-profit organisations (such as charities or associations) registered to provide specific services to the public (here the community) or specific groups (such as vulnerables, farmers association etc.). It is run by members, not shareholders. The profits are reinvested back into the company to be used following predefined objectives. The company has no shares so cannot redistribute back to the shareholders.
Small, personal businesses may be run privately by **Limited by Shares** company where the profits are distributed to the owners/shareholders but needs to consider the ethics of collaboration versus competition and communal vs personal benefit.
Limited companies offer the advantage of separating financial and legal liabilities from personal ones.
There is also a possibility to combine profit oriented and non-profit projects within the organisation, in which case it needs to be indicated, which segments of the project to be run for or not for profit e.g school garden, education centre, food processing, community shop etc.

4.2.3 Stakeholders values

The main values and ethics of the project are based on respecting the intrinsic value of all forms of life (human and non-human) to live and thrive, but without impacting on the wellbeing of others. The right livelihoods allow for a balance within the system, in order to cause no harm and help each components to regenerate so that to ensure the stability and viability of the whole system. A holistic view of interdependence and fair share is crucial in most decisions and actions each member undertakes individually or collectively. The proposed economic model is primarily based on restoring a healthy ecosystem by reviving the traditional Zunde

culture in association with permaculture practices, for the establishment of a peaceful and integrative community in harmony within its natural habitat, where life becomes just and easier for all.

a- Economical ethics

"We can only be ethical in relation to something we can see, understand, feel, love, or otherwise have faith in." Aldo Leopold

Earth Rights are the legal basis for a sustainable and regenerative future, integrating human economy into natural cycles in an non damaging way. Aldo Leopols's **Land Ethic** is a call for moral responsibility to the natural world: care for the people, the land and the relationship between them, where land includes soils, water, plants and animals. All of which, and Earth itself, possess inherent rights to live and thrive into the future.
The vision of the project is to guarantee the prosperity of the community, but not selfishly and regardless of future consequences, but re-establishing the balance and improving the impact of human presence within its natural surroundings.
Through this project the possibility is given for the Earth and its ecosystems to be regenerated and given back its value. The implementation of this project allows humans to reconnect to the earth to which it belongs and care for it the same way they would like to be cared for. By working together in harmony, humans and the earth will then take care of each other and enhance themselves to reach a better quality of life in harmony with the land and nature in general.
In a more concrete way, helping youth to reconnect to the earth will help them find more meaning to their life and be able to quit drinking behaviours. Also, if the ecosystem is regenerated, people are empowered and needs of food and work are met, fathers might more easily and likely to come back from abroad and take part in the process.
The project had been designed to embed these moral responsibilities, being based on a circular economy design (restorative design; waste minimisation; renewable energy use; no toxic chemicals).

The typical local measure of wealth is based on the type of house; the number of cattle, goats and chickens and the number of children in the diaspora. This can be replaced by introducing the **Growth National Happiness Index (GNH)** instead, to measure holistic quality of life and social progress, taking into account non-material values of well-being such as education, health, psychology, governance, culture, time, ecology, community and living standards. (http://www.grossnationalhappiness.com/Questionnaire/2015%20GNH%20questionnaire.pdf)
A questionnaire for ongoing assessments at different stages of project (before/after school garden, organic farm, improved energy source, communal shop..) can be created to track the progression of success

With this proposed new measure of wealth, the economic activities of MOCT follow these ethics:

- they are primarily derived from the production of the organic farm (where the organisation and agricultural practices are environmentally sustainable and socially equitable with voluntary participation, equal opportunities and fair redistribution)
- the initial investments are funded through external voluntary donations (crowdsourcing) and collaborations (attendance to discounted courses at partner organisations**)** and by the formation of a co-operative (minimise cost, risk and share responsibilities) or similar organisation.
- from local to global worldview (changing individuals to changing the world) instead of the sole aim of personal economic growth as promoted by capitalism the project

promotes the unity of the community through its shared vision. So collaboration replaces competition, respect and care for natural resources through integration and restoration of lost traditional values, culture and natural native species.

The economic model is based on **two stages**. The ultimate aim is the implementation of a system, based on abundance, to generate income, while helping the future expansion of the project and the improvement of life.
The **primary** requirement is the production of food for survival and self-sufficiency. Food is the essence of life. It is representative of the values of a society: food as a gift from the land if treated with care (ecosystem health and connection), food as a source of physical and mental health for individuals and social health (abundance reduces conflict), food as essential social and cultural interactions (cultural rituals, social festivities, family reunions, sharing/trading, traditional cuisine, share of wisdom, knowledge). It will also become a source of income when selling surplus; adding value, while gives opportunity for free peer to peer learning and so becoming part of the education curriculum.

Value addition is the key to raise farm incomes through increased economic value and consumer appeal of an agricultural commodity. Using technologies such as processing and preservation techniques, dehydration and drying technology, freezing technology, packing and labelling can be used to add value. It results in job creation and skills development, both critically needed at this time when employment has been shrinking due to the economic crisis.
In Zimbabwe, and in many developing countries in Africa, a wide variety of agricultural products are produced, but have not yet optimised the economic benefits that can be derived from them. This is due in part to inadequate knowledge of appropriate value adding technologies, coupled with poor infrastructure facilities, and the absence of coherent policies to support such an undertaking, especially in rural areas.
People need training to broaden their understanding of the importance of value adding activities as well as enhancing their knowledge and skills in using various value adding approaches and technologies (construction of pack houses, silos, movable milling containers and on cold storage facilities).

Branding needs to be carefully designed to combine the of name, words, symbols or design that identifies the product and the Trust, while expressing its values and ethics and differentiates it from competition, offering instant product recognition and identification. Branding is beneficial for differentiation and it also conveys value- consumers perceive brand name products as high quality, more reliable and a better value than non-branded products. Labels will help for international trade and recognition for potential future investors

Fair Trade adds to the branding as it officialises the identification of the products with decent working conditions (no child labour), local sustainability, and fair terms of trade for farmers and workers in the developing world.
By replacing middlemen and several layers in supply chain by direct sale to certified organisations better price can be obtained. This includes non-food goods, such as crafts bought by charitable associations e.g. OXFAM.
Although, Fair Trade will be more relevant at later stages of the project, when the community starts exporting non-perishable goods, such as handmade crafts to national and international retailers (such as charities and ethical shops). Processing food and other goods also allows for the sale of a final product directly to consumers at a higher price than raw products, this added value also reduces intermediaries (even if not labelled Fair Trade) and seasonality. Confection of derived products: oil, soaps, marmalade, medicines, woven leaves, artisanal craftsmanship, beer**.**
Fair trade certificate in Zimbabwe can be obtained from ZOPPA (Zimbabwe Organic Producers and Promoters Association). ZimOrganic label guarantees international organic standard delivered by offering food sovereignty (taking control of one's own food supply chain)

and not only food security (access to sufficient food). Examples are **Wedza Mountain of Hope** and **Fambidzanai Permaculture Training Centre (FPTC)**.

b- Minimising negative impacts

- To lessen the negative environmental, social, and economic impacts along the entire supply chain of the products and services the project offers, the following actions are recommended:
- Organise local markets within the community for redistribution of local production for direct use/consumption. (Low cost option).
- Organisation of trading facilities (if excess) in areas easily accessible to neighbouring villagers or on major routes/crossroads popular with passing vehicles, to directly sell produce. This option is viable if the offer is diverse and of good quality (organic is unique). In order to increase popularity and influence (attract regular customers), implement veg box scheme: local/regional producers (each offering different speciality) can coordinate to create a communal market.
- Negotiating an official and sustainable collaboration with local businesses to supply directly merchants/restaurants in neighbouring wealthier towns (if regular production) to avoid the logistics of transport and authorisation of establishing a market space in the city. This option offers more long-term security but is highly dependent on reliability.
- Organize open days where the products can be purchased
- Have a stall/shop at the Permaculture Pentre, where fresh and processed produce, local crafts and tools can be purchased
- Supply organic food and vegetables for the local schools, clinic

The business model for the project is inspired by collaborative (community) consumption, also elements of peer-to-peer collaboration can be added.
A survey (see Appendix B1- Introductory questionnaire from team to community) is usually carried out at the beginning of the project. For community engagement and to gain information about the everyday life of the community members as well as their opinion about the project.

The eventual impacts on various ecological, economic and social aspects can be assessed through regular monitoring. Surveys of various social and ecological wellbeing indicators can be used as a measure of success of the project. By repeating the surveys at regular intervals, the change can be recorded and announced. If viability is shown, more people would be willing to join the project and could be used as a tool to attract further investments. These surveys, depending on their complexity, can be carried out by designated members of the community, by a general census report, by a local school project or in association with external bodies, students, researchers and activists. This offers further collaboration opportunities for partnership with organisations in association with free training, seed exchange or farmer's competitions.

Fields of interest to be recorded:

- climate resilience: constant availability of food and water (production/storage of crop), stable infrastructure and facilities during climate disasters or economic crisis.
- regeneration of natural habitat and biodiversity (estimate of forest land, record of trees planted in food forest, seed bank)
- development of local skills, services and production of by-products for self-sufficiency and for sale/trade
- social and demographic balance: evaluation of local youth unemployment/inactivity/delinquency; men returning to work in villages

- organisation of social enterprise and co-operative
- emergence of new valued positions: guardian of vulnerable children walking to school, guardian of reforestation area, organic and fair-trade inspector, administrator, counsellor/mediation role,
- evolution of children attendance at school and impact on safety (education on conscious consumerism, family planning and sexual assault)
- health benefit due to the elimination of chemical pollution, poor sanitation/waste disposal, poor diet
- influence on neighbouring communities and other global organisations (training, trading, collaboration, external donation/volunteering)
- monitoring of meteorology at micro scale
- assessment of the proportion of the population feeling positive, directly benefiting and/or participating in sustainable or regenerative practices
- quantitative financial asset allowing for qualitative prosperity and future security (individually or collectively)

c- Designing for generosity and gift services

Designing for generosity offers the challenge of looking at further non-monetary advances the project could gain.

"Goodness is the only investment that never fails" - Henry David Thoreau

This could include the **creation of an online platform** like an aid network for gift of goods and services:

- voluntary kindness: time offer
- voluntary time for generosity: regularly proposed challenges to be shared on social media in order to raise awareness and potential funds or other kind of support.
- non-monetary donations such as crowdfunding directly linked to sponsors/merchants so that the money raised automatically act as payment for the purchase of essential goods instead of collecting money that need to be transferred and changed with additional fees etc…
- non-monetary donations such as directly asking for goods instead of funds (such as sending seeds or paper etc.). It requires to set up a delivery point

The **reliance on external help** is ought to be perceived as an exchange or interdependence. Indeed, the aid received will fulfil a purpose in line with the wishes and vision of the donors, that is to take part in the global transition of societies and planetary healing. Small, unnoticed actions are the most powerful when repeated and spreading. The ripple effect could be that an act of generosity via the internet from a person in a wealthy and safe Western country, helps with the kick starting of an organic plantation program, which restores the local ecosystem and rebalances the hydrological cycle. These impacts multiply through demonstration to neighbouring and distant, but similar regions. The loop is closed when such places act on global climate and micro-climates in remote areas, or the production of imported goods or provide future potential for eco-tourism, all of which the initial donors can benefit too. Following this logic, aid becomes a collaboration tool with highly valued returns for all.

Generosity economy designed for gratitude: by offering symbolic gifts in response to gestures of kindness, (such as in confirmation email of donations, when completing a valuation survey) in the form of a poem or a drawing created by members of the community and free of copyrights, or option to name a plant or choose the colour of a brick with a future photo when sponsoring a building project etc.

Gift services are investigated if they could be linked to the current website, for example by combining crowdfunding or time banking. Sponsors, who are unable to donate much money could instead give their time to offer help remotely such as giving advice or design, researching various aspects needed for the project like a plan for a bridge, or the best bank to apply for loans, writing a grant proposal, or writing a blog entry etc…To be effective, the website needs to state the different skills or micro projects for potential volunteers to donate their time accordingly. This will also help growing a network of people, who are not necessarily able to support financially or by going on site.
A free/easy to use website: https://www.servicespace.org/about/index.php?pg=cfsites

Crowdfunding is a tool to help raise funds from individuals or organisations through a website, that contains details of the project the money is collected for. The advantage above grants include the instant money access (you don't need to wait for a decision) and the ability to share the funding page on different social platforms. More than one person can join in to organize and popularize the fundraising, so the results amplify. The projects funding page is available here: https://www.gofundme.com/f/mangwende-permaculture-center

4.2.4 Social enterprise

By mapping the goods and services consumed, the productive potential of the region (including resource, material, waste and energy flows) and identifying threats and opportunities helps localizing production and consumption. Looking also at the demand for skills, knowledge, technology, infrastructure and financing, informs the project leaders in designing solutions and retain bioregional economy that's currently leaking out from community.

The first step is to identify and plug the eventual leaks to the system.

Table 4.3: Identified leaks in the local economy

External sourcing: • Household products: Cooking oil, margarine, fizzy drinks, solar panels, lights etc • Clothing: Cheap clothes from China • Tools: All tools as the industry is not functioning • External services: none
Export: Agricultural produce i.e. maize, groundnuts, tomatoes, onions, vegetables, garlic,
Waste thrown away: Tins, bottles, plastic containers

To identify these 'leaks' is an important step as:
- Local sales keep money in the local community
- Drinks (e.g. Cola; Fanta etc) could be substituted by fruit drinks
- Plastic toys can be substituted by natural materials-based toys, locally handmade or substituted by activities

The production of Skindo, a local beer is brewed in the village, but this kind of beer is prohibited by law (skindo, highly intoxicating 24-four-hour brew made from maize porridge, yeast and sugar). It is likely been consumed by local youth. By introducing a variety of other drinks including legal local beer, involving them in the production (skills training) could reduce the consumption of Skindo.

a- Principles of One Planet Living

Bioregional https://www.bioregional.com/one-planet-living/ created a One Planet Framework, based on ten principles that covers all aspects of social, environmental and economic sustainability to provide advice and ideas on the goals, actions, targets and indicators to help organisations achieve their vision. The reflections of the projects for the ten principles are below:

Table 4.4: Reflection of the principles of the Ten Principles of One Planet Living on the project

Health and Happiness: producing and direct consumption of organic food (healthier diet and less agricultural pollution) and creating jobs (re-establishing family unity); educate people on waste; water and environmental awareness; encouraging community cooperation; make celebrations to promote good health and wellbeing	***Local and sustainable food***: diversity of native crops and non-edible plants; supporting sustainable/regenerative and human scale farming, promoting access to healthy, low impact, local, seasonal and organic diets and reducing food waste- waste should be analysed if it can be used further (i.e. corn husk for weaving and different products); looking at composting options; used as mulching material; Hügelkultur; biogas production = zero waste
Equity and local economy: providing work for men, women and young people to have a meaningful contribution to their own life; the different smaller projects within the big one require different skills (education; seed growing; harvesting; building etc.) this offers different opportunities on different skill levels and interests; cooperating with farmers and other villages is strengthening the bioregional economy through the creation of local trading network and supports sustainable and diversified economy with different measures of wealth.	***Sustainable materials:*** the main materials used on site aimed to be local and natural with little energy required for processing such as sand; clay; adobe; grass (maybe vetiver for thatching), stones for foundations and decoration for buildings. The Study Group suggests the introduction of bamboo, that is local to the area and non-invasive. Wood can also be used, although due to scarcity and termites its use needs to be carefully considered. NB. jackfruit tree is termite resistant. Plants, wood and clay can also be used for craft products and furniture - their harvest and manufacture based mainly on human and animal labour. Recommendations to reuse plastic waste: include: plastic bottles for seedlings; plastic bags to reuse or use as crochet material; investigating waste collection option (houses in the area can be 100-200m apart making waste collection difficult). It could be a good educational school project so the children could find out more about the origin and effect of plastic and could use their creativity to provide solutions

 ***Culture and community:*** the project's vision is to create a livelihood and culture based on permaculture and sustainability. Raise awareness on risky temptation for Western/city life-style vs transition back to traditional local values and wisdom. Current rituals such as harvest (see Social Dimension 5.2.3) can be extended to include more aspects of environmental consciousness.	 ***Sustainable transport***: mostly man powered means of transport. Travelling is mainly on foot or ox-carts as bikes and cars are expensive and rare; the Ecological Dimension (3.2.5d) contains recommendations for transporting children and along the river (raft). Further research needed for solutions if there would be a frequent stream of people arriving for the courses or business to offer low impact options
 ***Land use and wildlife:*** Sustainable agricultural, residential and natural land management including: restoring land through (Zunde based) permaculture principles creating food forest; tree nursery; using agro-ecological farming practices; involving domestic animals; retention of water through keyline process; buildings to be made from naturally occurring materials; planting two trees if cutting out one.	 ***Zero waste***: recycling of farm and household waste = closed circle *plant based excess:* compost/wormery; biodigester; using as mulching material; croft material; animal feed; *animal waste:* looking at using animal skin; feathers (e.g. for pillow) and other parts of the animals for different purposes. *animal manure* to heating; compost and fertilisers, biodigester; *human manure* biodigester; nutrients - arborloo *recycling* plastic and clothing
 ***Sustainable water***: conscious use of water (and other resources - consumption/waste/pollution) using keyline design and water management practices to lessen the effect of draughts; looking at water purification (water comes from wells); reducing watering needs through good 'garden' design - that can be applied by neighbouring farmers; finding biological fertilisers and biological solutions against pests instead of pesticides; managing the riverbank to have better control of flooding on a way it also cleans the water of the river - riverbank is very fertile - could be a good place to start the food forest	 ***Zero carbon***: use of renewable and biodegradable materials, carbon sequestration and creation of **offsetting programs** Using thermal storage of walls and floors to keep buildings cool in the summer and warm in the winter; Orientation of windows for gain of light, and heating in the evening and early hours, but not during the day; Using shades for cooling; plants for windbreaks; Solar cookers for households (have to re-evaluate the role of the kitchen as a place of the business and discussions - solar cookers work outside); biodigester for heating and cooking in the schools, clinic, centres. (see also Ecological Dimension 3.2.5b)

b- ReEconomy Toolkits and How to Guides

The five steps of ReEconomy Toolkits (Base building, dynamic planning, practical partnerships, place analysis and space creation) help transform local economies from the bottom up. REeconomy Project aimed to strengthen the resilience of communities to problems including climate change, rising energy prices, economic uncertainty and inequality.

Figure 4.4: *ReEconomy, the bottom up economic transformation*

- Five steps to REconomy**:**

1. Base Building

- Developing a mobilised and motivated 'Community of Investors' to secure continuous funding for longer term
- Expanding core group through community events, social media activity, podcasts, open days, by giving talks in surrounding villages and for different organizations (project ambassador).
- Project manager to build a team of core members and regularly invite all members of the community to listen, share and give feedback on their proposed plan, concerns and updates.

2. Dynamic planning

Developing shared vision of what change the community wants to see, setting priorities and creating a plan of how to get there. The vision is built together with the project manager, Evans and with the community. Setting project steps (phases) will keep the project going and people motivated (instead of burnt out), these steps should be interlinked.

3. Practical partnership

Partnerships to increase access, expand reach, accelerate progress, provide resources and reduce barriers

- inclusivity; opportunity to anonymous counselling
- increase access by providing transport (including access through the river when flooded); communal bike/truck scheme)

- expanding outreach through schools; events; chief; village visits; online platforms - cooperation with organisations having agroecological practices for knowledge and resource sharing (current links e.g. with PORET)

4. Place analysis

Opportunities, demand gaps and obstacles in the project areas (see also SWOT analysis in each dimension)

- Water: Problem: droughts; floods; water purity. Action: need for access and storage of clean and agricultural water and crop and infrastructure protection against weather.
- Economic situation: Problem: not stable economic background; hard to earn daily bread. Action: therefore, the need for financial independence
- Gender inequality: Problem: men are away; likely to be linked with the younger generation's negative habits. Action: need to relocalise the economy
- Youth: Problem: bored, don't know what to do in their free time; no challenges/motivation. Action: give them responsibilities; skills; project involvement; role models; create youth activities
- Lost skills in agriculture: opportunity to include elders in re-teaching these skills, introduce permaculture training.
- Degraded natural land and poor agricultural land: raise awareness for ecosystem health
- Loss of cultural identity and social network: revive Zunde philosophy through elders
- High demand for local jobs

5. Space creation

- Providing physical and/or social spaces for sharing and developing ideas, resources, knowledge and projects.
- The proposed education centre and library would give the opportunity for cultural exchange; the shop and local markets would engage with the local community that could lead further cooperation (farmers; volunteers; customers)
- Crafting workshops, art projects would create a creative atmosphere and opportunity for discussions; sharing tales; singing.
- Rituals would celebrate the success of hard work and review the process what was the input and what had been achieved.
- Allocating spaces for children and youth (e.g. playground and youth corner) their activity can be indirectly supervised, while allowing them peer-to-peer learning.
- Resource yourselves**:**

Money: A Funding Strategy needs to be put in place, that includes:

- Adequate fundraiser campaigns
- maintaining social media sites (Facebook, LinkedIn); regularly updated crowdsourcing site; website with news; blog; newsletter to engage a wider community, online media to be easy to manage electricity/computers/internet expensive and not easily accessible
- identifying potential funding sites; grant application sites (grant template had been prepared by Robin Woolner and some grant resource had been identified. See Appendix C2 - List of Potential funders/ organisations offering grants)
- looking for potential funders in the area: bringing local companies; influential people together to show them the business plan. They could maybe help with materials; expertise even if not with money; it also raises awareness and gives a sense of involvement (or elsewhere). A good opportunity would be the proposed stakeholders meeting

People and skills:

- establishing (expanding) a core group of people for the project (to maintain vision; develop strategies; organize the projects; determine needs; help with administration and funding)
- identify the necessary skills and knowledge required and organise trainings; tools and equipment
- bring in volunteers with the necessary skills (if the skill is not required for longer term or to teach the skills for the community)

Gaining the support from the rest of the community:

- involving the community through surveys, personal meetings with senior members and open assemblies
- explaining what the benefits of the project are; what the project success means for the whole community
- keep the chief, community, stakeholders and supporters updated on the progress and future plans of the project
- inclusivity through school projects and open days

Economic Evaluation (The project's contribution to economic re-localization and the strengthening of the local/regional economy):

- Estimating the potential value of the key parts through the Business Canvas Model and Business Plan
- Forecasting how much revenue and how many jobs it will generate
- Relocalisation of the economy by becoming financially independent of national and global markets. The local production, job opportunities and skill development reduce the need for any external purchases or monetary transactions subject to fluctuations. The local and bioregional network of business collaborations, trading, peer to peer training and (natural) land stewardship connect local communities with each other and become interdependent within the regional economy.

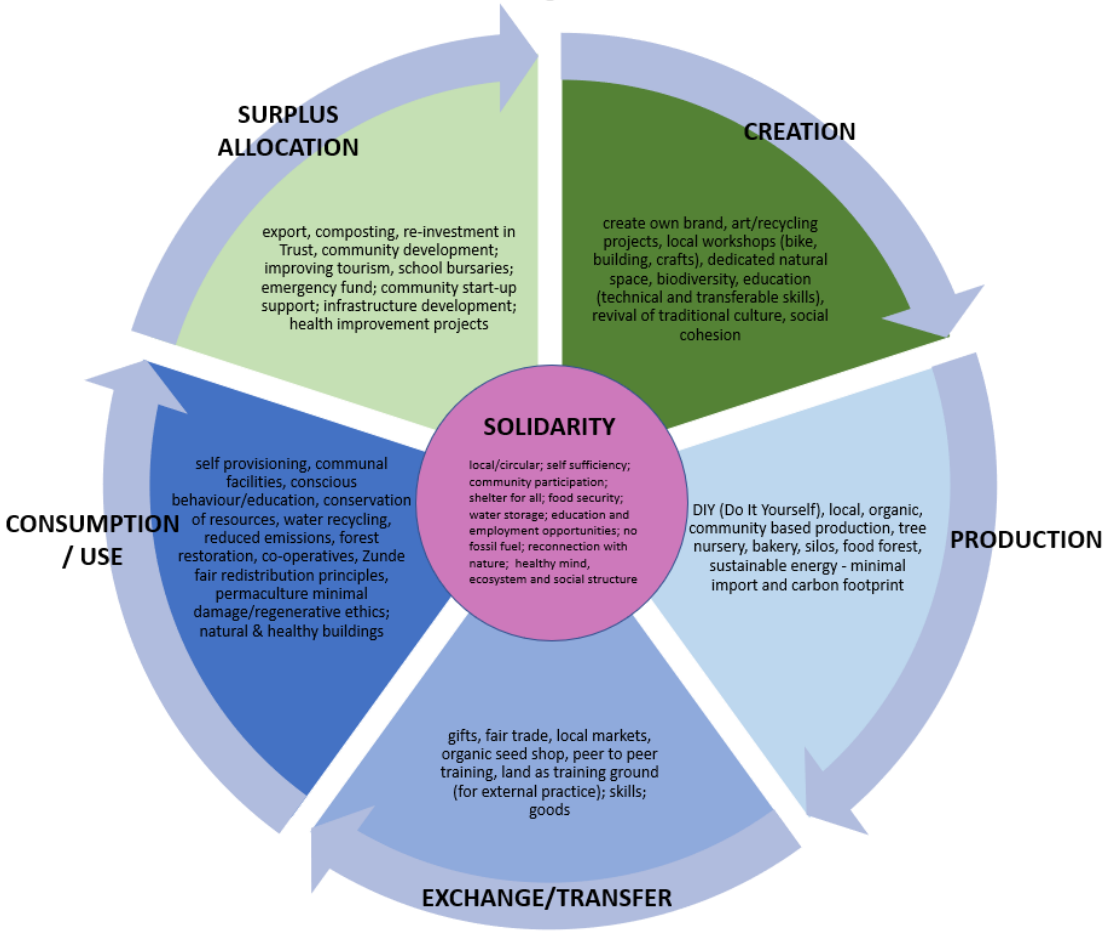
The characteristics we want to see in the enterprises identified with the project include:

- trade to strengthen community resilience: food resilience; access to energy; job security; knowledge exchange
- more than profit: including fair distribution of profit/goods improve living standards of the community
- connected and owned by the community
- appropriate resource use: within available natural; human and financial resources;
- appropriate localization and appropriate scale involving communities in the immediate proximity and replicate in other communities
- creation of collaborative work systems and possible a local labour exchange for goods system (see alternative trading systems) will strengthen the community cohesion and the economy, too.

c- Solidarity Economy

To analyse how the project can co-create a collaborative economic model that builds rather than divides communities, Ethan Miller's 'Map of the Solidarity Economy' had been adapted. Socioeco.org **(**www.socioeco.org**)** is the resource website for the social and solidarity economy.

Figure 4.5: Map of MOCT's Solidarity Economy (Adapted from Ethan Miller)



d- Inspirations

- Examples of social innovations:

Collaborative consumption business models:
microloans (initiated by Mohamead Yunus through Grameen Bank http://www.grameen.com/); peer-to-peer lending; *crowdfunding*; government supported co-production; self-help health groups; self-build housing; neighbourhood nurseries; neighbourhood wardens; complementary medicine; restorative justice and community court
DIY projects: biodigesters; wind turbines; solar products; bamboo bikes;
Building projects: pergolas; sanitary system; waste-water recycling/reed bed/septic tank; composting toilets;
Women's crafts: soap; candles; thermal bags; woven products; baskets and booms; scented (aromatic herbs) bags/pillows; recycled clothing (e.g. quilts; bags); dyes
Educational enterprise: skills sharing and spiritual teachings; sports coaching; courses
Agricultural products: permaculture design; forest garden; keyline design; plant identification/complementary plants; organic farming; tree and plant nursery; processed plants;
Art: newspaper recycling; paintings; arts from natural materials; theatre (e.g. oppression based)

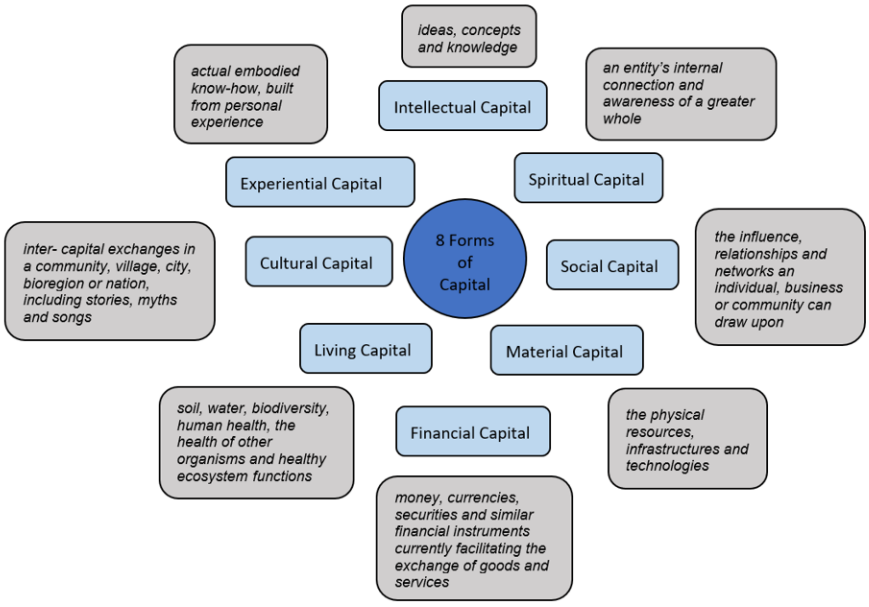
- Regenerative Enterprise Model:

A regenerative Enterprise is a venture that pro-actively grows and cultivates the foundational pools of social cultural, spiritual and living capital by providing goods and services in a way that creates net positive gains for the system as a whole. The project builds on the Regenerative Enterprise Model proposed by Ethan Roland and Gregory Landua, based on exploring how entrepreneurs can contribute to regenerative development.

The enterprise should be designed:

1: to mimic living systems following clearly defined ecosystem principles
2. to be an integral part of living systems, building living capital through all their processes
3. collaboratively with other enterprises to form conscious enterprise ecologies

Figure 4.6: The theory of designing a regenerative economic model based on the Eight Forms of Capital



Eight forms of capital

Adapted from Ethan Roland& Gregory Landua

"A regenerative enterprise helps to grow the roots deeper and wider, healing the damage that has been done and eventually creating the possibility to new and larger fruits"

The project focuses on qualitative as opposed to quantitative growth by supporting "nurture capitals" (social, cultural, spiritual and living capital) at local and later at regional scale by transforming financial capital into living capital. By supporting the personal development of the community members, the project ensures its longevity and success.

Table 4.5: The Eight Forms of Currency associated with the MOCT

Eight Forms of Currency		
Capital	**Currency**	**Complexing to**
Social Capital	Connections	*influence relationships:* chief; stakeholders; clinics; community; farmers and local businesses; teachers; volunteers; universities; governmental and NGOs; family unit
Material Capital	Materials, "natural" resources	*tools, buildings, infrastructure:* buildings-built; composting toilets; sanitary system; renewable energy production tools & equipment; granaries; products (dried and milled products; crafts; ceramics; seeds; tree seedlings; honey; beeswax; beer; wine; fruit juices); raw materials: packaging; plants; seeds; plastic; roads/paths; fence; handcrafts
Financial Capital	Money	*financial instruments & securities:* granaries; goods exchange system (vouchers; time-banking; organic seeds); initial loan/private capital; donations; sale of produce and services
Living Capital	Carbon, Nitrogen, Water	*soil, living organisms, land, ecosystem services:* water (ground; river; run off; grey water); seeds; plants (carbon sequestration), clay; soil; timber; animals; health of humans and other organisms; biodiversity; manure, pollinators, sun; wind; rain
Intellectual Capital	Ideas, Knowledge	*words, images, "intellectual property":* vision (concept) of the project; permaculture knowledge; good school education; education centre
Experiential Capital	Action	*embodied experience, wisdom:* elder's wisdom; local/farmers know-how;
Spiritual Capital	Prayer, Intention, Faith, Karma	*spiritual attainment:* respect of all faith, connection with nature spirituality
Cultural Capital	Song, Story, Ritual	*community:* stories; myths; songs; art; theatre, festivals, celebrations, general assembly

4.2.5 Business planning

The organisation of the community is based on the model of a **social enterprise** with social, community based (and charitable- orphans/school) objectives. The aim is to make a profit using different business strategies in order for it to be re-invested for improving the economic, social and environmental wellbeing of the community and its bioregion.

- **Agriculture:** based on permaculture, local production of diversified organic plants primarily for direct consumption in villagers' diet; non-edible plants for composting, energy, building and other crafts; animal husbandry mainly for dairy produce and energy/compost (possibility for aquatic species)
- **Manufacturing/maintenance**: milling of grains (flour) and pressing plants (juice, oils), climate resistant cheap/local buildings and shelters (for housing, storage, animals and communal facilities), bakery, beer, wine and fruit juices production; food conservation (drying; smoking; jams);
- **Craftsmanship**: weaving (baskets, roof/curtains, rugs, strings, furniture from trees and corn tusk), oils (cooking, fuel, cosmetics from pressing seeds and roots), tools, containers, decorand souvenirs (from plants and animal by-products and from recycling such as plastic), natural medicine (and herbal teas); soap and candles. They could be the base of women enterprises
- **Trade:** essentially local, primarily fresh/raw fruits, vegetables and organic seed production, (also some processed goods, advantages of storage/transport for year-round supply), bakery products; direct sale/trade (minimal intermediary to maximise fair price), street vendor, community market, restaurants and shop in the city, international Fair Trade (selling for charitable associations)
- **Banking:** minimal typical banking (mainly for loans, reserve funds, international transactions), localisation of the economy to become financially independent and focus on barter (and direct donations/exchange of goods and services); create registrar or accountancy to administer village economic activities
- **Transport:** an opportunity to create a transport co-operative (shared vehicle for large quantity e.g. a truck to deliver goods to markets (that could operate as a school service truck, too), communal scheme for borrowing bikes (so no need for each individual/household to buy)
- **Workshop/education:** role model for best practices for sustainable lifestyle, not only permaculture

a- Business Model Canvas

Through the Business Model Canvas the project is better informed about the correlation of the different sectors (see table in Appendix C4 – Business Model Canvas)

Key partners: (*Who are the key partners? Who are the key suppliers? Which key resources is the business acquiring from partners? Which key activities do partners perform?*)

- local villagers (16 villages): neighbouring farmers/landowners (including participation of women and elders)
- local schools (5 schools)
- 2 clinics
- Chief and members of the traditional leadership structure
- Stakeholders
- local council represented by councillors
- ministry of local government (represented by the District Administrator)
- Ministry of Agriculture (represented by Extension workers)

- GEDS Team; and current remote volunteers e.g. WhatsApp team; future international volunteers
- Zimbabwe Permaculture Network
- national (and South African countries) universities
- international organisations for remote expert training and invitation of consultants/teachers (e.g. Savory Institute, GEN Africa)
- Fair Trade
- Accommodation providers/ food providers; community/public transport 'companies'

Key resources: *(What key resources does the value proposition require? What are the distribution channels? Customer relationships? Revenue streams? Which assets are indispensable in the business model?*)

- **Natural:**
  - locally sourced and produced, mainly renewable or recycled goods (natural building materials, energy and agriculture)
  - food and non-edible materials (leaves, compost, timber; soil) from food forest
  - water management and filtering for household and agriculture (river potential for transport
  - local flora and fauna
- **Physical:** land; buildings; plants; seeds; delivery equipment; tools; infrastructure
- **Financial:** grants; donations; income from sales; loans (latter to be avoided)
- **Intellectual:** teaching skills; leadership skills; elders' wisdom; knowledge on permaculture etc.
- **Human:** community; volunteers; orphans; teachers

Key activities: *(What key activities does the value proposition require? The distribution channels? Customer relationships? Revenue Streams?*)

- priority: permaculture farming and storing of diverse resources for constant food availability and employment (selling added value products)
- education centre: skills training; seasonal permaculture internship for external visitors and live demonstration for local communities; administration of visitors and business activities;
- school education and participation in general sustainable practices and harmonious social interactions
- local markets and regional festivities and rituals (including connection with traditions and retreat in nature)
- community assembly with regular audit of population's satisfaction: conflict resolution and reassessment of long-term common vision and realigning short term individual missions,
- structured organisation with defined roles and responsibilities valuing every position integrative of diversity

Value propositions: *(What value does the business deliver to the customer? Which customer's problems can the Trust help to solve? Which customer needs are being satisfied?*)

- **Products:** milled maze; seeds (beans; maze; sorghum; millet; butternut; garlic; tomato) dried fruit; medical plants and possible extracts; soap
- **Educational courses:** permaculture; natural building; forest gardening; keyline design;
- **Skill courses:** cooking; DIY solar/wind turbine; compost making; compost toilet
- **Customer values:** organic; local; community based; ecovillage experience; newness; alternative lifestyle option; sustainability, rural development, nature spirituality, permaculture, equality, inclusivity, dignity, respect, Zunde, social unity, holistic management, co-operation, glocalisation, tradition, empowerment

Customer segments: *(For whom is value created? Who are the most important customers*?)

- comfortable space for (international) guests (private residence, outdoor classroom, internet access)
- Local people; orphans; young adults (schools, applied skills and knowledge complementary to standard curriculum, adapted to community life)
- local farmers (to replicate model)
- regional: urban (sale to businesses) and rural (direct exchange of quality and unique goods and services)
- national and international visitors (general public or journalists but mostly specialised students and researchers) in search of alternative/sustainable practical experience

Cost structure: *(What are the most important costs inherent in the business model? Which key resources are most expensive? Which key activities are most expensive*? *How much does it cost to create and deliver value? How much the key activities cost?*)

- providing school uniforms and meals
- building/running of orphanage and permaculture centre
- attendance to training courses (fees and travel)
- welcoming of teachers/experts (practical and technical building, farming, water management, social, business, educational, relational and IT skills...)
- basic materials for building infrastructure
- seeds, plants, tools and equipment
- power and technology (poor and expensive access to electricity and internet)
- long term maintenance of all the above
- emergency fund in case of unpredictable crisis (cyclone, migration; droughts...)

- **Phase one** financial need:

Table 4.6: Initial financial cost builds up

Activity / Material	**Cost**
Fencing total	$500
Irrigation total: • Borehole • Electric pump • Solar panel • Irrigation pipe	$4,500 • $1,500 • $2,000 • $500 • $500
3 types of natural buildings total	$3,000
Permaculture design course total • Teacher salary • Food and transportation for participants • Tools	$10,000 • $3,000 • $6,500 • $500
Nursery supplies total	$500
Total initial costs	**$18,500**

Revenue Streams: *(For what value are customers really willing to pay? For what do they currently pay? How are they currently paying? How would they prefer to pay? How much does each revenue stream contribute to overall revenues?*)

1. *Local workers (phase 1):*
    - raw food (direct consumption and sale of excess yield directly on markets and in collaboration with local businesses)- focus on quality (organic); potential for Community Supported Agriculture type of veg delivery scheme
    - processed food and natural by-products of farm with added value (dried fruits, jams, oil, wood, seedlings…) - focus on low price (no middlemen)
    - recycling scheme (collection of plastic and tins to be recycled)
    - long term financial security via creation of emergency communal fund
2. *External associations (phase 2):*
    - external visitors, students and researchers (focus on alternative methods of payment of fees: directly in goods or exchange of expert services);
    - accommodation for "tourists" in search of authentic residential immersion experience or daily guided tours with participation in local activities and festivities (encouraging local purchase of goods within the villages' businesses)
    - local and international volunteers to donate funds and goods (e.g. crowdfunding); grants
    - alternative source of "revenue" (qualitative instead of financial):
        - temporary offer access to land to training permaculturists, land restoration organisations or natural building schools, artists or journalists etc. for them to use site for practical field work (space can be scarce elsewhere), but instead of paying fees, they will bring necessary equipment and leave with improved landscape and infrastructure and global mediatisation.
        - volunteers to offer time and expertise (onsite or online)

Channels: *(Through which channels do customer segments want to be reached? How are they reached them now? Are the channels integrated? Which ones work best/ are the most cost efficient? Integrated with customer routines*?)

- local face to face meetings: markets; local shop; school visits; regular events (guided tours; open days, village assembly, festivities, community speeches) through the chief; stakeholders
- Online presence: website; social media (Facebook); WhatsApp; Slack; LinkedIn; podcasts; newsletters
- crowdfunding (direct donation, appeal for goods and voluntary time gift)
- flyers, posters and word of mouth: local advertisements in Harare shops, restaurants and tourist centre (and hotels) for farmers and craft markets, guided tours of permaculture farm project, village experience open to visitors
- attendance at events to represent the project and promote its activities (such as EDE, university talk; GEN and permaculture gatherings)
- making/sharing video: http://www.karmatube.org/index.php?op=subscribe

Customer relationships: *(What type of relationship does each of the customer segments expect the Trust to establish and maintain with them? Which ones are already established? How are they integrated with the rest of the business model? How costly are they?*)

- ask guests, customers, collaborators community members including children for feedback
- send all partners regular progress updates

- show gratitude to online customers (online crowdfunding or booking of courses) by offering a choice of gifts in confirmation email such as poem or drawing created by members of the community and free of copyrights, or option to name a plant etc…
- offer certificate of passage for all visitors on site with the above choice of gift
- suggest joining online community to build network and share experience (such as Facebook group; newsletters)
- Offer social events to strengthen local relationships within community and between villages

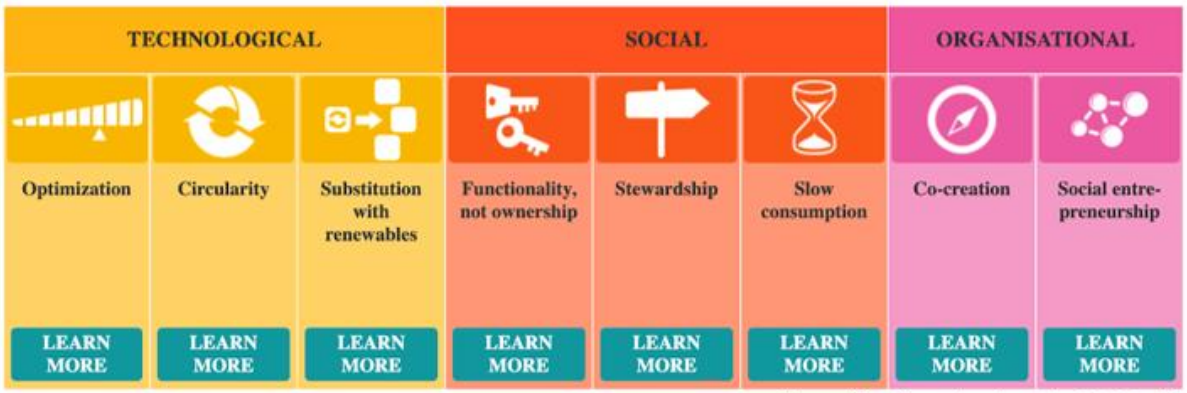
Potential competitors:

- Genetically modified seed houses fertiliser and chemical companies
- Other similar projects and organisations (instead of forming a collaborative network)

b- Business Model Innovation Grid

The C-Plan 'Business Model Innovation Grid' helps in comparing various Business Model options and finding the right one for the project to become more future proof by introducing environmental and social considerations at the core of the business model.

Figure 4.7: Business Model Innovation Grid form



Source: https://www.vlaanderen-circulair.be/bmix/

1) Technological

- **optimisation:** production on demand (for processed or less popular or rare specialities), low carbon solutions (mainly natural and local with minimal fossil fuel), multifunctionality (shared facilities and multi-purpose plants), dematerialisation (reduced transport/packaging, focus on personal wellbeing, social and nature connection), additive manufacturing (local resources and processing, direct sale)
- **circularity:** recycling (waste, plastic, water, plants), localisation (management, governance, economy, resources, employment, skills), shared ownership, responsibility and profit (collaborative labour and ethical consumption), transfer of knowledge and wisdom across ages and gender
- **substitution with renewables**: biomimicry (concept and housing design), solar and animal powered energy (conscious of animal welfare), move from fossil fuel, deforestation and lack of electricity to locally generated renewable energy

2) Social

- **functionality, not ownership:** simple design (ease of use, produce and maintain), communal access/shared usage
- **stewardship:** transparency (surveys on social and ecological impacts), ethical trade (fair trade, organic, no child labour guarantee labellisation), farm and natural resources

and biodiversity protection (seed bank, reforestation, PES), consumer care (health, gift, sense of belonging, peaceful environment, space creation)
- **slow consumption:** product longevity (repair workshop, adapted initial design, consumer education (conscious of limited availability of valuable resources)

3) Organisational

- **co-creation:** collaborative production, crowdsourcing, networking; minimal supply chain, collaborative management/decision making
- **social entrepreneurship:** localisation, social and biodiversity regeneration initiatives (local employment, reforestation), alternative ownership (co-operative, social enterprise; farmers/women collective; handcraft makers)

c- Primary sources of finance

Sources of finance that had been considered in various levels of the project include shorter time focus (such as crowdfunding and grants) and continuous income (e.g. courses; sales from plants and products):

1. Funds (crowdfunding, local NGOs, grants)
2. Sponsorship from some respectful, like-minded companies interested in the project
3. Gifts and donations from (outside) the community
4. Consideration of Microcredits
5. Permaculture Centre activities based on Zack Loeks's 3 pillars (detailed below)

*The project's **economic resilience** works at 3 levels:*

A. **Training centre** (running fully in 10 years) offers direct financial income. By diversifying and using multiple (three) interrelated income streams increases resilience by minimises the impacts of an eventual failed funding stream.

1. **Business centre:** AgriHub - hiring (design advice, tools, equipment); value adding of produce (such as honey, preserves); provides farmers' services, hiring implements, small microfinance section; receiving and distributing other organic farms' produce-hub of services to supply
2. **Education centre (education and network):** education as core income through courses, education can also be consulting work onsite and offsite, advice for others' permaculture plots,
3. **Agriculture:** seedling nursery, selling organic seeds and tree seedlings, vetiver grass, sell compost and become outlet /local agent; selling excess vegetables from demonstration plots, including food production (consumption) and surplus for processing into other produce (self-sufficiency and sovereignty), both for sale into community:
    - market day is an opportunity for social outing as the market stalls act as communication centre to advertise the centre and exchange knowledge; exchange of commodities (food, non-food items and services)
    - vegetable box or an alternative could form part of the CSA (Community Supported Agriculture)
    - Development of own seed banks -permaculture training centre future project (harvest local seed) they may need to buy some seeds in at the beginning to maintain variety (see Ecological Dimension 3.2.3a)

B. **Create economic resilience** at the whole community level through direct benefit derived from training centre (advantages invested back to community qualitatively not only financially). Multiple advantages to the community:

- **Diversity of crops to grow** (sugar cane, raised beds plants, moringa) not only he Trust's plots but in collaboration with local farmers: growing wide diversity of agricultural crops leads to improve landscape ecosystem and nutritional/health value
- **New agricultural technique and processing skills:** develop education, skills trainings, jobs, restoring ecosystem
- **Relocalization** of services, recycling waste into internal utilities, self-generation of energy (community income stream, saving money), linking with other facilities in the community
- **Self-sufficiency as an additional factor:** fourth income stream (by reducing the need for external purchase and dependency, thus reducing the need to generate/use further income. Self-sufficiency (food, water and energy) aids savings/independence need to avoid leakage and waste in external purchases and reliance.
- **Food sold from AgriHub,** used for direct consumption or barter within the community, so increase local health/use/economy/involvement

C. **Additional activities**: Local crafts to sustain local economy, workshops run by training centre:

- If obtaining materials to create bicycles or investing in machinery such as tractor they can be hired out to community,
- Mobile chicken tractors in raised beds, side-line business for staff (when not training), building chicken tractors for sale (see Ecological Dimension 3.2.2a)
- Processing sugar from sugar cane and paper from old clothing and plant fibre sugar - see Appendix E19 for sugar cane processing and E20 for Paper making)
- Retrofit old bicycles, create carts /trailer to carry products, children – also build bicycle- or buy cheaply imported human power transport
- Shared use: equipment for agricultural industry, tools and equipment shed to be used for the site or for private repairs (on site repairs) tools (including health and safety) trainings
- Service centre to administer the loans (agency housed at permaculture training centre- opportunity to become Agri-Hub)
- Workshops on other DIY activities such as solar cookers; biogas digesters; wastewater management;
- Raising environmental awareness: selective waste collection; plastic etc. upcycling; children's and art projects
- Job opportunities: living on the site for security: protect crop and maintenance; youth guardians of landscape and livestock

d- Overview of feasibility studies and business plan

In preparation of this report the Design Studio group revised available background information, considered various operation and management options, looked at various proposed and recommended activities. SWOT analysis had been prepared in general and for all four dimensions to uncover the strengths and weaknesses of the project, the opportunities and threats present in the natural environment. The resources required had been partially identified, but needs to be further assessed. The same applies for the financial projections, too. With the available information, strategies had been developed and included in this report with the overall aim to provide a holistic overview and a directions road map to the project.

The project is still in early stage of development, but with an urgent need to eradicate water and food shortages.
A three-fold holistic plan for a **sustainable solidarity economy** is suggested, that is: inclusive and integrative in regards to activities and initiatives (such as local businesses or informal networks), designed towards a common vision for social justice and improved quality of life at the bioregional scale (both human well-being and ecological health).

1. **Gift economy**: goods and services are given without expectation of monetary gain nor reciprocal gesture in return. The reward is based on values such as caring, honour, kindness and sense of community and being the change.
This is necessary in order to initiate the knowledge and resources needed to kick start the project. Buying goods such as building materials and plants in order to store water and grow food require some initial investment currently unavailable to the community which is still highly dependent on external provisions (financially, materially and advisory).
However, the community does not wish to rely on external aid permanently, therefore members need to gain various skills such as business management, marketing, accountancy, building, recycling, counselling, teaching, mediating, facilitating, computing, crafts and derived produce, energy efficiency, agroforestry etc... Funds are essential to cover the fees and travel costs for attendance to various courses or to invite teachers and experts on site.
The primary goal is to spread the word about the project to attract interest of generous donors so that the community can get (financial) help to train itself:

Suggestions for attracting further donors:
Creation of crowdfunding platform(s) (travel costs, course fees, building material, plants, acquisition of animals/transport/tools), but only running one campaign at a time and update with progress regularly

- Improvement of current website to attract donations by:
    - keeping more regularly updated including the addition of photographs and videos from the site progress;
    - offering feedback mechanism, such as an automated response acknowledging receipt of the email and informing of the limited network difficulty, which may affect the time of reply.
    - creation of a message box so that people can contact directly via the website without having to send a personal email
    - update the current contact email address, so that several people can manage including associates or volunteers with better internet access;
- Updating social media (Facebook page) to inform followers about the project's progress and create an associated Facebook group for members to interact more efficiently.
- Inform other interested parties (incl. stakeholders) by newsletters; blog; (later) financial report
- Partnership with organisations (willing to offer free or discounted participation rates to their courses)
- Contact charities with similar vision (offer advice, in kind support or other services such as visibility, endorsement and credibility)
- Apply for grants directly to foundations and NGOs
- Encourage individual fundraising events (social media challenges, charity sale)
- Networking to attract journalists; bloggers; photographers or other artists willing to take part, who could simply help advertising the project or share some benefits (such as from sale of calendar or indigenous recipe book)

2. **Subsistence economy:** based on non-monetary activities (possible barter transactions), wealth is measured in terms of natural resources, which provides the basic needs for direct consumption (primarily from agriculture). The focus on farming, as being the centre of the

project, to create an agrarian self-sufficient society, where the wealth of the community resides in the knowledge of local traditions and agriculture.
This allows the community to become self-provisioning in terms of production of food, harvesting water and other manufacturing e.g. shelter or clothing and to increase agrobiodiversity for human and ecological health.
The aim is to identify suitable (plant) species and locally occurring natural materials in order to:

- design vegetable gardens and food forest following permaculture design and adequate agricultural techniques for food sovereignty
- demonstrate appropriate building techniques mainly for shelter, storage (of food and water), recycling (sanitation, compost), energy generation/saving and harvesting of water (pump)
- education on the importance of native species, reforestation, seed saving and the dangers of urban/Western values and lifestyle- pride of traditional customs and care for the land

(See also Appendix E18 - Future potential uses of plants and materials)

3. **Regenerative economy** (beyond circularity)**:** stable, healthy, resilient and sustainable system which regenerate its assets (natural resources and derived socio-economic activities- mainly natural produce and educational services) and where the benefits provided outweigh the costs (to the environment and long term welfare of the whole community). Empowerment and leadership of community members (and extending to the bioregion) in the creation and reinvestment of holistic wealth from natural product enterprise into education centre.

- turn waste into benefits (plastic, kitchen and farm compost, production of by products, human and animal manure for compost/energy, grey water for irrigation)
- viable enterprises: production of abundance food, plants and derived goods and services (workshop/education/maintenance) to sell, process, exchange and export during markets and events
- repayment of micro loans to be debt free and start of saving fund
- transport infrastructure (bridge, raft), bicycles and communal truck
- creation of unique products and services and own branding
- empowered participation and steward ownership: entrepreneurs become agent of purpose where profits serve as means to a common benefit; the enterprise is controlled by active and responsible participants, not remote stakeholders, in order to honour community and place.
- structured and balanced organisation with relational representatives, clear decision making and financial management strategies, feedback assessments
- become small scale model for local demonstration and replicable elsewhere with creation of learning centre (facilitating capacity building programs)
- create partner programs for field work:
    - marginal land devoted for experimentation (in partnership with external organisations in need for in situ practice)
    - survey progress (biodiversity, crop, diet, employment...) in collaboration with universities or other institutions
- voluntourism: volunteers (particularly experts) to contribute the land regeneration and other areas of project development through self-financed stay. They would receive food, accommodation and involvement in local rural life and customs. The project need experts to take the project forward, but international experts can be very expensive. An option could be mixing volunteers who have experience with paying volunteers, who come to gain skills. Alternatively, offer two options: one for non-paying volunteers e.g. to take their own tent/limited facilities, the other and more expensive programs with more additional benefits to participants, where their fees will be used to pay for

material/training etc. Beneficial skills include: social skills; medical skills; teaching skills; organisational leadership skills. Also, cultural exchange programs, where shona people teach their skills for different skills in exchange.

Potential Expert Volunteers programs include: Habitat International Organisation; UN Nations volunteers' programs; Voluntary Service Overseas

4.3 Economic Conclusions

Economic review:

The current harsh economic circumstances make life even harder for the people of Zimbabwe. When the lack of industry and the low production of traditional farming methods don't provide a living for the residents, new ways are sought to create a collaborative, resilient economy. The Trust's aim is to create a permaculture-based community project, where the focus is on environmentally conscious farming. Through education and skills training the local people will be able to produce goods and services for the local and regional markets and become more self-resilient, while plugging the leaks by keeping money in the community.
The business analysis tools (SWOT analysis, Business Canvas Model, Business Model Innovation Grid, Business Plan and Feasibility Study) helped to map up the strengths, weaknesses, opportunities and threats of the projects as well as the key players; customer segments; costs; channels and potential income streams. The module explores the financial opportunities through the possible pillars (business centre; education centre and Agricultural products) for income streams; suggests ideas for local, regenerative enterprises (croft; DIY; permaculture based) and alternative exchange of goods, without the involvement of money, helping to reduce economic inequality. The project focuses not only on the financial wealth, but on the other seven types of capitals (intellectual, experiential, cultural, spiritual, social, material and living capitals), to look at wealth in a more holistic way, as a sign of peace, prosperity, health, stability, connection with nature, social cohesion and individual happiness (see the Eight Forms of Capitals). The adaptation of the Eight Principles of Regenerative Capitalism and Ten Principles of One Planet Living also emphasise other values and ethics to money/status symbols and encourages qualitative rather than quantitative growth. The Nine Planetary Boundaries and 17 Sustainable Development Goals reflect the economic growth in the environmental and social context.
The opportunities for financial donors and network building (including experts and volunteers) had also been explored including funds and grants; sponsorship; gifts and microcredit.

Table 4.7: Synthesis of MOCT economic aspect

<table>
<tr>
<td rowspan="2">PARTNERS
- Local villages
- businesses, institutions and farmers
- chief and governing bodies
- GEDS Team and volunteers
- Zimbabwe based related organisations (Permaculture Network, PORET etc.)</td>
<td>ACTIVITIES
- permaculture farming
- added value production
- education and skills training
- voluntourism; open days, agrotourism; markets</td>
<td rowspan="2">ECONOMIC VALUE
- raw and processed food, seedlings; organic seeds
- DIY and craft products
- training programs
- exemplar regenerative project
- co-operative</td>
<td>RELATIONSHIPS
- face - to- face and online relationships
- local and international supporters
- agro-ecological networks</td>
<td rowspan="2">CUSTOMERS
- local community
- schools and institutions
- farmers
- students of agriculture; natural building; DIY; sociocracy and related areas</td>
</tr>
<tr>
<td>RESOURCES
- local food and materials
- land, buildings, labour, tools
- sales, grants, donations
- community, educators</td>
<td>COMMUNICATION
- markets; open days, events
- village assembly, stakeholders meeting
-online interaction</td>
</tr>
<tr>
<td colspan="2">ECONOMIC IMPACTS
- higher standard of living
- local jobs
- better infrastructure and access to equipments
- healthier community (nutrition, family planning)
- improved business skills</td>
<td colspan="3">ECONOMIC BENEFITS
- self - sufficiency
- job creation with gender and ability equity/inclusion
- multiple income streams for economic resilience
- new, adaptable business model
- local skills and knowledge built up/exchange</td>
</tr>
</table>

Economic objectives:

By focusing on quality of growth rather than quantity, a more inclusive and healthier economy can be built. The project vision is very wide focusing only one or smaller projects at a time helps to set up milestones, maintain focus and celebrate success. In the conclusion chapter (6b) an action plan is recommended with timeframe, that needs to be reviewed and adjusted. The main economic objectives are:

- Focus on circular and responsible economy and alternative local trading system to decrease external financial dependency
- Diversification of income from organic produce, ecosystem services and local craft products
- Creation of jobs to counter gender inequality, strengthen social structure, sense of purpose and local identity
- 3 pillars (or more) income streams (Business centre; Education Centre; Agriculture)
- Improved access for social exchange, educational programs and external partnerships
- Bioregional and global networking (farmers, similar organisations, connected services, volunteers, experts)

Future economic recommendations:

- To raise initial funds (£15,000) for the project to take off, the marketing/communication strategy needs to be improved. This includes the upkeep of the social media, redesigning the crowdfunding site, approaching potential investors with the funding template, writing grant proposals and creating a strategy plan that gives a useful tool to Evans when talking to stakeholders and other potential donors /partners.

- Create an alternative trading system that can be used instead of money exchange.

- Strengthen existing cooperation and make connections/cooperate with organisations in the area Including with Julious Piti at PORET, cooperation with universities to conduct research, outreach to schools and organisations; publicizing the project on websites and magazines; became part of relevant networks such as the Zimbabwe Smallholder Organic Farmers Forum **(ZIMSOFF);** register as an exemplar permaculture site through **iLand project** and joining **Fair Trade** through **ZOPPA.**

- Measure the qualitative not only quantitative growth of the project **Growth National Happiness Index (GNH)** can be introduced along with carbon offsetting programs.

- Register the Trust as a charity to secure a wider range of funding

5. SOCIAL DIMENSION

From top left: women preparing grass for thatching; children attending class; school feeding program (Maud and Evans giving out the food)

"Social change is a snowball effect that starts within one self, before spreading to society as a whole" - Arthanas Matongo, Zimbabwe 2017 kantharoi participant

5.1 Current Social Situation

a- Social background summary

There are currently 385 orphans and 185 vulnerable children to enrol in the school and who need to benefit from this project in addition to the children that are non-orphan or vulnerable children. The closest school from the community is 15 km away and children do not have easy access to bikes as a mean of transport. The two new plots however are 8 kms apart and the school is 8 km away from the river. There are two schools in the village a primary and a secondary. From the bigger plot there would be 8km to go to school to the village.
Last term the project was caring for (feeding) 1354 children as the social services was giving maize which was completed by the school with vegetables, cooking oil, beans, soya chunks and salt. However, the government has stopped this programme and they can now only care for 66 children as the.
The school would be built in the last plot in the village which is 8km from the road and more than 8km from the clinic. The issue is that the school is far from amenities such as health services. Also, when the river nearby is flooded, the children cannot cross it and need to walk another 14 km to reach it (30 km return), which make them miss the school.

Here are additional issues regarding the social dimension to consider here:

1. Youth lack meaning and spend their time drinking local beer brewed in the community. In order to buy alcohol or other drugs, they steal livestock.
2. Fathers have left their families to find better situations
3. High rate of HIV/AIDS
4. High rate of teenage pregnancy
5. High rate of child marriage in the rural communities
6. Difficulties to reach health services
7. Lack of teachers

There are a number of suggestions to overcome these issues.
The most reliable people in the community are women, as they are the one currently present in the community, they plant food and do most of the work.
A problem with the discipline of the youth is that they normally listen to their father, not their mother. In order to reduce the drinking behaviours and start solving all kinds of problems, youth need to be given something meaningful to do and feel motivated again. Most of them know how to plant food and their inclusion in the permaculture project could give them a new sense of meaning.
In order to motivate them, the chief of the community could ask the kids to come to be trained in the permaculture project in order to become small scale farmers. The kids still have a lot of respect for the chief and although they might be under alcohol influence, they will normally come for the assemblies lead by the chief voluntarily.
This would also be a good opportunity to teach them other skills such as how to help their family and elders, reconnect social bonds, revive rural potential and hopefully reduce adult male work migration.

Another way to bring change is by including all voices such as women in the decision-making processes. Women are in a position of influence in village assemblies and have lots of things to share and say. The absence of men made women become the head woman. There are currently several female collaborators at the Mangwende Orphan Care Trust. A way to make all the community participate in the decision-making process would be to organise **focus groups** and ask open questions to community members (see Appendix B1). This would be a way to hear all the needs and all the wisdom coming out of the community members. Focus

groups would encourage elders and other vulnerable populations to take part in the discussions. Leaders of every family and community as well as teachers would organise discussions. They would ask open questions and take notes about what the common vision or issues would be like to report it then finally to the main representative of the project.

A way to reduce the adolescent pregnancy rate, HIV/AIDS rate and the child marriage rate would be for the community to receive some training on sexual rights given by the UN organisation working in Zimbabwe, UNFPA which can be directly contacted (https://zimbabwe.unfpa.org/en/news/launch-national-teenage-fertility-study-asrh-strategy).
The training could start in the school with teachers and students and then go reach the larger community.
In addition, there is the Waruka Trust Academy which fights against forced and early childhood marriage in the Rural communities in Zimbabwe, which was set up in 2017 by Arthanas Matongo from Zimbabwe.
The main purpose of these trainings is to empower community members, youth and women in becoming their own agent of change.

In order to prevent pregnancy and sexual disease rates, raising awareness into the community is important. There is however also the need to think about the infrastructure when making the school to make it be as safe as possible for girls (and boys too).
Indeed, walking many kilometres alone in the dark to go back and forth from school is not the safest for girls. Here are a few suggestions:

1. Using bamboo bikes to go to school
2. Putting light next to the road
3. Encouraging girls to be accompanied by older trusted children or adults
4. Separating men and women toilets properly

Bringing back the Zunde philosophy in parallel with the permaculture training and education around human and sexual rights would help the community find a better balance and empowerment. This better equilibrium would eventually lead fathers to come back to their families and contribute more fully to the social change already happening there.

In addition to Zunde, there is a need for teachers. The permaculture school would teach science, geography, English, history and maths in addition to permaculture and local language. Teachers are easy to find, but the economic situation makes it hard to pay them. A solution would be to recruit international volunteers as teachers asking them a reasonable fee that would allow local teachers to be paid. Local teachers have skills that international volunteer teachers might not have and vice versa. Local teachers know about the local language and culture, when international volunteers would have other great skills to share such as permaculture skills, English or other. This would allow thus a rich amount of skills to be taught to the children.

b- Social analysis and statements

The SWOT analysis reviews the strengths, weaknesses, opportunities and threats of the social dimension from an internal and external viewpoint:

Table 5.1: Social SWOT analysis for MOCT

Strengths: *Internal:* • Revival of the Zunde social system • Women contributions and knowledge • Dedicated, motivating and inspiring multi-faceted leader (Evans) • Inclusion of vulnerable members and diverse social system • Shared long term vision *External:* • Worldwide collaborators • Bioregional interaction and benefits	**Weaknesses:** *Internal:* • Loss of meaning in life (and alcoholism) • Demographics imbalance due to male economic migration • Girls are not safe and suffer from teenage pregnancy and child marriage • High rate of HIV/AIDS • Need of family planning, sexual and human rights education • Difficulties to reach health services • Lack of teachers *External:* • Difficult access due to poor infrastructure
Opportunities: *Internal:* • Training skills through peer learning • Freedom of expression and empowerment to become actors of change • build new capacities and skills for all • horizontal-shared leadership (vs vertical-unilateral leadership) for more engagement, inclusivity, equity, diversity and responsibilities. • sense of belonging and communal identity *External:* • collaboration with different local, national and international actors from public, private and social justice sectors • Long term potential for eco-responsible tourism	**Threats:** *Internal:* • Lack of understanding and motivation • Governance conflicts *External:* • Instability of political movements • Climate, political and economic migration • No legal security of land ownership, at risk of land grabbing

The following statements were derived from the above SWOT analysis as a guideline for the proposed social solutions.

Social vision:
The social dimension related vision would be to create a cooperative community acting as a model for others, empowering all of its members throughout permaculture and education skills and inspiring the transition of other communities as well.

Social missions:
The mission would include to re-establish family unity, support the implementation of a stable social structure (Academy), enable self-sufficiency (food and water sovereignty, health and facilities) and a regenerative empowered rural community (economic productivity and ecological resilience), an integrative of social diversity in harmony with the local ecosystem and traditional culture, based on the principles of permaculture.

Core social values:
Some of the core social values would include freedom of expression, human rights (i.e. equality, education, right to life for all, freedom from discrimination), collaboration, voluntary

participation solidarity and openness to collaborate with a diverse group of individuals within the community and with other communities which may foster different cultures, empowerment of underprivileged populations (i.e. women, youth, elderly, individuals with disabilities, etc.) by more privileged populations (i.e. men, adults). It would also include respect and inclusion for diversity (ethnicity, gender, age, spirituality, disability, sexual orientation, etc.), integrity and transparency, social justice, education, supportive structure, networking and bioregionalism.

Social goals:

- Create an educational centre for practical demonstration and sharing of knowledge on best sustainable practices
- Revive the local traditional wisdom of the Zunde farming/social structure
- Create infrastructure (lightening, bamboo bikes, foot bridge, separate bathrooms, etc.) to ensure children and mostly girls/women security
- Ensure better access to health services
- Give meaning to youth by empowering them through building new capacities and skills as well as by becoming their own agent of change (becoming themselves trainers)
- Educate the community about sexual and reproductive rights as well as human rights
- Implement a horizontal leadership system where everyone finds its place and contributes actively

5.2 Social Solutions

5.2.1 Community governance

a- How to deal with conflict

In order to feel well and at peace in a community, it is important to know how to deal with conflicts that are entirely normal parts of the process, but not always easy to manage.

More generally, a situation is conflictual when we have lost our sense of connectedness (interbeing), of belonging or of being understood. Issues commonly leading to inefficiency and dysfunction and conflict need to be addressed, such as personal traumas and doubts, unmet basic needs, lack of respect, cohesion and common goals and values, power/rank issues etc. A social structure offering a diverse range of support to prevent these issues from arising is key to prevent conflicts.

Potential causes of conflict in this project:

- Problem of hunger/drought (access to water/food resources)
- Safety women/children (long distance by foot, no lights)
- Jealousy (why care for orphans when personal basic needs are not met which could lead to bad treatment of orphans)
- Economic/employment precarity
- Current power/governance system

In order to **address conflict positively,** one needs to

- clarify misunderstandings
- express their needs
- identify responsibility without blaming others
- promote listening and participation of everyone
- focus on future and common goals

There are some **tools** that can help address conflict positively. We will describe a few of them further:

- Educating communication skills such as Non-Violent Communication, listening, feedback, counselling, etc.
- Fostering healing tools, such as mediation, sharing circle, council, ceremonies, celebrations, games, art, food, activity sharing, workshops, etc

b- Nonviolent communication

Here are some guidelines to be used in case of emerging conflicts among individuals during the process. It can be resumed in these four following components. (For more information on NVC see: https://en.wikipedia.org/wiki/Nonviolent_Communication)

1. **Observation**: State concretely the facts that have been observed making sure to avoid any evaluation or judgement. Use preferentially “I” statements instead of “you” statements.
2. **Feelings**: Say how you feel about the situation you observed
3. **Needs**: state your needs (the ones that have not been met during the situation)
4. **Request**: Suggest a specific action leaving the other person free to decide

Figure 5.1: Principles of NVC

Source: https://www.pinterest.ca/pin/306033737164040765/

- How to give feedback:

There are generally two types of given feedback:

1. **Positive feedback**
2. **Constructive feedback** (better to hear it this way than *negative or critical feedback*)

As it is usually easier to give positive feedback, it is not as easy to provide constructive ones. This is why we suggest starting **by giving positive feedback before giving constructive ones**. Even if you were not planning to give any positive feedback, make sure you find anything positive that will allow the other person to feel valued before being given more difficult feedback to hear. **Always try putting yourself in the other person's shoes**, this will help you develop more empathy and allow the conversation to go more smoothly.

When giving constructive feedback, **review the non-violent communication guidelines**. The other person might also need to share her point of view of the situation and might also have some needs that have not been met. So, make sure to be open to the person's feedback and in return in order to find a good common compromise.

Here is more information https://www.mindtools.com/pages/article/newTMM_98.htm if you would like to go a little deeper on how to give feedback.

- How to receive feedback and practice active listening:

When receiving feedback, but also when listening to someone's opinion or issue, it is important to practice active deep listening. The **Zunde** philosophy also includes lots of wisdom and needs to be taken into consideration as well.

Here are a few guidelines concerning active listening:

- Listen deeply and with your heart
- Suspend judgement in order to stay open to greater individual or group wisdom.
- Try not interrupting the other person until she/he is finished talking
- Reflect by repeating what has been said by the other person (What I hear you saying is that…)
- Summarize
- Ask open questions
- Leave space for silences

Exercice:
People gather in pairs and think about a small they have and would feel comfortable sharing with another person.

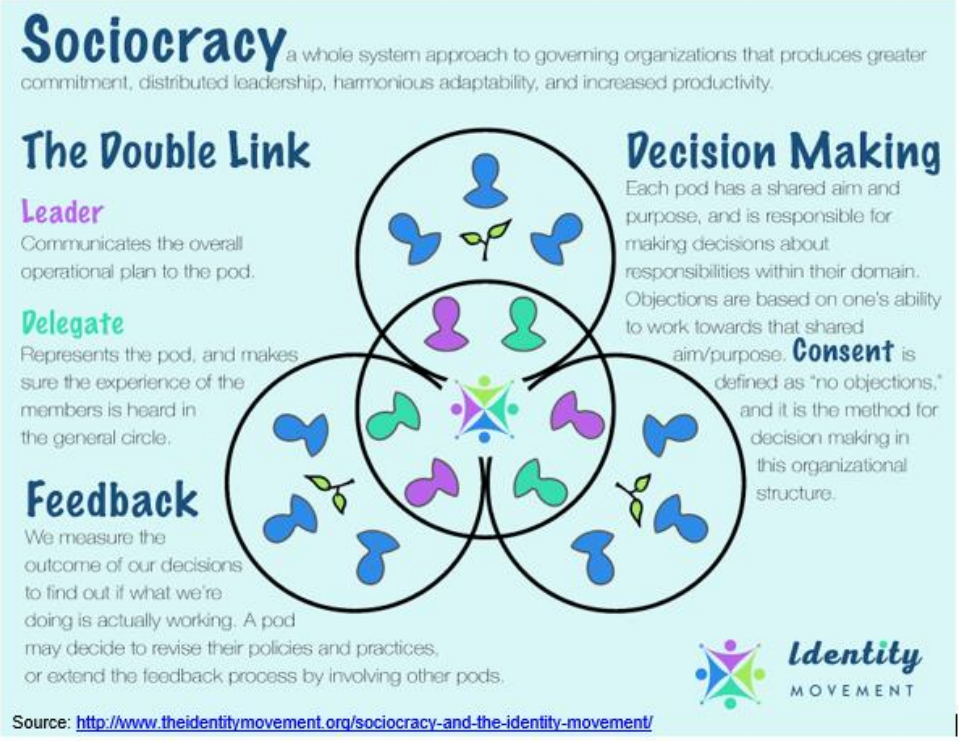
1. **Practice the opposite of active listening**: One person starts talking, but then gets interrupted by the other who comes back to his or her own issue. Do not hesitate to exaggerate the role play (10 min altogether).
2. **Practice active listening:** each person talks 10 min and then switch. The person listening follows the previous guidelines.
3. **Share in group** about the difference the difference felt between the first and second role play.

c- System of governance

In order to have all members of a community motivated to take part in the project, it is important to foster a system of governance that is **participatory** and possibly shared. Indeed, this creates opportunities for all members of any group to give meaningful contributions to decision making and helps to broaden the range of people who have access to power opportunities.
Participation of all members enhances social capital, build and strengthen new existing network of relationships, encourages interactions, encourages different people to bond and share different ideas together.

Here is a suggestion of participatory governance system - the **Sociocracy model** - that can be implemented at the level of the permaculture education school and which values inclusivity, making sure that everyone's voice is heard. It also values collaboration among members. Compassionate communication such as active listening and non-violent communication are tools that are very importantly used in this context.
In sociocracy, there are multiple small groups (8 to 12 people) including 1 leader and 1 delegate that is going to report the main message to another group of delegates. In this delegate group, there will again be a leader and delegate which will again go to another more central delegate group to report the main message, etc. This helps participants to be heard, express their ideas and find some common grounds. This system might be more interesting in certain cases than a voting system where generally half of the participants vote against and are then not participating anymore in the decision-making processes.

Figure 5.2: Schematics of Sociocracy principles



5.2.2 Leadership

The traditional leadership in the village is based on these 4 levels:

1. The top is the Chief
2. Headman (5 in the district)
3. village head
4. Individuals (homestead)

The wisdom of elders is also given an important role.

Leaders are usually active participants and role models, sharing experience and motivating change as well as community development.

Relationship skills of good leaders or facilitators (also called *holistic* leaders):

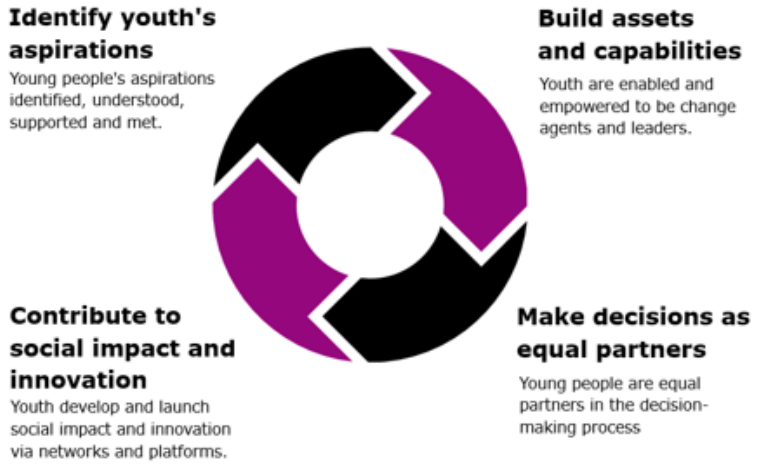
- Honesty and Integrity
- Confidence with humility
- Inspire others (Role model)
- Motivation
- Commitment and Passion
- Compassionate communicators
- Decision-making capacities
- Accountability
- Inclusive
- Empowerment of unprivileged population
- Creativity and Innovation
- listening to people's needs
- Know when and how to give positive and constructive feedback

- Adaptable
- Conflict mediators
- Critical thinkers
- Strategic thinkers
- Foster collaboration instead of competition
- Foster creative not repressive power
- Focus on the quality of relationships.
- Collaborative and participatory
- Bridge builders and edge workers
- Open invitation to new vision
- Offer clarity
- Trustworthy and inspirational
- Enhance communication and reduce tensions by observing, listening, working together and understanding the global/environmental context
- Create a harmonious atmosphere
- Show compassion to improve relationships within community and with external stakeholders

a- Sharing leadership

Leadership can and needs to be shared in order for the whole community to feel involved and motivated to take part in expected changes. Sustainable project involves the empowerment of its members so that they are all practice leadership skills in some way (for example at the basic level of their own life). Leadership is a role, not automatically gained or taken by force by a specific person because of their status or entitlement. Anyone can be a leader depending on abilities and circumstances.
Youth, women, elders and other less privileged populations need to be considered in being given responsibilities as well. This will allow all the wisdom from all subgroups of the community to be taken into account.
Because youth are particularly important agent of change in this project, here is a small chart that helps understand how to include this group in the actions:

Figure 5.3: Youth Engagement Success Framework



Source: https://www.vsointernational.org/news/blog/engage-youth-successfully-to-drive-change

b- Skills to practice to become good leaders

- **"I" skills:** Practice inner work, self-care and awareness necessary for emotional intelligence, ability to respond to change (enthusiastic, authentic, integrity -responsibility, accountability and initiatives- commitment, discipline and humility: admit and learn from mistakes)
- **Relationship skills:** group dynamics awareness, listening, communication and motivation while honouring differences (motivate not control, positive influence and role model, humane interactions, handling conflict, able to receive negative and give positive/constructive critical feedback,)
- **Strategic thinking skills:** vision and goals for the benefit of all, finding resources (clear vision and planning, realistic goals with short term visible miles stones/objectives, empower others/delegate tasks, record resources needed/available)
- **Systemic thinking skills:** meaning of group activities and position in respect to holistic community and external/environmental context, create appropriate structure of organisation (critical thinking: anticipate problems, address weaknesses and seek opportunities- observation and learning, including from other members: adaptive and flexible)

c- Guidance during meetings

It is important to know the different given roles during a meeting. Roles are encouraged to be interchanged in order for all members to experience them (if they want) in order to become more autonomous and reproduce similar meetings more easily.

Here are a few **roles** to define at the start of the meeting:

- Facilitator
- Minute taker (to keep track of the session for following meetings and for absent people)
- Agenda planer
- Timekeeper
- Celebrator of successes

Here are a few key roles of the **facilitator:**

- practice active listening
- be inclusive
- remain impartial
- Suggests the agenda beforehand (what will be the content of the meeting), other topics can be added by other members.
- Suggests the frame of the meeting:
    - One person talks at a time
    - Direction of talking goes in circle
    - Everyone waits for their turn to talk
    - The person talking holds a talking stick and others are listening
    - People talk promptly and don't hold the conversation too long
    - Kindness and empathy is key
- Creates participatory environment (manage conflict, honour diversity)
- Guides group to useful outcome (encourage self-awareness, consensus and proposal)
- Needs to determine the frequency of meetings and who will take the different roles

In addition, it is important for all members to focus equally on the **project, process**, as well as the **relationships** in order to foster a successful project.

Moreover, in order to have a healthy community it is also important to build a good community resiliency. Here are a few guidelines which defines how to build this (from resilience.org).

Six foundations of resiliency:

1. **People**. The power to envision the future of the community and build its resilience resides with community members.
2. **Systems thinking.** Systems thinking is essential for understanding the complex, interrelated crises now unfolding and what they mean for our similarly complex communities.
3. **Adaptability.** A community that adapts to change is resilient. But because communities and the challenges we face are dynamic, adaptation is an ongoing process.
4. **Transformability**. Some challenges are so big that it's not possible for the community to simply adapt; fundamental, transformative changes may be necessary.
5. **Sustainability**. Community resilience is not sustainable if it serves only us, and only now; it needs to work for other communities, future generations, and the ecosystems on which we all depend.
6. **Courage**. As individuals and as a community, we need courage to confront challenging issues and take responsibility for our collective future.

5.2.3 Community celebrations

In order to mark important dates or events, it is important to make celebrations or use rites together as a community, within smaller groups or even by ourselves. By recognizing these important events, this not only helps create collective bonds but also foster evolution, helping to pass from one step to another.

- Rituals used in the community:

Every community or tribe has stories about their ancestors, and they perform different rituals depending on their traditions, beliefs and customs.
As a community they believe that there has to be a **resting day every week** and no one is supposed to work in the fields on this particular day called Chisi in the Shona language. The day differs from village to village.
Mukwerera is a **rain ceremony** marking the beginning of the rainy season. The beer drunk for this ceremony is brewed by elderly women who have reached menopause and are thus no longer sexually active.
The new year or Goreidzva is the celebration of the new year (1 January) and **Christmas** is celebrated on the 25th of December.
School term starts in January and there is a holiday in April. The second term starts in May and school holidays are in August. The third term starts from September to November and there is a holiday in December.
In April or May before harvesting are held the **Green Shows**. These are competitions to select the best farmer in the community and prices are given to the best ones.
August to early October marks the beginning of **Seed Fairs** where farmers with the best seed varieties will win prices and they also have a chance to sell their seeds at competitive prices.

- Other events to celebrate or ritualize within the local or wider community:

- Harvest / abundance celebrations (through planting, collecting, doing market day, biodiversity)
- Life cycles / transition (birth, death, marriage, adulthood, school completion)
- Natural/ seasonal cycles (sunrise, winter, rain…)
- Art giving / sharing (illustration books, wall paintings/posters, school theatre for adult audience, community gift / welcome dance for visitors...)

Art and creativity can convey joy and solidarity, but can also act as healer to express hard feelings, used as a bridge between generations and cultures or considered a teaching material to pass wisdom.
Celebrations take the role of a weaver to link the different dimensions of the project such as transferring worldviews on the ecological aspect can be integrated into a social activity which gains economic advantage (for example a display to convey information about permaculture and village's success to attract visitors who either pay or by buying goods and services).

5.2.4 Bioregional analysis

It is important to have a good bioregional analysis in order to build a good project with strong actors and strong bonds. Here are a few keys to how the bioregional analysis is held in Zimbabwe in general and more specifically around the project itself.

a- General bioanalysis context in Zimbabwe

In Zimbabwe, the land is usually owned by clans with tribal authorities. When those tribes are big, they have wards with a head chief who is responsible for holding cultural values and the traditional system. There is also a headman (usually elders) who are responsible for allocation and management of the land as well as mediating disputes.
Rural lands do not belong to anyone. The advantage is that there is security in terms of land availability, there is no threat from confiscation, cannot be removed or bought from the government or foreign companies – rural areas are peaceful, except for areas near towns, where land can be acquired, which create contested areas with the added western way of living.
The disadvantage however is that there is no financial security. Indeed, the lack of ownership means it is difficult to obtain a loan from the bank: there is very little land worth because there is no freehold title.

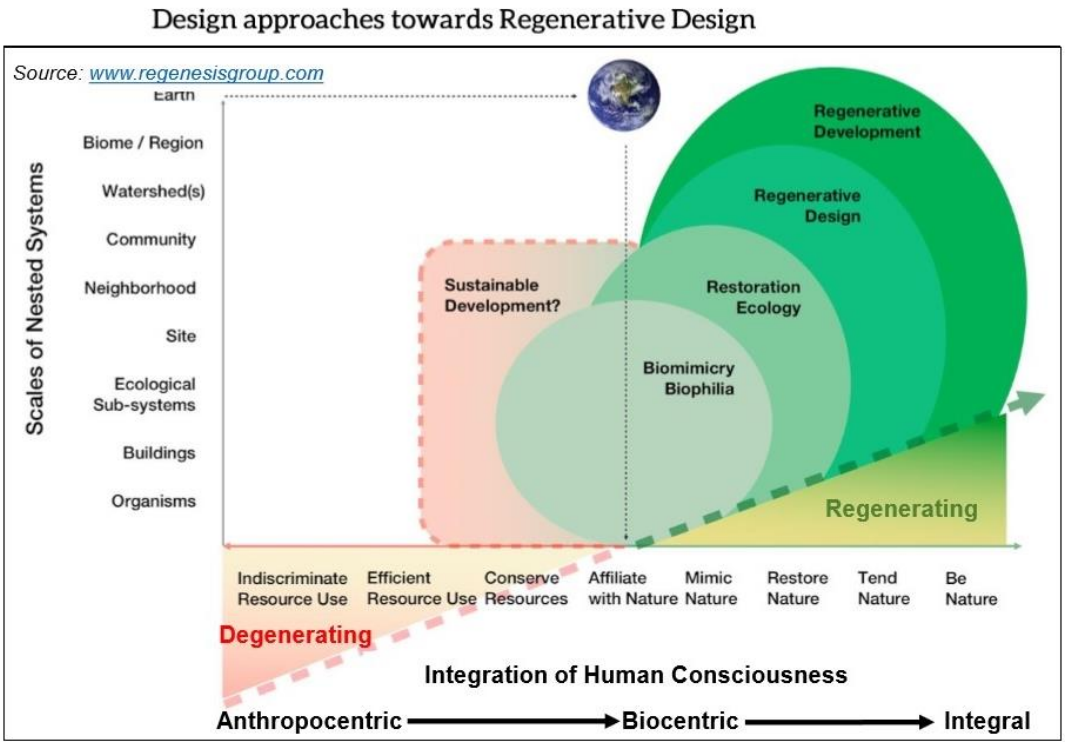
b- Bioregional analysis of the project

Current or potential partners in the region:

- Local community (villagers & farmers)
- Julious Piti (PORET; CELUCT)
- Fambidzanai Permaculture Centre in Harare
- Rural Soil Project
- Mpumelelo: permaculture
- Ecovillage with permaculture workshop: Mybaya
- iLand centres
- GEN Africa
- UNDP
- UNICEF

- UNFPA
- OXFAM
- WhatsApp network for expert knowledge
- Habitat for Humanity
- Engineers without borders
- Sustainable agrifood initiatives in Zimbabwe
- Chikukwa permaculture project
- Waruka Trust Academy

Figure 5.4: Scale linking bioregional map



5.3 Social Conclusions

Social review:

By engaging and empowering the community through asking them their opinion about the different aspects of the project as well as through education will allow everyone to feel motivated in participating in the project, thus creating a more resilient project/community. Fostering **engagement**, **empowerment** and **education** are key. Indeed, considering the whole system of this project will help people better understand how they can contribute to it, but also how they can adapt and transform in case of unexpected changes.
If we help teenagers find meaning in their lives through the implication in permaculture education, they would eventually feel a bigger sense of fulfilment and worth. When the permaculture project will be able to generate revenue and help families sustain themselves, fathers will then be able to come back and become part of the solution.
Reinstoring and honouring back Zunde philosophy while sensitizing about human and rights will also be key in order to restore a peaceful equilibrium within human beings but also between humans and nature. If everyone finds meaning in what they do for the community and for themselves, while owning back their sense of power and responsibility (through empowerment and education), a thriving, autonomous and healthy community can then emerge.

TABLE: 5.2 Synthesis of MOCT social aspect

<table>
<tr>
<td rowspan="2">LOCAL COMMUNITIES
- Local Community
- Community of Murewa</td>
<td>GOVERNANCE
- Respecting local governance
- Including sociocracy
- Horizontal vs vertical
- Inclusive</td>
<td rowspan="2">SOCIAL VALUE
- Freedom of expression
- Respect for diversity
- Human rights
- Voluntary participation
- Solidarity
- Empowerment
- Education</td>
<td>ETHICS
- Respecting the intrinsic value of all forms of life
- right livelihoods
- Fair share</td>
<td rowspan="2">NETWORK
- Farmers
- Julious Piti
- Local, national and international volunteers and institutions</td>
</tr>
<tr>
<td>EMPLOYEES
- Local community
- Orphans and other children from school
- Women, adolescents, elders, men, etc.</td>
<td>SCALE OF OUTREACH
- Local community
- Regional bioregion</td>
</tr>
<tr>
<td colspan="2">SOCIAL IMPACT
- Empowered individuals (orphans, children, adolescents, women, elders)
- Community autonomy
- Owning back each others sense of responsibility
- Restoring meaning in adolescents' life
- More security for women and girls</td>
<td colspan="3">SOCIAL BENEFITS
- Less drinking behaviours from adolescents
- More motivation from all community members
- Unlock individual and collective potential
- Creation of new and meaningful jobs and activities
- Fathers might more easily come back</td>
</tr>
</table>

Social objectives:

- Establishing a self-sufficient community through teaching orphaned and partly orphaned kids holistic permaculture skills will serve as a blueprint for other communities in Zimbabwe or worldwide.
- An inclusive approach that takes into consideration everyone's voice and participation and makes sure every person is heard, respected and safe will be the most profitable.

It is important to sensitize community, girls and men about human rights and put into place strategies to prevent sexual violence towards vulnerable girls. Education is key in preventing sexually transmitted diseases and HIV/AIDS.

- There is an already existing leadership form, but it would be very beneficial to suggest some type of shared (empowering) leadership at other levels of the permaculture education project using the Zunde philosophy and other tools such as non-violent communication.
- Importance of celebrating each step.

Future social recommendations:

- Informative and applicable course layouts
- Educational permaculture curriculum design
- Introducing participatory government
- Using non-violent communication
- Connecting with local and regional organisations

6. GENERAL CONCLUSIONS

Evans working with volunteers to secure fencing around the permaculture garden

“Success, like happiness, is the unexpected side effect of one's personal dedication to a cause greater than oneself” - Viktor Frankl

a- MOCT Overview

The Mangwende Orphan Care Trust was launched to promote empathy, love, collaboration, trust and respect for all living beings, to transition from the current begging attitude (no longer able to depend on the diminishing aid) towards participative contribution by replacing scarcity with abundance. It has the possibility to become a role model for many other places in the region, in Zimbabwe, in Africa or even worldwide.

Starting from a disposition with minimal resources, the centre is set to create a self-sustaining program based on the revival of the Zunde reMambo values of sharing and caring. Similar conditions are to be found elsewhere in the world where orphans and financially disadvantaged populations, have the chance to be granted access to a piece of land to protect or restore, as a means to empower their own livelihood and revitalise the local community dynamics and economies. The key is to be found in permaculture design through the idea of establishing an organic demonstration garden not only to feed these children but for teaching the local farmers the guidelines of a holistic sustainable design and spread this experiential learning to the whole community and beyond.

Regenerative agricultural practices contribute to reducing emissions and restoring the water and carbon cycles, thus improving local farm productivity, bioregional landscape functions while also increasing global resilience to climatic variability. Food has this power of influence.

Food is more than a commodity and it depends highly on the water supply which is low in the region. By using the minimal natural water supply as efficiently as possible, a self-managing food production system is established. Hereby, the soil is restored in its structure, fertility and water services, giving back true meaning and value to the land. Soil and vegetation management offers the added potential for enhancing the capacity to sequester and stabilise atmospheric carbon, thus providing a solution with rippling effects to the pressing planetary challenges.

The orphanage, agri-hub and permaculture farm form a solidar pedagogic centre. It offers a unique opportunity to transition from local to global impacts by connecting residents with visitors and to the land through gardening and communal celebration through festivities, training and the simple act of sharing meals. A place where the contribution of each participant is valued together with the high importance of protecting fresh air, clean water, biodiversity and the beauty of nature, culture and societies.

The proposed design offers the opportunity for the local Mwera community to invest in themselves, to create change by restoring their land and to regain pride in their role as protector of the past, current and future continuity of life. By replicating to neighbouring villages, it will help motivate individual responsibilities for common benefit by regaining a sense of stewardship for the bioregion, natural ecosystem and traditional values and culture.

-Worldview factors: Due to the industrial exploitation of the area, Zimbabwe and African communities in general, a lot of ancient knowledge of planting and farming are going extinct and the connection between nature and humans is not very strong. Restoring the regional Zunde tradition combined with permaculture principles however is supposed to help enhance this connection and create a new spirit of ancient traditions and modern global conscious feeling of connectedness to nature and the holistic system. This can be achieved by bringing the elderly and especially the women into the design process and find a way to restore their wisdom and integrate it into permaculture guidelines. Also the local traditional festivities and celebrations are intended to be revived so that they enhance the collective and traditional spirit within the community.

-Ecological factors: The key towards a self-sustaining permaculture centre is through a holistic approach towards environmental stewardship. This means to sustain the site respecting agro-biodiversity, establishing a holistic interdependent system and therefore improving human health and livelihood. Eco literacy is a fundamental component to success which relies on understanding the advantages of respecting Nature in order to benefit from the multitude of ecosystem services. Water and soil are essential resources to be preserved and so must be protected the surrounding natural forests too. Through a detailed keyline design with swales, forest belts and raised beds, the aim is to rehabilitate the harmony between humans and the environment without impending on the existing capitals.

-Economic factors: As there cannot be much financial help expected from the government of Zimbabwe and even less from international industries, the main goal within the economic dimension is to constitute economic independence. This is supposed to be achieved mainly through eliminating expensive farming costs and dependence upon GM seeds and industrial pesticides but also to free from the reliance on the declining governmental subsidies or international aid like school meals. The education centre is supposed to grow through participation of farmers (instead of external stakeholders) and create jobs in farming, construction, education, shop for farming products and seeds, etc. and therefore strengthen the region's infrastructure and economic prosperity and keep the money within the region. Also, a local trade system, independent from money, is a suitable solution to exchange products of the farm and other material goods and services within the local or regional community.

-Social factors: The proposed establishment of a self-sustaining education centre is aimed to bring back jobs (and therefore men) into the region and enhance the collective spirit of the locals. Especially the youth who appears hopeless and unmotivated at the moment is warmly invited to participate and integrate themselves into the design and construction process, so that they understand the possibilities for their community and therefore find a meaningful purpose in the project. The project is supposed to grow and also enrichen resource streams regionally so that it can also become an information centre and role model for other communities elsewhere

b- Action plan

Each goal successfully achieved by the Mangwende Orphan Care Trust is derived from the succession of interlocking and thoughtfully planned actions and decisions in accordance with its core values. This is achievable thanks to the flexible social and organisational structure of the Trust and its activities, bringing back cohesion, purpose and pride within the Muwera community to reach its long-term vision. The objectives are therefore categorised following a broad timeframe such as the first steps to be implemented **immediately** (within six months to one year), the **short term** period expands to two to three years and the **long term** aims for a plan still viable in three years and beyond. Meanwhile certain tasks ought to be undertaken on a **continual** basis.

Figure 6.1: Timeline of objectives

Further suggestions:

- Discuss the proposed program of this report for consultation, feedback and final approval within the community to be included as part of the decision-making process and to tailor a more appropriate action plan in accordance to their needs and means
- Ensure that the vision, missions and values of the community is communally shared, reassessed and constantly commemorated. Feedback loop: continually learning from the system and reassessing design
- Finalise business plan, administrative, governance and organisational structure of the social enterprise
- Define a precise timeline and undertake a budget analysis.
- Officialise the cooperative and register the Trust as a recognised charity (to benefit from Gift Aid, fundraiser events and advantages such as promoting fundraisers on Facebook/Ebay)
- Secure the legal ownership and natural status of the land to protect local occupancy against external exploitation (and legislate access to and distribution of the Commons)

- Agree on a written charter or Common agreements with ethical guidelines for members and visitors
- Link to a platform for open source knowledge for communal sharing of advice, experience and donations in kindness
- Consolidate communication strategies (such as updating website, offering training in marketing, presentation and language skills and IT literacy) to reach investors, donors, collaborators, experts or volunteers
- Join membership for specialised international groups such as holistic management, GEN, Gaia Ed etc to broaden network of influence
- Design training programs (PDC, mental health awareness, hygiene, family planning, crafts)
- Liaise with different institutions (such as university students, scientists or social researchers) for future projects, field work, or assessments (health, building design, agriculture, happiness)
- Expand outreach via publication of articles, blogs and products derived from photographs, reports, recipe books
- Consider various offsetting programs to compensate for unavoidable emissions (such as transport for visitors)
- Set up a Zero Carbon, Plastic, Waste policy (or set-up tax/fines)
- Investigate the possibility of eco-voluntourism (include excursion package combined with ticket to Harare horticulture garden)
- Introduce Happiness Index as a measure of quality of life as an alternative to measuring the financial growth only
- Improve marketing strategy

"An adequate strategy will enact an ethic grounded on the relational interdependence of everything that exists. It will embrace diversity and pluriversality; autonomy and sufficiency; solidarity and reciprocity; commons and care; the integration with Nature and Nature's rights; simplicity and sufficiency; rights and responsibilities; ecological sustainability; and non-violence and peace. An adequate strategy will tilt towards the marginal, the exploited, and the oppressed. The transformations and transitions will give time to integrating the multiplicity of dimensions: political, economic, social, cultural, ethical, and spiritual." Extracted from:
https://www.opendemocracy.net/en/oureconomy/development-colonialism-disguise/

7. RESOURCES

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Sambalino, F., Steenbergen, F. (2012). Securing Water and Land in the Tana Basin: a resource book for water managers and practitioners.

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Spaling, H. and Kooy, K. (2019). Farming God's Way: agronomy and faith contested. Agriculture and Human Values. 10.1007/s10460-019-09925-2.

Yeomans, P.A. and Yeomans, K.B. (2008) Water For Every Farm: Yeomans Keyline Plan.

7.2 Further reading

7.2.1 Worldview

Solution Library: https://ecovillage.org/solutions/?gen_region=gen-africa

Creativity and expression: https://www.the-open-mind.com/the-african-village-where-every-house-is-a-work-of-art

Theatre of the oppressed https://www.cardboardcitizens.org.uk/theatre-oppressed
https://www.youtube.com/watch?v=vi1HfSiMxCU

Sharing positive stories: http://www.dailygood.org/share.php

Make videos: http://www.karmatube.org/index.php?op=subscribe
Free/easy website: https://www.servicespace.org/about/index.php?pg=cfsites

Community support:
https://www.ted.com/talks/dixon_chibanda_why_i_train_grandmothers_to_treat_depression/transcript

Ecological Medicine: http://www.sehn.org/ecomedicine.html

Life principles: https://bio-sis.net/life-principles/

7.2.2 Social

similar local project review:
https://sustainableagriculturezimbabwe.wordpress.com/2013/08/29/sustainable-agrofood-strategies-in-zimbabwe-sovereignty-community-and-eco-social-transformations-part-iii/

Women:
https://onetreeplanted.org/blogs/stories/women-climate-change
https://news.mongabay.com/2019/04/study-concludes-that-nature-benefits-when-more-women-make-land-management-decisions/

Leadership program on social entrepreneurship, environmental protection; human rights; education and disability : https://www.kanthari.org/about-us/

Focus Group Discussion:
https://www.swisstph.ch/fileadmin/user_upload/SwissTPH/Topics/Society_and_Health/Focus_Group_Discussion_Manual_van_Eeuwijk_Angehrn_Swiss_TPH_2017.pdf

Teenage pregnancy: https://zimbabwe.unfpa.org/en/news/launch-national-teenage-fertility-study-asrh-strategy

Inspiration/empowerment/conflict:
https://www.youtube.com/watch?v=vi1HfSiMxCU
https://www.cardboardcitizens.org.uk/theatre-oppressed

Nonviolent Communication: https://en.wikipedia.org/wiki/Nonviolent_Communication

Communication and leadership: https://ideas.ted.com/what-great-leadership-and-music-have-in-common/

Giving feedback: https://www.mindtools.com/pages/article/newTMM_98.htm

Youth engagement: https://www.vsointernational.org/news/blog/engage-youth-successfully-to-drive-change

Birdsongs: https://www.facebook.com/events/506094730206113/
https://www.facebook.com/events/1120192638369051/

Sociocracy: https://www.youtube.com/watch?v=b6r3-s2p7eI;
http://www.theidentitymovement.org/sociocracy-and-the-identity-movement/

Community resilience: https://www.resilience.org/six-foundations-for-community-resilience/

Key roles of women:
https://onetreeplanted.org/blogs/stories/women-climate-change
https://www.ft.com/paidpost/columbia-business-school/when-women-rule-nations-prosper.html

7.2.3 Economic

Happiness index:
http://www.grossnationalhappiness.com/Questionnaire/2015%20GNH%20questionnaire.pdf

GDP and current Zimbabwean economy: https://tradingeconomics.com/zimbabwe/gdp-per-capita

https://www.bbc.co.uk/programmes/p07qn5qc

https://www.aljazeera.com/ajimpact/economic-crisis-deepens-zimbabwe-president-pleads-patience-191001133947141.html

Business plan requirement summary: https://ecovillage.org/solution/creating-a-business-plan/

Gift economy: https://ecovillage.org/solution/gift-economy/

Credit: http://www.letslinkuk.net/

Microcredit: http://www.zmwft.co.zw/

Funding:
https://www.fundingcentral.org.uk/access.aspx;
https://www.servicespace.org/about/index.php?pg=cfsites

Mobile payment: https://www.obopay.com/money-management-solutions/

Payment for environmental services: https://www.iied.org/markets-payments-for-environmental-services; https://ecosystemsknowledge.net/resources/tools-guidelines/pes

Alternative trading systems: https://www.community-exchange.org/home/

Andro Leopold's Land Ethic: https://www.aldoleopold.org/about/the-land-ethic/

GoFundMe page: https://www.gofundme.com/f/mangwende-permaculture-center?fbclid=IwAR0a46nteAhbidMcZDLN5yFeY3Z530ep4RxF47zZnXsW9QGNi-XWNo8eaxI

One Planet Living: https://www.bioregional.com/one-planet-living/

ReConomy: http://reconomy.org/starting-a-reconomy-group/five-steps-to-reconomy/

Solidarity economy: www.socioeco.org

Business partners/collaborating organisations
http://kazanaturaloils.com/#home
http://naturallyzimbabwean.com/2015/07/01/marula-makes-a-difference/
https://www.redsoilproject.org/
http://fambidzanai.org.zw/
https://www.vsointernational.org/

7.2.4 Ecological

- Agriculture:

Ecological training: (RESCOPE program): http://seedingschools.org/blog/94-permaculture-in-schools-in-southern-and-eastern-africa

Zimbabwe farming issues: https://viacampesina.org/en/wp-content/uploads/sites/2/2018/11/Zimbabwe-final_layout.pdf

Food marketing: http://naturallyzimbabwean.com/2017/12/21/our-magnificent-indigenous-fruits/

Boschveld chicken:
http://naturallyzimbabwean.com/2016/03/23/the-boschvelds-are-back-in-town/

Natural oils: http://kazanaturaloils.com/

Seed banking: https://inhabitat.com/diy-how-to-start-your-own-seed-bank/

Companion plants: http://guyanachronicle.com/2015/01/17/companion-planting-final-part

Agroforestry plants information: http://old.worldagroforestry.org/

- Plants:

Native cultivated plants of Zimbabwe: https://www.zimbabweflora.co.zw/cult/index.php

List of trees by Trees for the Future in Africa: https://trees.org/faqs/

Moringa: https://www.idc.co.za/wp-content/uploads/2019/06/Luhlaza-ISS_Moringa-Research-Study_Final-Report.pdf

Bamboo: https://www.scribd.com/document/141583688/African-Bamboo-Species

Jatropha: http://www.angelfire.com/ks3/go_diesel/files042803/jathropa2.pdf
http://www.ong-adg.be/bibliadg/bibliotheque/opac_css/doc_num/divers/the_jatropha_booklet.pdf

Aloe vera health benefits: http://www.healthymuslim.com/articles/fewed-aloe-vera-a-natural-cure-for-cancer-diabetes-inflammation-and-much-more.cfm

Num Num: https://en.wikipedia.org/wiki/Carissa_macrocarpa

Kei Apple: https://en.wikipedia.org/wiki/Dovyalis_caffra

Raffia: https://abury.net/blogs/abury-blog/natural-raffia-fair-fashion ;
https://www.edenproject.com/learn/for-everyone/plant-profiles/raffia ;
https://pfaf.org/user/Plant.aspx?LatinName=Raphia+hookeri

In shona language: https://www.aquamor.info/uploads/3/4/2/5/34257237/mhm_booklet_-_shona.pdf

- Water:

Water systems and water tank construction: http://metameta.nl/wp-content/uploads/2010/05/FINAL_tana_manual_digital_LQ.pdf

Ceramic water purification: https://s3.amazonaws.com/PfP/IDEASS+pamphlet.pdf

Sand filtration:
https://www.aquamor.info/uploads/3/4/2/5/34257237/sand_filtration_of_water.pdf

Water distiller : https://www.instructables.com/id/DIY-Solar-Water-Distiller-Simple-Solar-Water-Disti/

Ram pump: http://www.homeandgardeningideas.com/homemade-ram-pump/

Ram pump DIY: https://www.doovi.com/video/how-to-make-the-hydraulic-ram-diy-hydraulic/O2w7IQtbzPQ

Rope pumps: http://www.ropepumps.org/how-to-make.html

Building a rope pump: https://www.rural-water-supply.net/_ressources/documents/default/ROPE-Pump_Mozambique_Manufacturing_English_Ed-2006.pdf

Installation of rope pump: https://www.rural-water-supply.net/_ressources/documents/default/ROPE-Pump_Mozambique_Installation_English_Ed-2007.pdf

Manual bush pump:
https://www.aquamor.info/uploads/3/4/2/5/34257237/paper._zimbabwes_user_friendly_bush_pump.pdf

Bush pump:
https://www.unicef.org/videoaudio/PDFs/RFP_ZIMA_2014-0_Borehole_Drilling_Phase2_Annex18.pdf

Spiral pump: https://lurkertech.com/water/pump/tailer
https://docs.google.com/document/d/1JelRZfnxmUbKbB9dnyAOPxIObS646k1AFjXLMIaqZg4/mobilebasic

Water harvest with mesh: http://www.warkawater.org/warka-tower/;
http://www.fogquest.org/f-a-g/

Water transport: http://www.toshekaproducts.co.ke/home/tosheka-rolling-springs/

- Sanitation:

Peter Moran from Harare (toilets, pumps, sanitation, filtration): https://www.aquamor.info

Hand wash:
https://www.aquamor.info/uploads/3/4/2/5/34257237/ess.15.how_to_make_simple_hand_washing_devices.pdf

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Arborloo: https://www.aquamor.info/uploads/3/4/2/5/34257237/manual_for_the_arborloo.pdf

Compost toilet: (video) https://www.permaculture.co.uk/videos/embercombes-dual-vault-compost-toilet-design

Grey water system: (video)
https://www.youtube.com/watch?v=uZXMOfkrZYA&fbclid=IwAR2Og6mX82UP_icsQhM_lSD5zXW1LOzjHzfr38QPoX5iJBeaw2CvPU61f1I

Female hygiene: banana pad sanitary pads:
https://www.appropedia.org/Banana_Tree_Fibre_Female_Hygienic_Pads

- Building:

Plastic bottle building: https://www.ecobricks.org/how/

Green walls: https://www.salisburygreenhouse.com/workshops/how-to/pallet-garden-how-to/

Charcoal wall chilled room: https://www.youtube.com/watch?v=ipqvedQW6a8

Earthen floors: https://www.milkwood.net/2014/01/28/making-a-diy-earthen-floor-two-methods/
http://sustainablenations.org/Resources/earthenfloor.pdf

Sugar mill: https://www.youtube.com/watch?v=qMx6u0fr4Ao

- Transport (and art project):

https://detours.canal.fr/pour-eviter-labsenteisme-cette-ecole-va-chercher-les-eleves-en-train-tonneau
https://pre-tend.com/scool-bus-lets-go-to-school-by-bike/
https://www.edutopia.org/article/climb-aboard-school-buses-reimagined-emelina-minero

Bikes (bamboo/wood): https://inhabitat.com/zambikes-bamboo-bikes-that-help-fight-poverty-save-lives-in-africa/ https://ourworld.unu.edu/en/riding-towards-sustainable-development-on-bamboo https://www.coroflot.com/TomasAguila/Moto-electrica-sustentableSustainable-E-Bike#keyword=Sustainable&sort_by=5 https://www.handimania.com/diy/bamboo-bike.html

Wood scooter: http://www.saffron-ventures.com/personal/woodbikes/

Trailer:
https://customwagonwheels.com/wp-content/uploads/2014/08/prod_lrg_mormon-hand-cart-2.jpg
https://i.pinimg.com/236x/7b/2e/28/7b2e287d405f2fed86e2dde2441ba804--bike-trailers-cargo-bike.jpg
https://senaterace2012.com/wp-content/uploads/floriana-design-more-candy-cart-diy-plans-creative-idea_37139.jpg

Pedal powered tractor: https://farmhack.org/tools/culticycle
Bike powered generator: https://www.treehugger.com/slideshows/gadgets/make-bicycle-powered-generator-10-steps/

Tree canopy crossing:
https://boingboing.net/2010/03/22/kids-take-high-altit.html ;
https://charlottephilby.com/features/britains-best-treetop-walks/ ;
https://www.alamy.com/stock-photo-painet-hl0243-canopy-walking-cagayan-oro-mindanao-philippines-trees-11392354.html

Bridges for flooded areas: http://mentalfloss.com/article/526199/footbridge-netherlands-transforms-rising-waters ; https://www.shutterstock.com/image-photo/walking-legs-on-footbridge-flood-venice-127759214
https://www.biomatrixwater.com/wp-content/uploads/2019/02/spiral-floating-garden-biomatrix.jpg

- Energy:

Solar energy generator: https://www.madisonzim.com/

Energy supply : http://zimsolar.co.uk/cgi-bin/online/storepro.php
https://www.solarcity.co.zw/product-page/2-0kw-solar-system

Hydrogen storage : https://www.energy.gov/eere/fuelcells/hydrogen-storage;

Algae for energy storage: http://www.growenergy.org/verde

Solar air heater :
https://www.builditsolar.com/Experimental/PopCanVsScreen/PopCanVsScreen.htm
http://www.reuk.co.uk/wordpress/solar/make-a-simple-solar-air-heater/

Vertical wind turbine:
https://www.instructables.com/id/Building-a-Vertical-Axis-Wind-Turbine-VAWT-/

Horizontal wind turbine : https://www.instructables.com/id/How-I-built-an-electricity-producing-wind-turbine/

Timber windmill :
https://www.youtube.com/watch?v=Uv3Pn2DFkDw&feature=emb_rel_pause

Self-made water turbine:
https://www.hunker.com/12201924/how-to-build-a-homemade-water-turbine-generator

Biogas systems : https://wildaboutafrica.wordpress.com/2010/07/27/details-of-the-flexi-bag-biogas-system/

Small scale biogas : https://www.instructables.com/id/Biogas-Digester /

Biomeiler: https://www.youtube.com/watch?v=Fcd4_UZ7hus
www.native-power.de

Biogas:
http://www.solarcities.eu/education
https://ecovillage.org/solution/biogas-everywhere/
http://www.build-a-biogas-plant.com/PDF/20140708033708_Construction%20Manual.pdf
http://itibetan.org/biodigester.htm; http://bio-gas-plant.blogspot.com/2012/01/mini-biogas-digester-project-photo.html?m=1

Wind turbine: DIY
https://www.instructables.com/id/How-I-built-an-electricity-producing-wind-turbine/
https://www.motherearthnews.com/renewable-energy/wind-energy/diy-wind-turbine-zm0z17amz?slideshow=6

Lamps from plastic bottles: https://uk.blastingnews.com/science/2017/07/these-plastic-bottle-lamps-are-brightening-lives-across-poor-countries-worldwide-001883969.html

Street light: https://mashable.com/2016/10/20/a-liter-of-light/?europe=true

Clean cooking forum: https://www.cleancooking2019.org/

Solar cooker:
https://greenterrafirma.com/diy-solar-oven.html https://www.sciencedirect.com/science/article/pii/S0048969718330894#f0040;
http://www.lowtech.co.za/solar-oven
https://solarcooking.fandom.com/wiki/Easy_Lid_Cooker

Earth oven: https://www.appropedia.org/Blue_ox_earthen_oven

Solar heater: https://greenterrafirma.com/solar-air-heating.html

Mass heater: https://richsoil.com/rocket-stove-mass-heater.jsp; https://en.wikipedia.org/wiki/Rocket_mass_heater http://elkecole.com/2018/12/smoke-free-kitchen/

Heat pumps: http://thegreenhome.co.uk/heating-renewables/heat-pumps/how-do-heat-pumps-work/ https://www.wbdg.org/resources/geothermal-heat-pumps

Thermal bag cooking: https://permies.com/t/8127/kitchen/Haybox-Cooking-Thermal-Cooker-Box?fbclid=IwAR1fC5FNWlYJSib1mCY8uVqgxeBkJiYqu8OpR_ElttLAfuxV-so0uyaOPck; https://www.theatlantic.com/business/archive/2014/04/the-slow-cooker-that-requires-no-electricity/361343/#b05g08t20w14

Off grid system in Ghana: https://www.youtube.com/watch?v=iasTvDbXiu4&feature=youtu.be&fbclid=IwAR0EJ713Bxn3YAiVoMSturQOxgzjrsKxXN08SWsGF4Oy0FzWj3YTtpAXqIc

Collection of low tech solutions in Africa: *https://snv.org/explore-more*; Solar CITIES = Open Source Education for Biogas, Solar Thermal, Small Wind, Photovoltaics, Gasification and more

8. CONTRIBUTIONS

8.1 Acknowledgements

The starting point is inspiration and enlightenment. For this, it was a great pleasure to assist **Evans Mangwende** (https://mangwendeorphancaretrust.org) who is an effective, committed and influential visionary change maker, in his hope to make lives better for his community by planting, literally, the seeds towards independence.
A special thanks goes to **Gaia Education** (https://gaiaeducation.org), in particular Giovanni Ciarlo, May East and James Stix, for accepting the proposal for this case study as part of the GEDS (Design in Sustainability Design Studio) and for expressing support to promote the project among its community. The authors would like to extend their immense gratitude to the GEDS Case Study course facilitator, **Ezio Gori** (http://www.permaculture2012.co.za) for his generous availability and patience, constant enthusiasm and highly valuable advice and feedback, greatly contributing to the progress of this report (especially towards the business strategy and the keyline process for the permaculture concept plan).
Further collaborators also deserving mention for their personal involvement in the project and specifically helping the team with assistance on grant proposals, provision of photographs, creation of a fundraiser campaign and fliers and online communications (namely, Robin Woolner, Eller Everett, Adam French and Marlon Keanu Christ).

8.2 Authors

This project was initiated by the team leader, Viktoria, after learning about the Mangwende Orphan Care Trust in the Ecosystem Restoration Camp group. The team was originally formed by three members (Viktoria, Nadia and Eve). After familiarising themselves with the background of the local situation and sending an initial contact survey to the community, the authors collectively formulated their vision as they imagined the transformation towards a realistic future prospect supporting abundance, consciousness and sharing: “To facilitate the foundations and framework of a holistic design for a permaculture educational community centre addressing the immediate needs (orphanage) while securing its future success (agrihub) and acting as a pilot model of ecovillage to be replicated at a glocal scale”. As positive and holistic agents of change, their mission was agreed to provide guidance on the functional processes to lead the organisation of the MOCT (methods of self- governance) based on the concept of right livelihood (respect of human rights, nature and local traditional culture) and help transitioning its community into regenerative agriculture and holistic wealth.
A fourth member, Tilla, subsequently joined the group. As a professional graphic designer, she specialised to produce the permaculture concept map based on the keyline design elaborated by Viktoria. The authors all then attempted to answer some of the probing questions for each of the four dimensions, as part of the interdisciplinary training to become qualified consultants in sustainability design.

In parallel, Viktoria and Nadia jointly investigated related aspects of the project such as identifying and contacting numerous organisations for obtaining seeds, discussing potential future partnerships and funding opportunities, creating advertisement on social media, offering suggestions to improve the current official website, liaising with the other collaborators to promote a crowdfunding strategy and create fliers or facilitating the participation to an EDE course. They both also kept contact with the Trust founder, Evans, and the course facilitator, Ezio, in order to explore in more detail specific design models to gather the necessary documentations and references for creating the various graphics and also to further

researching incomplete designs across the four dimensions so to facilitate the overall writing-up phase afterwards.
Meanwhile, Nadia combined all the materials as part of the integration process to organise the structure of the whole report. Following this, the team chose to write the report in the form of a guidance to provide a tailored advice to help the community develop their strategic action plan. Deriving from the previously researched information, members divided the report so that the final writing of specific sections was based on their individual affinity, such as Nadia, being a research scientist, favoured the writing of the Ecological dimension and wrote the general Introduction as well as the Executive Summary. Viktoria, having some experience in the Business Canvas Model decided to write the Economic chapter and helped with the Energy module. Eve, being an educator and counsellor, chose to focus on the writing of Worldview and Social, with help respectively from Tilla; who, together with Nadia contributed towards the general Conclusion.
Viktoria an Nadia assembled the Appendix and generated all the graphics, from which Viktoria compiled a slide show and a bonus promotional video (https://videopress.com/v/MFamOnL1) to present for educational, investment or marketing purposes.

8.3 Disclaimers

All content (writing, photos and graphics), unless specifically referenced, represent the views of the authors and can be shared freely from copyrights.

9. APPENDICES

Appendix table of contents:

Appendix A: Communication

A1 - Mangwende Orphan Care Trust - Further Information

Trust details:
Registration number: 0000435
date of registration: April 2015
Contact details: LOVENESS JANI (Secretary): 0777 622 897,
EVANS MANGWENDE (Head of Trust and Project Manager): 0772 954 545

Address: Mangwende Orphan Care Trust,
Dombodzvuku Primary School
Box 830, Marondera, Zimbabwe
Tel: +263772954545
Email: mangwendeorphancaretrust@gmail.com
Website: https://mangwendeorphancaretrust.org/
Facebook: https://www.facebook.com/Mangwende-Orphan-Care-Trust-315653568626213

For donations:
Marlon Christ
IBAN: DE98430609671177157201
BIC: GENODEM1GLS
Country: Germany
(Authorised account for donations)

LIST OF TRUSTEES

-Evans Mangwende (Founder & Trustee with accredited permaculture design certification)
-Tichafa Chibanda (Founder & Trustee)
-Maud Nyerai Tonha (Founder & Trustee)
-Nhamo Muterere (Trustee)
-Tayengwa Chibanda (Trustee)
-Tafirenyika Chibanda (Trustee)
-Charles Togarasei Mukarakate (Trustee)
-Marlon Keanu Christ (Assistant Project Manager and website developer)
-Loveness Jani (Secretary)

A2 - Associates and volunteers

Robin Woolner: is a human systems designer focusing on landscape management in rural villages. He builds competencies within villages and connects the dots outside to foster harmonious human-nature relations.
Horticulturist, worked with Ecosystem Restoration Camp in Spain; he says in his report, that Evans contacted him and keen to help the project. Lives in the US.
https://mangwendeorphancaretrust.org/2019/11/19/visit-by-robin-woolner/

Adam French: Designer, entrepreneur, hip-hop head, and lifelong learner who wants to change the world and have fun with the process. Involvement: Project management and connector.
https://emote.design/grow-your-social-movement-by-cultivating-its-soil

Eller Everett: sustainability business growth consultant, helped with the mangwende project analysing the best ways to implement permaculture principles regarding the space and needs of the community. “I was researching which building techniques should be used and what each plot of land should be used for. I also suggested different sustainable methods to access water, and cooking methods along with which plants should be grown in order to best help the land and needs. I considered community involvement throughout the process and planning to ensure that the project reflects the needs as well as receives support from the local community.”
https://www.facebook.com/watch/?v=627264414477925

Marlon Christ Kenau: The Trust’s Assistant Project Manager and website developer/maintenance. He has a background in organic farming and sustainability. Currently focusing on permaculture.

A3 - Established network

Organisations expressing interest in offering help with training and marketing:

Julious Piti: founder of PORET (Participatory Organic Research Extension and Training): http://poret-zimbabwe.org/; Key local partner for the organisation and teaching of a PDC on the MOCT site

CELUCT website: www.chikukwa.org

Sonita Mbah (GEN): https://www.facebook.com/africakitchenrevolution/

Sarah Savory: Savory Institute connection in Zimbabwe (https://www.savory.global/)

Permaculture Sydney North (Cat Dorey, PSN newsletter editor)
https://www.permaculturenorth.org.au/

Love Food Forests already shared Evan's activity and agreed to do an update in 6 months' time: https://www.facebook.com/Lovefoodforests/posts/151498376231665

Appendix B: Surveys

B1- Introductory questionnaire from team to community

Dear Respondent,

We are Gaia Education students, Nadia, Eve, Viktoria and Tilla studying Ecovillage Design through four aspects: Ecological; Social and Economic Dimension and Worldview. For our project we have chosen to help Evans Mangwende in setting up the Ecovillage and Education Centre by Mangwende Orphanage Care Trust.
We would like to include the local community in our design and would like to ask for your help by answering our questions below. In return, we will take your response into account as much as our time frame allows, but please accept that the final result might be an alternative option to your recommendations.
Please also bear in mind, that our course is finishing at the end of October 2019, after which the participation in the project by team members is voluntary and not related to Gaia Education. Evans Mangwende will be our main point of contact during the project, but if you would like to be in touch through other channels, please let us know.
We would like to thank you for your contribution to our project and would be happy if you would participate in our future surveys, too.

Questionnaire

1. What is your current, most urgent need that you hope will be addressed by the ecovillage/orphanage farm/school?

2/ What is your long term prospect for this project? Rank in terms of importance from 1 to 5, where 1 is the least important, 5 is the most important:

Question	1	2	3	4	5
Provide food and clean water to the community					
Restore the ecology of the bioregion					
Become a role model for similar communities					
Become a teaching hub					
Generate income					
Provide shelter to the vulnerable					
Educate the local villagers to become resilient ecologically and financially to create a regenerative community					

Unite the cohesion between villagers into a socially structured community to reduce conflict					

Other? …….

3/ What do you think are the primary limitations to the success of this project? Please mark maximum 3 answers

- current finances
- securing future finances/self reliance
- weather conditions
- health
- language
- political instability
- conflict within your community of villagers
- fear of future development and monopoly by foreigners

- other? ……...

4/ What would be your primary expectation from the Gaia student team in their case study?

a/ Help with general planning of setting up an ecovillage integrating the 4 dimensions (ecological, social, economical and worldview)

b/ Help with something more specific such as:

5/ How do you see yourself contributing to the project?
Please tick down some of the skills you have that could help in implementing the project:

i.leading focus groups to understand the needs of the people working in the project
ii.teaching

iii. Promote ancestral stories by teaching them to children and other people in the community

i.Celebrate rituals

v. permaculture design

i.gardening
i.(green) building design skills
i.Technical skills

1. Water systems
2. Renewable energy
3. Other:....

i.Giving permaculture training (PDC) or EDE

x. Accounting skills

i.Skills to promote local economy (ex: local artisans)

6/ What do you want/plan to see being taught to residents, orphans, villagers and external visitors at the school? Please choose the most appropriate.

- basic skills such as cooking and hygiene
- communication skills such as language and computing
- specific skills such as building and traditional farming techniques
- governance and financial skills for running the organisation

- other?.....

7.a/ What goods would you like to see being produced on site?

- food …….

- services ……

- crafts ……

- other? ……..

b/ Do you see the production for self -sufficiency only within the centre/villages or for export/trade to generate income? -

12.a/ How tolerant the project should be for members with different religious views?

b/ Would you like the project have a bigger focus on:
- spirituality? Yes/No
- nature? Yes/No
- education? Yes/No

- other …….

9/ Would you be interested in joining in the project by sharing your land with the Trust?

10/ / Do you feel positive, negative or neutral about adopting the deZunde method again?

Thank you for taking part in our survey!

Gaia project team/ Nadia, Eve, Tilla & Viktoria

B2- future recommendation for garden monitoring (garden checklist)

National Wildlife Federation's GARDEN FOR WILDLIFE™

Garden Certification Walk-through Checklist

It's easier than you think to create your own wildlife garden! Use this walk-through checklist to confirm you have all the elements necessary to be certified:

*Note: this checklist is only a tool to prepare your garden, please certify online at www.nwf.org/certifiedwildlifehabitat

FOOD: Your habitat needs three of the following types of plants or supplemental feeders:

- ☐ Seeds from a plant
- ☐ Berries
- ☐ Nectar
- ☐ Foliage/Twigs
- ☐ Fruits
- ☐ Sap
- ☐ Pollen
- ☐ Suet
- ☐ Bird Feeder
- ☐ Squirrel Feeder
- ☐ Hummingbird Feeder
- ☐ Butterfly Feeder
- ☐ Nuts

WATER: Your habitat needs one of the following sources to provide clean water for wildlife to drink and bathe:

- ☐ Birdbath
- ☐ Lake
- ☐ Stream
- ☐ Seasonal Pool
- ☐ Ocean
- ☐ Spring
- ☐ River
- ☐ Butterfly Puddling Area
- ☐ Rain Garden
- ☐ Water Garden/Pond

COVER: Wildlife needs at least two places to find shelter from the weather and predators:

- ☐ Wooded Area
- ☐ Bramble Patch
- ☐ Ground Cover
- ☐ Rock Pile or Wall
- ☐ Cave
- ☐ Roosting Box
- ☐ Evergreens
- ☐ Brush or Log Pile
- ☐ Burrow
- ☐ Meadow or Prairie
- ☐ Dense Shrubs/Thicket
- ☐ Water Garden or Pond

PLACES TO RAISE YOUNG: You need at least two places for wildlife to engage in courtship behavior, mate and then bear and raise their young:

- ☐ Mature Trees
- ☐ Meadow or Prairie
- ☐ Nesting Box
- ☐ Wetland
- ☐ Cave
- ☐ Burrow
- ☐ Dead Trees or Snags
- ☐ Dense Shrubs/Thicket
- ☐ Water Garden/Pond
- ☐ Host Plants for Caterpillars

SUSTAINABLE PRACTICES: You need to employ practices from at least two of the three categories below to help manage your habitat in a sustainable way- *to better help wildlife, we advocate employing one or more practices from each category*:

☐ Soil and Water Conservation:
- *Riparian Buffer*
- *Capture Rain Water from Roof*
- *Xeriscape (water-wise landscaping)*
- *Drip or Soaker Hose for Irrigation*
- *Limit Water Use*
- *Reduce Erosion*
- *Use Mulch*
- *Rain Garden*

☐ Controlling Exotic Species:
- *Practice Integrated Pest Management*
- *Remove Non-Native Plants and Animals*
- *Use Native Plants*
- *Reduce Lawn Areas*

☐ Organic Practices:
- *Eliminate Chemical Pesticides*
- *Eliminate Chemical Fertilizers*
- *Compost*

B3- Google Earth Pro area close ups for future monitoring purposes

The big plot (18 ha) and the perennial river

The smaller plot with the earthen roads

Appendix C: Networking and funding

C 1 - Prospective collaborators and sponsors

Permaculture centre in Harare http://fambidzanai.org.zw/
SCOPE children's permaculture educational program https://www.scopezimbabwe.org/
Network for Ecovillage Emergence and development in the Sachel
Sache Agroecology School
http://redes-ecovillages.org/eng/
Utilize livestock to restore degraded watersheds, wildlife habitat, and croplands to health, Zimbabwe
http://www.africacentreforholisticmanagement.org/
Conservation Farming and Conservation Agriculture practices, Zambia
https://conservationagriculture.org/
Faith based conservation farming, Zimbabwe: http://foundationsforfarming.org/new/ ; https://www.farming-gods-way.org/home.htm
Non-profit innovation hub, research on commercial applications for indigenous underutilised plants Zimbabwe https://www.bio-innovation.org/
Alliance for Food Sovereignty in Africa https://afsafrica.org/case-studies-agroecology/
The Zimbabwe Smallholder Organic Farmers Forum **(ZIMSOFF)** http://zimsoff.org/ ; East and Southern Africa Small-scale Farmers' Forum (**ESAFF**) and La Via Campesina **(LVC)** envisions improved livelihoods of organized and empowered smallholder farmers in Zimbabwe practicing sustainable and viable ecological agriculture.
Design and implementation of sustainable development programmes Cape Town: http://afristarfoundation.org/
Register to become an iLAND centre: https://www.permaculture.org.uk/ipen/iland-centres-and-network ; https://www.ipenpermaculture.org/ipen-priorities/iland-demonstration-centres/iland-criteria-system/
Sustain wildlife and wilderness through integrated conservation and education programmes http://www.wildernessfoundation.co.za/, launched http://www.wildernessfoundation.co.za/blog/posts/sa-s-first-dedicated-sustainable-landscape-finance-coalition
Sustainable farming (Uganda) https://www.redsoilproject.org/
GRAIN supports small farmers and social movements for community-controlled and biodiversity-based food systems https://www.grain.org/
Regen Network builds open tools that facilitate ecological regeneration https://www.regen.network/

Connect organizations and people around the world that are accelerating voluntary private and civic sector action that protects and stewards land and water resources: https://www.landconservationnetwork.org/who-we-are

Writing in magazines such as: http://naturallyzimbabwean.com/contact-us/ ; https://www.seda.uk.net/seda-magazine-landing

Registering funding sites such as Funding Central:
https://www.fundingcentral.org.uk/access.aspx
Regenerative Network Platform: https://weavernetwork.org/
Abundant Earth Foundation: https://abundantearthfoundation.org/ sponsored Evans to go to the East Africa Permaculture Convergence by ARANYA SUSTAINABLE SOLUTIONS.

Example of a grant proposal by Green Climate Fund for Climate Resilience of Food-insecure Smallholder Farmers through Integrated Management of Climate Risks (the R4 Rural Resilience Initiative)
https://www.greenclimate.fund/projects/fp049?inheritRedirect=true&redirect=%2Fhome

Joining **Fair Trade** through **ZOPPA** (Zimbabwe Organic Producers & Promoters Association)
https://www.facebook.com/zoppatrust

C2 - Potential funding bodies

Organisation	Name of grant	Amount offered	Application due date	Criteria/Focus	Does it fit criteria?	Website
UKAID	Community partnership grant	Applicants can apply for up funding for up to £250,000 per grant.	By April 2019	https://www.ukaiddirect.org/apply/community-partnership/	Yes - Zimbabwe considered lowest 50 with HDI	https://www.ukaiddirect.org/apply/community-partnership/
The St Andrews Prize		The winning environmental project receives funding of $100,000 USD and the runner(s)-up will receive $25,000 USD	2020 prize now closed. First submission round takes place over an intense, time-limited, period in May and June.	Originality, Innovation, Evidence of potential or achieved technical and or business success, Impact on environment, Impact on stakeholders, Wider application of your work	Yes	https://www.thestandrewsprize.com/whatmakesagoodentry
Permaculture Magazine		£30,000	Closed May 31st 2019	This prize is for individuals, communities, businesses, groups and organisations that can demonstrate inspirational work over more than three years.	Yes	https://www.permaculture.co.uk/content/permaculture-magazine-prize-2019-application)
Lush Spring Prize	Social and environmental regeneration	$200,000	Applications not open for 2020	Regeneration: Restoring natural systems, and communities	Yes	https://springprize.org/regeneration/ https://lushprize.org
UN Environment	SEED award		Application deadline April	Socially inclusive, environmental sustainable, economically viable	Yes	https://seed.uno
	Sasakawa	$200,000	Deadline around January.	Sustainable development that can be scaled up or replicated	Yes	https://www.unenvironment.org/about-un-environment/awards-and-prizes/sasakawa-highlights
The A Team Foundation			Not open for applications at present	food and land projects that are ecologically, economically and socially conscious. Nutrition, Environment, Community, Equality, Education	Yes	https://www.ateamfoundation.org/#homepage
Universal Risk				Sustainable Development Goals	Contact for grant info	https://www.universalrisk.org/projects/
Ernest Cook Trust			No current grants available	Learning from the land, education		http://ernestcooktrust.org.uk/grants/
The Funding Network			To apply for funding, non-profits must be nominated by a current TFN	TFN supports grassroots non-profits whose aim is to achieve positive social change for individuals, communities and the	Maybe	https://www.thefundingnetwork.org.uk/who-we-support
Global Greengrants Fund				Climate Justice, Healthy Ecosystems and Communities, Local Livelihoods, Right to land, water and resources, Women's Environmental Action	Yes	https://www.greengrants.org/what-we-do/
International Tree Foundation	Sustainable Community Forestry Programme		Not open for applications at present	We are committed to help communities to build secure livelihoods and improve their local environment through sustainable tree planting programmes	Yes	http://internationaltreefoundation.org/community-tree-planting-grants-uk-africa/

				tree planting programmes		
The Mitsubishi Corporation Fund for Europe and Africa	Environmental Conservation		Funding programme announced in October 2019, but doesn't accept applications at present	Environmental Conservation, Environmental Education, Poverty Alleviation	Yes	https://www.mitsubishicorp.com/gb/en/csr/mcfea/
Savitri				Environment and livelihoods	Yes - ask for collaboration	http://savitri.org.uk/projects/environment-
Synchronicity Earth				Species in decline	Yes - contact for collaboration	https://www.synchronicityearth.org
Rufford Small Grants for Nature		£8,000-15,000		The Rufford Foundation provides startup funding for nature conservation projects in developing countries.	Maybe - main focus is supporting MSc or PhD students or those who have recently graduated from such studies.	https://apply.ruffordsmallgrants.org
Rapid Response Facility Grants	EMERGENCY FUNDING FOR NATURE IN TIMES OF CRISIS	$30,000		emergency fund that provides grants to protected areas during sudden crises to world heritage site	Maybe - not sudden crisis (Cyclone)	http://www.rapid-response.org
Becoming an ILand Centre	Permaculture education centre		continuous, better earlier before funds run out	We will need to consider the progress your project has already made, your project design and other information	yes	https://www.ipenpermaculture.org/ipen-priorities/iland-demonstration-centres/iland-
Ecosystem Restoration Camps	Expertise and design help		31-Oct-19	on degraded land - intention to restore a large area-including areas outside your land; have restoration plan in place; basic infrastructure; safe for people to travel there; ability to upkeep the buildings; document the work	if working with farmers landowners in the surrounding area	https://www.ecosystemrestorationcamps.org/new-camp-application/
Global Ecovillage Network	Hildur Jackson Award	3,000EUR	09.09.2019 maybe next year?	The prize is awarded to projects bringing the most impactful inspiration about ecovillages/ecovillage lifestyles to a broad audience. Innovative character; Impact;Longevity;Appeal to a wider audience; Close link to GEN (GEN member if applicable in your region) and GEN's work; Alignment to and inspiration to new developments in GEN; Capacity to report both visually and verbally to a high quality;	not yet	https://ecovillage.org/get-involved/hildur-jackson-award/?fbclid=IwAR2-Xw7eoWQ_EHGxOMOz6pdB2YoyVy9WctDDZ_q46Ek1dgLtIZEpZvzqE2Q

African Women's Development Fund			15/1/2018 maybe runs every year?	AWDF funds women-led, women's organisations as a priority. Organisations must have: •a track record of work on women's rights, •a woman as organisational director/lead •a majority (at least 70%) of women staff •at least 70% women involved in the governing board/body •a stated commitment to women's rights/gender equality in the organisational mission/vision/values •At least 70% of programmatic resources must be dedicated to direct programming on women's rights; •the project applied for will be managed by a woman	not yet, maybe side organisation?	https://awdf.org/apply/
Ecosia	regenerative agriculture	£500,000 to be distributed through two years for a few suitable projects	15-Dec-19	We kickstart agricultural projects that build soil and plant trees to fight climate change, demonstrate the financial viability of regenerative practices, protect animal welfare, and produce healthy food. Invests in pioneering farming projects anywhere in the world that demonstrate regeneration of soil and financial viability, recreating a healthy, sustainable ecosystem. Trees and perennial crops are natural elements of such systems. REVERSE the destruction of TOP LAYER SOIL; CREATE HEALTHY ECOSYSTEMS; demonstrate viable alternatives to conventional production	Yes!	https://www.ecosia-regenerative-agriculture.com/?fbclid=IwAR2MQIIKwZxgQtqkkCMLTDApPZkIQWBUrIsC3HI5QdQHStMLQa9GDqanWHw
Urbis Foundation	Renewables		01.07.2020 - 30.09.2020 First 40 applicants only!	Focus of project content on renewable energies (solar power, solar thermal, biomass). Regional focus on Sub-Saharan Africa (especially East Africa) or Eastern Europe	Yes!	http://www.urbis-foundation.de/en/application-for-funds.html

Funding opportunities collected with the help of Eller Everett

C3 - Crowdfunding details posters

1. Extracted from the GoFundMe site, edited by Nadia and Viktoria

gofundme

Mangwende Permaculture Center

Our aim is to provide ecological education in Zimbabwe to:

- Vulnerable children/youth and women
- Improve the overall health of the community
- Provide safe drinking water
- Implement permaculture practices in the region
- Connect farmers and businesses to grow organic produce

THANK YOU!

Show your support by going to this link

gf.me/u/vubjug

Mangwende Permaculture Center gf.me/u/vubjug

2. Flyer designed by Adam French

Want to help build a regenerative eco-village in Zimbabwe?

This man, Evans Mangwende, has been working tirelessly for years to make his vision come to life. His vision? To transform his villages of Mzembe and Marembo in central Zimbabwe into productive places of agriculture where people can come to learn growing techniques for the desert that covers much of Sub-Saharan Africa. He wants to spread food security and prosperity around Zimbabwe, and hopefully further.

But to do this, WE NEED YOUR HELP! It costs around $5000 for the initial construction of the farm and education center.

A collection of seedlings that will be used for the permaculture-based garden.

A couple of children from Mzembe, the village in Zimbabwe Evans wants to transform in to an eco-village.

A hut that is currently under construction. Once it's fully built, people can live on site instead of walking 8-9 km each day to do the work.

Can you help us create massive change on a local level?

Go to the link below to donate or send an email for more details on the project.

bit.ly/2N7tPNS

v.szilvas@hotmail.com afrench53198@gmail.com n.khuzayim@gmail.com

Grow Zimbabwe bit.ly/2N7tPNS

C4 - Business Model Canvas

Key Partners

local villagers (16 villages): neighbouring farmers/land owners
local schools (5 schools), 2 clinics
Chief and members of the traditional leadership structure
Stakeholders
local council represented by councillors
ministry of local government (represented by the District Administrator)
Ministry of Agriculture (represented by Extension workers)
GEDS Team; and current remote volunteers e.g. WhatsApp team; future international volunteers
Zimbabwe Permaculture Network
national (and South African countries) universities
international organisations for remote expert training and invitation of consultants/teachers (e.g. Savory Institute, GEN Africa)
Fair Trade
Accommodation providers/ food providers; community/public transport 'companies'

Key Activities

priority: permaculture farming and storing of diverse resources education centre: skills training; seasonal permaculture internship, live demonstration,administration of visitors and business activities;

school education and participation in general sustainable practices

local markets and regional festivities and rituals (including connection with traditions and retreat in nature)

Key Resources

Natural: locally sourced and produced, food and non-edible materials, water management *Physical:* land; buildings; plants; seeds; delivery equipment; tools; infrastructure *Financial:* grants; donations; income from sales; loans *Intellectual:* teaching skills; leadership skills; elders' wisdom; knowledge on permaculture etc. *Human:* community; volunteers; orphans; teachers;

Value Propositions

Products: milled maze; seeds (beans; maze; sorghum; millet; butternut; garlic; tomato) dried fruit; medical plants and possible extracts; soap

Educational courses: permaculture; natural building; forest gardening; keyline design;

Skill courses: cooking; DIY solar/wind turbine; compost making; compost toilet

Customer values: organic; local; community based; ecovillage experience; newness; alternative lifestyle option; sustainability, rural development, nature spirituality, permaculture, equality, inclusivity, dignity, respect, Zunde, social unity, holistic management, co-operation, glocalisation, tradition, empowerment

Customer relationships

request feedback; regular progress updates;

showing gratitude (online crowdfunding or booking of courses) by offering a poem or drawing created by members of the community

offer certificate of passage for all visitors on site with the above choice of gift

suggest to join online community to build network and share experience (such as Facebook group; newsletters)

Social events to strengthen local relationships within community and between villages

Channels

local face to face meetings: markets; local shop; school visits; regular events (guided tours; open days, village assembly, festivities, community speeches); flyers, posters and word of mouth

Online presence: website; social media (Facebook); WhatsApp; Slack; LinkedIn; podcasts; newsletters; crowdfunding

attendance at events to represent the project and promote its activities (such as EDE, university talk; GEN and permaculture gatherings)

Customer Segments

comfortable space for (international) guests

Local people; orphans; young adults (schools, applied skills and knowledge complementary to standard curriculum, adapted to community life)

local farmers (to replicate model)

regional: urban (sale to businesses) and rural (direct exchange of quality and unique goods and services)

national and international visitors (general public or journalists but mostly specialised students and researchers) in search of alternative/sustainable practical experience

Cost Structure

providing school uniforms and meals; building/running of orphanage and permaculture centre; attendance to training courses (fees and travel); welcoming of teachers/experts (practical and technical building, farming, water management, social, business, educational, relational and IT skills..); basic materials for building infrastructure; seeds, plants, tools and equipment; power and technology (poor and expensive access to electricity and internet); long term maintenance of all the above; emergency fund in case of unpredictable crisis (cyclone, migration; droughts..)

Revenue Streams

Local workers (phase 1): raw food, focus on quality (organic); CSA; processed food with added value; recycling scheme; long term financial security via creation of emergency communal fund

External associations (phase 2): external visitors, students and researchers; accommodation for "tourists"; local and international volunteers to donate funds and goods; alternative source of "revenue" ; temporary offer access to land to training permaculturists, land restoration to use site for practical field work to bring necessary equipment and leave with improved landscape and infrastructure and global mediatisation; volunteers to offer time and expertise

Appendix D: Instruction Manuals

D1 - How to obtain contour lines using Google Earth pro

Google Earth pro contour lines

1. search contour map creator (http://contourmapcreator.urgr8.ch/)
2. find the location (coordinates might not work, we used Google Earth Pro for guidance)
   Dombodzviku primary school: 17°52’32.6”S 31°38’54.7”E
   Dombodzvuku Secondary School: 17°52’50.7”S 31°38’40.1”E
   Mangwende Centre: 17°52’43.8”S 31°38’54.2”E
   Casino township: 17°53’06.7”S 31°38’34.2”E
   Sambamuto clinic: 17°52’20.1”S 31°38’22.1”E
   Main road: 17°53’29.0”S 31°37’55.4”E
3. you can make the ‘frame’ of the place you want the contours on by clicking on the map - the red place pins appear
4. you can drag the pins to adjust the distance/direction
5. on ‘Samplings’ press get data
   set both sampling points (N-S axis & W-E axis) to 22
6. at ‘Plot Options’ click level interval and set to 1m
   tick plot sampling points
   units in ‘meter’
7. click on ‘redraw contours’
8. scroll down on the page and click on Download KML file
9. Click on this file in your Download folder
10. Go to Google Earth Pro and it will appear in the temporary places
    by left click properties- you can change the colour the contour lines
11. save the picture and edit in another software

D2 - Recommended plants list

-Native plants: aloe, baobab, jacaranda, euphorbia, palms, succulents, bushveld, Msasa (Brachystegia spiciformis) Sygyzium Guineense, bauhinia Petersiana, Peltophorum Africanum (weeping wattle)

-Recommended plants: moringa; Jatropha, fig trees; lavender; rosemary; Faidherbia Albida tree; luffa gourd plant; moringa tree (recommended for companion plant in raised bed Zach Loeks Permabed); Julbernardia globiflora; Vetiver Grass (against soil erosion and flooding while filter greywater and river contamination)

-Medicinal plants: Aloe vera; Cannabis oil (hemp plant) medicinal purposes (with CBD and TBHC contents, but need to notify warning and controlled small production)

-Herbs: Lavender, cinnamon or rosemary bushes; thyme, Basil, chives, dill, fennel, lavender, marjoram, mint, oregano, parsley, celery, wormwood, sweet rocket, coriander, watercress, narstatium, comfrey, borage, moringa, chervil, shallots, garlic chives, lemon grass

-Fruits/trees: avocados; papaya; orange; lemon and banana (in September), mangos (in November-December); coconut; fig trees; Natal plum (Num Num); Sour plum: (jam, jelly and dessert, with edible nuts and seeds' oil used to make lotions, and as lighting for lamps).

-Native fruit trees: *Shambahuro, Masekesa (Piliostigma thonningii), Magwingwiziri, Hubva (Vitex payos), Matohwe (Azanza garckeana), Chechete (Mimusops Zeyheri), Makwakwa, Matamba (Strychnos spinosa)*

-Staple crops for raised beds and allotments: sorghum, millet, butternut, garlic, tomatoes; sunhemp, pigeon pea, comfrey; sugar cane; hemp; maize , beans, onions; Mova guru; mova; Nhungunira; Nyeve/runi; Nyenje/gusha; Nyemba

-Indigenous vegetables: Covo (high in iron and protein), African nightshade (*Solanum scabrum*), jute mallow (*Corchorus olitorius*) and the greens of cowpeas or black-eyed peas (*Vigna unguiculata*). Also pumpkin leaves (*Cucurbita moschata*), amaranth leaves, (*Amaranthus* sp.), Spiderleaf plant/Nyeve/ilude (*Cleome gynandra*) and African eggplant (*Solanum aethiopicum*), Mowa/ bononge/ imbuya (*Amaranthus hybridus*), Nightshade/ musaka/ ixabaxaba (*Solanum nigrum*)

Zimbabwean indigenous vegetables:

Scientific name	**Shona name**	**Ndebele name**
Amaranthus hybridus	Mova guru	Imbuya
Amaranthus thumbergii	Mova	Imbuya
Bidens pilosa	Nhungunira	Ucucuza

Cleome gynandra	Nyeve/runi	Elude
Corchorus olitorius	Nyenje/gusha	Idelele
Vigna unguiculata	Nyemba	Indumba

-Garden Around houses: 3 lines for beds with the three sisters species in middle, surrounded by moringa- rotate yearly with soy or beans, sorghum, hemp (cannabis oil) or maize

-Living fence: matten gulu; thorny acacia bush, along swales, prickly pear (fruits for personal food consumption), *Jatropha curcas*; Kei Apple (*Dovyalis caffra*); Amathungulu or Num-Num (*Carissa macrocarpa*); Aloes (*Aloe ferox*) - known as bitter aloe, a purgative medication with a non-bitter gel that can be used in cosmetics

-Riverbank: vetiver grass; bamboo, bush willow (antelope enjoy its leaves, while its wood, gum, roots and fruits have various practical uses, from medicine to dye and varnish)

- Seed oils: Baobab; Marula; Kalahari Melon; Ximenia; Mafura; Mongongo (Manketti); Resurrection bush (Myrothamnus flabellifolia); Sausage tree (Kigelia africana)

-Pergola plants: beans; grapes; passionfruit

Books (Free PDF download): https://www.nap.edu/catalog/2305/lost-crops-of-africa-volume-i-grains
https://www.nap.edu/catalog/11763/lost-crops-of-africa-volume-ii-vegetables
https://www.nap.edu/catalog/11879/lost-crops-of-africa-volume-iii-fruits

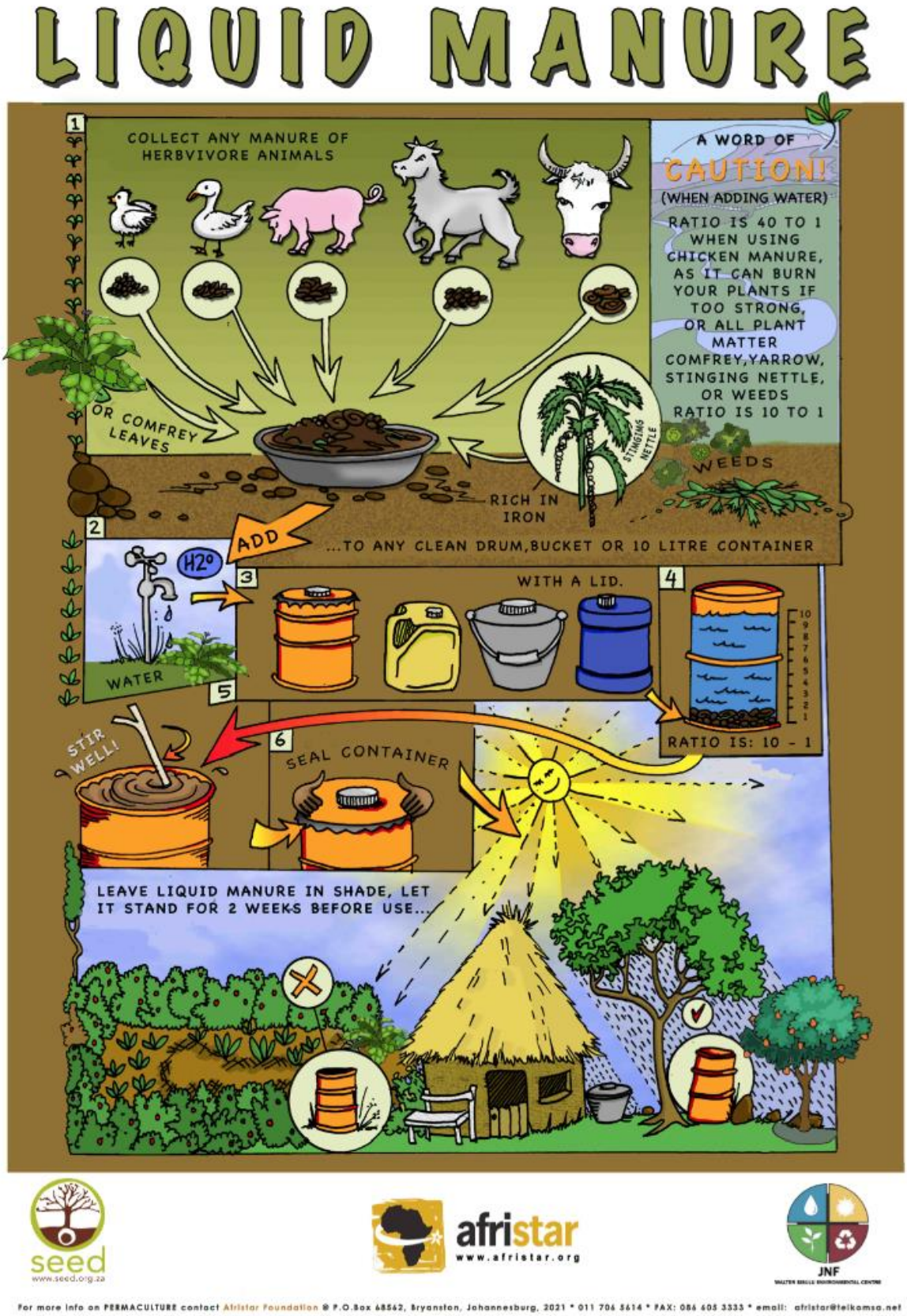
D3 - Future potential uses of plants and materials

Plants & Materials	**Future Potential**
Fruit trees (avocados, papaya, orange, lemon, banana, mangos etc.)	Jams; fruit leather; fruit candy; dried fruits; snacks mix; Fruit crisp; tea;
Herbs (Basil, chives, dill, fennel, lavender, marjoram, mints, oregano, rosemary, parsley, celery, wormwood, sweet rocket, coriander, watercress, narstatium, comfrey, borage, moringa, chervil, shallots, garlic chives, lemon grass)	Spices, teas, medical extracts; soap; scented bags; scented candles
Vetiver grass	Waste water cleaning; thatching material; soil retention (prevention of landslide); used as water pump due long roots and soil aeration
Bauhinia petersiana (Coffee bauhinia)	coffee substitute; grounded seeds can be used as porridge; leaves and roots have medicinal purposes; bark for rope
Julbernardia globiflora	Leaves for livestock; bark for ropes, cloths; dye (13% tannin); root for medicine (dysentery, diarrhoea)
Crops	Organic seeds Croft products (e.g. corn husk);
Aloe Vera	Cosmetics; healing of wounds
Hemp/cannabis	Tea; medicine; building material (to increase adhesion of clay)
Bee's products	Beeswax: candles; handcraft; soap; cosmetis; honeycomb
Bamboo	Bikes; gutters, pipes; lightweight structures: Arborloo; roof; fence; livestock feeding (coppice and leaves); furniture; baskets another crofts
Plastic bags & bottles	Bags used as crochet material; bottles as for tree nursery; living wall; seedlings;
Cans	Solar heater; gutter; solar cooker

Appendix E: Visual guides

E1- Making Compost

E2 - Liquid manure



For more info on PERMACULTURE contact Afristar Foundation @ P.O.Box 68562, Bryanston, Johannesburg, 2021 * 011 706 5614 * FAX: 086 605 3333 * email: afristar@telkomsa.net

Flooding Zone and Finger Ponds

(extracted from Sambalino, Francesco & Steenbergen, Frank. 2012. Securing Water and Land in the Tana Basin: a resource book for water managers and practitioners).

Use shallow groundwater by tubewells

Most flood plains have ample shallow groundwater resources. As they are continuously recharged from either the floods and the river flow, they constitute a highly dependable resource that is relatively easy to exploit. It requires the use of shallow tubewells – that can be sealed during the flood season – rather than dugwells that will inevitably damaged when inundated and will take a long time to rebuilt. There are several low cost techniques that can be used to develop such shallow tubewells manually (see table 70).

Diversification to fishery

Flood based farming system provide the basis for diversified livelihood systems. They support not only farming, but also fishery and livestock. Also the wetlands in and around flood based systems often offer opportunities for non-timber, medicinals and other products.

Flood based farming systems support finger ponds (figure 79) that can be used to set up fisheries. Finger ponds are excavated at the fringe of the inundation areas. They fill with water and fish stock

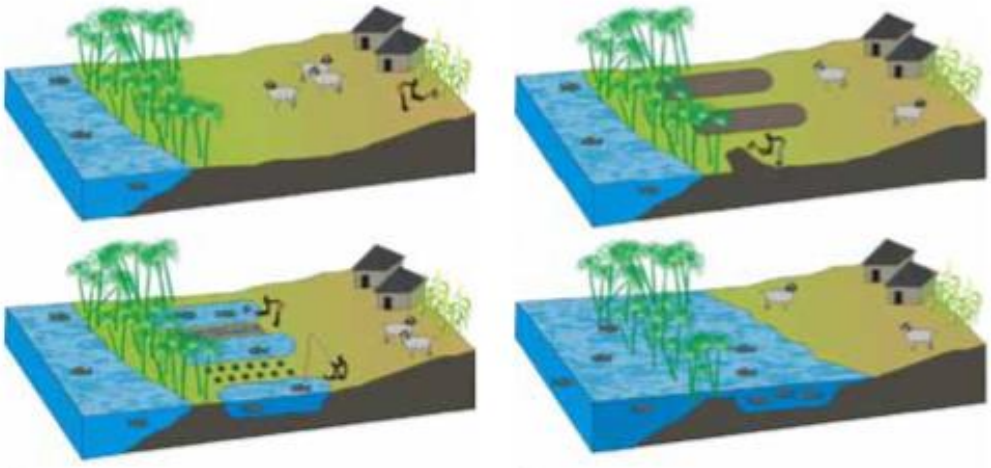
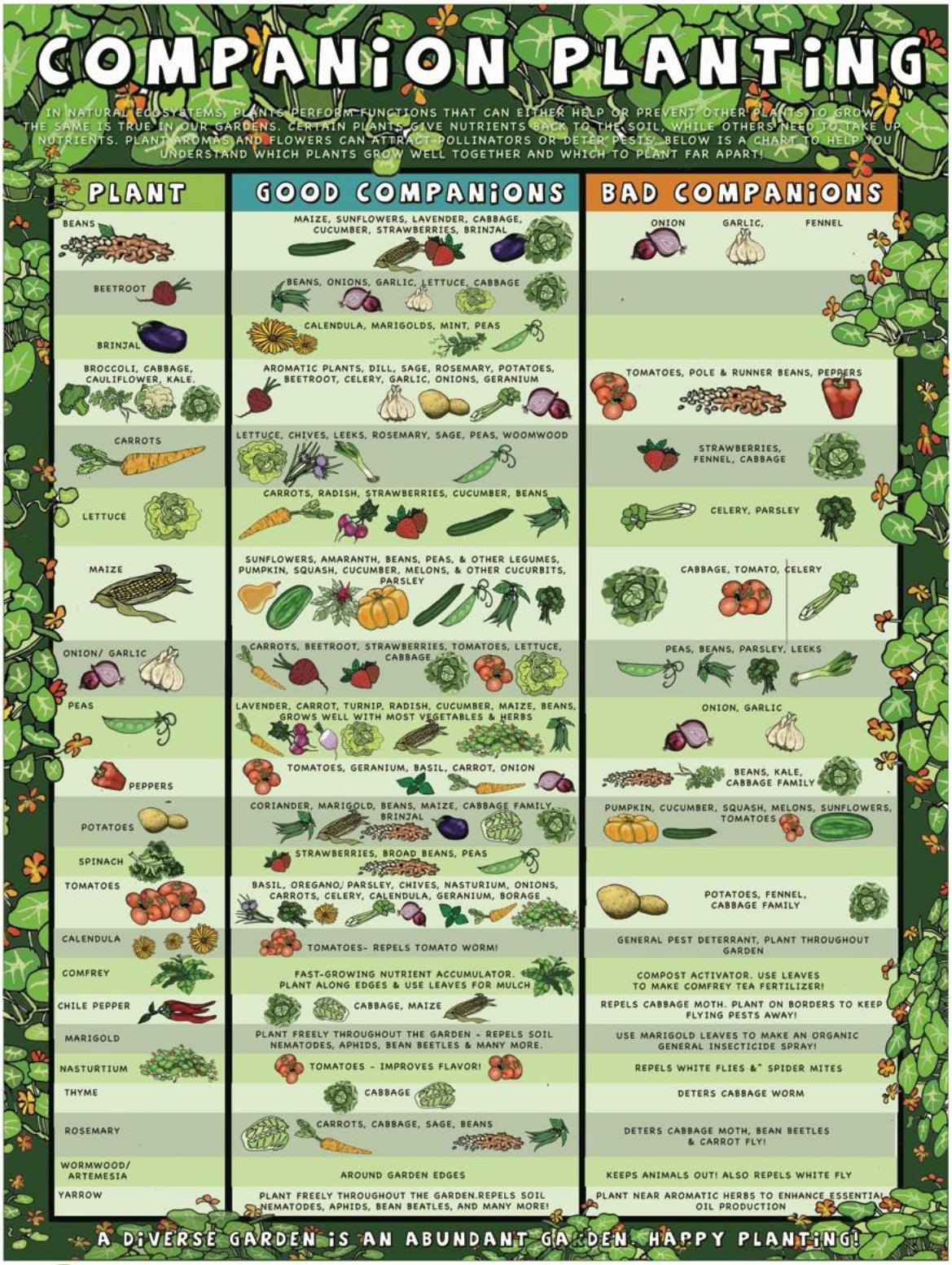


Figure 79. A diagrammatic sequence in the construction of fingerponds. (a) The land/swamp interface at the height of the dry season when water tables are at their lowest. (b) The digging of the ponds and preparation of the agricultural area when water levels are still low. (c) The fingerpond system becomes flooded during the next rains and fish migrate into the floodplain. (d) On retreat of the floodwaters the fish get trapped in the ponds and are cultured whilst the land in between is cultivated. (Source: Denny et al., 2006).


COMPANION PLANTING
IN NATURAL ECOSYSTEMS, PLANTS PERFORM FUNCTIONS THAT CAN EITHER HELP OR PREVENT OTHER PLANTS TO GROW. THE SAME IS TRUE IN OUR GARDENS. CERTAIN PLANTS GIVE NUTRIENTS BACK TO THE SOIL, WHILE OTHERS NEED TO TAKE UP NUTRIENTS. PLANT AROMAS AND FLOWERS CAN ATTRACT POLLINATORS OR DETER PESTS. BELOW IS A CHART TO HELP YOU UNDERSTAND WHICH PLANTS GROW WELL TOGETHER AND WHICH TO PLANT FAR APART!
PLANT
GOOD COMPANIONS
BAD COMPANIONS
BEANS
MAIZE, SUNFLOWERS, LAVENDER, CABBAGE, CUCUMBER, STRAWBERRIES, BRINJAL
ONION GARLIC, FENNEL
BEETROOT
BEANS, ONIONS, GARLIC, LETTUCE, CABBAGE
BRINJAL
CALENDULA, MARIGOLDS, MINT, PEAS
BROCCOLI, CABBAGE, CAULIFLOWER, KALE.
AROMATIC PLANTS, DILL, SAGE, ROSEMARY, POTATOES, BEETROOT, CELERY, GARLIC, ONIONS, GERANIUM
TOMATOES, POLE & RUNNER BEANS, PEPPERS
CARROTS
LETTUCE, CHIVES, LEEKS, ROSEMARY, SAGE, PEAS, WOOMWOOD
STRAWBERRIES, FENNEL, CABBAGE
LETTUCE
CARROTS, RADISH, STRAWBERRIES, CUCUMBER, BEANS
CELERY, PARSLEY
MAIZE
SUNFLOWERS, AMARANTH, BEANS, PEAS, & OTHER LEGUMES, PUMPKIN, SQUASH, CUCUMBER, MELONS, & OTHER CUCURBITS, PARSLEY
CABBAGE, TOMATO, CELERY
ONION/ GARLIC
CARROTS, BEETROOT, STRAWBERRIES, TOMATOES, LETTUCE, CABBAGE
PEAS, BEANS, PARSLEY, LEEKS
PEAS
LAVENDER, CARROT, TURNIP, RADISH, CUCUMBER, MAIZE, BEANS, GROWS WELL WITH MOST VEGETABLES & HERBS
ONION, GARLIC
PEPPERS
TOMATOES, GERANIUM, BASIL, CARROT, ONION
BEANS, KALE, CABBAGE FAMILY
POTATOES
CORIANDER, MARIGOLD, BEANS, MAIZE, CABBAGE FAMILY, BRINJAL
PUMPKIN, CUCUMBER, SQUASH, MELONS, SUNFLOWERS, TOMATOES
SPINACH
STRAWBERRIES, BROAD BEANS, PEAS
TOMATOES
BASIL, OREGANO, PARSLEY, CHIVES, NASTURIUM, ONIONS, CARROTS, CELERY, CALENDULA, GERANIUM, BORAGE
POTATOES, FENNEL, CABBAGE FAMILY
CALENDULA
TOMATOES- REPELS TOMATO WORM!
GENERAL PEST DETERRANT, PLANT THROUGHOUT GARDEN
COMFREY
FAST-GROWING NUTRIENT ACCUMULATOR. PLANT ALONG EDGES & USE LEAVES FOR MULCH
COMPOST ACTIVATOR. USE LEAVES TO MAKE COMFREY TEA FERTILIZER!
CHILE PEPPER
CABBAGE, MAIZE
REPELS CABBAGE MOTH. PLANT ON BORDERS TO KEEP FLYING PESTS AWAY!
MARIGOLD
PLANT FREELY THROUGHOUT THE GARDEN - REPELS SOIL NEMATODES, APHIDS, BEAN BEETLES & MANY MORE.
USE MARIGOLD LEAVES TO MAKE AN ORGANIC GENERAL INSECTICIDE SPRAY!
NASTURTIUM
TOMATOES - IMPROVES FLAVOR!
REPELS WHITE FLIES &" SPIDER MITES
THYME
CABBAGE
DETERS CABBAGE WORM
ROSEMARY
CARROTS, CABBAGE, SAGE, BEANS
DETERS CABBAGE MOTH, BEAN BEETLES & CARROT FLY!
WORMWOOD/ ARTEMESIA
AROUND GARDEN EDGES
KEEPS ANIMALS OUT! ALSO REPELS WHITE FLY
YARROW
PLANT FREELY THROUGHOUT THE GARDEN.REPELS SOIL NEMATODES, APHIDS, BEAN BEATLES, AND MANY MORE!
PLANT NEAR AROMATIC HERBS TO ENHANCE ESSENTIAL OIL PRODUCTION
A DIVERSE GARDEN IS AN ABUNDANT GARDEN. HAPPY PLANTING!
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Fog catcher assembly drawing

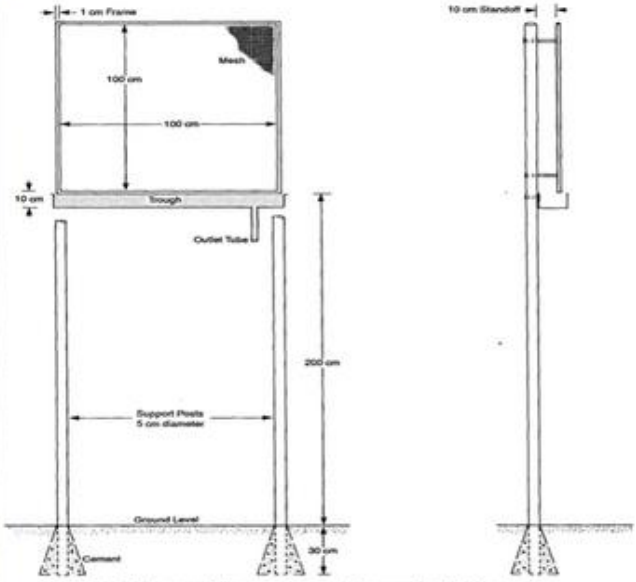
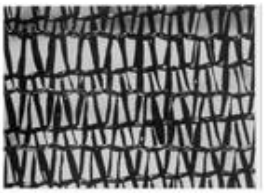


FIG. 2. Dimensions of the main components of the proposed standard fog collector.

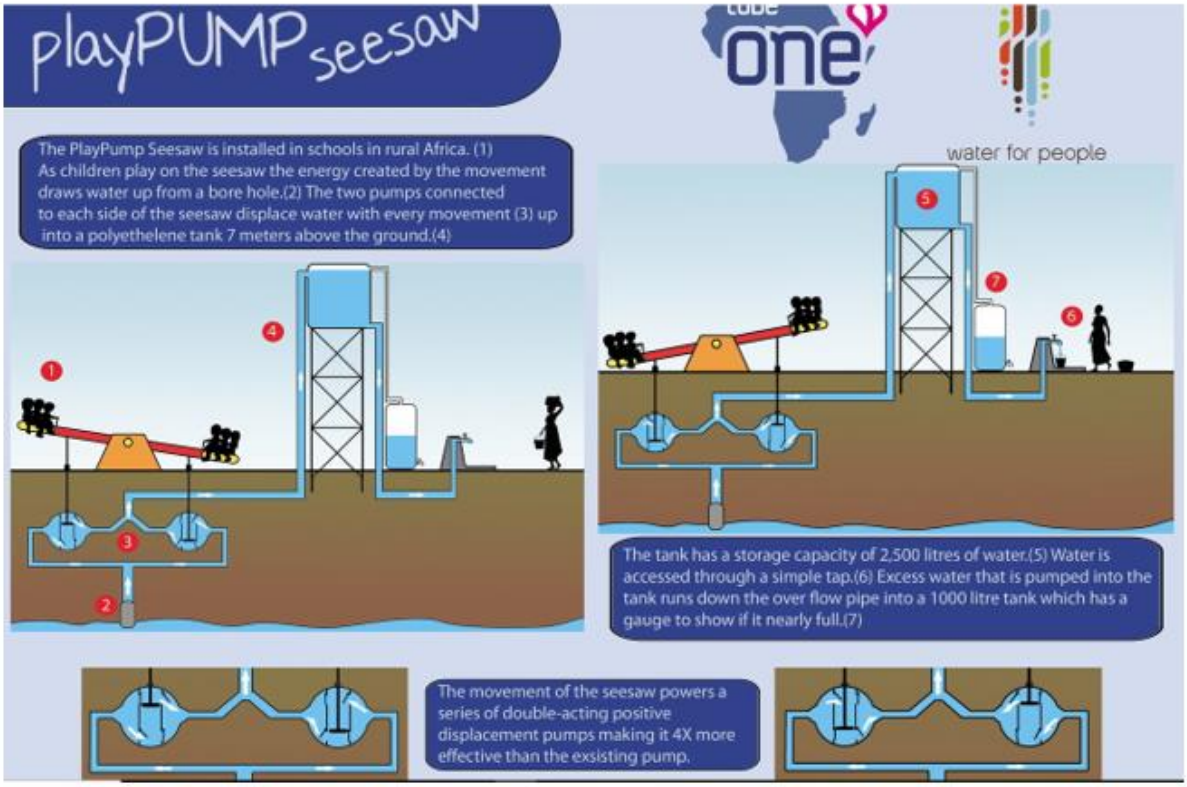
https://watersustainabilityandfogwater.wordpress.com/fog-catchers-and-how-to-make-your-own/



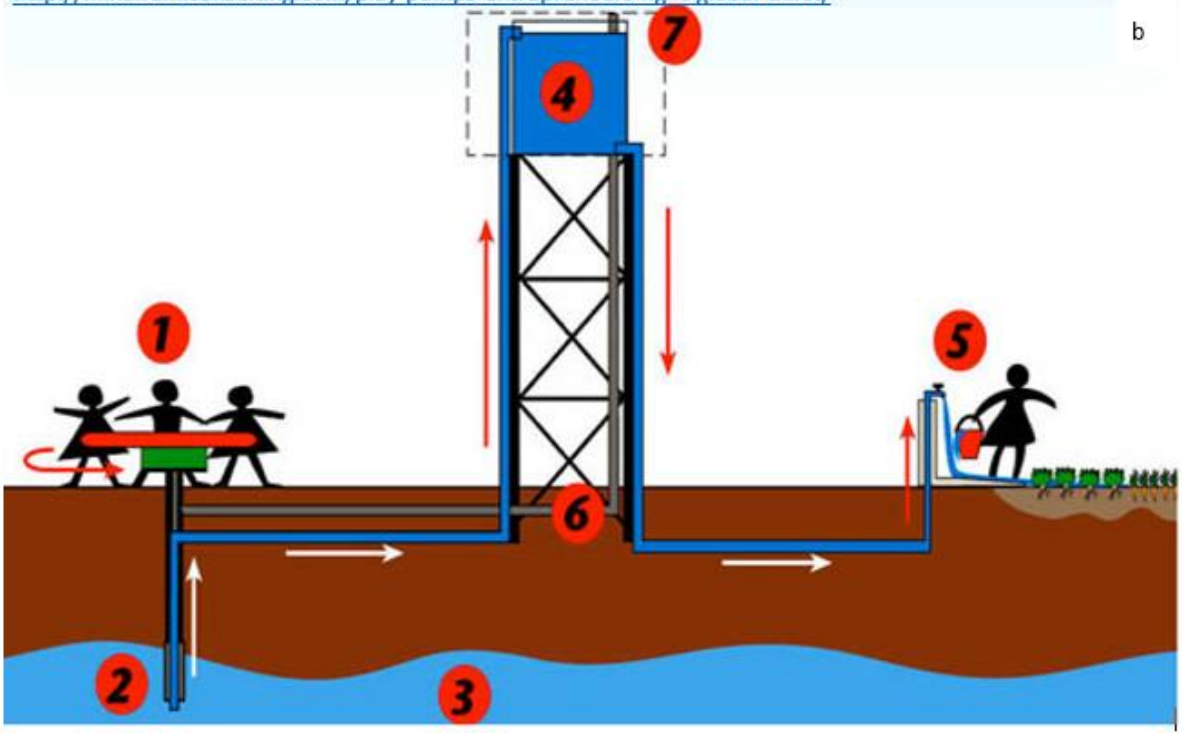
- Use woven sheets for catching the fog
- Make a frame and put additional pole for strength
- Make a stand, that needs to be fixed with ropes or similar
- Add a tray under the fog catcher and use a barrel; bucket or clay pot to capture the collected dew.

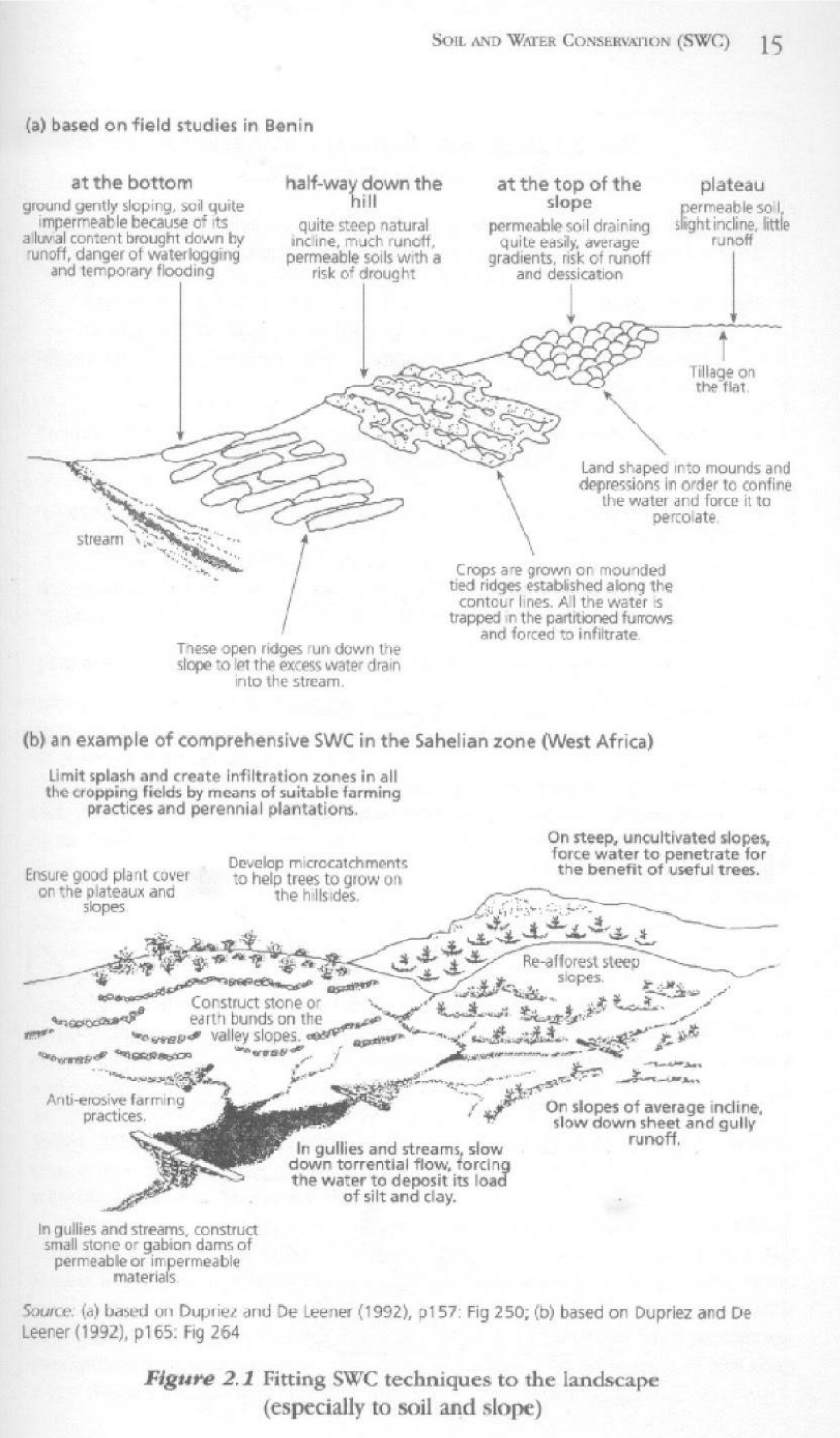
E6 – Play pumps

Manually activated children's playpump



http://mikefrankconsulting.com/play-pumps-entrepreneurs-fight-global-thirst/





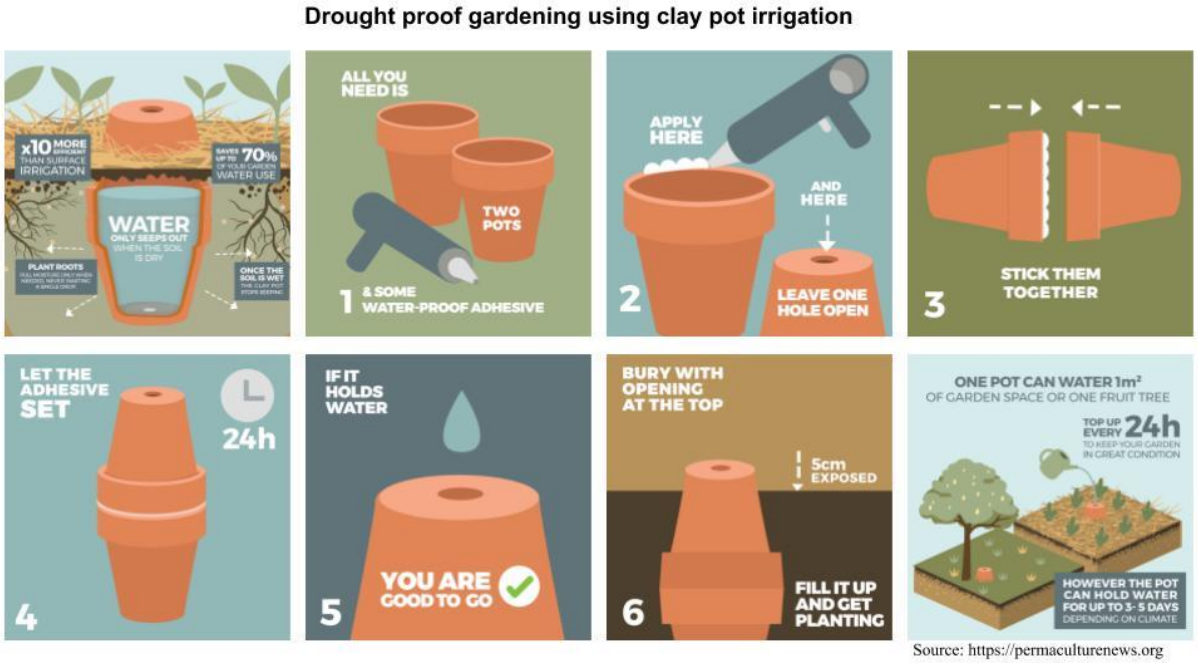
Alternative Irrigation - The Promise of Runoff Agriculture
Christopher Barrow

5

Source: (a) based on Dupriez and De Leener (1992), p157: Fig 250; (b) based on Dupriez and De Leener (1992), p 165: Fig 264

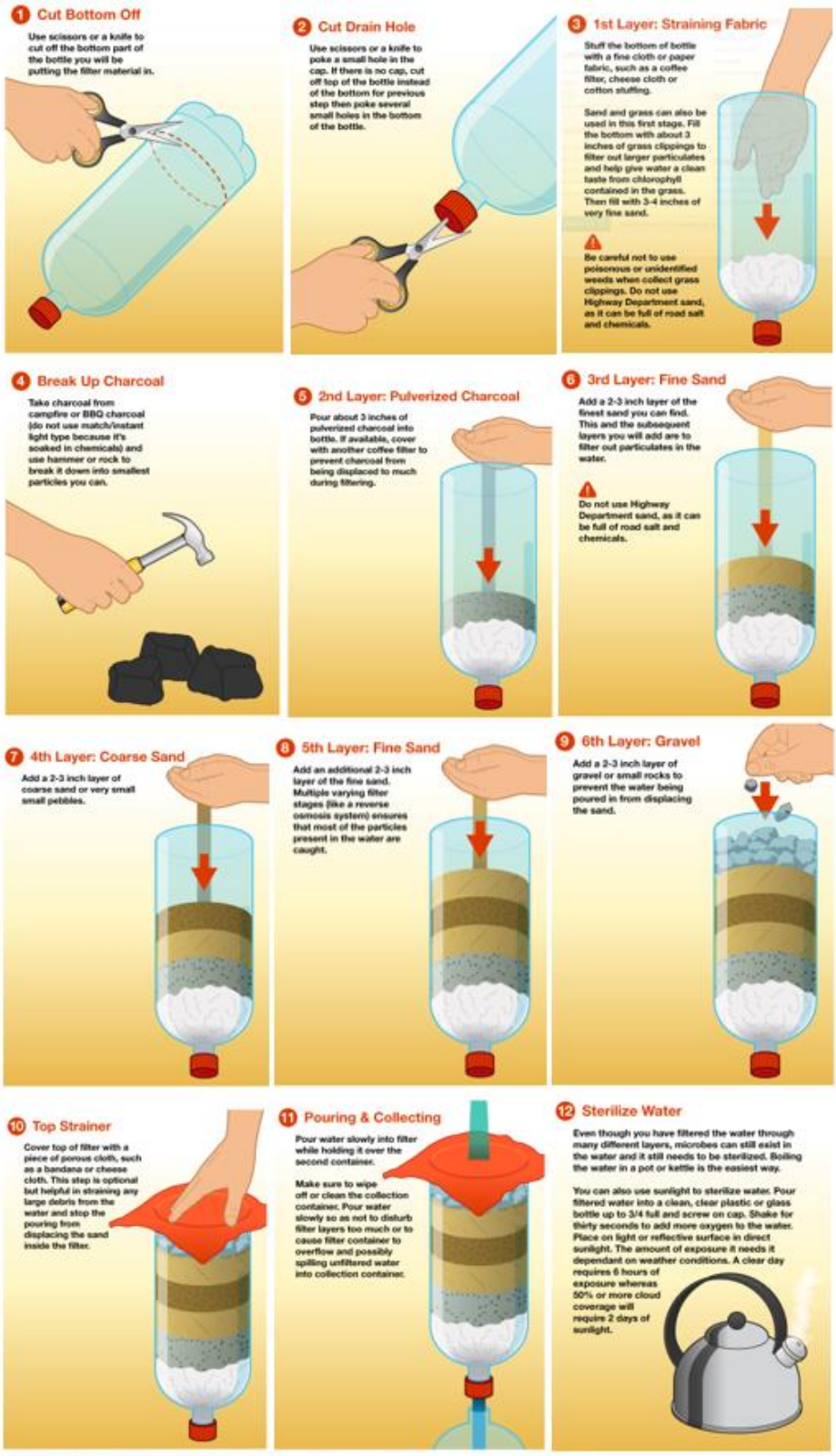
Alternative Irrigation - The promise of Runoff Agriculture by Christopher Barrow

E8 - Pot irrigation



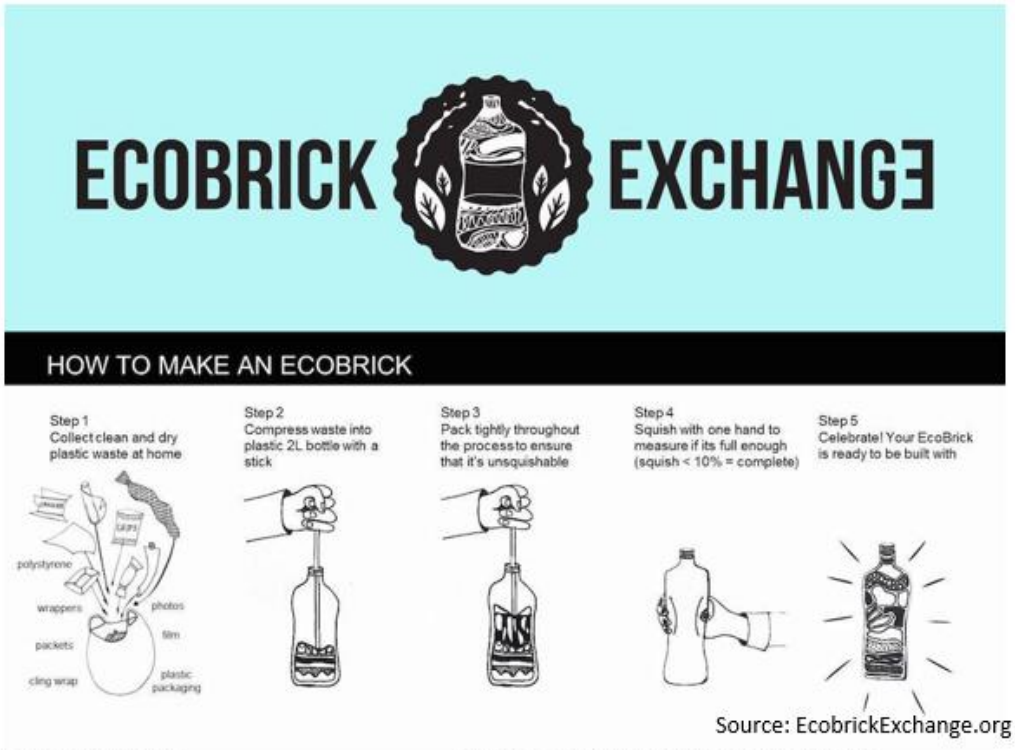
Source: https://permaculturenews.org

E9 – Emergency water filter

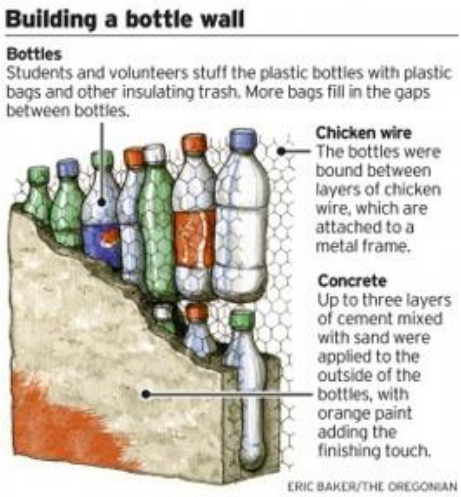


Source: https://www.h2odistributors.com/pages/info/how-to-make-a-water-filter.asp

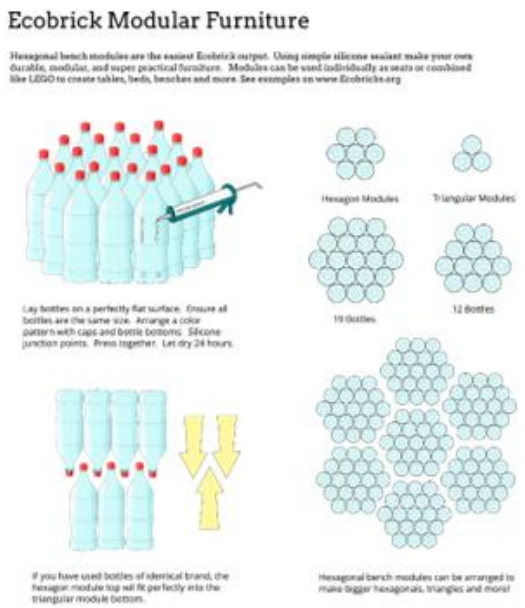
E10 – Ecobrick preparation and use



Vertical wall variants:



Modular Building with plastic bottles:



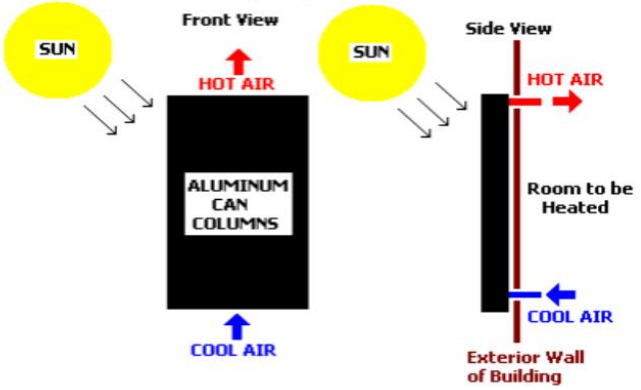
Source: Ecobricks.org

E11 - Plastic bottle roof

E12 - Solar heater assembly

Solar heater from aluminium cans

- Make a frame
- For the last can of each column a hole drilled on the side, for the other cans drill a hole on the bottom
- Glue cans together
- Paint the cans MATT black
- Seal the frame with glazing



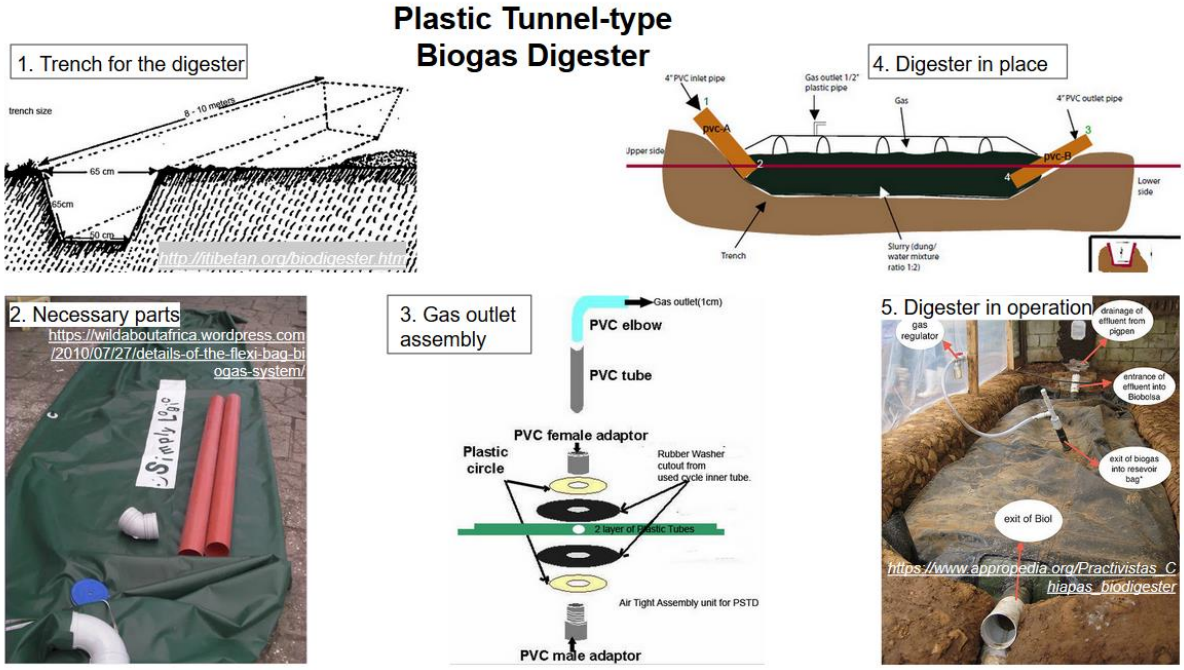
http://www.reuk.co.uk/wordpress/solar/make-a-simple-solar-air-heater/

Screen absorber collector

- Make an absorber frame.
- Put 1 layer of screen in the middle of the frame, wrap and fix around the remaining material the front and back.
- Cut inlet and outlet holes in the collector box to fit pipes in
- Fix the absorber frame in the collector box

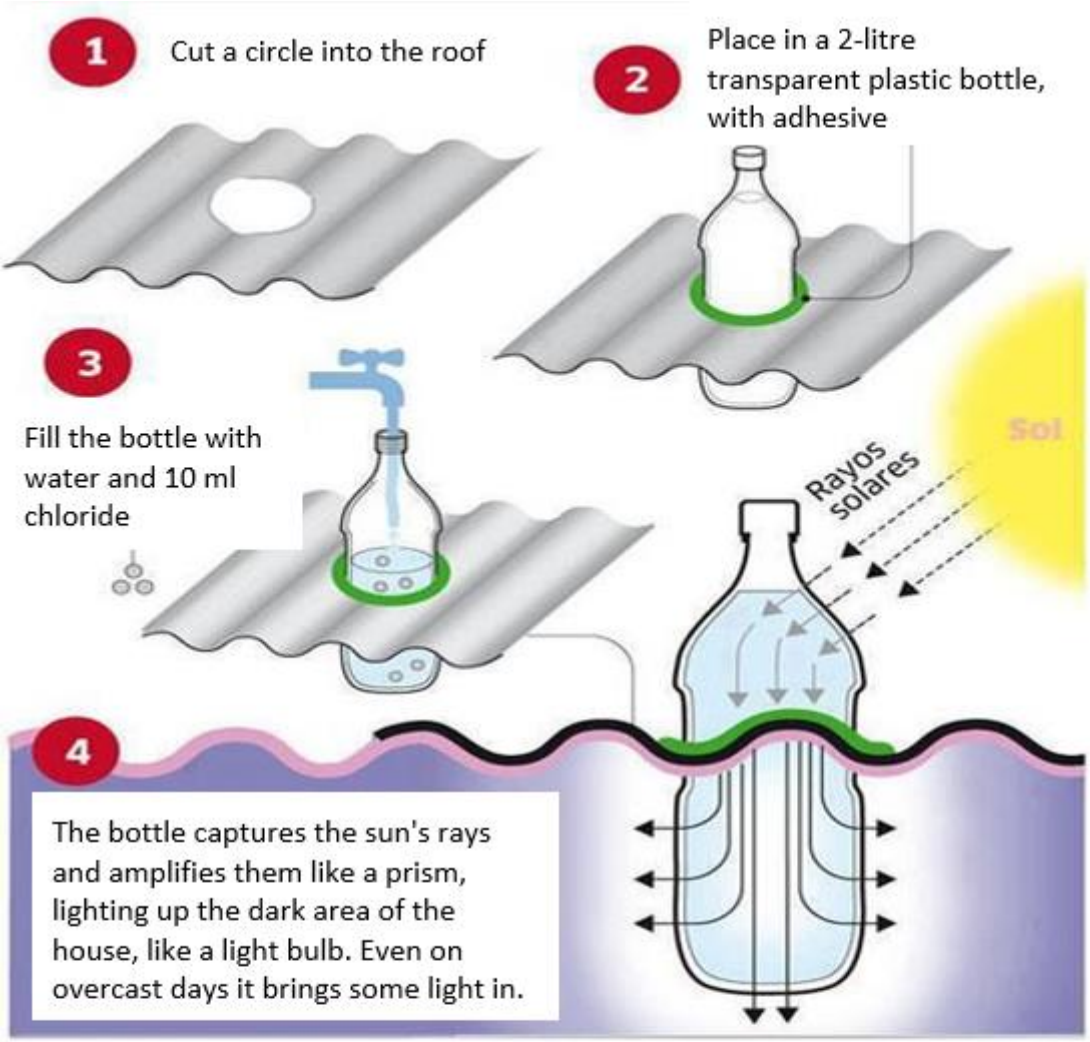
https://www.builditsolar.com/Experimental/PopCanVsScreen/PopCanVsScreen.htm

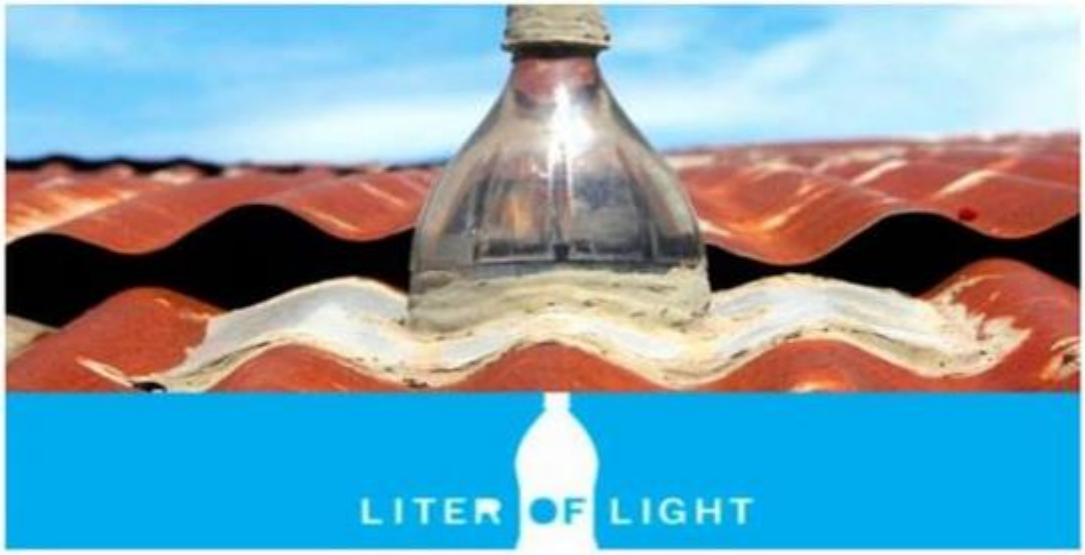
E13 – Tunnel-type biogas digester assembly guide



E14 – Small scale DIY biogas digester assembly guide

E15- Using plastic bottles for lighting

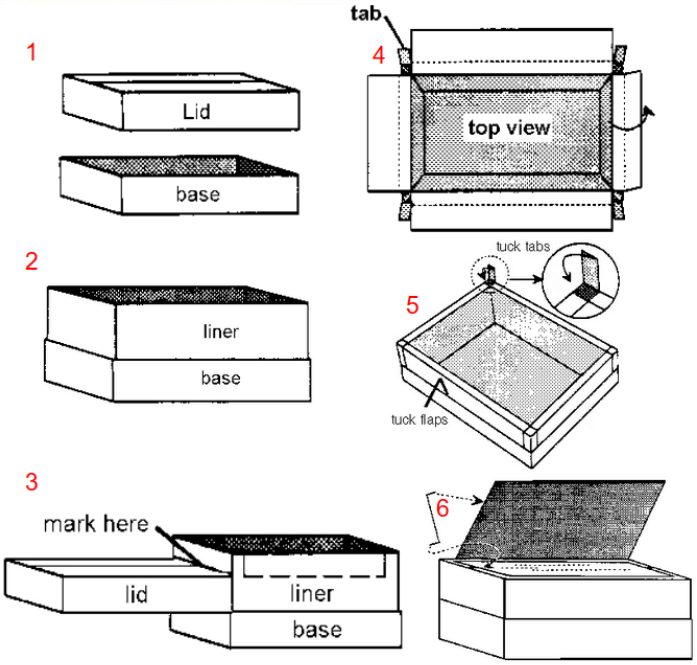




Solar box oven

1. Frame and box made of wood.
2. Cardboard sides covered with tin foil (glued with flour+water mixture)
3. Metal box inside the cardboard box.
4. Add a metal plate with 10mm spacers Glass on the top to trap heat
5. Or slightly inward for fruit drying

http://www.lowtech.co.za/solar-oven

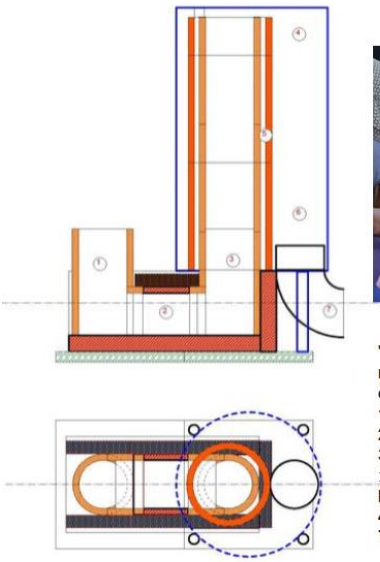


Easy Lid Solar Cooker

1. Cut a large card box in half
2. Fold an extra cardboard piece so that it forms a liner around the inside of the base
3. Using the top half of box1 cut out the liner leaving tabs
4. Glue aluminum foil to the inside of the liner and to the bottom of the outer box inside.
   Place a smaller box into the opening.
   Place some newspaper between the two boxes for support.
   Fold the flaps of the smaller box so that fill the space between the two boxes.
5. Fold the tabs to the inner box.
   Paint the bottom of the inner box black.
6. Use the top of box one for lid.
   A wire can be used to keep the lid open.
   Place a baking sheet or glass to the top of the box.

https://solarcooking.fandom.com/wiki/Easy_Lid_Cooker

Rocket Stove Heater



"J-style" combustion unit of a Rocket mass heater profile view (top) and top down view (bottom).
1: **Fuel feed**.
2: **Burn tunnel**.
3: **Heat riser**. **5**
: **Fire box** (comprising the fuel feed, burn tunnel and heat riser).
4 and **6**: **Downdraft bell / barrel**.
7: **Manifold.**

A. The J-tube made of bricks
B. Almost finished stove
C. Outer chimney on a base platform
D. Inner chimney
E. Finishing touches

Photos from Africa Kitchen Revolution, Baful, Cameroon
https://www.facebook.com/africakitchenrevolution/

https://en.wikipedia.org/wiki/Rocket_mass_heater

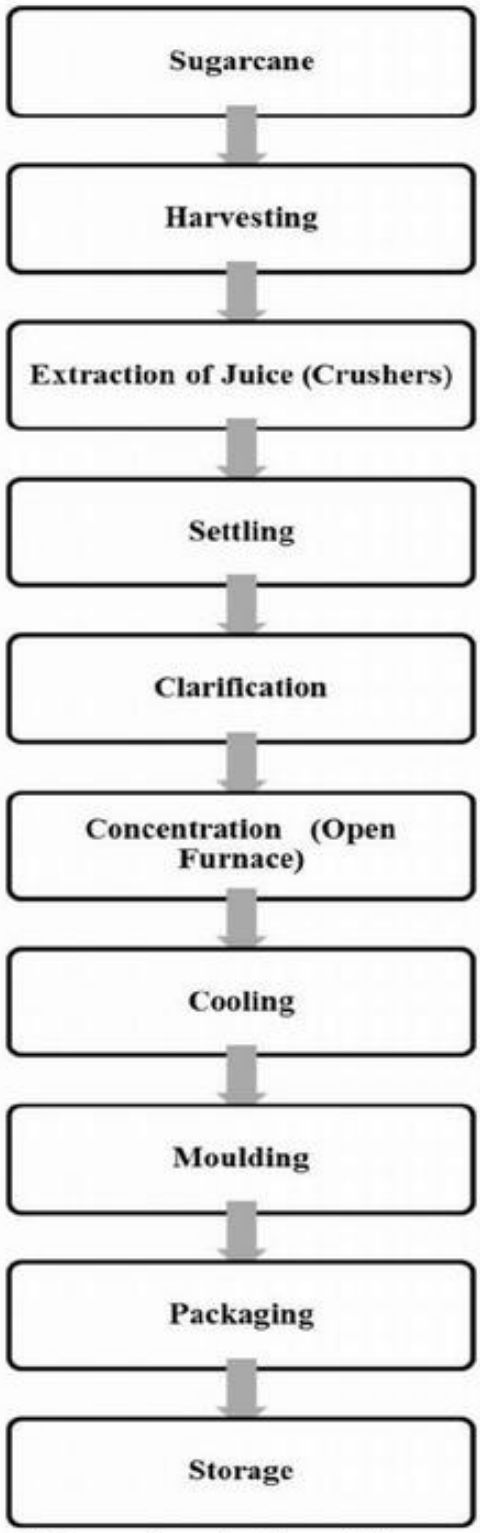


Fig. 1. Process flowchart for solid jaggery production

Fig. 2. Horizontal three roller crushers

Fig. 3. Juice Boiling in open pan

Fig. 4. Wooden moulds

Fig. 5. Solid Jaggery


MAKE PAPER
first you need to find some
CELLULOSE FIBER
or
or
CLOTH RAG
100% plant-based (Cotton or linen works)
PLANTS
Bast, leaf, grass or seed fiber
SCRAP PAPERS
Printing, watercolor or drawing papers are best
Boil plants with caustic, removing impurities & leaving cellulose fiber
break down fiber to
MAKE PULP
or
or
HOLLANDER BEATER
Necessary for rag, but also works for plants & recycled papers
HAND MALLET
For Japanese style paper-making with kozo, gampi or mitsumata plant fibers
KITCHEN BLENDER
For scrap papers. Cut into inch square pieces, soak, & blend with water
now the pulp is ready for
SHEET FORMATION
MOULD & DECKLE (A SCREEN)
VAT OF WATER AND PULP
Lift the mould & deckle up through the slurry; a thin layer of pulp is left on the screen
COUCHING*
Transfer wet sheet from screen to an absorbant surface
* Prounounced "coo-ching." Not a lie.
remove the water by
PRESSING
Use a sponge & brayer, a book or flower press, or a hydraulic press
&
the final step is
DRYING
Press onto a flat surface, or use a papermaker's stack dryer
PAPER
PAPER SLURRY
Keep exploring papermaking! Subscribe to paperslurry.com
FREE TO SHARE

THANK YOU

As a sign of gratitude, the community shared a precious gift: the smile as a message of hope for the future generation

"We don't need to have deep pockets or be rich to help the needy, the poor and the hungry. We need to have a heart." - Kevin Dcruz