A Permaculture Design for Shimbwe

Shimbwe village, Kilimanjaro Region, Tanzania



This Booklet

Permaculture Foundation Tanzania (PFT) asked the Design Team to do a permaculture design for its land on the lower slopes of Mount Kilimanjaro.

The design work period was from January 10th until January 26th 2018, and the Design Team made the presentation of their design to PFT (Tim Tubb and Victor Kinyaiya) on Saturday January 27th 2018.

This booklet is intended to accompany the design put forward at that presentation, and it includes the original maps and diagrams (with improvements). In addition, a lot more material has been included: background information on the project and the area; a section explaining permaculture; our observations, analysis and proposals in much greater detail; further information on land management; plus a resources section.

The Design Team also felt it was important to express our thoughts and concerns regarding the management of land in Shimbwe by local farmers and potentially by PFT.

We think that all of this information combined will be of benefit to present and future members of PFT and others involved in the project including volunteers, and we think it should be disseminated to all interested parties, including decision-makers, village leaders and farmers.

With the extra information provided here, this booklet can stand alone as a permaculture design, and has information that could be useful for land management elsewhere on Kilimanjaro, and possibly in other tropical regions.

The Design Team wants to make it clear that this booklet was produced entirely by us, the Design Team, who are completely independent of PFT, and the ideas and opinions expressed here may not reflect the views of PFT.

We believe this booklet is an accurate reflection of the design process, our proposals, and our concerns, and we have produced this booklet and make these proposals in good faith, in what we believe to be the best interests of the land and the people of Shimbwe.

PFT are responsible for the safe undertaking of their work, and the Design Team advises that PFT seeks specialist knowledge before any major works are undertaken, in particular any works relating to earth moving, re-directing water, and construction works of any kind. For the avoidance of any doubt, and as we state throughout this booklet, we strongly advise against the cultivation of steep slopes, the creation of terraces in the valley, and the felling of trees. The Design Team cannot be held liable for the consequences of any work implemented by PFT.

Terms and	Acronyms	used in	this	booklet

KINAPA	Kilimanjaro Nation
PFT	Permaculture Four
The Design Team	Florencia Spirito, F Martin Hawkins, O
The Clients	Tim Tubb/PFT and
The Land	The land in the va Kinyaiya family
The Homestead	The homestead of
The African House	The African House homestead) – see
PDC	Permaculture Desi
The Project	The management
Shamba (s), Mashamba (pl)	The Swahili word f consisting of the d In Chaga: kihamba
UN FAO	United Nations For

Text:	Lisa Höpfl, Oak Johnson, Sophia Leroy
Photos, Diagrams, Editing:	Lisa Höpfl, Oak Johnson, Sophia Leroy, Florencia Spirito, Franziska Pemsel, Martin Hawkins
Booklet Design & Layout, and digital maps / plans:	Lisa Höpfl

Published July 2018

Contact info and digital copies: Facebook group: hoepfl.lisa@gmail.com; oak.johnson@yahoo.co.uk Permaculture on Kilimanjaro nal Park

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Franziska Pemsel, Lisa Höpfl, Dak Johnson, Sophia Leroy

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f the Kinyaiya family

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and development of The Land

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I. Project Introduction

The Permaculture Foundation Tanzania and the Location of the Project

Permaculture Foundation Tanzania is a new NGO project (registered in 2017). It has 15 acres (6 ha) of land situated in the valley of the Rau River, Shimbwe village, in the foothills of Mt Kilimanjaro. It is adjacent to Shimbwe Juu, which was designated by the UN FAO as a Globally Important Agricultural Heritage System because of its centuries-old agroforestry system.



Tanzania East Africa

The Local Area

The Land is on the edge of Shimbwe village, a spread-out settlement consisting of small-holdings of about 0.5-1 acre (0.2 - 0.4 ha). Together with Shimbwe Juu, it extends up to the boundary of Kilimanjaro National Park. It lies 8 miles (12 km) from Moshi, a town of 200,000 inhabitants.



Kilimanjaro Region in Tanzania

Kilimanjaro Region

Location on the slopes of Mt. Kilimanjaro

The Land

The Land is owned by the Kinyaiya family who are supportive of the project and have agreed that PFT can use the land. It is in a beautiful steep-sided valley, on the west side of the village of Shimbwe. There was a small-holding on the land until about 50 years ago, and there remains two areas of banana, coffee and yams which are still maintained.

Some areas have a cover of canopy trees including avocado trees, but there are also deforested areas which have been colonised by Lantana camara, a very invasive shrub. Most of the land is very steep, with just a small area of flat ground by the Rau River. It has poor access along narrow tracks.



Location of The Land in the Rau Valley



Path to The Land

Typical land use: Agroforesty system

View from the lower path to The Land

Project Vision & Mission

According to the PFT founder Tim Tubb the vision of the project is to develop a permaculture community, and for it to inform and influence local people in sustainable development.

The project will develop the land to demonstrate permaculture principles and methods, and to provide training and employment opportunities for local people.

In the longer-term the PFT wants to provide ongoing support for local farmers.

Founder of the PFT

Tim Tubb Founder and Representative of PFT

Although PFT was initiated by Tim, he is not a member of PFT.

Current members of the PFT

/ictor Kinyaiya	Chairman, Shimbwe
Zulfa	Secretary, Arusha
Fraterne Kinyaiya	Family Member, Shiml
Arnold Kinyaiya	Lawyer, Family Membe
Prisckiller Felix	Treasurer, Moshi

History and Current status of the PFT

PFT was finally registered as an NGO with the Tanzanian government in July 2017, after a process that took more than two years. The benefits of being an NGO are to give official recognition to the project as a whole, to allow volunteers to stay on a 12 month visa, and for tax exemption.

There is a verbal agreement between PFT and the Kinyaiya family for use of The Land. There is no written agreement. The PFT and the Project at Shimbwe have been promoted by PFT to the village council and the villagers over the last two years.

Involvement of The Design Team

In December 2016, Tim Tubb, acting on behalf of PFT, visited Keveral Farm in Cornwall, England, and asked Oak Johnson if he would like to be involved in doing a permaculture design for The Land. Further plans were made in August 2017, and after a Facebook page was created, and a notice put on the Permaculture Association (UK) website, a design team of 6 people was assembled.

The design process started on January 10th 2018 at the Homestead in Shimbwe.

After 14 work days of mapping, research and analysis, meeting people and designing The Land and The African House the design presentation was made by the Design Team to the clients (Tim Tubb and Victor Kinyaiya) on Saturday January 27th 2018.





bwe er, Dar Es Salaam





Victor Kinyaiya

II. Introduction of the Design Team



The Design Team (italic) at a meeting with local farmer Dr. John

Florencia Spirito

- From Argentina
- Biologist with a PhD in Ecology
- Focus on sustainable use of land and the effect on soil Carbon storage

Franziska Pemsel

- From Germany, based in Leipzig
- PDC in 2016, working towards Diploma in Applied Permaculture Design
- Student of African Studies

Lisa Höpfl

- From Germany, based in Munich
- PDC in 2017, at Sunseed Desert Technologies, Spain
- Landscape Architect with experience in tropical environments
- Has her own company and teaches at TU Munich

Martin Hawkins

- From South Africa
- Based at Keveral Farm in Cornwall since 1993
- PDC at Keveral Farm in 1994

Oak Johnson

- From the UK, based at Keveral Farm in Cornwall since 1990
- PDC in 1994, putting permaculture into practice for 25 years
- Helped to organise 15 PDCs at Keveral, including some teaching
- Management of woodland and orchard at Keveral
- Experience in managing co-ops and working with groups for more than 25 years

Sophia Leroy

- From France, based in the UK
- Intro course to Permaculture in 2017
- Background in Wildlife Conservation in Africa, Social Sciences
- MSc in Conservation Science

III. Permaculture - What Is It?

Definition, origin, and a brief explanation

"Permaculture is a design system for creating sustainable human environments" (Mollison).

The concept of Permaculture was developed by Bill Mollison and David Holmgren in Australia in the mid 1970s. Their ideas focus on the ecological but productive management of land, and on working in harmony with nature. The importance of people co-operating and caring for each other has also been developed by many permaculture practitioners. The ideas can be put into practice in any environment – rural and urban, temperate and tropical – and on any scale, to help us live in a more ecologically sustainable way.

The Permaculture Ethics

Red definition from: Permaculture – A Designers' Manual by Bill Mollison (1988) Purple definition from: Brighton Permaculture Trust

1. Care of the Earth:

Provision for all life systems to continue and multiply. Earth care aims to look after and rebuild natural capital. Although often depicted as a plant, it isn't just about plants and trees, but also the air, the soil, water, and other species.

2. Care of People:

Provision for people to access those resources necessary to their existence. People care aims to provide for people's needs. This includes access to good food, water and air, but also goes beyond that to include other needs like community, companionship, joy, and fulfilment.

3. Fair shares

Setting limits to population and consumption:

By governing our own needs, we can set resources aside to further the above principles. Fair shares is about setting limits on our consumption, as well as creating and re-distributing a surplus. Scarce resources such as water and firewood must be used fairly and wisely.



The Permaculture Principles

(For a fuller explanation on all of these principles, see: www.permaculture.org.uk/principles)



Bill Mollison's Principles

text in black: taken from Mollison's books (with some small changes) text in green: written by Oak (and Flor where stated)

From: Permaculture – A Designers' Manual (1988):

1. Work with Nature rather than against ..assist nature rather than impede..

Make your work easier by working with nature, not fighting against. If possible, let nature take its course. Intervention is extra work, which may not be necessary. 'Weeds' can often be left, as they can be beneficial - they can shade the soil in the dry season, and hold the soil in the rainy season. There is no bare soil in nature.

2. The Problem is the Solution:

(and ,Everything Works Both Ways' in Introduction to Permaculture) (Problems are Opportunities) It is how we see things that makes them advantageous or not. Our fixed attitudes are problems when dealing with 'problems'. Disadvantages can be viewed as problems, and we can take an energy-expensive approach to get rid of the problem, or we can think of everything as being a positive resource. It is up to us to work out just how we can make use of it. Problems can be intractable weeds (eq lantana in the tropics)... How can we turn these into useful components of our system ? Lantana is an excellent soil builder; it can be shaded out, or slashed and used as rough mulch around pioneer trees (which will eventually shade out the lantana). Addressing a problem will lead us to better ways of working. If soil erosion is the problem, then solving it will lead to better land management than we had before. Flor: If you see yourself confronted with a perceived problem, why not try and look at the situation from a different angle? Is there any way to use it to your advantage? "You don't have a snail problem, you have a duck deficiency!"

3. Make the least Change for the greatest possible Effect (Minimum Intervention for Maximum Effect)

Work efficiently, your time and energy are resources - use them to good effect on the most beneficial tasks, don't waste them on unnecessary tasks. Use fuel-efficient stoves - collecting firewood is time-consuming and may be unsustainable. Digging over of the ground in the Shimbwe agroforestry system - removing ground cover plants, leaving the soil bare, the extra work – is it necessary ?

4. The Yield of a System is theoretically Unlimited

The design can always be improved; something can always be added; more uses can be found for what is already there. Bee hives can be added to provide honey and increase pollination and fruit yield.

5. Everything Gardens (All living things have an effect and can benefit their environment) In a diverse system, pests are eaten by other animals; burrowing animals aerate the soil and help with infiltration and retention of rain-water; animals including livestock turn vegetation to faeces and manure to improve the soil.

From: Introduction to Permaculture (1991):

6. Relative Location

The core of permaculture is design. Design is the connections between things. ... It is how the water, the chicken and the tree are connected. To enable a design component to function efficiently, we must put it in the right place. Create beneficial relationships. The house is located close to the water supply, and the vegetable plot is close to the house.

7. Each Element performs many Functions

Each element in the system should be chosen and placed so that it performs as many functions as possible. A tree has many benefits – firewood, fodder, soil stabilisation and improvement, a habitat for birds and bees, being part of the water cycle, maybe also fruit or nuts, and shade, and eventually timber.

8. Each important Function is supported by many Elements

Important basic needs such as water, food and energy should be served in two or more ways. Have a range of sources for a resilient system.

Water can come from a spring, stream or rainwater collection.

Food can come from agroforestry, the vegetable garden, livestock, foraging from the wild, and trading.

9. Efficient Energy Planning: Zones, Sectors, Slopes

Efficient Energy Planning: Zones, Sectors, Slopes (very relevant to PFT and the Land)

Zone planning means placing elements according to how much we use them or how often we need to visit them. The more visits needed, the closer they need to be to the house ... or we waste a great deal of time, effort and energy visiting them.

The golden rule is to develop the nearest area first, get it under control (and productive), and then expand. Too often, a beginner chooses to garden far from the house, and neither harvests the plants efficiently, nor cares for them well enough. Slope largely decides the placement of access, water supply, forests and cropland.

10. Use Biological Resources

In a permaculture system, we use biological resources (plants and animals) wherever possible to save energy and do the work of the farm. Plants and animals provide fuel, fertiliser, tillage, pest control, weed control, nutrient cycling, habitat, erosion control, and so on.

Building up biological resources on site is a long-term investment which needs thought and management in the planning stages - as it is a key strategy for recycling energy and developing sustainable systems. Plant trees for livestock fodder that then becomes manure for the vegetable plot. The wood and mud houses of Tanzania are very ecological – but only if the wood comes from a sustainable source.

11. Energy Cycling (Cycling of Energy, Nutrients, Resources – Catch, Store and Use)

A community supported by a diverse permaculture is assured of a varied diet, providing all nutritional requirements, while not sacrificing quality or destroying the land that feeds it.

Permaculture systems seek to stop the flow of nutrient and energy off the site and instead turn them into cycles, so that, for instance, kitchen wastes are recycled to compost; green manures (and bean plants, which have fixed nitrogen in their roots), are returned to the soil ...

Keep things local (support local farmers). Don't lose resources from the site (prevent soil erosion).

12. Small-scale intensive systems, including Plant Stacking

Small-scale intensive systems means that much of the land can be used efficiently and thoroughly, and the site is *under control*; start at your doorstep; fully develop the nucleus before moving on. It is easy to make the mistake of spreading out too quickly with extensive gardens. This is a waste of time and energy.

If we cannot maintain or improve a system, we should leave it alone, thus minimising damage. Work outwards from well-managed areas, keep it manageable.

Plant stacking uses the vertical space and maximises the use of the light coming in: tall trees, shorter trees, shrubs, herbs, vegetables, climbers. The agroforestry at Shimbwe is a good example of stacking.

13. Accelerating Succession and Evolution

A natural system develops towards mature climax vegetation eq. a forest. Conventional agriculture (including maize) fights against this, keeping everything small by growing mono-cultures of annual crops, and requiring a high input of energy.

The mature system (such as the Shimbwe agroforestry system) requires management rather than energy input, and always has yields.

Woody perennial shrubs such as lantana and gorse make excellent soils when they break down after being cut back (and from leaf fall), and are eventually shaded out by forest trees.

Use what is already growing to speed up the evolution to a mature system. Use lantana to aid reforestation !

14. Diversity

The sum of yields in a mixed system will be larger than the yield of a monoculture.

Tidiness separates species, creates work, and may invite pests. Disorder integrates species, reduces work and discourages pests. Disperse yield over time, so that products are available during every season. The importance of diversity is the functional connections between the elements.

15. Edge Effects

The edges where two ecosystems meet are the most diverse and productive places, for example, between land and water, grassland and forest. There are the species of both ecosystems, plus species unique to the edge habitat. These are the places where human settlements developed. Edges can be increased by having hedges and shelter-belts between areas of crops. An agroforestry system has lots of edge because of the vertical stacking.

16. Permaculture is Information and Imagination-intensive

Permaculture is not energy- or capital-intensive, rather it is information-intensive. It is the quality of thought and the information we use that determines yield... We are using not only our physical resources, but our ability to access information and to process it. Information represents the knowledge, experience, ideas, and experimentation of thousands of people before us. If we take the time to read, observe, discuss and contemplate, we begin to design systems which save time and give us yields.

Zones in Permaculture

Zones 0, 1 and 2 are where we spend most of our time, where most of our activities take place, and where we locate the things that need most attention. We can easily keep our eyes on things, not forget about jobs that need doing, and not spend lots of time walking between places. Zones 3 and 4 are visited less frequently, where things are located that need less attention. Zone 5 is visited very rarely, and is mostly wild, so needs little or no intervention.

Zone 0

The home, or work-station.

Zone 1

The area immediately around the home or work-station: the yard, the garden, outdoor seating, a small greenhouse (for propagation and salads), a herb garden, the pizza oven, the tool shed and workshop; a children's play area, the firewood store, water tanks for domestic use, rainwater collection butts, the waste and recycling area, a small compost area, the compost toilet. In Shimbwe, Zone 1 would also include the livestock, as they are so small-scale and kept permanently in small sheds, meaning that they need regular feeding. It would also include the cook-house, the poultry and the plot of mchicha (amaranth).

Zone 2

A little further away from the house, this could include the vegetable plot, greenhouses / polytunnels, soft fruit, a small forest-garden, a small pond, poultry, small-scale dairy animals (goats, cows), larger composting, farm-buildings / barns, larger water tanks for irrigation. In Shimbwe, Zone 2 would be the agro-forestry of the mashamba, consisting mainly of bananas, coffee, yams, avocado trees and shade trees such as mruka.

Zone 3

Larger-scale, more extensive production: field crops, livestock and pasture, orchard, agroforestry, shelter-belts, larger ponds and reservoirs.

Zone 3 is not applicable to Shimbwe as the small-scale farming means that these land uses are in Zone 2 or don't exist at all - the possible exception being the maize production in the upper part of Shimbwe Juu.

Zone 4

Woodland and forest that is

managed - for firewood, timber and fodder. Wild foods can be harvested. Planting and reforestation may be necessary. Most of the valley of the River Rau by Shimbwe is Zone 4.





Zone 5

Mostly left to nature and rarely visited, such as the native forest of the Kilimanjaro National Park. It is a biodiversity reserve where the local ecosystem is allowed to thrive. Even on a small area of land, a small Zone 5 could be created in a quiet corner.

The Permaculture Design Process – a brief summary of the different stages

1. Observation / Survey

A base-map of the land is created showing boundaries, buildings, roads and paths, topography, water features, significant trees, and North/South. Sun and wind directions should be shown if relevant. Observations are made over as long a time period as possible, looking at land use and human activities; vegetation; wildlife; soils; and climatic events including frosts, droughts, strong winds, and water flows in times of heavy rainfall. These are recorded on overlays on the base-map.

The designers start to note the Limiting Factors, which are problems or potential problems that we may need to overcome.

2. The Client Interview

This gives us additional information, which may provide solutions to some limiting factors but may also raise new ones. The client interview also informs us of the client's objectives that we should try to meet, though sometimes they may not be realistic.

3. Evaluation / Analysis

We evaluate our observations. We assess the limiting factors. Can we live with them, or do we need to know that we can overcome them (and how) so that they do not hold back aspects of the project ? We look at "leaks" that need fixing, where valuable resources might be being lost. We start to think about broad strategies to meet the client's objectives and to address any other issues that we have identified. We can explain our reasoning behind our strategies. We add the details at the Designing stage.

4. Designing

Knowing the client's objectives (eg. food production), and taking into account the Limiting Factors (eg. steep slopes), we identify Systems (eg. agro-forestry) and Elements (eg. an avocado tree) that meet the objectives. We also address other issues that we have identified, that the client may not have considered. We decide on the Placement – the most suitable locations for these systems and elements.

We reject or defer ideas that are unrealistic, not cost-effective, not time-efficient, or not beneficial enough. If limiting factors need to be overcome, we put forward solutions. We must take into account the resources that we have, or could have, available to us.

5. Design Proposals

Our ideas and solutions are integrated to become our design proposals.

We prioritise these according to:

- the urgent need to "fix leaks" or avoid destructive events in order to not lose resources (eq. maintaining water channels to control the flow of water)
- the necessary resources (eg. labour, materials or money) being available now or not till a later date
- some actions must happen before other actions can happen (eg. improving access to facilitate the construction of a building)
- the client's priorities (which may not always be achievable)

We can then develop an Implementation Plan (a programme of work). The proposals can be presented to the client in various ways – maps, diagrams, drawings, photos, text, verbally.

6. Implementation

Subject to the client's agreement and the necessary resources being made available, the practical work is undertaken to implement the design proposals, as set out in the Implementation Plan.

7. Maintenance

We maintain what has been implemented, and modify it according to what is working well and what is not working well.



IV. Research

Action Plan for Shimbwe Juu

The Land available for PFT is situated in the Valley of Rau River, on the western edge of Shimbwe. In 2010, the UN FAO designated the neighbouring village of Shimbwe Juu as a Globally Important Agricultural Heritage System (GIAHS) because of it traditional agroforestry system.

In its Action Plan for Shimbwe Juu, the UN identified the Chagga "home-gardens" (Kihamba) as "one of the country's best examples of a resilient upland farming system deserving support in line with the GIAHS objectives. Its dynamic conservation through targeted measures on the ground, combined with the right policy support would ensure food security and livelihood sustenance, as well as sustainable management of its environment and the continuity of its living agricultural heritage."

The Agroforestry System in Shimbwe

The agroforestry system is characterized by a multi-layered vegetation structure. The upper layer is trees which provide shade, fodder, fruits, firewood, timber and medicine. Below this, more than 15 varieties of bananas are grown, then coffee, and then vegetables. This multilayer system maximizes the use of the land and its productivity. Livestock, mainly cows, pigs, goats and chickens are also kept on the vihamba. The average size of a home-garden varies between 0.5-1 acre (0.2 - 0.4 ha)

Thus, agroforestry simulates a natural system but with the components (trees, crops and animals) consisting of species carefully selected for their useful products and/or services. The Chagga home-gardens are mainly for subsistence, but include coffee as a cash crop (although the value of this has declined). Bananas, avocados, mangoes, meat and honey are also sometimes sold, providing a small income.



Typical Chagga home garden

Vegetation profile & ground plan of a typical Chagga home garden

Climate

The climate of Shimbwe Juu (and therefore Shimbwe) is characterized by a typical equatorial day-time climate, and annual rainfall is approx. 1200-3000mm (UN Action Plan for Shimbwe Juu).

According to A. Hemp, (2005) the distribution of precipitation over the year follows the intertropical convergence zone and is modified by the respective elevations.

Due to its equatorial location, two distinct rainy seasons occur in the area:

The long rains from March to May, and the short, but heavy rains around November. The driest period is from July to October, while April and May are the wettest months. However, rainfall and temperature vary with altitude and exposure to the dominant wind from the Indian Ocean.

The mean annual temperature in Moshi (813 m height above sea level) is 23.4°C (Walter et al 1975). It decreases to 18.2°C at 1400 m inside the coffee-banana belt (data according to A. & C. Hemp 2009) and -7.1 °C on the top of Mt Kilimanjaro at 5800 m (Thompson et al, 2002)

Climate change and the importance of the Mashamba



Distribution of the Chagga home gardens Hemp and Hemp, 2008)

In this zone the rainfall is very high while evaporation losses are low due to an almost permanent cloud cover. A great amount of water from this zone flows underground, directly to the savanna plains.



Climate of the Kilimanjaro district



By 1984, the Chagga home gardens were estimated to cover 120,000 ha of Mt. Kilimanjaro mainly between 900 and 1800 m above sea level, in the climatically most favourable zone of the southern and south-eastern slopes.

Mt. Kilimanjaro is a critical water catchment for both Tanzania and Kenya, because of its high rainfall and extensive forests. The forest zone forms the main upper catchments of the Pangani River, one of Tanzania's largest rivers.

Mt. Kilimanjaro's ice cap is relatively small in comparison to its height and surface area and its contribution in developing water sources must be assumed to be equally slight (Ramsay 1965). Very few streams originate in this zone and most of these have small flows. In contrast, the montane forest belt between 1600 and 3100 m provides most of the water (96%) coming from the mountain (Ramsay 1965).

Potential impacts of climatic changes:

Tanzania is already experiencing the effects of climate change. The most obvious indicator of this is the shrinking of the ice cap on Mt Kilimanjaro. At the current rate, most of the ice on Kilimanjaro will disappear by 2040 and it is highly unlikely that any ice body will remain after 2060 (Wikipedia). Although visible, this change is believed to have little effect on the water flows further downstream. On the other hand, the increasing temperatures since the mid 1900s as a result of climate change are in turn increasing the risk and prevalence of fires on the slopes of the mountain (Agrawala et al., 2003; Hemp, 2009) reducing forest cover which represents a crucial water catchment, a source of forest products and an important biodiversity hotspot. The loss of forest cover is further exacerbated by illegal logging and the expansion of agriculture land at the expense of indigenous tree species.

Although predictions regarding future precipitation trends remain uncertain, records point to a general decrease in rainfall since the 1880s in the Kilimanjaro area (Agrawala et al., 2003) whilst the onset of the rainy seasons is becoming ever more unpredictable. This coupled with increasing temperatures is already having an effect on agricultural practices, with reduced productivity due to overall drier conditions in large parts of the country. For instance, maize production will likely be negatively impacted by rising temperatures (Agrawala et al., 2003). On the other hand, coffee production could benefit from it. In some areas of Tanzania, higher temperatures are pushing some farmers to grow drought resistant crops at the expense of indigenous crops (Mason 2016), a worrying trend that contributes to the impoverishment of seed varieties. Pests are also becoming more common. Finally, the rising temperatures are pushing vector born diseases such as malaria to higher altitudes, causing a serious health concern.

The agricultural practices of the Chaga are highly dependent on channel based irrigation systems derived from the forest's capacity to capture and retain water. Therefore, the loss of forest cover represents a worrying trend, that would not only affect the immediate surrounding areas (such as Shimbwe) but also regions further afield which are dependent on the climate regulating effects of Kilimanjaro's montane forests. The preservation of the remaining tracts of indigenous forest coupled with reforestation initiatives are therefore a crucial step towards mitigating the effect of climate change. Both elements form the core of the strategy put forward by the Design Team which recommends responsible agriculture practices and reforestation of native hardwood species.

Soil

The Soil found on the Land is probably a Nitisol type.

According to the FAO World Reference Base for Soil Resources it is a deep, red, well-drained soil with a clay content of more than 30% and a blocky structure. Nitisols form from fine-textured material weathered from intermediate to basic parent rock and kaolinite, halloysite and iron oxides dominate their clay mineralogy.

The natural vegetation on nitisols includes tropical rain forest and savannah. Limitations frequently include low phosphorus availability, but once ameliorated, these deep, stable soils have high agricultural potential, and are often planted with crops. (Wikipedia)





Typical red soil

Chagga garden: soil with typical crops

Vegetation on Mt. Kilimanjaro



Due to its height and its location close to both the equator and the Indian ocean, Mt Kilimanjaro provides conditions for highly differentiated and distinctive vegetation zones.

Cultivated zone and forest (800m-2800m)

The forest zone, along with the cultivated zone that lies below it, together receive the most rainfall. It houses the greatest variety of both fauna and flora.

Heath and moorland (2800m-4000m)

These two zones overlap, and together occupy the area immediately above the forest from around 2800m to 4000m – known as the low alpine zone. Temperatures can drop below 0° C up here and most of the precipitation that does fall here comes from the mist that is an almost permanent fixture at this height.

Immediately above the forest zone is the alpine heath. Rainfall here is around 1300mm per year. Grasses now dominate the mountain slopes. Further up the moorland zone continues, which tends to have clearer skies but an even cooler climate. Average annual precipitation is now down to 525mm. The most distinctive plant in this area – indeed, on the entire mountain – is the Senecio, or giant or tree groundsel.

Alpine desert (4000m-5000m)

At the Saddle, only three species of tussock grass and a few species of the Helichyrsum family can withstand the extreme conditions. This is the alpine desert, where plants have to survive in drought conditions (precipitation here is less than 200mm per year), and put up with both inordinate cold and intense sun, usually in the same day.

Population

Figures for Shimbwe (2017/18):

Shimbwe Chini:8,000Shimbwe Juu:7,000(according to Bertin Mkami: Uru Shimbwe council leader, April 2018)

The slopes of Mt. Kilimanjaro have been inhabitated continuously for the last 2000 years (Schmidt 1989), but in the last century the population has increased drastically:

Population	Reference
50,000 - 60,000	Widenmann (1899)
100,000	Raum (1914)
1,053,204	National Bureau of Statistics (2003)
	Population 50,000 - 60,000 100,000 1,053,204

The main concentration of settlements can be found at an altitude between 1000 and 1800 m, with densities varying from 500 to 1.000 people per km² in some areas (FAO 1986; Timberlake 1986).

Data for Tanzania (Wikipedia)	
Fertility Rate (Children per Woman):	5.2
Annual Growth Rate:	2.9%

The population approximately doubles every 25 years.

Settlement structure

The Chaga people of Shimbwe live on their mashamba (average size 0.2-0.5ha) which are dispersed across the whole of the village area.

Most buildings are simple, one story buildings, half the houses are now concrete (including nearly all of the new houses) - and all have tin roofs. Older houses were made out of a traditional structure of branches with a clay filling or wood boards and a tin or a banana leaf roof.



Traditional building

Main Road of Shimbwe

V. The Design Process

Summary

The Design Team undertook the following steps whilst doing the design work:

- 1. We made Observations of The Land
- 2. We created a Base-map of The Land
- 3. We conducted a Client Interview, which included: 4.
 - the client's visions
 - the client's objectives
 - finance that may be available
 - resources that may be available
 - limiting factors
 - other land that may be available
- 5. We discussed the Permaculture Principles that would guide our strategies
- 6. We Evaluated the information we had gathered so far
- 7. We made Observations of The African House
- 8. We created a Base-map for The African House
- 9. We discussed the Systems and Elements that would meet the client's objectives
- 10. We discussed Placement the locations for the most appropriate systems and elements
- 11. We drew up the Design Proposals, including maps and diagrams, and an I Implementation Plan
- 12. We made the Design Presentation to the clients, Tim Tubb and Victor Kinyaiya, on Saturday January 27th 2018
- 13. Over the following months, we produced this Booklet





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A. General Observation

The Land - Basemap

The Land available for the use of Permaculture Foundation Tanzania is situated in a steep valley formed by the Rau River and a second, smaller stream. The Lower Path is the main access path to flatter part of The Land and to the Lower Shed.

The Upper Path leads to the Upper Shed and further to the existing camping area.

There is no easy network of paths around the Land. The paths are narrow and difficult, especially in wet weather. It takes 30-40 minutes to reach the Land from the Homestead.



The Land - Topography

The Design Team did not have any contour maps or height measurements to rely on. The size of The Land, the overall steepness, and its dense vegetation made it impossible to gather enough information to draw contours. Instead the Design Team decided to use different categories to describe the gradient. Most parts of The Land were considered "steep". The Design Team found only flat or gently sloping areas around the Upper and the Lower Sheds and one medium steep slope next to the flat area around the Lower shed.



The Land - Soil

The Soil found on the Land is probably a Nitisol type as already explained in the Research section. During the observation the Design Team found a deep profile, humus rich soil on the Land. Due to the high clay content, compacted soil on paths gets slippery during and after rainfall.



The Land - Fauna

During the observations and mapping excursions the Design Team was able to spot the following wildlife species or its tracks:

- Monkeys
- Duikers
- Goats
- Many bird species
- Bees, butterflies, beetles and other insects
- Snakes, geckos and amphibians



The Land - Vegetation

The Design Team observed three different vegetation types:

- a) Forest Area; characterized by at least a 4 storey/layer profile with
 - canopy trees
 - smaller trees
 - shrubs, few bananas
 - ground layer

b) Agroforestry of the flatter areas

- canopy trees, eg. mruka
- smaller trees, eg. avocado, plus banana
- shrubs, mainly coffee
- ground cover like Yams, Taro, Cassava or other annuals and perennials
- c) Deforested, mostly lantana camara, quite dense but with some ground cover plants and grasses



B. The Client Interview

The client interview was a very important and intense part of the Design Process in order to understand the client's needs and ideas, but also to learn more about the history of the place, the habits of the local people, and the existing ecosystem.

With the help of the client interview, we were able to see the opportunities and limiting factors of The Land, and build this into our design.

The whole client interview can be found in the Appendix.

1. The Clients main objectives



2. Time-frame & Funding

There was no clear time-frame given by the clients.

Tim Tubb said he could provide funding for PFT and The Project for 6 months (possibly longer), and they would look into other funding options when they become more established.

C. Detailed Observations, Limiting Factors, Evaluation and Design Proposals

These are our observations of the Limiting Factors, and our Evaluation of them. Numbers 1-4 apply only to The Land, numbers 5-7 apply to the Land and the African House.

1. Access

Observations

- The paths are narrow and difficult, especially in wet weather (although local people seem to manage)
- The paths to the Land pass over land belonging to other villagers
- There is no easy network of paths around the Land. The Lower Path and Upper Path are currently only connected by a steep and even smaller path, meaning that it is difficult or impossible to walk around the Land
- It takes 30-40 minutes to reach the Land from the Homestead

Limiting Factors

Poor Access to the Land and around the Land

Evaluation

- Access must be improved to help moving people, materials and produce in and out of the Land
- · Access must be improved to help undertake observations and management work

Design Proposals

- The access to the Land must be improved. (PFT need to organise this in collaboration with other landowners and the village)
- On the Land (managed by PFT), we recommend improving the existing paths, and expanding the the land

2. Topography

Limiting Factors

Steep gradients across most of the Land

Evaluation

- Water can cascade down these slopes in heavy rain
- The soil is vulnerable to erosion •
- There is limited access to these areas
- There are limited options for using these areas

Design Proposals

• The steep ground should be left as wild and natural as possible (Zone 5), though if the native forest has already been cleared or degraded, there must be a programme of reforestation.

3. Soil Erosion

Observations

· Although there was little evidence of soil erosion on the Land, there have been major land slips on neighbouring land caused by deforestation and cultivation



network of paths to create circular routes, including opening up the path above the river. This would make it easier and more enjoyable to walk around the land, and would make it easier for managing



Big land slide close to the Land

• "Contour farming" is being encouraged on a village level, but this only amounts to the planting of elephant grass or similar in rows along the contour, even on steep slopes. Many steep slopes have been completely cleared of trees and are now cultivated for maize, with occasional rows of elephant grass along the contour, perhaps in the belief that this constitutes, "contour farming" or even "terraces", leaving the soil vulnerable to serious erosion.

Limiting Factors

• There is a high risk of soil erosion and loss of nutrients from deforestation and cultivation.

Evaluation

- Soil erosion could be serious if cultivation happens on any medium-steep slope.
- Land-use must take into account the threat of soil erosion.
- The soil must be enhanced, not depleted and degraded.
- Contour farming and terraces are not suitable for any of the land in this section of the valley as it is nearly all too steep. The whole valley should be reforested (including agroforestry), so even if there was some less steep ground where terraces could go, it is doubtful that there would be enough sunlight to grow the higher value crops that would make the creation of terraces worthwhile. We do not want to encourage any form of cultivation of annual crops in such a fragile environment.

Design Proposals (See also pages 40-45)

- Medium-steep slopes must be reforested.
- Less steep slopes (such as by the Lower and Upper Sheds) should have only perennial crops (as they currently do) to protect the soil - the only exception being two small flat areas close to the Lower Shed where annual crops could be grown (but this will only succeed if there is enough sunlight, without felling any of the canopy trees).
- There must be NO cultivation on medium-steep slopes. This includes NO terraces and NO "contour farming".
- Terraces could be trialled on more gently sloping land (a gradient of no more than 25°) in the "settled" part of Shimbwe (the area of the homesteads) so that good and safe terraces can be demonstrated. The terraces must be flat ! Specialist knowledge must still be obtained before undertaking this. (The reason for this location is that on gently sloping land, larger terraces can be created for less work, and there is less risk of erosion in heavy rains).
- Contour Farming (without terraces) must not be carried out on ground of more than 18° gradient.

4. Lantana Camara (for more info, see Lantana Factsheet, page 58)

Lantana camara is a shrub native to Central and South America, that grows up to 3m in height. It is an invasive species that has spread to many tropical and sub-tropical countries, including Tanzania.

Observations

- The non-native invasive shrub Lantana camara covers large areas of deforested land in the valley, both on the Land and on neighbouring land
- It readily colonises more open areas and disturbed ground, such as deforested land and land cleared for agriculture, and can form dense thickets
- It does not survive in a forest situation as it is not shade tolerant

Limiting Factors

- Lantana camara inhibits native species and reduces biodiversity (by its allellopathic effect and by shading)
- It is toxic to livestock
- The land where it grows has little or no productive value
- It restricts access over the Land

Evaluation (see also Lantana Factsheet page 58)

- One of the primary objectives of the Project must be the of elimination of Lantana camara
- This must be achieved through a programme of reforestation as a long-term strategy

Design Proposals (see Lantana Factsheet page 58)



5. Human Resources

Observations

- PFT does not have a person with the specialist skills, knowledge and experience necessary to fully develop a project of this kind
- The working practices of some local people are damaging to the soil and ecosystem (eq. cultivating steep slopes, illegal logging)
- Local people will work for about Tsh7000 / \$3 per day

Limiting Factors

- PFT members lack relevant skills and knowledge
- Tim Tubb and Victor Kinyaiya may have less time than planned because of other commitments and interests
- Local people lack knowledge in ecological land management •
- Local people may be less involved than expected •
- Foreign volunteers may be hard to attract
- Lack of a project manager

Evaluation

- Under present circumstances, the Project is limited in what it can achieve
- The Project would benefit from having more people involved •
- Local people need to be clearly informed when working on the Land
- Local people need training in ecological land management (eq. permaculture and soil conservation)
- Foreign volunteers may not be attracted without a co-ordinated and educational approach
- A Project Manager with the necessary skills, knowledge and experience could be vital to the success of a project of this size and scope
- PFT may need to apply for funding to meet the cost of having a project manager

Design Proposals - Human Resources

• PFT should recruit a Project Manager; Because of the potential size and diverse nature of the Project, to the success of the Project.

The Project Manager must:

- have the ability to implement permaculture, agroforestry and reforestation
- have experience in guiding, instructing, and teaching a variety of people and groups
- have good communication and interpersonal skills to address issues between the various
- stakeholders, beneficiaries and officialdom
- monitor and evaluate the progress of the work
- ensure the continuation of the Project

PFT may need to apply for funding to meet the cost of having a project manager.

- Training for PFT members and local people in ecological land management and related issues, including sending Victor and Denis on a PDC (run by Sustainable Agriculture Tanzania near Morogoro)
- · Identify enthusiastic local people who could get involved longer-term (Denis Kinyaiya !)
- A plan of how to integrate foreign volunteers and how to make it a worthwhile and educational experience for them

• Local people need to be involved in, be inspired by, and learn from the Project for it to be successful

we strongly advise that PFT recruits a project manager with the specialist skills, knowledge and experience that are necessary to develop the Project in all areas of its work. We think this could be vital



6. PFT - Organisation, Agreements, Finances, Training

Observations

- There is no written agreement for PFT to use the Land, only a verbal agreement
- PFT does not have meetings or a clear decision-making process
- There is an absence of record-keeping, including financial records
- PFT's finances rely on donations from Tim Tubb, with no other current sources of income
- Some of PFT's members do not appear to be actively involved
- PFT members do not have a good knowledge of permaculture

Limiting Factors

- PFT is not currently functioning well as an organisation
- Lack of finance for a project of this size and scope
- Lack of co-ordination and direction
- No clear plan of work from week to week, and month to month

Evaluation

- PFT needs to be managed in a more organised way
- A written agreement to use the Land, and clear aims and objectives, would reduce the possibility of misunderstandings between the different stakeholders (PFT, the Kinyaiya family, Shimbwe Village Council, and the villagers), especially if PFT starts to invest a lot of money in the Land and/or if the current active members (Tim Tubb and Victor Kinyaiya) were to leave and/or new people were to join
- PFT's ability to access funding is reduced because of no financial record keeping and the lack of a written agreement to use the land, which would be requirements of most official funding bodies
- An awareness of income and expenditure is important for monitoring and planning
- PFT would benefit from having more active members

Design Proposals - PFT as an NGO

- PFT should have regular meetings, and designated roles for the individual members
- PFT should clarify its short and long-term goals
- A programme of work with costings and time-frame should be drawn up
- PFT should keep accounts and other records
- PFT should provide its members with any necessary training
- There should be a written agreement between PFT and the Kinyaiya family for the use the Land

7. Economic, Social and Cultural Issues

Observations

- Most people seem to be poor and have difficulties to escape poverty
- Wages are low and there is a lack of employment opportunities
- Men and women have traditional roles according to gender (though farm tasks seem to be shared)
- The families are large, and the population growth puts increased pressure on the land and resources
- There are no waste disposal facilities and domestic waste (including plastic bottles, packaging, and bags) is burnt, causing air pollution and serious risks to health

Limiting Factors

- Poverty
- Traditional gender roles
- Taboos (more research is required on this)
- Low level of mechanisation
- Population growth and land division
- People having fixed ideas, being set in their ways
- Limited access to the internet
- Language and translation issues

Evaluation

- Poverty means people have little money for investment to improve their circumstances
- Traditional gender roles means that people's abilities are not used to the fullest
- Much time is taken up with labour-intensive tasks and chores

- An increasing population has to share diminishing local resources (agricultural land, forest, water)
- non-agricultural sectors
- Fixed ideas mean that better options and opportunities may be missed
- People must be open to new and innovative ways of seeing things and doing things
- and from books
- Language issues limits the sharing of information between "westerners" and locals

Design Proposals - Economic, Social and Cultural Issues

- better internet access
- diversifying the local economy, eg. with tourism, so that people are less dependent on agriculture
- educational and environmental work should be undertaken with the local schools

Agriculture and Land Management in Shimbwe

- The traditional agroforestry system of Shimbwe is believed to have originated about 800 years ago, trees); a shrub layer (banana, coffee); and a ground layer (yams)
- A lot of land has been deforested, and a lot of this has been colonised by the shrub lantana camara, which is of little benefit
- small scale
- from streams inside the forest zone of Kilimanjaro National Park (KINAPA)
- with fodder brought to them
- Most of the produce of each shamba is used by the family, with small surpluses being sold to merchants or in Moshi



Agricultural productivity is just about at its maximum, so all further employment must be created in

Internet access and language issues limit the information available to local people from the internet

• Language issues will make it more difficult for PFT to run an education and training programme

Addressing these issues fully is beyond the scope of this design, but solutions could include:

and typically comprises of a tree layer (large shade trees such as mruka, plus avocado and mango

In other areas where the trees have been cleared, maize is grown on a larger scale and beans on a

Water for irrigation is supplied to the mashamba through a network of channels that bring the water

Livestock (cattle, pigs, goats) are kept permanently in small sheds with movement severely curtailed,

Observations

- The subsistence agriculture relies on the same few crops on every shamba
- There is little or no diversification, or experimenting with new methods and crops
- There is not much variety in the food consumed by local people
- Despite the favourable climate, plentiful water and traditional agroforestry, there appears to be a smaller diversity of crops grown in the whole of Shimbwe than at Keveral Farm in Cornwall, UK, which has just 4 acres (1.5 ha) of crops in a temperate climate (Oak's observation)
- Land inheritance results in the division of family land into smaller and smaller units which are less viable and generate very little income
- It is densely populated for a rural area where most people live off the land
- Population and economic pressures force farmers to use more marginal land such as steep slopes
- Natural resources are over-exploited: illegal logging clears the native forest, which causes soil erosion, reduces biodiversity and affects the hydrological cycle
- The land is fragile and vulnerable because of the loss of tree cover, the steep slopes and high rainfall
- In February, just before the rains, all of the farmed land is cultivated: in the open areas for the planting of maize; under the bananas and coffee to reduce competition; but also alongside water channels for no apparent reason other than its just what they do - even though it will lead to loss of soil
- "Contour farming" is being encouraged on a village level, but this amounts to the planting of elephant grass or similar in rows along the contour, even on steep slopes, with false assurances that the land can be safely cultivated without the risk of soil erosion
- The work is very labour-intensive, using only hand tools. There is no mechanization at all, so many tasks are very time-consuming, such as collecting firewood and fodder

Limiting Factors

- There is not enough land for the growing population
- A lot of the land is steep
- The irrigation channels do not feed all of the land
- · Incorrect and inappropriate information is sometimes given on new methods, for example contour farming, which could lead to increased soil erosion
- Difficulty in getting reliable information on species (plants, trees, animals)

Evaluation

- Fixed ways of doing things can perpetuate bad practice, such as digging over all of the farmed area just before the rainy season, including steep slopes and alongside water channels, so increasing erosion
- Much better information and training on contour farming and terraces is required
- The available land is not able to support the growing population
- The agricultural economy is not sustainable, and people will get poorer unless the economy is diversified, or people work in other locations
- The fragile ecosystem of Kilimanjaro is very vulnerable to further growth in population and development
- Being one of the most important ecosystems in Tanzania, every effort must be made to safeguard this ecosystem

Proposals for Shimbwe (and the whole cultivated zone of Kilimanjaro)

- · A demonstration project on gently sloping and accessible land could show correct terrace design, alternative methods such as 'no dig', and experiment with new crops
- Provide training in ecological land management and related issues (Sustainable Agriculture Tanzania near Morogoro run a big training programme)
- Cultivation of annual crops on sloping ground (maximum 18° gradient) must employ correct contour farming techniques
- There must be restrictions, perhaps legislation, to protect the land from over-exploitation and from inappropriate and excessive development
- There must be a programme of reforestation, especially of the bigger valleys and steep slopes
- Tree-planting and management must be encouraged and incentivised
- Maize cultivation in Shimbwe must decrease
- People could be paid to give their land over to reforestation and tree-crops (so they can afford to buy maize rather than having to produce it themselves), or the village could be given flatter land (near Moshi ?) for the cultivation of maize, where it would be easier and less damaging. (These schemes could be financed through the revenue of KINAPA).

D Analysis

Based on the information gathered so far, the Design Team considered how to best meet the client's objectives, while taking into account the permaculture ethics and principles.

Due to the huge number of limiting factors on the Land, the Design Team decided to consider other, complementary areas to show permaculture in diverse settings, with different scales and focuses.

The Land itself features a unique treasure of possibilities mainly regarding its potential to become a great demonstration site for agroforestry by optimizing the existing forest, and also for the reforestation of cleared areas.

Although PFT originally asked the Design Team to design only for the Land, Tim and Victor informed us that other land could become available for PFT to use, including land by the existing mashamba in the settled part of Shimbwe. This could be ideal for demonstrating permaculture on a smaller scale, while also being more accessible to local people.

One of these options was the African House and the adjoining land (part of the Kinyaiya homestead). After looking at this with Victor, we realised that the African House should be included in our design, as this area and the land in the valley could be very complementary.

Village



- On the ridge, numerous flat areas
- Place of high activity, people living & working
- Place of community (family, tribe, village)
- Infrastructure, access, network
- Intensive food/ crop production at Kihambas
- Livestock



Valley

- Formed by rivers
- Steep slopes
- Generally covered with forest (some open areas)
- Little erosion on Kinyaiya land, but a lot of erosion on neighbouring land
- Small paths, limited acess
- Few settlements
- Wildlife

The Land

- Access to water
- Place for Recreation, Nature

The African House & the adjoining Land

• Existing building • Existing vegetable garden, lawns & ornamental gardens Access to the family's livestock • Well known place within the community

• Parking area



The advantages of including the African House and adjoining land

The Design Team realised that there are many benefits of including the African House and adjoining land in the design, together with The Land.

The African House and The Land can be seen as two areas, being complementary in meeting the objectives of the clients, as each area can demonstrate different aspects of permaculture, and together they offer a much wider range of opportunities for food production, for education and training, for volunteers and for local people.

- The African House will become the base for volunteers and possibly residential courses
- There are unused and underused areas close to the African House, which could be used for fruit trees,
- annual vegetables, camping pitches, recreational space, tree nursery
- There is separate and good access to these areas from the road
- People using these areas need not intrude on the family areas of the homestead
- It can demonstrate different aspects of permaculture compared to The Land
- The African House could possibly become an office for the PFT

The Design Team therefore created designs for both 'The Land' and 'The African House'. Both designs could stand alone and be developed as separate projects, but developing both in unison would result in a much more holistic design and provide greater opportunities.

It could be that the Kinyaiya family will implement the design for the African House rather than the PFT.

The African House and the adjoining land: Existing Elements

Road





The permaculture principles that The Design Team considers most relevant and important to the Designs are:

- Start small
- Work out from well-managed areas
- Minimum input for maximum effect / Least effort for greatest gain
- Use available resources
- Work with nature
- Stacking (multi-layered systems)
- Fit the design to the site / Only do what is appropriate for the site







E The Design Proposals

The African House and the adjoining Land



Improvement of the vegetable gardens and converting new areas into food production areas

The Design Team suggests to optimise the vegetable gardens and the front yard into permaculture gardens, as well as converting parts of the existing lawns (nos. 2 and 3) into vegetable gardens.

A good garden will produce high yield and provide food consistently throughout the year. The Design Team recommends the following strategies to ensure a healthy, productive and nature friendly garden:

Crop Rotation System

- Used to control pests and diseases that can become established in the soil over time. Changing crops interrupts pest cycles.
- Helps to avoid nutrient deficiency in the soil
- An example of a 4 year crop rotation could be: legumes, brassicas, alliums, roots

Companion Plant System

- Plants are grown amongst each other in a number that will benefit each other
- Most plants benefit each other, only some are antagonistic.

Raised beds

- Help to boost drainage
- Use of different soil types possible
- Improved access
- Avoiding soil compaction
- Increasing soil temperature
- Restricting the movement of weeds

Other Suggestions for the Area around the African House

Entrance

Main Entrance of the African House should be renovated and opened up to enter the house without disturbing the family.

Bar

Lawn 1 could be converted into an outdoor bar and community meeting place with a structure and some sitting furniture

Lawn 2 and 3

The client's vision was to have a place to relax and hang out as well as an area where people can put their tents. The Design Team suggests using Lawn 2 and 3 for this purpose. It would be a nice idea to leave a patch of lawn in the middle and plant a veggie garden around. For shade, some new trees should be planted.

The Land: Design Proposals

By overlaying the observations made in "Topography" and "Vegetation" the Design Team identifies 3 different types of area on The Land.



Food Forest Areas

flatter areas, agro-forestry

The Design Team identifies two blue areas, characterized by being flat or gently sloping, existing structures (simple sheds), a higher density in crop production (mainly coffee and banana), and an existing canopy tree cover.

These areas are the most suitable sites to use as a demonstration and production site for the PFT.

Important: No trees should be cut down, nor should any terraces be built!

The Design Team decided to focus on the lower area in order to illustrate the possibilities (see following pages).

Conservation and Restoration of Forested Areas

steep, forest with good canopy cover

The green areas are characterized by their steepness and an existing forest cover. The Design Team proposes to maintain existing forest cover and enhance the areas with new tree-planting e.g. with Mruka or other hardwood species. The land is too steep for cultivation. Ground disturbance should be avoided or reduced to a minimum to prevent erosion.

Control of Lantana camara and Ecosystem Restoration

deforested, mostly Lantana

The pink areas are characterized by steep slopes that have been deforested and colonised by the nonnative and very invasive shrub Lantana camara

- One of the primary objectives of the Project must be the elimination of Lantana camara
- This must be achieved through a programme of reforestation as a long-term strategy
- Restoring the forest will protect and improve the soil, increase biodiversity, and be a much more a sustainable way
- Maintaining functioning (healthy) ecosystems is key to preventing invasive species from establishing and out-competing native flora

SEE APPENDIX FOR MORE DETAILED IMFORMATION

productive use of the land, as the trees can provide food, fodder, firewood and eventually timber, in

The Land: Focus Area around the Lower Shed







Right above: Lower Shed

Right middle: View from the Lower Shed towards the small flat area, the location of the former house

Below: Flat Area near the river with coffee, banana and mruka (canopy trees)







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The Land: Focus area around the Lower Shed - Proposals

New Structure

The Design Team proposes to take down the existing shed and build the new structure at the same place. Material needs to be chosen carefully due to the existence of termites.

Instead of digging into the ground, the Design Team propose to build the new structure on stilts. By using this technique air can flow under the building and rainwater coming from the slopes above can run off without damaging the structure or the materials. Storage space would be created under the building which could be used for rainwater tanks or tool storage.





Vegetable/ Herb garden and compost

If the new structure hosts quests, volunteers stay overnight or it develops into a frequently visited place, a veggie and herb garden can provide fresh food.

The Design Team suggests to only use two areas for establishing the vegetable gardens:

1) the flat area in front of the new structure 2) the flatter area behind the new structure

It is important to stay close to the building (Zone 1) and to use crop rotation and companion planting, as already described in the African house section.

Compost for soil building would complement the system, and save energy and resources

Nursery

The Design Team suggests establishing a nursery on the lower flat area.

The aim of the nursery is to raise and propagate trees, shrubs, perennials and other plants in order to assist their growth in a safe, efficient environment. Those plants should be planted around The Land or could be sold to other farmers. The nursery provides a job opportunity and income for Local People.

A shading structure, potting tables, soil mixing and compost boxes should be installed at the beginning. Bigger plants can be grown directly on the ground (in pots/ recycled bottles/ bags), but shading trees would make sense here as well to protect the plants from the sun.



The Land: Focus Area around the Lower Shed - Proposals

Forest Garden System

Forest Gardens are used globally for the benefit of both nature and humans. It is an agronomic system (Definition agronomic: application of soil and plant sciences to soil management and crop production) based on woodland ecosystems, which aims to increase biodiversity and productivity by:

- Maximizing the use of space
- Utilizing available light at different heights
- Elimination of the need for insecticides and adding fertilizers
- Reducing the workload
- Creating a niche for wildlife
- Including indigenous trees and plants
- Increasing the beauty of a place

A Forest Garden consists of the following 8 layers (often referred to as stacking):

- Canopy (Trees)
- Understory (Shade tolerant tree layer)
- Shrub layer (Fruit bushes)
- Vertical layer (Climbing plants, vines)
- Herbaceous layer (Herbs, Perennials, Seeding annuals)
- Ground cover (Annuals like Sweet potato, strawberries)
- Root plants (Carrots, beets)
- Mycelium layer ("Dynamic Accumulators": mining minerals from the subsoil to the topsoil)

It is a system which is well demonstrated especially in the tropics.



Trees for Agroforestry - some examples





Mruka (Albizia Schimperiana) Nitrogen fixing, firewood, charcoal, timber, medicine, bee fodder, shade, soil conservation.







Mringaringa (Cordia Africana) Edible fruit and seeds, useful timber, good bee forage.



Silky Oak (Grevillea Robusta) Straight and fast-growing tree, durable timber, bee fodder, plentiful leaf litter, shade



Msesewe / Quinine tree (Rauvolfia Caffra) Up to 30m, evergreen, timber (including carving and bee-hives), fuel, shade-tree, fresh roots used for brewing, medicinal

F Summary of proposals for general Land Management

No tree felling

Do not cut down any trees unless absolutely essential. If trees are shading the food production areas too much, it is preferable to cut off branches rather than felling the whole tree.

No cultivation and no terraces on medium and steep slopes

This will lead to catastrophic soil erosion. As this is already happening in Shimbwe, it is important for PFT to try to discourage this practice.

We did not observe any true terraces (ie, flat terraces) in Shimbwe. Quite often, the cultivated ground is too steep to even allow terraces.

The idea of terraces in Shimbwe seems to be planting rows of elephant grass or similar along the contour when cultivating sloping ground, but this does not prevent serious soil erosion from occurring. We consider this to be very bad practice, yet it is widespread.

Because of this, an important role for PFT could be to demonstrate the creation of flat terraces on gently sloping ground (ideally in Shimbwe village), for water retention and reducing soil loss.

However, specialist expertise must be sought, as doing terraces badly will lead to increased soil erosion. See "Management of Slopes and the use of Terraces" in the Appendix.

No new water channels

Apart from restoring the water channel alongside the lower path, to take water from the small stream to the area of the Lower Shed, no new water channels should be created without specialist expertise. Doing water channels badly could lead to serious soil erosion.

Doing any of the above will leave the soil open to erosion and/or colonisation by Lantana.

Reforestation - Plant trees

The reforestation of medium and steep slopes is the most important principle and practice that PFT can demonstrate, and also the most challenging.

The forests on Kilimanjaro are very important for the hydrological cycle, upon which the whole area depends.

The forest also provides essential resources to the local people (fruit, firewood, fodder, and eventually timber), while also preventing soil erosion, but must be managed in a sustainable way.

G Implementation of the Design for The Land

The order of implementation is based on PFT's needs and objectives, and also on the need for some work to happen first to make it easier for further work, such as improving the access before building the hut, and building the hut before undertaking more food production and other labour-intensive projects.

The time-frame for the implementation is for PFT to decide, based on its requirements and available resources.

Successful implementation will depend a lot on getting local people involved, but PFT have said that they can pay wages, so this should not be a problem.

Phase 1 – Access Aim: to facilitate the implementation of the work and ongoing management

Access to the Land

The Design Team thinks that the project would benefit if access to the land was improved. However, local people seem to manage fine with the path as it is now. If the path is to be improved, PFT needs to organise this, possibly in collaboration with the village.

Access around the Land

On the land managed by PFT, we recommend improving the existing paths, and expanding the network of paths to create circular routes, including opening up the path above the river. This would make it easier and more enjoyable to walk around the land, and would make it easier for managing the land.

Phase 2 – Structures

Aim: to provide short-term and possibly long-term accommodation, and to be a base for people who are working on the land

The Hut, or "Work-Station"

The hut will be multi-purpose, to include kitchen and sleeping space. It should replace the existing Lower Shed. It will be constructed of natural materials, the design to be decided by PFT. The Design Team suggests an elevated structure on stilts.

• Compost Toilet

This would be a long-drop type, and should probably go above the path to be further from the river (so long as the ground is not rocky).

• Waste systems

for compost, waste-water and trash. These can be very simple to start with.

Phase 3 – Food Production

Aim: to increase food production and income-generation

- Food Forest Diversifying the existing banana and coffee area with more species.
- Vegetable Garden We would say this is only necessary if people are staying or visiting on a very regular basis.
- Plant Nursery mainly for fruit trees and native trees, for planting around the site and selling
- Bees for honey and pollination

Phase 4 – Reforesting with native trees and Control of Lantana Aim: to return the land to forest, to protect the soil, regulate the water cycle, and shade out the Lantana, while at the same time providing fruit, firewood, fodder and timber

This work can happen at any time, subject to the availability of trees and labour. Tree planting should happen around the start of the rainy season, to allow the trees to get established before the dry season. The success of the tree-planting may depend a lot on the support of local people as it is a big project and the young trees would be vulnerable to goat-grazing and the cutting of fodder.

Phase 5 - Improvements to the Hut, or "Work-Station"

Aim: to make it more comfortable should it be used more permanently

- Extensions
- Solar power
- Improvements to waste systems

Phase 6 – Extras

Aim: to improve teaching and learning experiences around the land

The priority of these to be decided by PFT.

- Rest areas
- Educational material (signs, boards)

Design Implementation - 10 First Steps

(by Oak, Jan 29, after the design, given to Tim and Victor)

The Land

- 1. Clear the path above the river to create a circular route
- 2. Create a better path between the Lower Shed and the Upper Shed
- 3. Plant 5 fruit trees by Victor's camp-site on the ridge (plant in a small depression, 0.5-1.0m wide, so they collect rainwater, plant at the beginning of the rainy season – and protect them from grazing animals by putting woody material around them)
- 4. Plant 5 Mruka trees and 5 Grevillea trees on the upper slopes of The Land (plant in a small depression so they collect rainwater; plant at the beginning of the rainy season; put in 1.5m stakes/sticks to mark them; cut back surrounding Lantana and put around the trees to protect them from goats and fodder-cutting)
- 5. Make a plan for building the Hut / Work-station:
 - location
 - design
 - builder(s)
 - where will the materials come from ?
 - costinas
 - other jobs that need doing before it can start
 - time-frame with start-date

The African House and adjoining land

- 6. Plant 4 fruit trees on the lawns by the African House (2 on each lawn)
- 7. Create a small nursery area (initially 1m x 1m) by the edge of one of the lawns near the African House (dig up the grass and loosen the soil)
- 8. Collect 10 avocado stones and plant them in 2lt plastic bottles (tops cut off, holes made in the bottom, filled with soil) and put these in the nursery bed (mostly buried so they don't dry out - the top of the bottle should be 6cm above ground level) and water every 2 days when there is no rain
- 9. Clean up the kitchen, sitting area and two bedrooms of the African House so that it is ready and available for volunteers and other visitors
- 10. Have a place in the African House where the permaculture design work can be displayed on the wall, and where the other design documents can be safely kept, as well as other documents and records of PFT

Design Implementation - 10 Guidelines (by Oak, Jan 29, after the design, given to Tim and Victor)

- 1. Start Small and Slow don't rush into things, especially big jobs
- 2. Identify achievable steps and see them through to completion
- 3. Work with Nature (and protect the trees)
- 4. Take care of the soil improve fertility, avoid erosion, no cultivation of steep slopes

- 5. Lantana is bad but it's better than nothing. Cutting it back is good, digging it up on slopes is not good. Plant trees to shade it out.
- 6. Help people / Get people involved (People-care)
- 7. Put in effort to get results
- 8. Use local and natural resources
- 9. Do what is appropriate for the site (some things will not be appropriate)
- 10. Create nice spaces

H Maintenance and Evaluation

Maintain what has been implemented, and modify it according to what is working well and what is not working well.

I Further Suggestions

Involving the Local Community

- Tree-planting days
- Seed swapping events



VI. Note of Thanks

The Design Team would like to thank Tim Tubb and Victor Kinyaiya for the opportunity to be part of a great experience in Tanzania.

We would like to thank Victor's family for their hospitality and first class accommodation, and to Alex for his delicious meals.

Thanks also to the many people we met on our way, like Denis and his father Marcel, Dr. John, and all those other lovely people.

We always felt welcomed and taken care of in an open and mindful way.



VII. Addendum

A Reforestation proposal

In April 2018, Oak Johnson received a document from Bertin Mkami, leader of Uru Shimbwe village council, entitled "Reforestation of the Rau River Valley and the half-mile strip zone at Shimbwe"

This proposal demonstrates that Bertin and the village council are fully aware of the problems of illegal logging and deforestation, and the need for a massive programme of reforestation, especially along the steep valley sides, rather than farming activities.

It supports the Design Team's proposals for PFT to have reforesting the Land as one its main objectives, and it supports PFT's mission to educate local people in ecological land management.

The proposal mentions "the National Forest Policy" which prohibits farming activities within 60 yards (50m) of rivers, and this includes the River Rau. This could impact on PFT's plans for the Land.

Below is a summary of the document:

Reforestation of the Rau River Valley and the half-mile strip zone (of the Kilimanjaro National Park) at Shimbwe

Overview

The project's main priority is reforestation of the deforested area of the sources of the River Rau, including the area within the half-mile strip of the Kilimanjaro National Park (KINAPA) and along the Rau River valley and it's tributaries, at Uru Shimbwe, through the planting of one million trees.

Objectives

- a) To educate the people of Uru Shimbwe on the conservation of forests, and the management and development of forest resources - through "public outdoor seminars" and educational material, and organised through business, community and religious groups, and schools.
- b) Promote alternative sources of energy for domestic purposes rather than firewood, such as "dry-leaves firebricks" for cooking.
- c) Protect the diminishing forest at Uru Shimbwe by providing alternatives to using the forest as a source of income, to include environmental businesses such as tree nurseries (diversifying the economy).
- d) Rehabilitate the sources of the rivers Rau and Mware by planting a substantial number of trees, both in the half mile strip and besides the rivers (the 60 yards zone), and by the springs, waterfalls and marshes.

Implementation

2018:	10,000 trees to be planted in the These will be bought as seedling
2019 onwards:	One million trees to be planted These will be grown from seeds "There will be a massive plantati tributary. This exercise will invo planted within the 60 yards rese

Cost / Funding request

\$5000. Villagers will also contribute \$3000 in kind through their labour.

- ne half-mile strip in KINAPA. qs.
- in the river valleys.
- in tree nurseries in Shimbwe.
- ion along the banks of the River Rau and the Mware lve every village person to make sure trees are erved belt."

VIII. Appendices

- **Resources and References**
- Factsheet about Lantana camara
- Managing steep slopes, including Terracing
- The full Client Interview
- The Action plan for Shimbe-Juu

Resources and References

Books

Bill Mollison: Permaculture - A Designers' Manual by (1988) Bill Mollison: Introduction to Permaculture (1991) Aranya: Permaculture Design, A step-by-step guide (2012)

Organisations

Sustainable Agriculture Tanzania

(Executive Director: Janet Maro, who is from Kilimanjaro) Training and support for farmers. They run PDCs and many related courses, in Kiswahili, at their Farmer Training Centre near Morogoro (200 km west of Dar Es Salaam) http://kilimo.org/WordPress/

UN FAO (Food and Agriculture Organisation - GIAHS)

Shimbwe Juu Agroforestry Heritage Site (designated by the UN FAO, 2008-2013) http://www.fao.org/giahs/giahsaroundtheworld/designated-sites/africa/shimbwe-juu-kihamba-agro-forestry-heritage-site/detailed-information/en/

Shimbwe Juu GIAHS - UN FAO Action Plan

Action Plan For The Dynamic Conservation Of The Uru Shimbwe-Juu As A Globally Important Agricultural Heritage System (GIAHS) Area (2010-11) http://www.fao.org/3/a-bp820e.pdf

Farmers gain skills to preserve and benefit from the Kihamba agroforestry system on Mount Kilimaniaro (UN FAO, 2017)

www.fao.org/climate-change/news/detail/en/c/881113/

Agroecology and Agroforestry

Agroecology - The Bold Future of Farming in Africa

(The Alliance for Food Sovereignty in Africa (AFSA) and Tanzania Organic Agriculture Movement (TOAM), 2016)

http://afsafrica.org/wp-content/uploads/2017/02/Agroecology-the-bold-future-of-farming-in-Africaebook1.pdf

Traditional Agroforestry Systems: One Type of Globally Important Agricultural Heritage Systems; Journal of Resources and Ecology, 2014 www.jorae.cn/fileup/PDF/20140404.pdf

Useful Species

Indigenous Multi-purpose Trees of Tanzania: Uses and Economic Benefits for People UN FAO, 1993 http://www.fao.org/docrep/019/x5327e/x5327e.pdf

Tropical Plants database

Information on 11,000 plants (Ken Fern, Plants For A Future, Cornwall, England) http://theferns.info/

Climate Change

Development and Climate Change in Tanzania: Focus on Mt. Kilimanjaro Agrawala, S., Moehner, A., Hemp, A. et al; Organisation for Economic Co-operation and Development (2003)

Climate Change and its impact on the forests of Kilimanjaro Hemp, A.: African Journal of Ecology, 47(s1), pp.3-10. (2009)

Living at the Edge of Climate Change (director Kirk Mason; 2016?) www.climatechangetanzania.com

Conservation, Vegetation, Biodiversity and Human Settlement

Soil and Water Conservation on the Slopes of Kilimanjaro (The Oakland Institute, 2014?) http://afsafrica.org/wp-content/uploads/2015/11/Soil Water Conservation Kilimanjaro Tanzania.pdf

Continuum or zonation? Altitudinal gradients in the forest vegetation of Mt. Kilimanjaro Hemp, A., Lehrstuhl für Pflanzenphysiologie, Universität Bayreuth, Bayreuth, Germany (2005)

The Banana Forests of Kilimanjaro: biodiversity and conservation of the Chagga home-gardens Hemp, A., Department of Plant Physiology, Universität Bayreuth; Bayreuth, Germany (2004)

Culture, History and Identity: Landscapes of Inhabitation in the Mount Kilimanjaro Area Hemp, A. and C.; Archaeopress; Oxford, England (2009)

Factsheet about Lantana camara

Lantana camara is a shrub native to Central and South America, that grows up to 3m in height. It is an invasive species that has spread to many tropical and sub-tropical countries, including Tanzania.



Why is Lantana a problem ?

- It readily colonises more open areas and disturbed ground, such as deforested land and land cleared for agriculture, and can form dense thickets
- It shades out native species, inhibiting the regeneration of forest and reducing biodiversity
- It produces chemicals that have an allelopathic effect on other plants, including agricultural crops, by inhibiting germination and root growth
- It is toxic to livestock, causing liver damage
- Land where lantana grows has little or no productive value
- It restricts access
- It can make wild fires more destructive
- It hosts mosquitoes

What is Lantana good for ?

- In the absence of other trees and shrubs, it can stabilise and improve the soil (though not as effectively as a forest)
- On medium-steep slopes, it is better than having no vegetation
- It can be cut back and its branches used as protection for newly planted trees

How to control Lantana camara

- Soil disturbance in deforested areas should be minimised to prevent establishment of lantana.
- It does not survive in a forest situation as it is not shade tolerant.
- It can be eliminated through regular cutting back and/or reforestation.
- Avoid digging up lantana as this would be very time-consuming and would expose the soil to erosion
- As a priority, control any lantana growing in the forest area, and plant trees where there are gaps in the canopy.
- Move on to control lantana in other areas of low infestation, and plant trees.
- Then move to areas where lantana is widespread, cutting back small areas and planting trees, as resources (time and money) allow.
- Young trees must be marked with 1.5m stakes and protected from grazing animals, which could be done by using lantana branches that have been cut.
- Tree species must include enough tall-growing trees to eventually form a good canopy, but can also include fruit trees and other useful species.
- Control work is a long-term commitment, otherwise one's efforts may be in vain.
- Maintaining functioning (healthy) ecosystems is key to preventing invasive species from establishing themselves and out-competing native fauna and flora.

For reference: 'Introduction To Permaculture' by Bill Mollison (1991):

1. Everything Works Both Ways (The Problem is the Solution; Problems are Opportunities) to work out just how we can make use of it." into useful components of our system ?

Lantana is an excellent soil builder; it can be shaded out, or slashed and used as rough mulch around pioneer trees (which will eventually shade out the Lantana)."

2. Accelerating Succession and Evolution A natural system develops towards mature climax vegetation eg. a forest. Conventional yields." Use what is already growing to speed up the evolution to a mature system.

"Woody perennial shrubs such as Lantana and gorse make excellent soils when they break down after being cut back [and from leaf fall], and are eventually shaded out by forest trees."

Managing steep slopes, including Terracing

Cultivation of steep slopes

During and after the design process, the Design Team was asked about the idea of terracing the slopes for crop production.

In the observation we could see a lot of deforested areas that had been converted into what locals call "terraces", but in the view of the Design Team it just sub-divides the slope with contour planting, and this would do little to prevent erosion on such steep slopes with heavy rainfall.

The Design Team does not recommend building terraces on any steep slopes of the valley, because:

- Building terraces means deforestation, and increased risk of erosion and fire
- The invasive plant Lantana camara can spread due to new open spaces to colonize.
- No tradition of terrace building can be found, instead the agroforestry system has a long tradition, skills and knowledge

No Terraces on steep slopes! See following pages.

"Every resource is either an advantage or a disadvantage, depending on the use made of it." "Disadvantages can be viewed as problems, and we can take an energy-expensive approach to get rid of the problem, or we can think of everything as being a positive resource. It is up to us

"Problems can be intractable weeds" (for exampla Lantana in the tropics). How can we turn these

agriculture fights against this, keeping everything small by growing mono-cultures of annual crops. "The mature system requires management rather than energy input, and always has





The cultivation of steep slopes in the village of Shimbwe (about 200m North from the Secondary School)

Steep Slopes and Terraces in Shimbwe

Shimbwe village council promotes "contour farming" to protect the soil from erosion – but their idea of this is planting lines of elephant grass or similar across the slope, then thinking it is fine to cultivate the slope above regardless of gradient.

This was even sometimes referred to as "terracing". Cultivating steep slopes for annual crops (usually maize) seems to be becoming more common. The Design Team believes this will cause serious soil erosion and deplete the land of nutrients. Therfore it is very important that the PFT does whatever it can to discourage this practice.

The Design Team also think it is important to demonstrate the correct establishment and maintenance of FLAT terraces, as there does not appear to be a tradition of using flat terraces in Shimbwe. This would need to be done in the homestead area of Shimbwe as nearly all of the land in the Rau valley is too steep for terraces, and we are proposing that the valley is reforested. The new forest would stabilise the soil and negate the need for terraces. There would also not be enough light getting through to make the cultivation of crops on terraces worthwhile. Also, for demonstration purposes, the terraces would be seen by more people if they were in Shimbwe village.



Steep, newly cultivated land in Shimbwe, probably for maize, with no contour planting, just before the rainy season.



The cultivation of very steep land on the Shimbwe side of the Rau valley, just before the rainy season.

What Bill Mollison says about managing slopes

Permaculture Two (1979); Text in square brackets [...] added by Oak

Broadscale Landscape Analysis (p16-17)

The high plateaus [eg Kilimanjaro National Park], where snow is stored, and trees and shrubs prevent quick run-off [of rain-water] give way to the steep upper slopes [eg. the valley of the River Rau], which are rarely (or catastrophically) of use to agriculture per se, but are often cleared of their protecting forest and are subject to erosion because of this.

The high plateaus ... are fragile systems which must be guarded from over-grazing and soil loss ... The best usage is the planting or maintenance of as many trees, shrubs and ground cover as possible to trap and hold moisture.

The high slopes are of next importance to the general hydrological cycle, and it is in clearing these that most countries come undone; for the trees that occupy these areas are the groundwater pumps that prevent the rise of salted water to the surface downslope The upper-slope forests are essential, reducing cold air flow and erosion...

A moratorium on clearing or grazing of slopes of 18° or more should be an international concern. Reafforestation of slopes with useful forage and fuel trees, their cautious use by man and his animals, and permanent forests as buffers to the lower slopes are the only moral use of steep slopes.

Where we venture (as in Nepal) to clear and terrace such systems, graze off the regrowth, and attempt the only subsistence left to us (grain terrace culture) [or maize cultivation in Shimbwe] catastrophe awaits us.

Permaculture - A Designer's Manual (1988)

Slope Measures (p231, Table 9.1)

- 20% (18°) gradient moderate slope: usually accepted as the maximum slope for safe cultivation and erosion control [but probably less in high rainfall areas such as Shimbwe].
- 30% (27°) gradient steep slope: can be cautiously harvested for firewood

50% (45°) gradient very steep slope strictly not for tree clearing, needs permanent forest.



A landslip in the Rau Valley (from above and below), near the top of the valley-side, just above the ,upper path' and adjacent to the area of homesteads on the flatter ground above. It was probably a result of deforested and unstable land becoming saturated in the previous rainy season.

Types of Earthworks: Terracing (9.6; p 236-7)

Terraced lands, given a reserve of local green manures or composts and adequate water, are potentially very stable production systems [allowing cultivation of steeper ground].

Exceptions to this arise when we:

[Conditions 1: Do NOT]:

- Attempt to terrace in unstable soils;
- Risk hydraulic pressures on hill slopes from impounded or infiltrated water [water behind dams or in swales, and ground water];
- Create terraces that are unstable at the bund [top of the terrace wall] or wall face;
- Extend terracing as annual crop over too large a proportion of the landscape [no more than 30%], and so lose leaf or tree nutrient input to the crop;

• Make very large series of terraces in high rainfall areas so that run-off is concentrated.

In addition, trees (on bunds, and between, above and below terrace series) should form 40-60% of the total landscape plan, and both soils and installed water inlets and outlets should permit safe and controllable irrigation.

The great benefits of terraces are:

- Very easy crop access on slopes;
- Easily controlled and effective irrigation procedures;
- Water retention
- Minimal soil loss from overland water flow or slope cultivation;
- A potential gain in silts or nutrients in irrigation or run-off waters and from leaf fall.

As with dams, terracing is most effective where slopes are least, as earth moved versus area of cropland developed becomes impractical or inefficient as slopes steepen. At about 30° slope [and below], but preferably at 10-18°, terracing becomes worthwhile.

Every terrace system is ideally designed to allow perennial bund and terrace wall plants, specifically for wall stability and green manure crop.

It is wise to limit the extent of a terrace system in the tropics because of heavy rainfall (and hence expected run-off). The terrace system should occupy no more than 30% of land in the tropics, and a tree crop should be developed to maintain fertility of the terrace areas.

[Conditions 2:]

Wherever people occupy very steep sites (slopes of 20° or more), especially in areas of high rainfall, it is preferable to abandon broad terracing for a series of 4-6 narrow production terraces, each series carefully drained to spill excess rain down permanently vegetated slopes.

Maximum slope between terraces [the face of the terrace wall]: 37° Maximum height between terraces: 2m

Terraces are flat!



This land has been dug over just prior to the rainy season. Terraces would be easy to establish on this gradient, with ground over a 25-30° gradient under permanent vegetation. This would greatly reduce soil erosion. (This is just above the valley side, where the Upper Path meets the more level ground of the homesteads area).

Earth Shaping in the Tropics (10.4; p260)

One-half to one third of the total terraced area should be devoted to tree crop that provides fodder for livestock or direct leaf and branch mulch to terraces. Ideally, the upper one-third of hills, the very steep slopes of 30° or greater, terrace side borders, and the outer faces and tops of bunds (walls) should all be planted to productive and mulch-producing tree and ground crop. This adds to terrace stability and provides manure and mulch.

Aditional Notes by Oak

I consulted two very experienced permaculture teachers from the UK, Chris Evans and Bryn Thomas, (who both taught many PDCs at Keveral Farm), about terracing.

Chris, who has done many years of work in the mountains of Nepal and who was taught by Bill Mollison on his PDC, concurs with Mollison's figures.

Bryn added that these figures can vary according to soil type (stability), intensity and frequency of rainfall, and natural vegetation type - these will all affect the vulnerability of the soil to erosion - and that rain at the end of the dry season will cause erosion on slopes because of vegetation die-back [and also because of cultivation of the ground in preparation for the rainy season].

Bryn added that "cultivating steep slopes for annual crops will cause erosion and create an ecological disaster zone, and is not permaculture. It may be a necessity for poor locals, but it should not be part of a demonstration project".

Summary

The gradient of slope in high rainfall areas where terraces would be worthwhile, viable and safe is from 10° up to 25-30°.

In creating terraces, Conditions 1 (under 9.6, above) must always be followed, and if the gradient of the land is 20-30°, Conditions 2 (above) must also be followed.

In relation to Shimbwe, most of the land in the Rau valley has more than a 30° gradient, so that land should all be permanent forest (which can be carefully harvested for firewood and fodder). Terraces are not appropriate there.

Terraces could be demonstrated on flatter ground in the homestead area of Shimbwe, but specialist advice must be sought in constructing the terraces, and in channelling water to, between and away from the terraces.



A trial by the Devon Wildlife Trust (SW England) shows soil washed down a gently sloping field over a two month period in winter. There is estimated to be 6-8 tonnes of soil caught here. This would all have flowed into the streams and rivers. Rainfall is generally light.

In the case of Shimbwe, with steeper ground, heavier rainfall, and newly cultivated ground, a lot more soil will be washed away.

Shimbwe Permaculture 2018

Client Interview with answers, comments and issues

The Client Interview was conducted on January 16th 2018 blue = client answers

magenta = comments by design team (mainly Oak) red = other questions and issues that may need to be looked into further

PFT = Permaculture Foundation Tanzania

I. Organisation and Decision-making

Who is the client?

Tim: "the recipients"; "giving, receiving, sharing"; "to benefit the people of Shimbwe and the people that will come here".

But Tim seemed to misunderstand the question, confusing 'the client' with 'the beneficiaries', so it was re-phrased:

Who are we, as designers, working for / dealing with ?

- We (the designers) are the 'consultants' engaged by 'the client' to do a design for the land. We ask
- quide, and PFT) are the clients.
- There is no written agreement from Victor's family to PFT for use of the land just a verbal agreement - but Tim says it is a clear agreement with the whole family.
- long process.
- actively involved. Tim is the driving force but he is not a member.
- Should PFT seek a legal agreement for using the land, especially if it starts to invest a lot of money in the land ?
- Who are the members of PFT ?
- How much do they know about permaculture ?
- Can PFT improve how it is managed ?
- goals, and how these will be implemented ?

How are decisions made relating to the land?

- Tim: "knowledge is foremost". In other words, having the knowledge will guide the decisions (?)
- Tim and Victor will make decisions by consensus. Victor needs to keep his family informed, but does not need to ask their permission.

II. Vision (broad)

What does permaculture mean to you ?

- Tim: sustainable development; crop production for nutrition and income generation; conservation Victor: teaching people about producing organic food
- Organic food production may not necessarily be permaculture !

the client questions so that the client provides us with the information that we need to do the design. It was clarified that Tim (representing PFT) and Victor (representing his family, himself as a tour

PFT registered as an NGO to give official recognition to the project as a whole, to allow volunteers to stay on a 12 month visa, and for tax exemption. The registration was finalised in July 2017 after a

At present, PFT does not seem to be fully functioning as an organisation – only Tim and Victor are

Should PFT have regular meetings, clarify their individual roles, clarify their short and long-term

What is the broad, long-term vision for the land?

- Tim: permaculture farm, best practice, continuity, harmony, attractive, productive, sharing info, people working the land to generate income, demonstration farm, education, expand.
- Victor: benefit the local community, sharing skills, organic seeds, network.

III. Historic and Current Use of the land

How has the land been used over the years up till the last year?

- Victor's grandparents lived on the land approximately 50 years ago, on the flatter ground by the River Rau. Victor's grandmother is still alive, aged 99.
- They grew coffee, banana, sugar cane (no sugar cane observed in Shimbwe !) and yams
- Cows and goats were kept on the land
- Victor's uncle then lived there some of the time
- Victor and his cousin stayed there occasionally and did some work on the land
- There are 4 existing structures:
 - an old animal shed just above the river (close to the location of the grandparents' house, which no longer exists)
 - a simple hut and animal shed higher up (which was last used August 2017)
 - there is the frame of a small hut in the camping area on the ridge

Are you aware of any past challenges and problems with working this land?

- The access is difficult when it rains, but this is not a problem for Victor
- Victor: Flooding and erosion have not been a problem on the land

What food plants are present now ?

- Banana, coffee, yams, avocado, passion fruit, beans, self-seeding vegetables. Two main areas of banana and coffee remain around the existing lower and upper sheds
- There are about 150 avocado trees, the oldest being 15-20 years

What human activities are happening now?

- No one is living on the land (Some people are living nearby in very simple structures that have been recently established)
- Victor has a camping area on the ridge where tourists sometimes camp overnight.
- Banana and coffee are sometimes harvested
- 2 Cows were kept down there June-August 2017 but that needs someone to be down there the whole time. They probably do other work at the same time, such as cutting fodder and pruning coffee plants.

Are any local people using the land, and how?

People can cross the land but not cut or harvest anything

IV. Bio-diversity

Are there any problem species on the land?

Lantana camara – a invasive, non-native shrub that grows up to 3m in height. It readily colonises more open areas and disturbed ground. It has an allelopathic (negative) effect on other plants, and can prevent native trees from regenerating. It also hosts mosquitoes. It is widespread on the Land

and the surrounding land.

• Stinking nettle (??) - a plant that irritates the skin (??)

Are there any threatened or endangered species that need their habitat protecting ?

- Monkeys have declined in number
- useful timber, good bee forage)

V. Weather and Climate and Water

What extreme weather events are you aware of, such as extreme rainfall or drought?

Fairly constant from year to year.

Does the river change much from season to season, and from year to year?

• 0.5-1.0m higher in the rainy season. It's course does not change.

Have you thought how climate change will affect land use ?

- No thoughts
- and from forest fires resulting in less absorption, quicker run-off, and less regular flow.

Other Water observations and questions:

- There is always water available on the land
- Water is available in both of the existing agroforestry areas: by the Upper Shed where there is a irrigation system – so only a small portion of the Land could be irrigated.
- Is the land moist enough for annual crops throughout the year ?
- Can irrigation water be supplied to the upper slopes ?

VI. Specific Plans and Ideas for using the land (the Clients' Objectives)

Will the land be used for income-generation, and if so, how and to what extent?

- Eco-tourism (Victor: eco-tourism means knowing the land, not destroying, sharing local culture). A percentage of this income would go to PFT, but most of it would be for Victor's business.
- Crops to create employment opportunities
- Plant nursery
- Courses and workshops

Do you envisage people living on the land?

- Tim: No (later changed to 'Yes', himself)
- Victor: can see himself living there in the future, possibly in a traditional house

Mringaringa trees have been over-exploited in the past. (Cordia Africana – edible fruit and seeds,

The rivers and streams that supply Shimbwe originate in the montane forest belt, so will not be affected by glacial retreat on Kilimanjaro. However, the water flow in the rivers and irrigation channels could be less in the dry season because of changes to the hydrological cycle: less rainfall; higher temperatures causing greater evaporation; loss of forest due to changes in rainfall and temperature,

small stream, and by the Lower Shed if the water channel that runs alongside the lower path from the stream is restored. It is doubtful that water could be brought to the Land from the existing village

Who will visit or stay on the land (local people, volunteers, tourists) and for how long?

- Victor occasionally
- Tourists camping on the ridge
- Volunteers for a few days at a time (their main base will be the African House at the Kinyaiya homestead)

How do you see the land being used as an educational resource?

- Permaculture courses
- Workshops, for example running a plant nursery
- Demonstration of best practice
- Local people taking part and seeing how things are done

Do you plan to use the existing structures (buildings), and how?

(question missed out) We have not seen inside the top hut. It may have been lived in when cows were kept in the shed in 2017. The other sheds are for animals.

Would you like any new structures to be built (what and where)?

- Victor: A simple hut to include a sleeping space
- Tim: "a work station" with basic facilities where the Lower Shed is

What ideas do you have for food production (what and where)?

• Bananas, passion fruit, apples, vanilla, saffron

What are your top priorities, and what is the time-frame for implementing each?

 Tim: The permaculture design – so there is something to work from Improving the access to the land (this goes across land belonging to other people)

Priorities for the land itself:

- Improving the access on the land 1.
- 2. 3. Planting crops (food production) – in the next 2 months, before the rains (not realistic ?)
- Building the hut / work-station
- 4. Getting local people involved in the work (employment opportunities)
- 5. Showing local people 'the permaculture way' (education and training)
- Receiving people from abroad (volunteers and trainees) 6.
- Also an office for PFT

VII. Physical and Biological Resources (for example plants, building materials, tools)

What resources are available on site?

- Bananas can be propagated on site
- Seeds of native trees, including avocados
- Wood, mud and banana bark for building
- Stones and boulders

What resources are available in the local area?

- Plant nurseries in Moshi. No-one in Shimbwe is growing plants for selling. Later found out that there are Grevillea trees available in Shimbwe from Alexander, the village leader
- Seeds from Moshi
- Other building materials from Moshi
- Tools can be bought or borrowed
- available

VIII. Human Resources

What are the skills and time-availability of current members of the project ?

- Tim: logistics, experienced in building work, available 5-6 days per week.
- per week.

What skills and time can be contributed by local people (voluntary or paid)?

- Arsene skilled builder
- Other local guys as labourers. Tsh 7-10 000 (approx \$ 3-4.5) wages for a days work
- Dennis Kinyaiya seems knowledgeable and enthusiastic, and could be an asset

Are there other un-met needs?

- Knowledge of permaculture
- A project manager

Do you envisage taking western volunteers ? (all the time / occasionally)

Yes – subject to requirements

IX. Finances and Funding

What finance is available now?

- Tim: "enough to do what we want to do now": the African House renovation, improving the access, the hut, tools, plants, seeds
- The money for all this would be sourced independently by Tim, and would be a donation, not a loan

What could be available over the next 1-5 years?

- in this time-frame
- Look into International Development Funding in a few months when the project has a bit more to show
- An office is planned

The main house and the African House at the Kinyaiya homestead are also excellent resources if

Victor: Experienced at organising, knowledge of the area, has many local contacts, available 3-4 days

Purchasing a Landrover: Tim thinks this is a priority in the next two months before the rains. It would be financed independently by Tim. It is unlikely that it would affect the project if this did not happen

Do you plan for the project be self-financing, and if so, when?

- Tim: yes, perhaps after 6 months Not realistic, unless costs are kept to a minimum ??
- Victor: a local farmer can earn income throughout the year because of the diversity of crops There could be diverse income streams

X. Local and National Laws and Regulations

What laws and regulations may restrict how the land is used (eg cutting trees)?

- No permit is needed for building
- A permit is needed for cutting down trees this can be obtained the same day but only if it is justified, such as in the way of a new building project. Illegal logging happens within Shimbwe.
- Victor would need to consult with the council about improving the path to the land (it is on land belonging to other people)
- No permit is needed to extract water from the river on a small-scale

XI. Limiting Factors

Can the access be improved, and if so, how and when?

 Victor: It could be a village project, one days work for 40-50 people, it would better connect Shimbwe with Uru village. Victor would need to speak to the village leader, but it may not happen soon, or even at all. The local people seem the manage perfectly well with how it is now.

Do you see soil erosion as an issue, and have you thought what could be done to address this?

• Victor: little erosion on the land There are some gulleys where there is erosion There have been landslips on nearby land, apparently where tree cover has been removed

Are you aware of any pests and diseases ?

- Monkeys eat some bananas
- Rats (or some other ground-dwelling animals ?) can eat the base of banana plants

Are you aware of any other limiting factors (constraints)?

• Security of buildings and equipment

Summary of main stated Limiting Factors:

- Access to the land and around the land
- Lantana camara invasive shrub
- knowledge of Permaculture and food production
- A Project Manager

Other obvious Limiting Factors:

- Steep slopes
- Potential for erosion (there have been landslips on nearby land, apparently where tree cover has been removed)

XII. Local People

How much do local people know about the project now?

- Tim and Victor talked about the project in front of about 80 local people (men and women) in Shimbwe Juu in early 2017 when the UN delegation visited to mark their designation.
- Tim and Victor did a talk to local people (15-20 ?) at the Kinyaiya house in August 2016
- Victor, Tim, Oak and Sophia met the leader of Shimbwe village in January 2018 to talk about the project.

Victor was the spokesperson as the conversation was nearly all in Swahili, mostly without translation. Victor wrote in the council guest book (in Swahili) that permaculture was about making improvements using "high technology". This was near the end of the meeting, and there was not the opportunity to change the wording to "appropriate technology". Tim said that plans for using the land could involve producing crops "for export". So the village leader could have got an incorrect idea of permaculture, and an unrealistic idea of what the project could achieve.

• Tim and Victor have talked to individual people about it. A lot of people know of the project, but project and permaculture in more detail – but this would need careful thought.

What are the hopes of the local people for the project?

They want to get new ideas

What are their fears, if any?

None

Are there any local taboos that we should know about (eq compost toilets)?

- Victor: "Women would need permission from their husbands before getting involved in the project".
- The compost is not removed. More info on the local toilet systems would be useful.

How will local people get involved?

- Working on the land, doing paid work. Are there other opportunities, such as using the land to start their own projects?
- Educational opportunities

How will local people benefit from the project?

- By getting new ideas (from training events, from seeing what is happening)
- From employment opportunities

Do local people need any specific training?

• Victor: Yes – permaculture

How will any training be implemented?

- Workshops
- Demonstration of best practice

probably do not know much about it. We could arrange a meeting with local people to talk about the

Many local people use compost toilets – the long-drop type. When the pit is full, a banana is planted.

- People taking part
- Learning by example

There will be language issues unless the training and events can be run by Swahili speakers.

XIII. Alternative Scenarios and Options

Could other land be available that may be more suitable in meeting the needs of the project? (for example: better access, closer to a settlement)

- The neighbour's land above Victor's land
- Land at the Kinyaiya homestead for small-scale permaculture?
- other land may become available

What other options are there (should a 'Plan B' be required)?

(not asked)

XV. Anything else

Is there anything else that you think we need to know or you would like to say?

- Tim: desire for communicating and disseminating info about the project.
- Victor: "Very good to get this project going to benefit this community". "I have good expectations after these questions". "Keep in touch, the people who start this project".

ACTION PLAN FOR THE DYNAMIC CONSERVATION OF THE URU SHIMBWE-JUU AS A GLOBALLY IMPORTANT AGRICULTURAL HERITAGE SYSTEM (GIAHS) AREA

Project background

The Globally Important Agricultural Heritage Systems initiative was launched by the Food and Agriculture Organization (FAO) in 2002 with the aim of establishing the basis for the global recognition, conservation and adaptive management of outstanding traditional agricultural systems and their associated landscapes, biodiversity, knowledge systems and cultures. The initiative aims to "protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements" [cf. CBD: Article10(c)], specifically within agricultural systems. In many of these systems, the prosperity of nature and the poverty of people unfortunately coexist. Therefore, the initiative does not intend to freeze systems in time, but rather calls for their "dynamic conservation", emphasizing a balance between conservation, adaptation and socio-economic development. It aims to empower smallholder farmers/pastoralists, traditional communities and indigenous peoples to maintain their traditional agricultural systems and to create an economic stake in the conservation of (agricultural) biodiversity so that nature and people can prosper together.

Within this context, the Federal Republic of Germany through the Federal Ministry of Food, agriculture and Consumer Protection (BMELV) and the German Technical Cooperation (GTZ) approved the current effort to establish sites in Kenya and Tanzania and to support the food security and reduce poverty of the local communities in GIAHS areas.

In Tanzania, the Kihamba (Chagga homegarden) Agroforestry System was identified as one of the country's best examples of a resilient system of upland farming deserving support in line with the GIAHS objectives. Its dynamic conservation through targeted measures on the ground, combined with the right policy support would ensure food security and livelihood sustenance, as well as sustainable management of its environment and the continuity of its living agricultural heritage.

Development of the Action Plan

Since the project inception the following milestones have been achieved in Tanzania: 1. Potential sites in Mbinga district (Songea Region), Same and Moshi Rural districts (Kilimanjaro region) were evaluated in March 2010, using the GIAHS site selection criteria (FAO).

2. Main characteristics, threats and opportunities for each of these sites were identified and analyzed by the national project team through community consultations and field-visits before they were presented to the Project Facilitating Committee (PFC) for further deliberations, ranking and eventual agreement of the Project Site.

3. The Kihamba forestry system in Shimbwe juu village (Moshi Rural District) was decided upon; 4. A team comprising of members from the National Project Facilitating Committee carried out a "Free Prior Informed Consent" procedure in the community. The community gave its consent by acclamation;

5. The visit was also used to further discuss the threats and opportunities presented by the site and priority interventions. 6. On this basis, a draft Community Action Plan was developed by the project team.



Photo's: Left: A typical "Kihamba" with shading fruit trees, bananas, coffee and annual crops such a taro. Right: Meeting with village community to give prior informed consent for the project's implementation in Shimbwe Juu.

Why is the Kihamba agro-forestry system a National/International heritage?

Agroforestry refers to land-use systems in which woody perennials (trees, shrubs, etc) are grown in association with crops, pastures and/or livestock in a spatial arrangement, a rotation or both, and in which there are both ecological and economical interactions between the tree and non-tree component of the system. Thus, it simulates a natural system but with the components (trees, crops and animals) consisting of species carefully selected for their useful products and/or services. Agroforestry is a very old practice that has grown out of necessity as primitive farmers tilled the land to grow crops out of forested areas and tamed wild animals. The principles of agroforestry have been in use for centuries, most commonly in tropical and subtropical regions.

Many agroforestry systems worldwide conform to the criteria laid out by the GIAHS Initiative of FAO, and particular examples conform to the standards of the World Heritage Convention (as Cultural Landscapes). The specific common values of agroforestry systems include their importance for the conservation and sustainable use of trees, cultivars, animal breeds, the landscapes which co-evolved with their cultural practices, which e.g. provide critical habitats for wild biodiversity, deep reservoirs of local/indigenous knowledge on crop husbandry and livestock rearing, as well as on ecological functioning. Moreover, they show remarkable resilience and capacity to adapt to climatic and other environmental fluctuations. The Kihamba (Chagga home garden) system, as practiced traditionally by the Chagga, provides an outstanding example of upland agroforestry system in East Africa and continues to have relevance for the sustainable management of its landscape.

The Kihamba (Chagga home gardens) agroforestry system: a brief history of challenges and survival

The kihamba (Chagga home garden) agroforestry system occupy mainly the climatically most favorable southern and eastern foot slopes of Mount Kilimanjaro covering an estimated area of 120,000 ha. They are located mainly at an altitude between 1000 and 1,800 metres above sea level forming a concentric pattern of half -circle around the mountain. The climate of this area is humid tropical montane forest. This ancient land use system is believed to have evolved around the 12th century. It is said to have started with irrigated banana intercropped with other annuals (beans, cabbage, cow pea, chill (pepper), eggplant, maize, onion, potato, taro, tomato and yam) and widely spaced shade trees. Coffee was introduced by the missionaries during the German colonial period early 1880s. It was first introduced at Kilema Mission where even today five of the first six plants still exist. After the First World War coffee demand increased and consequently production. The British colonial government encouraged the farmers to increase production

Coffee was thus incorporated in the kihamba where it proved to be compatible and being an important cash crop, it strengthened the role of kihamba to the Chagga livelihood system. The Kihamba or (Chagga home garden) is central to the identity and culture of the Chagga tribe. It is the central locus of social and ceremonial life. People are born, come of age, marry and are buried on their Kihamba.

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The Chagga home garden (Uru Shimbwe Juu site) has been selected for its uniqueness, integrity, high agro-biodiversity and the ecological significance of Mount Kilimanjaro, which has immense geological and cultural value. Its community on the other hand has demonstrated a strong resilience to threats to their systems, which ensure its sustainable functioning and resilience under its environmental conditions. The Chagga home garden is characterized by the unique feature of multilayered vegetation structure similar to a tropical montane forest. A typical Chagga home garden is composed of four vegetation layers. The uppermost layer is formed by sparsely spaced trees which provide shade, medicine, fodder, fruits, firewood and timber for some species. Under this layer more than 15 varieties of bananas are grown. Under the bananas there are coffee shrubs and under these, vegetables of variable species including climbers are grown. This multilayer system maximizes the use of limited land.



Photo: The multilayer system maximizes production in 3 dimensions, as well as in time. Coffee, introduced in early colonial times, fit right into the kihamba ecology. This allowed the farmers to adapt their kihamba system to a more cash oriented economy. The project will identify and introduce other kihamba-compatible cash crops, including vanilla, to improve household income.

The home gardens are irrigated by traditional canals tapping water from perennial streams/rivers originating from the montane forest, as well as by trapping run-off in furrows. The canals convey the water to the nduwas. The nduwas are small ponds dug out for the aim of concentrating water (to get enough volume) to be used the following day to irrigate homegardens (vihamba) which are on schedule. The canals, ndiwas and furrows were run/regulated by canal/nduwa/furrow elders from subclans. The outlet of the nduwa is a hole on the bottom of it on the adjacent side which is blocked by earth and big stone overnight to concentrate water, and opened in the morning to release water for irrigation as required. The normal procedure for regulating water supplies was for the person whose turn it was to use the water, to do so from dawn until noon. He then had to turn back the water so that other people could use it.



Photo's: Left: Water is tapped from a river 8 km upstream from the village boundary in the what is currently Kilimanjaro National Park. This engineering feat in rugged terrain was done by the villagers more than 200 years ago. Center: The Nduwa's are small ponds where water is collected for irrigation in the dry season. Rehabilitating the 7 Nduwa's in the village will improve irrigation and allow the introduction of small scale aquaculture. Right: The water is shared between sub-clans. Here the stream separates the water for the Temba and the Kira sub-clans.

The main crops include banana, coffee, yams, maize, potatoes, beans, and fruit crops. Coffee is the major cash crop. Livestock are kept mainly indoor and they include diary cattle, goats, sheep, pig, and poultry. These are fed with fodder or crop residues from the kihamba and in turn they provide manure which is returned to the kihamba, thus enhancing the nutrients cycle. The Chagga home gardens are said to maintain a high biodiversity with over 500 species including 400 not cultivated plants. The home gardens enable the farmer to sustain production with a minimum of external inputs.

an effective and sustainable way of exploiting natural resources under such agro ecological environment. The traditional upland agrosystems are thriving to maintain their unique identity through maintenance of their socio cultural institutions. Today however, these traditional systems are under pressure, threatened by several factors including; population increase, labour shortage, climatic change and market of produce. In the selected site, through observations and discussion the following threats have been noted;

- 1. Low productivity of kihamba arising from low yields of coffee and associated crops. In addition, unreliable market of coffee is a disincentive to economy of kihamba.
- 2. Inadequate water for irrigation during the dry season. Climate changes over the past 2 to 3 decades have resulted to low and erratic rainfall. This has also consequently resulted to decreased streams and river volumes for irrigation.
- 3. Fragmentation of kihamba beyond economic size (less than 0.5 acre)
- 4. Labour shortage due to outward migration of Youths. This is caused partly by youths attending schools but mainly due to decline in income of the kihamba as a result of low productivity and decline in coffee price resulting to disincentive.
- 5. Low overall income (lack of alternative sources). This arise from low productivity of the kihamba (ref. no 1 above)
- 6. Low awareness among some policy makers on the potential and viability of upland farming system to give appropriate support. Some policy makers do not know the roles and potential of the kihamba system on people's livelihood, national economy as well as environmental benefits to support it effectively
- 7. Soil erosion on steep sloping areas under annual cropping. The home gardens (vihamba) occupy the foot slopes of Mount Kilimanjaro. The general slope is steep and the landscape is safe under the permanent crops. The change from coffee to annual crops contributes to soil erosion and land degradation
- 8. Degradation of traditional knowledge, culture and skills associated with kihamba as well as Chagga tribe. Since youths get less time to work in the vihamba (due to schooling and outward migration), they do not a good exposure to traditional life including knowledge. This lead to degradation of trsditional knowledge with time.

Nevertheless, kihamba has proved to be still resilient and continues to sustain livelihoods and valuable natural and cultural heritage. These areas continue to sustain valuable ecosystem services, including natural and cultural heritage of great relevance to sustainable development. It is the objective of the current action plan to safeguard the historic, inherently sustainable, agroforestry system of the kihamba (Chagga home gardens), through a combination of local and policy measures, for the benefit of its custodians and Tanzania as a country.

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- From a livelihoods and economic perspective, especially considering the nature of the landscape and the population it support, kihamba system is



Photo's: Prioritizing issues with the community: 1: addressing declining coffee productivity and diversifying cash crops 2: rehabilitating the traditional irrigation system; 3. improving pest and disease management 4. address soil erosion and fertility issues (not considered urgent).

The project site

The Uru-Shimbwe Juu village is located on the foot slope of Mount Kilimanjaro. It covers a surface area of 615 hectares. The village is bordering the forest reserve of KINAPA on the North. On the East, the boundary is Mware River which separates the village with Uru East (Materuni village). On the West, the village is bordered by Rau river and on the South by Shimbwe chini village. The inhabitants are Chagga tribe with a population of approx. 2569 people, of which 1251 are male and 1318 are female.

The area is characterized by a humid montane forest climate with bimodal rains. Although the village lands do not represent each and every habitat found throughout the Mountain system, there is a significant biological diversity typical of the humid montane forest ecosystem. Annual

rainfall range between 1200 - 3000 mm. The main rain season is from March to May, while the short rains are centered on the month of October/November. The driest period is from July to October.

The kihamba (home garden) is characterized by the unique feature of multilayered vegetation structure similar to a tropical montane forest. A typical Chagga home garden is composed of four vegetation layers. The uppermost layer is formed by sparsely spaced trees which provide shade, medicine, fodder, fruits, firewood and timber for some species. Under this layer more than 15 varieties of bananas are grown. Under the bananas there are coffee shrubs and under these, vegetables are grown.

Livestock keeping consist mainly of a few goats, sheep, chicken, pigs and cross breeds diary cattle. They are mainly kept indoor. Apart from providing livestock products and income, livestock is an important component of the agroforestry system whereas manure from livestock is applied to the farms to improve soil fertility. Its ecosystem has a high biodiversity with over 500 species including 400 not cultivated plants. Genetic resources include indigenous tree species and banana varieties, introduced tree sp, coffee, yams, beans, indoor livestock (cattle, goats, chickens and pig)

The community displayed a strong sense and cultural custodianship towards conservation of the agricultural land. The home gardens are irrigated by traditional canals tapping water from perennial streams/rivers originating from the montane forest, as well as by trapping run-off in furrows. The canals convey the water to the ndiwas. The ndiwas are small ponds dug out for the aim of concentrating water (to get enough volume) to be used the following day to irrigate homegardens (vihamba) which are on schedule. TThe outlet of the ndiwa is a hole on the bottom of it on the adjacent side which is blocked by earth and big stone overnight to concentrate water, and opened in the morning to release water for irrigation as required. The normal procedure for regulating water supplies was for the person whose turn it was to use the water, to do so from dawn until noon. He then had to turn back the water so that other people could use it.

The Shimbwe juu area was chosen after a structured comparison of different agroforestry systems and different and locations (ranking e.g. different aspects of natural and cultural heritage, the sustainability of the communities management practices and the integrity of the site), as a highly representative area of traditional upland agroforestry system in Tanzania. It is not only an area deserving of protection for its heritage values, but it is also an example of the benefits generated by the kihamba (Chagga home gardens) and its contemporary relevance for the sustainable development of upland agriculture in Tanzania. Additionally, the Shimbwe juu site (for Kihamba) further stands out because of the ecological significance of Mount Kilimanjaro on which it stands.

Objective and approach of the action plan

In order to secure the continuity of the sustainable cultural management of the area, as well as the heritage and environmental benefits it provides, a number of challenges are to be met and addressed. The project will aim to assist the community in preserving their natural resource base, land

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and crop management practices and knowledge system while adapting their system to contemporary challenges. Adaptive measures contained in the plan are designed to reinforce the underlying socio-cultural and ecological processes of this historically evolved system. A critical part of this approach is to improve the food security and well being of the community. This is not only desirable per se, but poverty is also one of the factors driving the adoption of unsustainable practices.

Apart from site-specific measures, the project also deploys a number of policy measures aimed at the recognition and protection of the area, and the heritage practices and resources it represents, through available national policy/legal measures, as well as broader awareness raising among policy and other stakeholders of the values of Tanzania's heritage agricultural systems. Overall, the project aims to turn the considerable benefits of kihamba agroforestry system as a sustainable form of livelihoods, incl. its compatibility with the landscape and its significant cultural heritage, into an advantage for the community of Shimbwe juu and the Republic of Tanzania.

To this end, this action plan contains the following measures:

- · Improved management of coffee (replanting, integrated pest management) and banana (re-introducing indigenous varieties) · Improvement of traditional irrigation water supply system (reinforcing water ponds/ndiwas by lining, provision of water control gates, lining
- some parts of the distribution furrows)
- · Development of a long term management plan for the area through community agreements building on traditional management institutions • Introduction of alternative cash crop to augment income eg.vanilla, water cress
- Create awareness to policy makers and public, the role of the kihamba agroforestry system through publication and policy workshops · Restoration of appropriate traditional values, knowledge systems associated with kihamba and establishing a mechanism for their transmission for application in their day-to-day lives
- Documentation of natural, cultural and combined heritage values
- · Development of activities and programs to address environmental degradation (soil erosion on annual croplands)
- Transmission of indigenous knowledge systems
- Development of marketing strategies
- · Explore possibilities of harnessing the following potentials that the site has Tourism i)
- ii) Aquaculture (fish farming) in ndivas upon rehabilitation

Site specific challenges and interventions

An analysis carried out with the community in the development stages of this Action Plan revealed a number of factors to which the project will need to respond. This section summarizes the findings of the analysis. The interventions by this action plan are referenced to the activities presented in Table 1 of the current document.

Challenge 1: Improving productivity and conservation of natural resources at the landscape level of the project area, in order to improve food security and long-term sustainability

In the context of developments in the Kilimanjaro uplands, the traditional kihamba system is under threat. The productivity of the kihamba system has declined due to decline in coffee production, unstable price, reduced water flow for irrigation, and decline in soil fertility. The decline in coffee production is caused by aging of the coffee trees, pest and disease resurgence and indirectly by fluctuation of coffee price. Most of the coffee stands are over 100 years old. They have thick stumps due to continuous cutting back. Although they can still produce, their potential is reduced by the age factor. In practice coffee trees have to be replaced when they reach the age of 50 years. Pests (such as stem borer) and diseases (leaf rust and coffee berry disease) have been reported to be one of the drawbacks; at the same time pesticides are expensive that they are not affordable by the majority of farmers. High yielding and resistant coffee varieties (to leaf rust and coffee berry diseases) have been developed and are being disseminated. It is however debated that the varieties require more light and no intercropping (associated crops). More information is being sought to clear the doubts. The problem of coffee is exuberated further by fluctuation of coffee price making the enterprise less reliable.

Historical evidence shows that the use of water for irrigation has co-evolved with kihamba. In the area/village, two canals have been constructed to extract water for irrigation from Mware River and Rau River which are several kilometres away. These canals have turned somewhat into permanent streams. To facilitate water distribution, small dams/ponds (ndivas) have been dug to concentrate water during the night for use in the next day. A schedule is used to control water use whereby each farmer or group of farmers have specific day to access water for irrigation. The head of the dam/ndiwa is in charge of the schedule. Clearing of the canals and ndiwa is done by the whole community. In a week there is one day whereby all community members are obliged to participate in collective work such as clearing the canal, digging up or clearing a road, construction works etc.

According to farmers over the past decade, water flows in these canals have decreased substantially especially during the dry season. Further, the short rains have become quite unreliable. This is possibly among the effects of climate change. Apart from reduced water flow during the dry season, the other problem related to water is canal losses and collapse of ponds walls due to water piping or burrowing animals. The mission witnessed that most of the ponds have collapsed walls on the outlet side.

Soil erosion is a potential threat in the area due to the sloping topography/landscape. It is not a big problem in the kihamba due to the perment cover of banana, coffee and undergrowth crops. It is however a threat in plots used for annual crops (Maize, Irish potatoes and Beans)

Intervention:

The Action Plan address the above through: assessment of the current natural resources and their dynamic use patterns and the development of a long-term land-use plan (an update of the existing land-use plan), in which natural resource uses are harmonized, based on principles of the traditional management of the kihamba agroforestry system (Activity 1.1 and 1.2). The long-term management plan will include a number of improved uses/management practices of land and crop which will include the introduction and promotion of high value crops and aquaculture to increase household income, and the restoration of degraded farmlands by appropriate soil and water conservation measures. Training for such improved management of land and crop under Output 2. Additionally, the Action Plan will also address the improvement of coffee production by facilitating establishment of nursery of coffee seedlings, assisting re-introduction of some indigenous banana varieties (Activity 2.2)

Challenge 2: Providing long-term incentives for the continuity of the kihamba system

Land fragmentation under the traditional system of inheritance is a limitation/threat to the sustenance of the kihamba system. The kihamba is passed to childrens through inheritance of normally the male children (the Chagga land tenure does not allow women to inherit land therefore land is entitled to men only). Thus, traditionally the sons would be allocated a piece of kihamba when they marry. and the remaining plot where family house stands is inherited by the last son. This has gone on through years until at present where the average size of kihamba stands at between 0.5 to 1 acre. If further fragmentation will go on, the kihamba system will become unviable/unproductive and ultimately collapse. During the early eighties the first President (The late Mwl Nyerere) had advised those who were short of land to shift to other areas in the country where there was ample land. To that notice, many had shifted to Arusha (Mount Meru slopes) and Morogoro (Turiani) and that somehow reduced the population pressure. Today, some families allocate the Kihamba land to the last son, whilst the rest would be allocated part of the lowland shamba or alternatively seek work in the town.

Traditionally, the kihamba is managed by the family. There is a division of labour whereas pruning of coffee trees, de-suckering of banana, clearing of water canals, irrigation of the kihamba is done by men while collecting firewood, weeding, feeding cattle, cleaning the shed and milking is done by women. Picking of coffee is done by the whole family, while primary processing (de-pulping, drying) is mainly done by women and children. Men are the supervisors of the kihamba and their roles were passed to the boys by fully involving them in related duties. Since the past two to three decades labour for the management of kihamba has become a problem due to youths attending schools or college (bording) or fleeing to towns to seek employment and more exiting life. The mission team noted some of the vihamba which were not properly managed, having poor coffee and banana stands. When asked about the reason for the poor condition of their plots, the owners responded that it's

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the problem of labour as children are either at collage or have left for town. Low and unstable price of coffee since the past 3 decades is said to have contributed to poor condition of vihamba as most farmers have been discouraged by the low returns relative to the cost of production. However at present the price of coffee has risen up thus motivating farmers to revive their plots.

Intervention:

The projects efforts to improve subsistence food security aims at capitalizing on the cultural and natural heritage associated with their management of the landscape. This will give the community a direct economic stake in the management of their system.

Under Activity 2.1 the Action plan will support the community to improve crop production in the vihamba thereby increasing crop yields and subsequently income which will be an incentive and therefore attract youths to work in the vihamba reducing their migration to towns.

To ensure sustainability of the kihamba the community will be required to agree on the minimum size of the kihamba (eg. 0.5 ha) that can economically provide requirements of an average family (6 members). They will be required to establish guidelines and integrate by-laws in long term land-use plan (Activity 1.3)

Introduction of alternative income generating enterprises compatible with kihamba eg. Vanilla crop, water cress, aquaculture could also provide an incentive by adding value to the system. Under Activity 2.2 and 2.3, the project will provide necessary training to the community on management practices required as well as market information.

In addition to economic incentives, social/customary law incentives will play a role in the implementation/enforcement of the land-use plan. Penalties may be imposed on offenders. Such rules will be developed through activity 1.3.

To create ownership the project will deploy a fully participatory approach, in which community members are key decision makers. By building the project's interventions on the community's traditional institutions and values the plan will encourage community ownership and control over their natural and cultural resources. During the implementation of the action plan additional livelihood development and diversification activities will be identified for follow-up to the project.



Challenge 3: Reinvigorating and improving transmission of traditional knowledge, cultural practices and institutions

Traditional Chagga communities were concerned with ensuring household food sufficiency and security, socio security (defence against invasion by other clans or tribes) and transmission of traditional knowledge, cultural practices and institutions to next generation. Their traditional institutions were tuned to socio-economic, security (incl. military) and natural resources management. Many of their cultural institutions, e.g. gender roles and the governance by elders, as well as the ceremonies associated with it, combined aspects of defence, natural resource management, social security and the transmission of traditional knowledge and skills to next generations. The colonial and post independence socio-economic and political realities have introduced a number of changes. Traditional leadership and the age group system are now complemented by state institutions and modern education. Changes in their cultural environment have given way to new aspirations, especially among the younger generations. The Chagga have a deep appreciation of formal education and this competes with the traditional institutions responsible for transmission of traditional knowledge and skills to the young. The introduction of state administrative institutions (e.g. village, ward, district, etc.) has created new social groupings and institutions, which both complement and compete with the traditional social units and

their leadership, based on clans or chiefdoms. These and other factors combined are leading to gaps in transmission of traditional knowledge and skills, as well as of traditional management/governance.

Despite this, some traditional institutions continue to perform critical roles in maintaining and transmitting social norms and values, natural resource management and conservation practices including traditional knowledge. In the area, local authorities and traditional leadership work in consort to address challenges. For the kihamba agroforestry system to perpetuate it is critical to preserve the traditional knowledge and management system that underpins it. This means that the content of the traditional knowledge has to be preserved, and the institutions for its management/governance and the transmission of knowledge have to be strengthened. For this to succeed, traditional institutions may need to be strengthened to address contemporary challenges, and need to work in harmony with state and other modern institutions. Additionally, there is a need to document the traditional knowledge and practices and raise awareness of their significance, in order to safeguard these for next generations.

Intervention:

Output 4 provides for a number of activities to address the loss of knowledge and the gaps in its transmission. The action plan will provide for the establishment of a local information centre, which will be the primary hub for documentation of traditional knowledge and education activities, both for community members and visitors. Traditional knowledge will be documented and made available through different media materials (eg. Flyers, video). A model kihamba with culturally significant crop species and vaieties will be established along-side the information centre to educate children and visitors about traditional kihamba (Activity 4.5). Tourism activities developed under this action plan (Activity 5.1 and 5.2, described in detail below) aim to educate tourists about the kihamba agroforestry system and the importance of their traditional management system. Additionally, the development and the long term land-use plan and the participatory implementation of the action plan will imbue the community with significant responsibilities for its implementation including through their development of by-laws and their enforcement.

Challenge 4: Mobilizing awareness and formal recognition/protection of the area, and its benefits

Though traditional agriculture in many African countries is blamed for environmental degradation, the kihamba agroforestry system has existed over centuries and did not change much over the last decades. Despite of these positive attributes many decision makers have poor vision or understanding to protect and promote it. Conversely there is a lack of appreciation of the value of this as a heritage, which continues to contribute to the management of the Kilimanjaro Mountain landscape and the identity of Tanzania as a whole. Formal recognition by the Tanzanian government and the international community of kihamba (Chagga home garden) agroforestry system and the project area in particular (Shimbwe juu), would greatly impact on decision-maker's and the public's perception.

Photo: Watercress occurs naturally in the irrigation canals, low costs adaptations to the canals can allow farmers to produce it as a cash crop for the tourism market in Moshi and Arusha

Intervention:

Under the provisions of the World Heritage Convention (UNESCO), the Ministry of Natural resources and Tourism (MNRT) maintains the Tentative National World Heritage List of Tanzania. The plan will gazette the selected area as a candidate for World Heritage recognition and include it in the tentative list. Entry on the Tentative List already provides a degree of protection and recognition at both national and international levels. It is expected that this will provide wider benefits in terms of raising awareness of the value of other heritage agricultural systems and their continued social, economic and environmental relevance (Output 6).

Additionally, the plan will explore the viability of including agricultural heritage issues explicitly in the Tanzanian Heritage Act and laws for the protection of heritage (Output 6).

Finally, decision-makers will be targeted by communication materials (flyers, publications and the project web-site) and national workshop/trainings will be held to raise awareness and understanding of agricultural heritage issues (see communication plan)



Photo's: The combined natural and cultural patrimony of the Chagga Kihamba system represents a valuable heritage of Tanzania: Mt. Kilimanjaro (Left), A traditional Chagga house (Center) Ancient Chagga defense tunnels (Right).

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Monitoring

The project defines the indicators for progress in its logical framework. During Activity 1.1 all baseline information on the indicators will be collected by the project team. At the project's conclusion, progress/impacts of the action plan will be measured by collecting information and data on the same indicators.

Implementation arrangements

Consistent with the decisions made by the project's inception workshop, the implementation arrangements are as follows:

- FAO's field-based technical officer provides for technical and operation oversight of the plan's implementation.
- · FAO's Representation to Tanzania will provide operational support, including procurement services and additional technical advice
- The Ministry of Agriculture, Food Security and Cooperatives (MAFC) the project's national co-focal point institution and its designated focal point provide direct technical assistance to the implementation of the action plan within its mandate and field of expertise.
- The project's national focal point institution for the Engaresero project area, MLDF, is responsible for the implementation and national • coordination of the plan. Its designated National Project Coordinator is its main liaison and the de-facto manager of the plan's implementation.
- The project's national inter-disciplinary Project Facilitating Committee provides a platform for coordination and the mobilization of additional expertise. Its members have been assigned concrete roles in the implementation of the action plan:
- 1) The National Environmental Management Council (NEMC) will assist with carrying out Environmental Impact Assessments and advise on other environmental issues, including PES schemes
- 2) The Ministry of Natural Resources and Tourism (MNRT) will assist with the documentation and conservation of heritage aspect, the establishment of the site's information centre and the national heritage designation and heritage policy aspects of the action plan.
- 3) Other members of the PFC will advise the community and the project team on issues within their fields of expertise.
- 4) The communities of Engaresero Village will contribute local knowledge, time and labour, within their means

The Action Plan's implementation will be closely coordinated with the district, ward and village authorities. The action plan's interventions will be integrated into district plans. Specific contributions by the district authorities include:

- Integration of land-use management measures into the district's land-use plan (activity 1.2)
- Recording of community NR use-agreements as official by-laws, as appropriate (activity 1.3)
- Training of community members in sustainable land and crop management practices (activity 2.1)
- Rehabilitation of traditional irrigation system (activity 3.2)
- Promotion of the kihamba as a heritabe (activity 4.3)

Main Outputs and activities	Activity details	Objective/ Expected	Lead agency and partners	Timeframe 2011	Inputs	Estimated budget Budget
		impacts		(calendar		(USD) /
				year)		Implementation
						modalities
Output 1: Long-	The objective is to put in p	lace long term arrang	gements for the ma	nagement of the	area, the	
term land-use and	conservation of its heritage	characteristics and	the improved liveli	hoods of commu	nity members. With	
management plan	the aid of GIS tools, an ass	essment of current n	atural resource use	patterns and pra-	ctices will identify	
developed for the	opportunities to harmonize	natural resource use	e patterns, manager	nent measures fo	r the sustainable	
project area,	management of the landsca	ape and its environm	ental, economic, so	cial and cultural	values, as well as	
consistent with	identify opportunities to di	versify livelihoods.	Through a visioning	g and planning ex	kercise with the	
GIAHS goals and	community the existing lar	id-sue plan will be re	eviewed, updated a	nd adjusted, whe	re necessary. This	
principles	plan will be complemented					
	manage community members' natural resource uses. The institutional arrangements and by-laws will					
	build on the Chagga's cult	ural management pra	ictices and institution	ons.		
	The outputs of this action p	olan provide building	g blocks for and ass	sistance to the de	velopment and	
	implementation of the long	term management p	olan	4th o		
1.1. Assessment of	Collect data on natural	Improved	Technical lead:	4 th Quarter	Experts fee	Contract with GIS
dynamic land-use	resources, including	information on	GIS Expert	2010 and 1 st		expert consultant
patterns, resources,	biodiversity, their	and community	consultant	Quarter 2011		(FAO)
values and	management and use, and	awareness of	.			LOLIVATO
management	livelihood patterns.	dynamic land-use	Logistics:			LOA MAFC
arrangements and	D 1	patterns,	MAFC			
collection of	Prepare reports and maps	landscape values	0.1			
baseline data for		and opportunities	Other partners:			
measuring project	Collect data on baseline	for their	MLDF			
impact	indicators for impact	sustainable	MNRI			
	monitoring	management	NEMC			
		Baseline	Community			
		indicators				

1.2 Review and	Conduct participatory	collected for impact monitoring The site's natural	Technical lead:	1 st and 2 nd	Experts fee	Contract with GIS
Update/adjust the existing land-use plan to become a	holistic land-use planning exercise to identify shortcomings in or	resources are preserved and utilized	GIS Expert consultant	Quarter 2011		expert consultant (FAO)
long term integrated management plan for the area	complimentary measures to the current land-use plan Update land-use plan Embed updated land-use plan at district level	sustainably and its cultural integrity maintained for future generations	Logistics: MAFC Other partners: MLDF, MNRT, NEMC District and local authorities		Subsistence Fuel	LOA MAFC
1.3 Development of community institutional arrangements and by-laws for the implementation of the land-use plan	Establish community guidelines/rules for NR use (water) Regulate the kihamba tenure by setting a minimum size (say 0.25 ha) for economic production	Community able to deter any land use activity that is incongruent to the agreements set out in the action plan	Community Technical lead: Expert in collaboration with the National Land Use Planning Commission, the District Authorities and MAFC	^{11st} and 2 nd uarter 2011	Experts Subsistence Fuel Lunch and tea	Consultancy (FAO) LOA with MAFC
	Integrate by-laws in long term land-use plan		Logistics: MAFC Other partners: MLDF, MNRT,			

			NEMC District Authority (legal expert) Community			
Total budget						30 000
	1					
Output 2: Improved land management and crop production practices	Land especially under annu erosion due to the steep slo under perennial crops (coff enrichment by farmyard m performance is common du water for irrigation due to a distribution furrows throug To address soil erosion pro other approaches will be pr low soil moisture during th improvement of water use the traditional water storag Training in sustainable lan- necessary.	ual crop production a ppes of the landscape fee, banana and association anure (from livestoch uring the dry season of reduced stream flow th infiltration and but oblem on farmland, h romoted in the reinst the dry season, small s efficiency (e.g. by lift e structures (ndivas) d and crop managem	is seen during the e (slope range of ciated crops) is gen k) and prunnings fr due to low soil moi resulting from low rrowing animals olistic approach of atement land produ scale irrigation will ning where appropri- to improve irrigation ent practices as we	xploratory visit i to%). The heat erally good due t om the crops. Po sture and at the s discharge and w soil and water co cctivity. To addre be promoted thr riate). There is al on.	s under high risk of lth status of the soils to constant por crop ame time inadequate ater losses in onservation among ss the problem of ough support to so need to improve gation practices is	
2.1. Promotion of sustainable crop	Promote holistic management approach in	Land productivity	Lead: MAFC	1 st and 2 nd Ouarter 2011	Subsistence	LOA with MAFC
and land	soil, crop and irrigation	crop production			Fuel	
management	(involving the whole	increased	Other partners:		Seeds & manure	
practices through	catchment)		MLDF, MNRT,		Tools	
training of	(to be imbedded in		NEMC		Transport	
community	activity 1.2)	Constituted	District and			
members		Capacity of	local authorities			

	Promote appropriate pest management measures including Integrated Pest Management Improve soil, crop and irrigation management by field training.	community to manage land and crop productivity improved	Community		Selected Pesticides of coffee Community Labour IPPM training	Community
2.2. Facilitate replacement of the aged coffee trees in farmers plots to improve production	Train farmers on coffee nursery establishment to facilitate replacement of old coffee trees and revamp production.	Productivity of kihamamba	Lead: MAFC Other partners: MLDF, MNRT,NEMC	^{2nd} and 3 rd Quarter 2011	Subsistence allowance Fuel Seeds & manure New coffee seedlings Tools	LOA with MAFC
			local authorities Community		Transport Community Labour	Community
2.3 Establish a model kihamba (preserving traditional banana, vegetable and coffee varieties)	Identify and aquire important indigenous banana varieties Establish a model kihamba (preserving indigenous banana and coffee varieties)	Kihamba agrobiodiversity improved	Lead: MAFC Other partners: MLDF, MNRT,NEMC District and local authorities	^{3rd} Quarter 2011	Subsistence allowance Fuel Seeds & manure Tools Transport Community	LOA with MAFC
			Community		Labour Plant material Signage	

2.4 Introduce and	Determine suitability and	Alternative	Lead:	^{3rd} Quarter	Subsistence	LOA with MAFC
promote other new	market for new crops in	livelihood support	MAFC	2011	allowance	
cash crops (water	place.	offered reducing			Fuel	
cress and/or		pressure on the	Other partners:			
vanilla) *	Acquire planting	natural resources	MLDF, MNRT		Planting materials	
	materials		NEMC,		(vanilla, water	
* Activity to be		Household	District and		cress)	
implemented after	Train farmers on	income improved	local authorities			
information on	management of new				Building materials	
potentials and	crops		Community		(water cress)	
established					Fridge (watercress)	
					Tools	
					Transport	
2.5 aquaculture	Introduce fish farming in	Household	Lead:	3rd Quarter	Allowances	LOA with
	improved ndivas	nutrition and	MLDF &	2011	Experts fee	MLDF/MAFC
		income improved	MAFC		Building materials	
			Other partners:		(local)	
			MNRT, NEMC,			
			District and		Fish foundation	
			local authorities		stock (fingerlings)	
			Community		Fridge/freezer	
					Transport & fuel	
Budget		1	1	1	•	50,000
Output 3	The development of water	resources in the proj	ect site is planned t	to be rehabilitati	on of selected	
Improved water	furrows and ndivas (mainly	y by lining) to impro	ve water availabilit	ty for irrigation	of the vihamba.	
provision for	Currently there is low efficient	ciency of the water di	istribution system (furrows and ndi	vas) consequently	
Kihamba	resulting in decreased	-				

3.1 Assessment of	Conduct field survey to	Dehabilitation	Load: MAEC	Ath Quartar	Irrigation	Contract (EAO)
5.1 Assessment of	conduct field survey to	Reliabilitation	Leau. WATC			Contract (I'AO)
performance of	assess renabilitation	need and cost	04	2010	Consultant/	
present irrigation	needs of present	established	Other partners:		Engineer	
infrastructure	irrigation infrastructure,		MLDF, MNR I			
	including bills of		NEMC,			LOA with MAFC
	quantities*		local authorities		Subsistence/travel	
			Community	, et and		
3.2 Rehabilitation	Rehabilitation of	Traditional	Lead: MAFC &	1^{st} , 2^{id} and	Irrigation	Contract (FAO)
of 7 nduwas,	irrigation infrastructure	irrigation system	District	3 rd Quarter	Consultant/	
Intake of the	(canal, furrows,	improved	(supervision)	2011	Engineer	
furrows and	nduwas)*					Contract (FAO)
reinforcement of		Productivity of	Other partners:		Construction work	
the 2 furrows	* MAFC to develop	vihamba	MLDF, MNRT			LOA with MAFC
(Tesheni,	TORs incl. for	increased	NEMC,		Subsistence	
Kowere/Ngaruma)	adjustments to make		local authorities			Community
to reduce water	nduwa's compatible for	Irrigation	Community			-
loss	aquaculture	efficiency			Labour	
	_	increased				
Budget	1		•	•		35,000
Output 4:	The heritage resources inc	luding the application	n of indigenous kno	owledge systems	have been declining	
Heritage	due to influences from ext	ernal cultures and ad	option of modern to	echnologies. Thi	is has led to the	
agricultural	erosion of traditional syste	ms that have for long	supported the kih	amba agroforestr	v system.	
practices and	Development of a site mus					
knowledge	its visitors on the importan					
systems recorded	generations.	··· ·· ··· ··· ··· ···				
and promoted	Series and the series of the se					
und promoted	The area is rich in agra biodiversity that the community has relied on for its sustainability but the floral					
	base biodiversity is now facing increased threats due to changes in the farming system driven by					
	base biodiversity is now facing increased directs due to changes in the farming system driven by					
	shall be given emphasis	The importance of t	ourversity colliserv		unional mstitutions	
	shan be given emphasis.					

4.1. Identify and conserve existing heritage (measures to be included in long term management plan)	Identify key knowledgeable persons and sites	Chagga kihamba heritage system conserved	Technical lead: MNRT Logistics: MAFC Other partners: MLDF, NEMC, District and local authorities Community	4th Quarter 2010	Fuel Subsistence allowance	LOA with MAFC (logistics) LOA with MNRT (other inputs, if any)
4.2. Document Indigenous Knowledge Systems, local technologies and best practices* * FAO (Tech.Officer) to develop TORs	Document and establish a database of Indigenous Knowledge	Utilization and transfer of Indigenous knowledge systems enhanced	Technical lead: MNRT Logistics: MAFC Other partners: MLDF, NEMC, District and local authorities Community	1 st Quarter 2011	TK Expert Legal expert Fuel Subsistence allowance	LOA with MNRT or consultancy (FAO) LOA with MAFC (logistics)
4.3. Disseminate and promote IK systems and technologies	Flyers, AV documentary (for TBC), newspaper articles and radio programmes produced for publicity	Indigenous Knowledge systems harnessed and utilization enhanced	Technical lead: MNRT Logistics: MAFC Other partners: MLDF, NEMC, District and	3 rd and 4 th Quarter 2011	AV Production costs Materials (dvd's, tapes, memory cards) Media Expert hosting fees Publication costs	LOA with MNRT

			local authorities			
			a			
4 4 Danalan a site	Derilden deterden	Kasaladaa and	Community	and and ard	A	LOA
4.4 Develop a site	Build and develop	Knowledge and	MNDT	2 and 3 Ouerter 2011	Architect/exhibitio	LUA WITH MINK I
information and	content of	Kihambai	WINK I	Quarter 2011	Concernation	development of
documentation	centre	agricultural	Logistics.		materials/	contents)
centre*	centre	heritage	MAFC		Construction	contents)
contro		preserved			materials (local) /	
* MNRT to		P	Other partners:		Construction	LOA with MAFC
propose			MLDF, NEMC,			
specifications			District and		Subsistence	
(functions and			local authorities		allowance	Community
design criteria) and						
select a location			Community			
for the centre (the					Community labour	
information centre,						
arts/crafts will be						
integrated design)						
Budget						20.000
Output 5: The tourism activities to be offered will be community-based targeting the unique kilomba and chagge						
Develop Local	heritage inherent in the sit	e and target tourists y	who can pay a prem	ium price for a g	enuine ethnographic	
Tourism Activities	experience. It will promote					
	aspects of their agroforestry heritage will be disseminated in the information and displays developed to					
	promote their appreciation.					
	A tourism charter will be developed with the community to ensure that heritage resources are					
	sustainably utilized for tourism purposes without endangering the fragile ecosystem and ensuring that					
	respect for the culture is adhered to. The charter will also address the fair and equitable sharing of					
	revenues from tourism. In line with this, tour guides will be identified from the community and given					
	appropriate training.					
	Authentic Chagga traditio	nai cians will be con	ected and displayed	i in the traditiona	ii chagga bollia	
	1					

	To ensure that the overall tourism products and activities offered by the site are not over exploited or					
	degraded, a tourism charter	for all the activities				
	of the different components such as the tourism information centre, cultural bomas and model kihamba					
5.1. Development	Community meetings	Heritage	Lead: MNRT	1 st Quarter	Expert	LOA with MNRT
of a local tourism		resources within	Other partners:	2011		
charter, including a		project site	MAFC, MLDF			LOA with MAFC
strategy and		sustainable	NEMC,		Subsistence	(logistics)
standards for		utilized	District /local		allowance	
tourism			authorities			
development and			Community			
revenue sharing;						
5.2. Promotion of	Walking tours/treks	Alternative	Lead:	1^{st} , 2^{nd} and	Architect/exhibitio	LOA with MNRT
the site for bio-	developed (ethno-botany)	livelihood support	MNRT	3rd Ouarter	n designer	
cultural tourism*		offered reducing		2011	Preservation	
	Cultural boma	pressure on the	Other partners:	-	materials/	
* (the information	established	natural resources	MAFC & MLDF		Construction	
centre, the cultural			NEMC.		materials (local) /	
boma, arts/crafts	Select tourism		District and local		Signage / Design	LOA with MAFC
will be part of one	stakeholders to visit site		authorities		and production of	(logistics)
integrated design)	for familiarization		uuuioniico		promotion	(logistics)
integrated design)	Fliers produced		Community		materials	
	Thers produced		Community		materials	
					Subsistence	
					allowance	Community
					unomunee	Community
					Community labour	
5.3. Train guides	Training	Alternative	MNRT	2^{nd} and 3^{rd}	Training fees	Direct payment
on heritage tourism		livelihood support		Quarter 2011		by FAO
-		offered reducing				
		pressure on the				
		natural resources				

Budget						20,000
Output 6: Mainstreaming of GIAHS goals and principles into national policy	The conservation of of government program aware of the different	Globally Important Agr s and policies once the t policies that are in sup	icultural Heritage Syst project cycle ends. Po port of it or need deve	ems must be nes licy makers will lopment for its i	sted within , therefore, be made nstitutionalization.	
6.1. Recognition of Shimbwe juu and Engaresero village under national heritage law	Establish task force Develop statement of outstanding universal importance & state of conservation (workshop & mission)	Site protected under national heritage and listed in the Tanzania World Heritage Tentative List	MNRT (lead) UNESCO	Ongoing 1 st , 2 nd and 3 rd Quarter 2011	Travel & subsistence allowance Expert fee	LOA with MNRT Consultancy (FAO)
6.2. Mainstreaming of GIAHS into national policy, plans and strategies, including training of policy makers through field visit to project sites	Develop proposal for Tanzanian Heritage Act. Produce comprehensive analysis of Tanzanian policies and laws in relation to GIAHS Hold national workshop to establish GIAHS within the permanent structure of the Tanzanian	GIAHS initiative institutionalized GIAHS goals adopted under the Tanzanian Heritage Act. Institutional responsibility for GIAHS matters beyond project cycle defined Policy makers are knowledgeable of	MNRT (lead) , NEMC MLDF, MAFC, MNRT and NEMC (as pertinent to their specific mandates)	Ongoing / 3 rd and 4 th Quarter 2011 (workshops)	Legal Expert Produce publication on national GIAHS Travel & subsistence allowance (workshops)	See AP for Engaresero

	Government Organize field visit for Policy makers Include provisions for GIAHS in pertinent policies of Tanzania	the GIAHS project/approach and its linkages with Right to Food objectives and principles		
Budget*				10,000
Total budget **				165,000

** Additional items covered by budget action plan for the Engaresero project area (incl. costs workshop – Activity 6.2) ** Budget is based on unit costs for October 2010 and may be subject to adjustments. Management costs incl. admin fees have been factored into the current figures.

Breakdown budget modality: A1: 25.000 Contract / 5.000 LOA (travel/logistics) A2: 50.000 LOA A3: 30.000 Contracts / 5.000 LOA A4: 15.000 LOA MNRT / 5.000 LOA A5: 10.000 LOA MNRT / 5.000 LOA / 5.000 training A6: 5.000 LOA MNRT / 5.000 Consultants (WH)

Summary:

LOA MAFC:	70.000
LOA MNRT:	30.000
Construction (A3):	30.000
Service (A1):	25.000
Consultants:	5.000
Training:	5.000