CHOLOLOECOVILLAGE

2011 - 2014

Chololo farmer Minza Chiwanga intercrops grains and legumes to feed her family

a model of good practice

in climate change adaptation and mitigation

empowering a community to test, evaluate and take up 26 climate change innovations

in

- **agriculture**
- **livestock**
- **water**
- **energy**
- **and forestry**

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We are extremely grateful for the contribution of Tim Clarke - former EU Ambassador to Tanzania - who pioneered the ecovillage programme in Tanzania, launched the Chololo Ecovillage project, and who continues to champion this holistic approach to climate change adaptation.

This publication provides an accessible guide to the lessons learned by the Chololo Ecovillage project, making a valuable and timely contribution to the growing body of knowledge and experience on climate change adaptation in Tanzania.

Filiberto Sebregondi - EU Ambassador

Foreword

by Filiberto Sebregondi EU Ambassador in Tanzania

Climate change affects virtually every corner of the globe regardless of a country's greenhouse gas emissions, or its capacity to deal with the effects of climate change. The Global Climate Change Alliance (GCCA) was launched in 2007 by the European Commission to strengthen dialogue and cooperation on climate change between the European Union (EU) and developing countries, which are hardest hit by the adverse effects of climate change even though they have contributed the least to greenhouse gas emissions.

The GCCA acts as a platform for dialogue and exchange of experience and provides technical and financial support to partner countries to integrate climate change into their development policies and budgets, and to implement projects that address climate change on the ground, promoting climate-resilient, low-emission development.

The Tanzania National Climate Change Strategy has identified agriculture, rangelands, water and forestry as some of the most affected sectors. Climate change poses great risks to food and water security, human health, natural ecosystems and economic development. The situation is directly affecting the most vulnerable populations, mostly living in the rural, remote, and food-insecure areas of the country. Women in particular are sharing a great deal of the burden. The response to such a wide range of negative effects must be holistic, integrated, multidisciplinary and community-based.

Chololo Ecovillage is one of three projects selected from an EU call for proposals aimed to increase the capacity of the most vulnerable Tanzanian communities to adapt to the adverse effects of climate change through sustainable use of their natural resources.

This publication provides an accessible guide to the lessons learned by the Chololo Ecovillage project, making a valuable and timely contribution to the growing body of knowledge and experience on climate change adaptation in Tanzania.

Background
how the project came about

Chololo Ecovillage is a part of The Global Climate Change Alliance (GCCA), an initiative of the European Union. The GCCA is a global alliance with a focus on helping the most vulnerable developing countries to more effectively address the challenges associated with climate change.

Developing countries have contributed the least to greenhouse gas emissions, but are often the most affected by climate change and have limited resources to address the challenges.

The National Climate Change Strategy has identified agriculture, water, energy and forestry as some of the most climate change-affected sectors. The situation is directly affecting the most vulnerable populations, often in the rural, remote, drought-prone and food-insecure areas of the country. Women in particular are sharing a great deal of the burden.

Chololo Ecovillage is one of three projects in Tanzania selected from a GCCA call for proposals, one in each of three types of ecosystems (coastal, drylands, and highlands) particularly vulnerable to climate change.

The call for proposals aimed to increase the capacity of the most vulnerable communities to adapt to the adverse effects of climate change through sustainable use of their natural resources. Specifically it called for an eco-village approach, where holistic, innovative and integrated approaches are tested, adopted and shared.

The 32 month project launched in September 2011 and was completed in May 2014.

Chololo Ecovillage project was delivered by a partnership of six organisations, led by The Institute of Rural Development Planning (IRDP). The partners are Dodoma Municipal Council, Dodoma Environment Network (DONET), Hombolo Agricultural Research Institute, Maji na Maendeleo Dodoma (MAMADO) and Tanzania Organic Agriculture Movement (TOAM).

The contracting authority is the Tanzanian Ministry of Finance & Economic Affairs (European Development Fund).

Tanzania is highly vulnerable to the impacts of climate change, and adaptation is our highest priority. More than 80% of the population depends on climate sensitive rain fed agriculture for their livelihood. Reducing vulnerability to climate change through different mechanisms is crucial for strengthening socio-economic development and assurance of food security.

Chololo Ecovillage as an exemplary is empowering communities to test, evaluate and apply a wide range of adaptation innovations in key sectors such as agriculture, livestock, water, energy and forestry. The project is providing practical solutions to the climate challenges as it works across several sectors. Through a holistic approach the project is breaking new ground, achieving synergies and strengthening the knowledge base of good practice in climate change adaptation, while reducing carbon footprints.

The National Climate Change Strategy encourages such initiatives to build the critical mass of expertise to address adaptation challenges, while safeguarding precious natural resources and strengthening the country's voice in the global climate change debate.

Dr Julius Ningu
Director of Environment,
Vice President's Office

The response to such a wide range of negative effects must be holistic, integrated, multi-disciplinary and community-based.

The problem
climate change impacts

Tanzania has experienced a mean annual temperature increase of 1°C since 1960. Annual rainfall has decreased at an average of 3.3% per decade. Six major droughts over the past 30 years caused severe damage to agricultural production, which provides one-third of the nations GDP, and income and employment to more than 80% of the population.

Extreme events such as droughts, floods, tropical storms and cyclones are expected to become more frequent, intense and unpredictable in Tanzania.

Women's security is particularly threatened due to their role in collecting water and firewood, providing labour for soil and water conservation, and caring for children and the elderly. (Muyungi et al., Unheard Voices – the challenge of climate change in Tanzania, 2009.)

In preparation for this project, a multidisciplinary team visited three rural villages in Dodoma to explore people's knowledge, perceptions and strategies on climate change using participatory Climate Vulnerability and Capacity Analysis (CVCA) methods, developed by Care International.

The key issues identified by residents and members of the village committee, triangulated by secondary research / climate change vulnerability reports / rainfall data were:

1. Drought – rain season starts later, finishes earlier, less predictable, hence change in crop calendar, crop losses, low agricultural productivity, lowered incomes, food shortage and famine;

2. Deforestation - loss of vegetation, increased desertification, reduced animal forage and pasture, shortage of fuel wood and timber, increased women's workload, increased land pressure due to poor natural resource management;

Women's security is particularly threatened due to their role in collecting water and firewood, providing labour for soil and water conservation, and caring for children and the elderly.

Unheard Voices, 2009

3. Flooding and strong winds – leading to soil erosion, crop losses, land degradation, and declining soil fertility;

4. Human diseases: skin diseases, cholera and diarrhoea;

5. Livestock diseases and crop pests: e.g. Rift Valley Fever, army worm, calidea bugs, stink bugs;

6. Inadequate ground water recharge, lowering water table, increased salinity, leading to shortage of drinking water for domestic use and livestock, and crop production.

These problems combine with traditional dependency on rain fed agriculture, use of poor farm implements (hand hoe), unsustainable use of natural resources, lack of enforcement of natural resource by-laws, and limited awareness of climate change issues. Existing coping strategies by the village (pit tillage, dry planting, well deepening, movement of livestock) were of limited and short term effectiveness.

The project worked with the community to identify, introduce, test, evaluate and take up a holistic range of integrated innovations, spanning agriculture, livestock, water, energy, and forestry.

The following pages tell the story.

Now, women in Dodoma typically walk 5-6 hours to collect firewood.

Climate change impacts include:

- Drought
- Deforestation
- Flooding
- Strong winds
- Diseases
- Water shortage
- Hunger
- Poverty

Agriculture - it's all about timing!

Paradoxically the cheapest innovation is probably the most important. It costs nothing, yet it has made a huge difference to food security in Chololo. It's all about timing!

Planting time is crucial. In the past, the first rains signaled the start of the rainy season and farmers were encouraged to plant their seeds as early as possible. The popular national farming slogan from the 1970s was "Mvua za kwanza ni za kupandia" ("The first rains are for planting").

However, the changing climate has disrupted the pattern, with farmers now reporting that the rain season is less predictable, starting later, finishing earlier, leading to low productivity or crop failure, food shortage or famine.

A study on drought and famine in Dodoma found that the presence of dry spells at critical periods of crop development contributes considerably to crop failure. Recent rainfall data shows the dry spell occurs around February and lasts for a month or so.

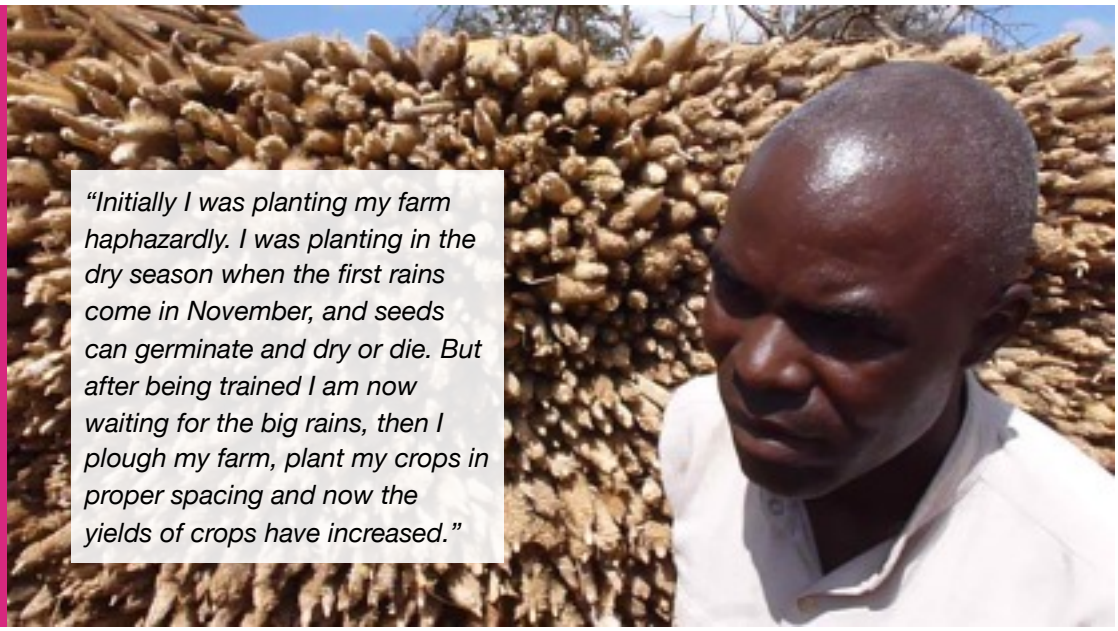
The way it works is that when planted early – at or even before the start of the rains - the seeds either germinate then die as the predicted rains fail to materialise, or they survive but later enter the dry spell in February at the critical 'flowering' period in their development when they need adequate soil water supply, and so they wither and die.

The big problem is Drought.
With climate change the rain season is less predictable, it starts late, finishes earlier, hence changes in crop calendar, crop losses, low agricultural productivity, lowered incomes, food shortage and recurrent famine strike.

Early planted maize withers and dies in the February dry spell

The solution we have found in Chololo is to resist the temptation to plant early, and wait 3-4 weeks until late December – early January. Seeds planted in January will have not reached flowering stage by February when the dry spell hits, so they do not need much water and can survive a few weeks without rain, reaching flowering stage in March when the rains return and guarantee a good harvest.

Chololo has a new slogan: "Panda baada ya Krismasi" ("Plant after Christmas")



Chololo farmer Stefano Chifaguzi with his bumper harvest of pearl millet.

"Initially I was planting my farm haphazardly. I was planting in the dry season when the first rains come in November, and seeds can germinate and dry or die. But after being trained I am now waiting for the big rains, then I plough my farm, plant my crops in proper spacing and now the yields of crops have increased."

"The project has changed me. In the past I was not using farmyard manure in my farm but now it is a great resource. I am using it in my farms. Combined with Good Agricultural Practices I am now getting enough food for my family and surplus for sale."

Gilbert Masiga, Chololo farmer

Good agricultural practices improve on traditional ones

Traditionally, farmers in Chololo practiced shifting agriculture using "kuberega" slash and burn methods.

Often a field was planted with the same crop year after year, and crop residues were burned. When the soil was depleted of nutrients, the farmer would shift to a new field, cutting down the trees to clear the land, and preparing for planting using hand hoes. Farmers planted seeds saved from the previous year's harvest, and hoped that the crops would survive. Now there is no more room for expansion, and for most farmers the often-recycled seeds have low yield potential.

The project has introduced a package of ecological agriculture technologies to make the most of the limited rainfall, improve soil fertility, reduce farmers workload, and improve the quality of local seeds.

Ox-drawn tillage implements like the Magoye Ripper reduce farmers' workload when preparing the land, and improve rainwater harvesting in the dry hard-pan soils.

Soil water conservation measures, like contour ridges, fanya juu bunds, grass strips, and gully healing, all help to capture rainwater and prevent soil erosion.

Farmyard manure improves soil fertility, supplying the crops with nutrients, improving the soil structure and water holding capacity.

Improved early-maturing, high-yielding seed varieties of maize, sorghum, millet, cowpeas and groundnuts have rejuvenated the village seed system.

Optimal plant population with correct spacing distance, then thinning and weeding, reduces competition between plants and improves yields.

Community seed production ensures that a good supply of quality seeds is available for planting each year.

Intercropping and crop rotation improve yields per acre and help control weeds, pests and diseases.

Magoye Ripper reduces workload, capturing rainwater, and reducing soil erosion

"I advise other farmers to follow good agricultural practices to avoid frequent food shortage because with the climate change we need to follow good agriculture practices. Preparing land with ridges, using Magoye ripper / ridger, and planting seeds with correct spacing. With Magoye ripper you can cultivate in hard pan. After cultivation you harvest rainwater and your seeds will all germinate and withstand drought. I advise other people with their farms in sloping areas to use ridges to capture water flowing down the slope, and prevent soil erosion."

Keneth Ndalu

Spreading farmyard manure before cultivation improves soil fertility and helps water retention

Good land preparation improves soil and water conservation

Fertile land and sufficient water are vital for sustaining agriculture and farmers' livelihoods. Lack of water reduces the ability of the soil to supply nutrients to growing plants.

In Africa productivity of land has been decreasing due to land degradation, caused by unsustainable agricultural practices like farming on slopes without sufficient use of soil and water conservation measures, mono-cropping, excessive tillage, non-replenishment of soil nutrients, burning of crop residues, conversion of forests to agriculture, over-exploitation through fuel wood and timber harvesting, overgrazing of rangelands, and lack of proper soil organic matter management.

Traditionally Chololo farmers (men and women) prepared their fields paying little attention to the maintenance of soil fertility, soil erosion control, and rainwater harvesting. Combined with climate change impacts of erratic rainfall, increased temperature and higher winds, the result has been declining soil fertility, increased soil erosion and gully formation, and loss of soil moisture through surface runoff and evaporation.

The project trained around 400 farmers in improved land preparation practices, including animal power tillage, soil water conservation techniques, and use of farmyard manure. Eighty farmers were trained on tillage techniques that enhance in-situ rainwater harvesting on cropland, fabrication of ox yokes, training of oxen, and practical use of ox tillage implements. Sixty farmers were trained on soil water conservation techniques like contour ridges, grass strips, trash lines, fanya juu, fanya chini, infiltration ditches, and the use of A-frames and line levels to accurately plot land contours. Farmers were shown how to prepare seedbeds across the slopes which minimizes runoff and enhances soil moisture. One hundred and forty farmers were trained on gully healing to tackle the massive problem of soil erosion through gullies which form after the rain.

Chololo farmers now realise that the use of these methods leads to reduced land degradation, more fertile soils, increased soil moisture, and increased sustainable production. A major shift from traditional "slash and burn" to improved tillage methods has been seen across the village.

Improved cropping systems increase yields and incomes

Improved seeds: With climate change, rainfall patterns have become erratic and unpredictable, with the rain season starting later and finishing earlier. Agricultural research institutions have developed a range of low-cost improved seed varieties to adapt to the challenges of climate change.

The improved seeds are bred to be more drought resistant, high yielding and early maturing. Chololo farmers were supplied with a range of these seeds to test and evaluate, namely sorghum (Macia and Pato variety), pearl millet (Okoa variety), cowpeas (Vuli 1&2), groundnuts (Pendo variety), and sunflower (Record variety).

The Macia variety sorghum seeds, for example, were developed in Tanzania by local scientists supported by ICRISAT – the International Crop Research Institute or Semi-Arid Tropics. The plants reach maturity in only 3.5 months, are high yielding with short stems and a large head, and provide green leaves for animal fodder. All the seeds are 'open pollinated' (not hybrids) so they can be recycled by farmers year on year.

"Before the project I didn't know about crop rotation. We were planting the same crop in the same field every year but now we know the benefits of crop rotation. Last year I planted sorghum (Macia variety) in my 1.5 acres farm and I got 65 tins. In the previous year 2012 I planted local pearl millet where I got only 30 tins. With crop rotation and good agricultural practices I was able to double the yield."

Keneth Ndalu, Chololo farmer

Intercropping makes better use of resources, provides higher yields per unit area, hedges against single crop failure, and helps protect against pests and diseases. Mixing two crops in the same field, for example a cereal-legume mixture of millet or sorghum with cowpeas or groundnut, reduces depletion of individual soil nutrients, replaces nitrogen, and can reduce pest damage. It provides a family with a balanced diet of staple grains, protein-rich beans, and green leaves for essential vitamins.

Crop rotation – planting different crops in a field each year – reduces depletion of soil nutrients (soil mining), and reduces insect pest attacks.

Minza Chiwanga, Chololo farmer

"I was trained on intercropping as a means of adapting to the impacts of climate change. The project gave me sorghum and cowpea seeds. I planted them in rows in proper spacing in January 2014. By early March the sorghum plants were starting to flower, and the cowpeas were fully matured and I started to harvest leaves and beans for my family. I expect to get enough yields in both cowpea and sorghum."

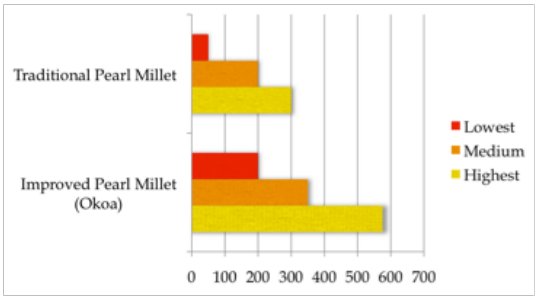
"I advise other farmers to use intercropping"

Yield increases through adoption of innovations

The agriculture innovations have been very successful in increasing yields, meaning more household food security and more income from sales of cash crops.

Data gathered by Hombolo Agricultural Research Institute supports farmers testimonies that yields have more than doubled since the project introduced the improved seeds and good agricultural practices. In the current third season, farmers are expecting even greater yield increases.

A participatory assessment revealed that different farmers have different abilities and resources, broadly categorised as low, medium, and high production. Farmers were asked to report the typical yields for each of these three categories, before and after the project interventions. Their responses clearly showed that the most benefit was noticed among those who had the lowest yields, for example the 'low' pearl millet producers are now achieving the same yields as the 'medium' farmers previously, while the 'medium' farmers are now achieving better yields than the best farmers before.



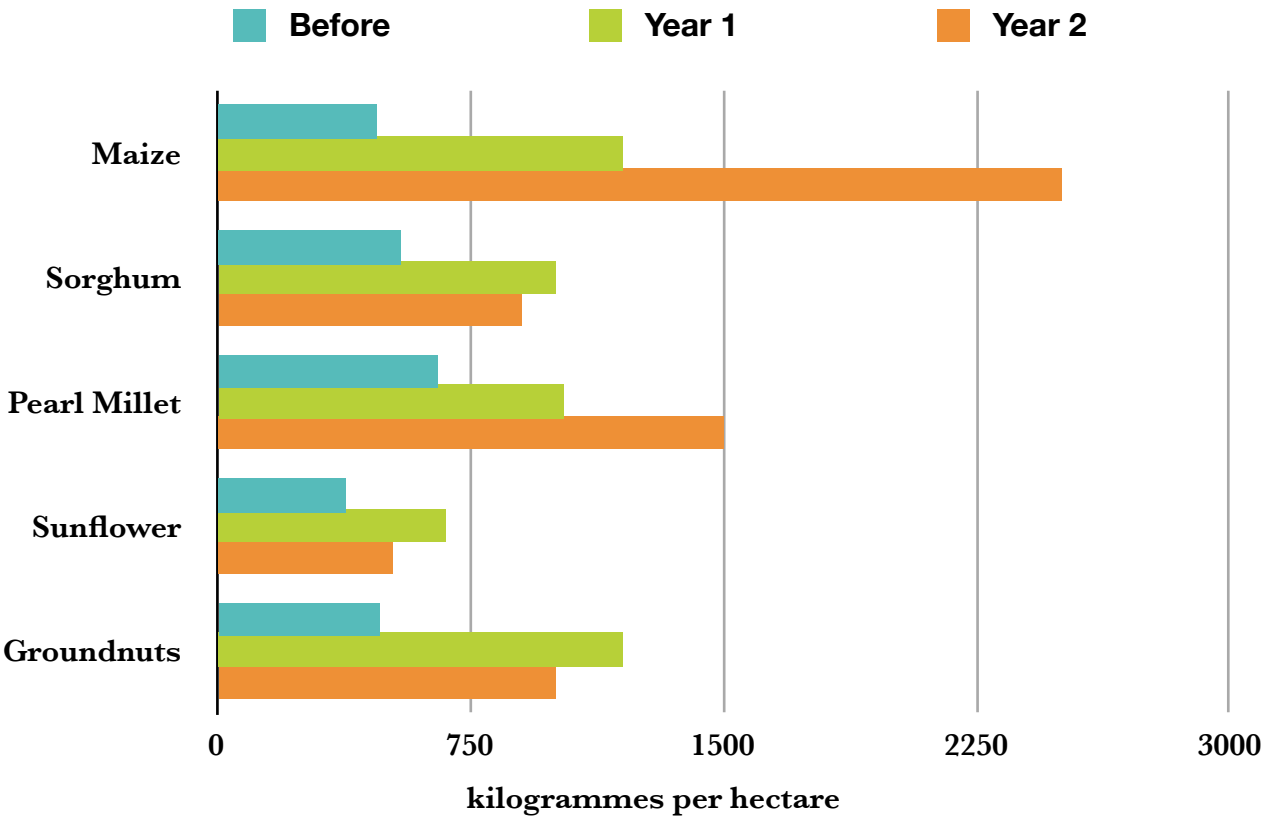
"Before the project I was farming traditionally. In pearl millet I was getting an average of 2 bags per acre but now I am getting 5-6 bags per acre. In sunflower I am getting 6-7 bags per acre as compared to the past where I was getting 2 bags per acre." ***Stefano Chifaguzi***

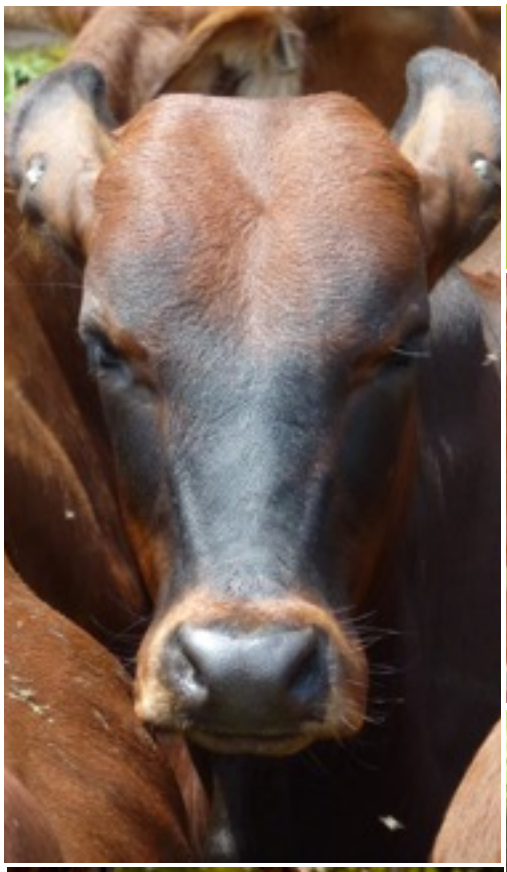
"Using the education I got in 2012 and 2013 I got enough food for my family and got extra food and cash crops for sale." ***Mary Mpiliml***

"With crop rotation and good agricultural practices I was able to double the yield." ***Keneth Ndalu***

"The most important good agriculture practices which I won't forget is using farm yard manure, ox-ploughing, proper planting date, using improved high yielding and drought resistant seeds, planting in spacing and rows, proper weeding, thinning and on-farm rain water harvesting using contours. These agricultural practices made great changes in my farm. The yields have more than doubled. We are now getting extra food for sale, and money for meeting daily expenses and building modern houses." ***James Abel Maligana***

Yield increases in Chololo Ecovillage





"The project aims to increase the genetic potential of local livestock breeds, improve productivity, livestock health and feeding"

Dr. Francis Njau, Project Leader

Livestock

Livestock often have a negative impact on natural resources and farming, through overgrazing of common land, compaction of earth, eating crops, and competing for scarce water resources. The project aimed to reduce the negative impact on natural resources and develop positive interactions between livestock and arable farming.

Oxen are now being used to prepare land for planting, reducing farmers' workload. Farmyard manure is now being used to help fertilise the soil. Crop residues are being used to feed livestock.

The project has increased the genetic potential of livestock in the village, through the introduction of improved breeds of cattle, goats and chickens. This has increased the productivity of the animals, producing more meat, and more eggs, more quickly.

Through training, livestock keepers are now more able to keep their livestock healthy, and ensure they have adequate feed, particularly during the dry season.

- ☑ Training on livestock management, disease control, and dry season feeding
- ☑ 30 improved Mpwapwa breed bulls
- ☑ 60 blended goat bucks
- ☑ 183 improved cocks
- ☑ 60 modern beehives
- ☑ Tick control, vaccination, and veterinary drugs
- ☑ Ten acres of improved pastures and browse species
- ☑ Ten small-scale tilapia fish ponds
- ☑ Leather production training

Mpwapwa bulls grow bigger faster

There are over 2,000 cattle in Chololo. As in other villages in the region, almost all are traditional Tanzanian Shorthorn Zebu (TSZ) breed.

Although this breed has high tolerance to diseases and feed shortage, it has low genetic potential in terms of milk and carcass yield, producing only 1-2 litres of milk per day and reaching age of first mating at 3 - 4 years. Such low production means farmers cannot profit without keeping a large number of animals, increasing pressure on grazing land, resulting in environmental degradation.

The project introduced 30 pure Mpwapwa bulls to improve the genetic potential of the local cattle in the village. The Mpwapwa breed was developed by the National Livestock Research Institute in nearby Mpwapwa, to improve the yields of milk and meat.

The crosses (Mpwapwa and TSZ) typically double milk production to 4 liters/day and reduce the age of first mating to 2-3 years as compared to traditional TSZ.

The introduction of Mpwapwa bulls went hand in hand with improvements in disease control (tick-born diseases and worm infections) and in livestock feeding through preservation of crop residues and hay during the dry season.

Introduction and improvement of this innovation will increase household food security and improve livelihood through production of more milk and meat for food and sale.

"The project trained me on improved livestock management and disease control and gave me one Mpwapwa bull to improve the genetic potential of my traditional Zebu cattle. Although it is just three and half years old, the bull is bigger than all the cattle. The bull has mated the female Zebu and has produced a very good calf, which is growing very fast."

Gilbert Kasiga - livestock keeper

Gilbert says:

"I advise other livestock keepers to preserve livestock feed for their animals for use during the dry season and use farm yard manure to increase crop yield."

"Making leather products has made us self employed. In November, we made 50 pairs of sandals and sold them for 12,000/= to 18,000/= each.

"I advise other rural people to make use of hides and skins to make leather and produce leather goods. This will reduce poverty and help them adapt to climate change."

Anna Malengo - Chololo community member

Leather tanning diversifies livelihoods

Chololo village has almost 3,000 goats. The neighbouring village market slaughters 100 goats every month. The skins are sold to 'middlemen' at a very low price of about 2,000 Tshs (1 Euro) each.

Leather tanning

The project trained 40 people - men, women and young people - in vegetable leather tanning using Mimosa tree bark extracts. By the end of 14 days training they were able to produce grade one leather. This increases the value of each goatskin tenfold to 20,000 TShs (10 Euro). 24 of the trainees formed a leather-making group. The group have produced 170 pieces of leather worth 3.5m Tshs (1,700 Euro).

Making leather goods

Production of leather goods such as shoes, belts, key holders, and phone covers can fetch more money than selling leather. Four members of the Chololo leather group were trained for 15 days on making leather goods by SIDO - the Small Scale Industrial Development Organization. A piece of goat leather from Chololo village can produce about 5 pairs of sandals, which sell for 15,000 Tshs (€7) each on average. In this way, one goatskin is transformed into sandals which fetch around 70,000 TShs (35 Euros). This is over three times the price of one piece of goat leather, or over 30 times the value of a raw goatskin.

These value addition activities strengthen the off-farm rural economy, enabling people to gain skills, making better use of local resources, and bringing more income into the village.

Diversifying livelihoods away from rain-fed agriculture (tanning leather and making leather goods requires relatively little water) makes people more resilient to climate change.

"I have benefited a lot from keeping goats and chickens. I have sold goats and got 550,000/=. I also sold chicken and got 250,000/=. I spent the money I got for paying school fees for my children, investing in farming and business and some for household use. I now have a modern house. My husband has no job and he is totally depending on me. The project has changed me a lot. If I get problems I am able to resolve them myself without depending on my husband."

Jeri Masianga - livestock keeper

Blended goat bucks
boost productivity and incomes

In Chololo village, the local goat breeds have low growth rates and low milk production potential, reaching 6-13kg carcass weight and producing only enough milk to feed their offspring.

Despite their low genetic potential they need few facilities, are cheap to buy, and have more rapid reproductive rate than the larger herbivores. They adapt to a wide variety of climatic conditions and survive on browse materials not normally consumed by other stock.

Improvement of the genetic potential of the local breeds in Tanzania through crossbreeding has been shown to result in animals (blended goats) that can give reasonable returns for the money spent in raising them. Blended goats have been shown to produce up to 28 kg at 72 weeks, double the weight of local breeds.

Sixty blended goat bucks from Kongwa Pasture Research Centre were handed over to 60 goat keepers (10 from each sub village). The selection criteria were ownership of female goats for mating with blended bucks, and willingness to allow the buck to mate with other female goats owned by neighbours. They attended training on goat management, feeding, breeding, record keeping, housing and disease control.

The goat keepers report increased sales of F1 offspring, with buyers paying around 50,000/=, double the price of local breeds, reflecting their increased weights and their value as breeding stock. The improved goats are producing twins, whereas the local breed only produced single offspring. The crossbred goats grow much faster so they can be sold at age 12 months instead of two years, creating more profits for the owners.

Improving local chicken keeping leads to women's empowerment

The project made a commitment to ensure that women are empowered to act at the forefront of transformation. One way was to identify and develop market sub-sectors of particular benefit to women. Community workshops ranked income-generating activities against criteria assessing both market demand and women's attitudes: can they do it? do they like it? can they keep the money?

Local chicken clearly emerged as the most beneficial sub-sector for women.

Interesting insights surfaced; goats and pigs are good business, but the man of the house invariably handles the money. While the money from chicken sales is kept and used by women.

Most Chololo households keep a few local chickens. Local chicken have low genetic potential but are well adapted to the harsh conditions. They grow to 1.5kg and lay only 40 eggs per year.

Exotic chicken breeds have high genetic potential in term of meat and eggs production. They can weigh 3 kg - 4kg and can produce over 240 eggs per year. The major disadvantage of the exotic breeds is their inability to withstand diseases and poor nutrition, and so they do not adapt well to the poor rural conditions.

Crossbreeding local hens with exotic cocks combines the adaptive attributes of the indigenous chickens with the high producing abilities of the exotic chicken. Comparative studies found that crossbreds produce 3-4 times more eggs and weigh twice as much (2.5-3 kg) as the local birds.

The project introduced 123 dual-purpose cocks (Barred Rock, Rhode Island Red and White Sussex) for cross breeding with local chicken. The 123 poultry keepers attended training on local chicken management including feeding, rearing, breeding, record keeping, housing and disease control. Ten local chicken vaccinators were also trained, helping to control the devastating Newcastle disease, a major killer.

Most of the people in the village had no poultry house. With the help of a progressive farmer from Kongwa district, poultry keepers from each sub village were trained on poultry house construction using locally available materials, and provided with chicken wire, nails and some feeders. All 123 chicken keepers have started to construct their chicken houses.

Women report increased chicken and egg production, and have been empowered with additional incomes to be able to meet the needs of their families - contributing to better housing, health and education.

"With improved livestock management and disease control, I was able to sell 100 chickens and I got 1,000,000/= (500 Euros). Now I don't have to beg money from my husband for things like clothing, medicine and school fees. I now have enough money for the household and extra money which is helping me to build our new house."

Mary Mpilimi - Chololo farmer

Mary says:

"Now I don't have to beg money from my husband for things like clothing, medicine and school fees."

"Modern beekeeping provides us more honey than traditional beekeeping"

Michael Mbumi - Village Chairperson

Modern beekeeping trebles honey production

Beekeeping is one of the traditional income-generating activities in the village, with over 500 traditional beehives, each producing on average 1.2 litres of honey per year.

The project recognised that the production potential is very low compared to using modern beehives and beekeeping practices. Sixty beekeepers (10 from each sub village) were trained on modern and traditional beekeeping, beehive preparation and installation, management of beehives, bee enemies and their control, beekeeping seasons, beekeeping products, harvest processing, marketing and selling. Sixty modern 'Tanzanian Top Bar' beehives were fabricated and handed over to the trained beekeepers. The beehives were hung in the trees within the village forest reserve, and a bait of wax was smeared in each to attract bees.

Two village carpenters were trained on making the modern beehives so that the villagers can buy at lower prices. In the 2012/2013 season only five of the beehives attracted bee colonies, and no honey was harvested, possibly due to poor rainfall and occurrence of bee enemies (Pirate wasp).

The beehives were again cleaned and baited to attract bee colonies for 2013/2014. Early reports show that some beekeepers harvested around 5 litres of honey per beehive, over three times as much as their traditional hives. At their best, the modern beehives can produce more than 20 litres of honey per year.

Bees also benefit farmers in other ways. Research shows that four beehives in an acre of sunflowers can increase crop yield by 30% through improved pollination.

"I got education in fish keeping and made a fishpond, which is supplying fish for my family. I am also using water from the fishpond to irrigate my flowers and papaya trees and seedlings. I am now getting papaya fruits and I am selling seedlings to different people within and outside the village. With water availability, fish can be produced at home and provide food for the household."

Agnes Mwalimu - Chololo community member

Fish farming
a first in this semi-arid area

Many people think that it is impossible to farm fish in dry and semi-arid areas. However, a visiting progressive farmer from Kongwa District convinced some Chololo farmers that small scale fish farming can work.

He explained how to construct a fishpond and offered to provide fingerlings (small young fish) to help them get started. He showed them how to fertilise the pond with chicken manure and feed the fish with locally available materials.

In the first year four farmers built and stocked fishponds, eventually harvesting adult fish for household consumption, and selling fingerlings to other fish farmers as they also joined in.

To date in Chololo there are eleven fishponds, constructed and managed by eleven fish keepers like Agnes Mwalimu.

In Chololo small scale fish farming is a seasonal activity, with farmers filling their ponds during the rainy season when water is plentiful, stocking with fingerlings, harvesting adult fish at around 4 months, then draining their fish ponds during the dry season. Once harvested, the fish keepers are using the water in their fishponds to irrigate trees and for other activities around their homestead.

The fish farmers are harvesting fish for home consumption, providing a rich source of protein for their families, and selling surplus fish and fingerlings to their neighbours.

Water

Water is a big problem. When the project began in October 2011, there was no drinking water supply to the village as the borehole equipment had broken down, so people (mostly women and girls) had to walk for two hours a day to get a bucket of water from the next village.

When the rains come, the water soon runs away, creating gullies, and causing soil erosion, while the groundwater aquifer is not being recharged. Seasonal rivers fill up during the rains then dry up as the water flows downstream.

The project is tackling these issues through several innovations:

- ☑ The village water supply is now powered by solar energy
- ☑ The village primary school has been equipped with roof catchment rainwater harvesting equipment, capturing 60,000 litres of water in underground tanks
- ☑ A sub surface dam now captures thousands of tons of water in the sandy river bed, providing water for domestic use and livestock through the dry season
- ☑ A sand dam captures seasonal rainfall and feeds a hand pump for domestic water supply

The project is harvesting rainwater from roof catchment, sub-surface dam, and sand-dam

The Deputy Regional Administrative Secretary inspects the school rainwater harvesting scheme,

and a view (right) of the sub-surface dam, retaining thousands of tons of water for use in the dry season.

"The first benefit to the school was from rainwater harvested through roof catchment. The water is enjoyed by the children and the community surrounding the school. Children are getting water all the time for drinking and washing their clothes. Water is also available to irrigate trees and tree nurseries. School children will carry the rainwater harvesting knowledge to their parents and start their own rainwater harvesting."

Amon Mada - Chololo Primary School Teacher

School roof rainwater harvesting provides 60,000 litres of fresh water

The project constructed a roof catchment rainwater harvesting system at the village primary school. The rain falling on the roof is captured in guttering, then fed down to underground tanks, via a sand filter. A hand pump lifts the water for drinking, washing clothes, and watering the school tree nursery.

The three tanks hold 20,000 litres each, making a total of 60 tons or 3,000 buckets of water.

The underground reservoir has a connection to the nearby solar-powered village water supply point, acting as an additional water storage facility later in the dry season once the stored rainwater has been used up.

"Since the installation of the solar water pump, water is available every day. The price of water has gone down from 50 TSh in the past to 25 TSh per bucket. When we were using the diesel pump, there were frequent breakdowns and we were using a lot of money for repairs, and during the repair water was not available."

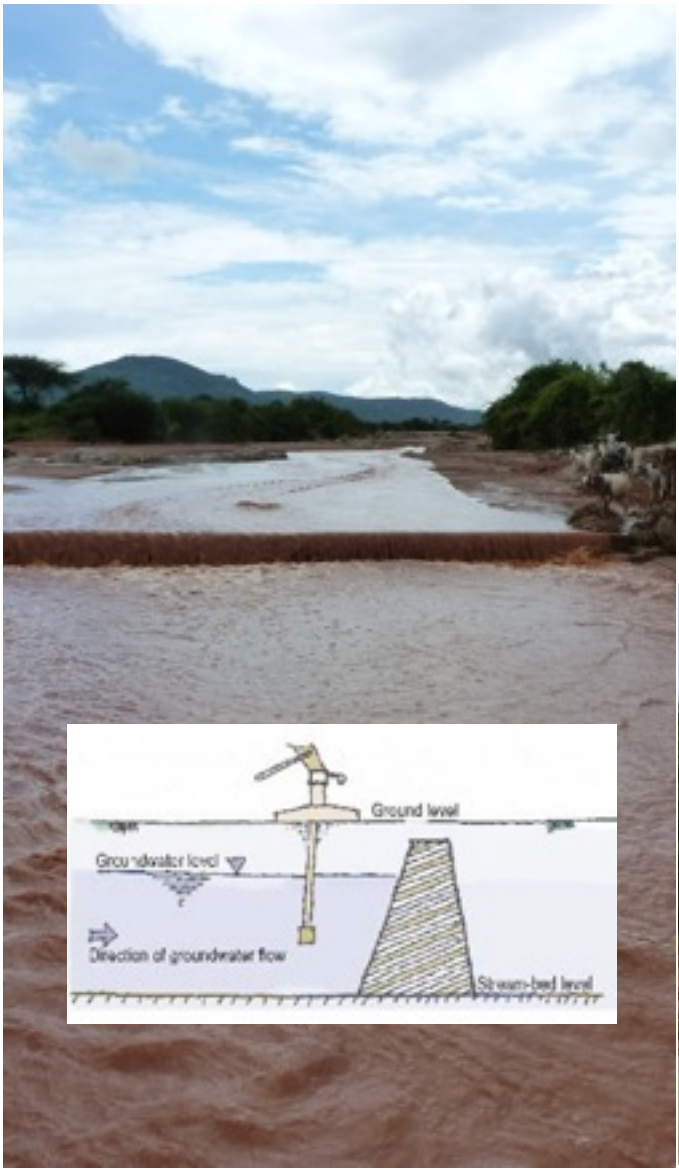
Joina Mgohachi - Chololo water committee member

Solar powered village water supply is cheaper and more reliable

When the project started in late 2011, there was no piped water supply in the village. The 40-year-old borehole pump and diesel engine had broken down. People (often women and children) were walking 2 kms to the next village to fill their buckets and carry them home on their heads. The project repaired the pump and engine and got the system running again, but the worn out hardware dating from 1971 continued to break down, requiring expensive and time consuming repairs.

The project replaced the old system with an electric submersible pump powered by a solar panel array. The new simple system avoids the use of batteries, with the energy generated by the solar panels directly driving the electric pump. Water is pumped whenever sunshine is available, roughly 12hrs per day. It fills up the village overhead water tank in the morning, releasing water to the community every afternoon.

As the energy is essentially free, and very little maintenance is required, the village water committee have reduced the price of water at the village taps by half, and provide water free to older and more vulnerable people. On average each water point in the six sub villages collects 2,000 Tsh per day making a total of 12,000 Tsh per day for the village. The money collected is used to support the water committee, to pay for a survey for another borehole, and for repair and extension of the piped water system.



Subsurface and Sand dams
capture thousands of tons of rainwater

Seasonal rivers flow during the rainy season, but dry up quickly once the rains stop, as the water flows on downstream. The project has constructed two dams – one in each of Chololo's two seasonal rivers - to capture the passing rainwater, and store it in the sandy river bed, providing thousands of tons of water for use during the dry season.

Subsurface dam

First a survey was carried out to determine the best place for a dam, then a trench was excavated (in the dry season) to expose the rocky base of the river. A reinforced concrete wall was built across the riverbed, from the base up to ground surface level, effectively damming the river but without restricting the downstream flow. See photo and diagram above

Now, during the rainy season, the water continues to flow downstream but a proportion of it is captured behind the dam wall, in the sand. A sump, hand pump, and cattle trough at the side of the river enables villagers to water their livestock or collect water for local irrigation or domestic use.

Sub surface dams are considered to be the most reliable and low-cost water source in arid and semi-arid lands.

Sand dam

The sand dam (photo above) is a reinforced concrete wall built 2 metres high across the seasonal sand river. During the rainy season, the seasonal river carries soil (composed of sand and silt) downstream. The heavier sand accumulates behind the dam, while the lighter silt is carried downstream.

Within a couple of rainy seasons the dam completely fills with sand. But up to 40% of the volume of sand behind the dam is actually water, held in the spaces between the sand particles. Because water is stored within sand, it is protected from evaporation, contamination and disease vectors. A two-inch pipe carries the water to a nearby hand pump, for use by the community.

A sand dam can store many thousand of tons of water - recharging groundwater and providing a clean, reliable and local source of water all year round for up to 1,000 people. Sand dams have very low operation and maintenance costs and can last for around 50 years.

"The project has enabled the group to start a tree nursery ourselves. In this season we have sold 386 seedlings to Chololo village people."

She advises: "Villages should plant trees and initiate tree nurseries, which will be the source of tree seedlings in the village."

Asnath Masianga - Tree nursery group member

Trees help adapt and mitigate

Women walk five hours to collect firewood from the forest, as the trees have been cut down for agriculture, fuel, charcoal and construction. Trees help to stabilize soils, provide shade and protection from the wind. The loss of trees increases soil erosion, wind speed and land degradation.

The project has increased access to natural resources through tree planting, agroforestry, and community land use planning and management, and increased the use of alternative sources of energy.

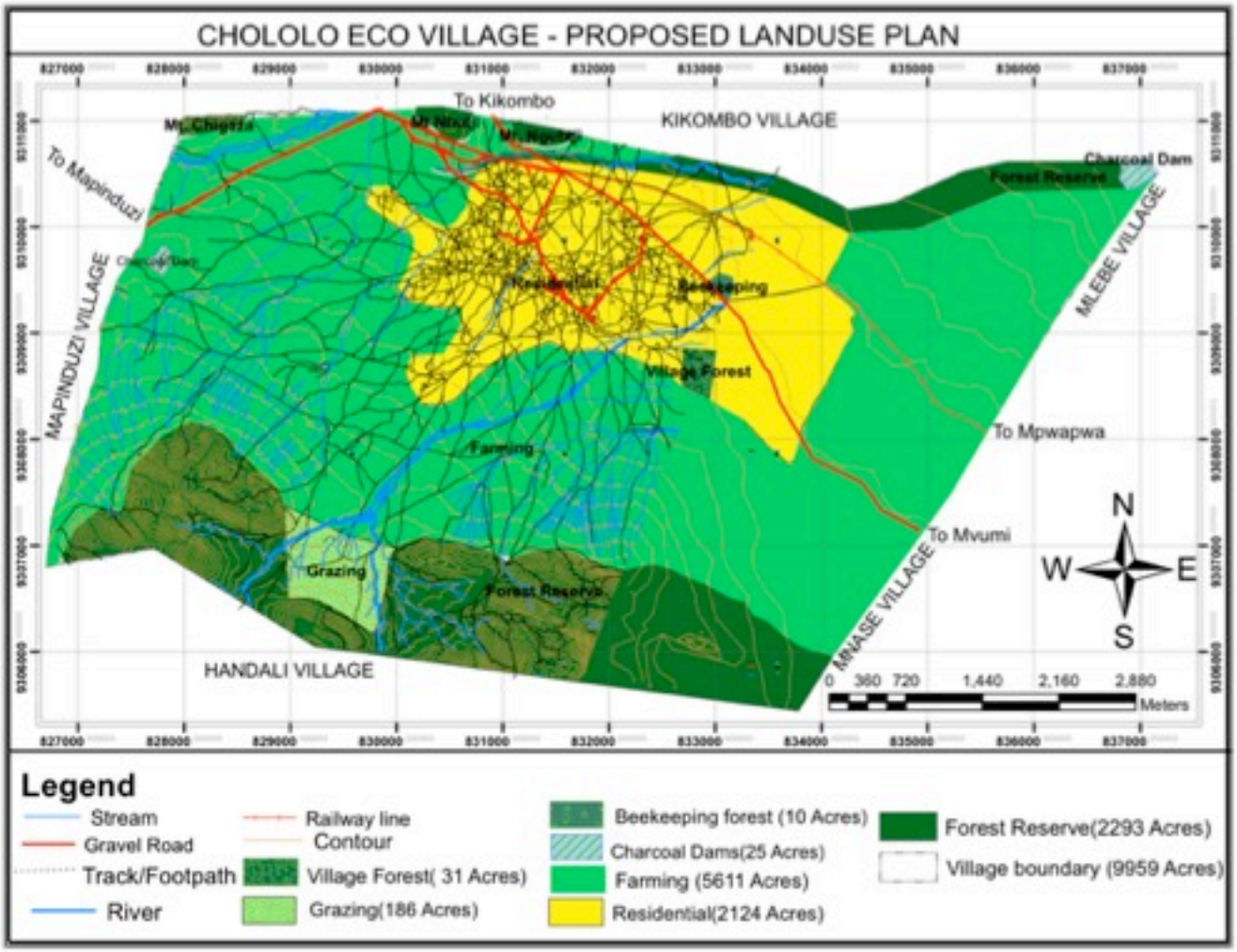
The project has:

- ☑ Trained 133 community members and village leaders on afforestation, nursery management and tree planting;
- ☑ Created tree nurseries at the school and several community institutions
- ☑ Planted 33,650 tree seedlings (including leuceana, acacia polycanth, neem, mango, guava) at hundreds of households, six churches, the primary school, and the dispensary;
- ☑ Planted 3,000 trees in three acres of village forest reserve.

The 2014 end-line survey showed that 86% of respondents reported having planted trees over the past year, compared to 50% in 2011. On average, households each planted 14 trees and 9 of them survived, roughly 65%. Most households obtained seedlings from village tree nurseries (40%), which has increased from only nine percent in 2011.

Respondents believe that forest management is important (94%) and almost all respondents (99%) see the necessity to plant trees.

Generally, the findings show that there is increased community awareness on tree planting, and that many households have planted trees for various uses. The survey report notes: "This is a remarkable achievement that needs to be sustained."



Community land use planning reduces degradation of natural resources

Poor land use management results in the degradation of land, forest and ecosystems as well as generating conflict among different land user groups.

The village community was strengthened and supported to develop land use plans and bylaws to ensure people use the village land sustainably. They identified areas suitable for crop and livestock production, settlements, woodlands, conservation, beekeeping, and industry in accordance with land policy and land laws.

The work included:

- ✦Educating community members on land policy and laws
- ✦Training village land committees and ward tribunal
- ✦Surveying and mapping the boundaries of village land and acquiring a village land certificate
- ✦Formation and training of District participatory land use planning team and Village land use planning team
- ✦Supporting the preparation of village land use plan and by laws
- ✦Facilitating registration of village land use plan at district level

"We decided to develop a village land use plan because the village forest has been severely depleted which resulted into massive soil erosion, and sometimes there are conflicts between livestock keepers and farmers. The committee prepared village environmental by laws and divided the village land into different uses. Now there are areas allocated for agriculture, grazing, settlements, forest, playing ground, livestock routes and roads."

Yona Sudai - Village environment committee member

Alternative energy reduces deforestation

Tanzania loses around 1% of its forest cover every year. This means around a million acres of forest is cut down annually. Reliance on wood fuel and charcoal for cooking is a key driver of deforestation, as 94% of all (rural and urban) energy consumption is derived from these sources.

Women in the villages of rural Dodoma tell us that 20 years ago there was plenty of wood freely available in the village. But now they have to walk 5-6 hours to collect firewood from the forest.

Deforestation is a driver of global climate change. Forest loss contributes 15 percent of annual global greenhouse gas emissions. Trees absorb greenhouse gases and carbon emissions. They produce oxygen and perpetuate the water cycle by releasing water vapor into the atmosphere. Trees anchor the soil, reducing soil erosion, and help stabilize temperatures, while providing a habitat to 70% of the worlds plants and animals.

The project has supported the community to take up, test, and evaluate a range of alternative energy technologies, including energy saving cooking stoves, and low cost domestic biogas plants.

Energy-saving stoves halve the amount of wood needed to cook, reducing pressure on forest resources, saving women time and effort, and reducing harmful smoke in the home.

Biogas digesters convert biomass, particularly cattle dung which is readily available and currently little used, into a gas that can fuel cooking stoves and lamps. A bi-product of the biogas digester is a ready-to-use nutrient-rich slurry, a natural soil fertiliser.

Solar panel array

Energy-saving stove

Biogas construction

Energy saving stoves use half as much wood

"You can cook two pots at a time and there is no coughing due to smoke.

"In the past I was using two bundles of firewood per week on my three-stone traditional stove but now I am using less than one bundle per week with the energy saving stove. This has lessened the burden of fetching firewood, which is now scarce due to deforestation.

"I advise other women to just get an energy saving stove."

Mama Chifaguzi - Chololo community member

Typically women in this region cook on three stones over an open fire inside their home. Without chimneys, the homes are smoke-filled leading to respiratory and eye diseases, while the open fire is a dangerous hazard for small children and vulnerable adults.

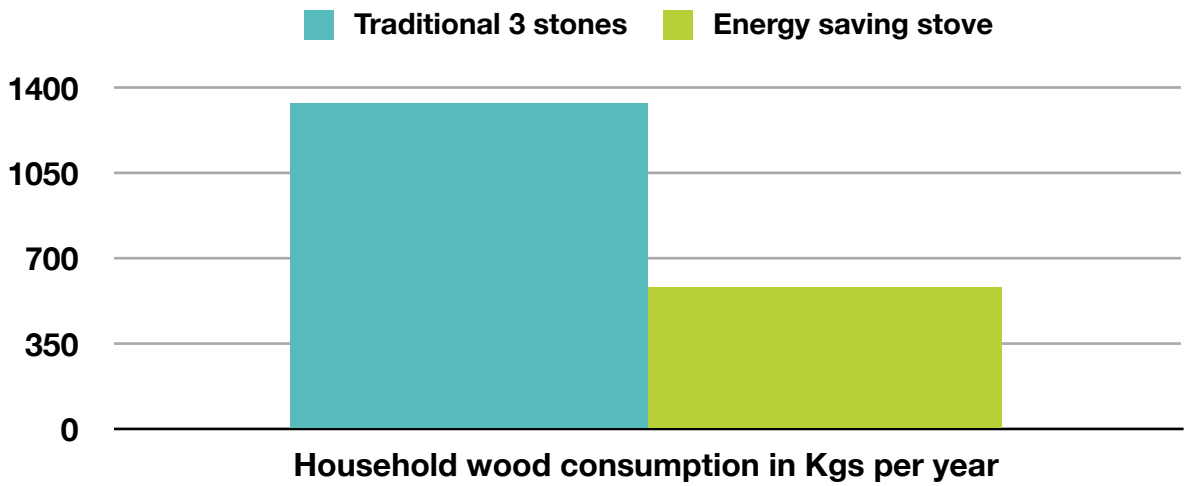
The project trained 12 women how to construct energy-saving stoves, carried out community sensitization, and provided a subsidy of 5,000 Tsh (€2.50) to cover labour costs. Householders were asked to collect the raw materials needed: clay, grasses, and water.

Around 240 Chololo homes now use the stoves for cooking. The stoves are a local adaptation of the Rocket stove design developed by German development agency GIZ.

The main advantages are that they reduce fuel use, reduce cooking time by having two burners, and evacuate the smoke through a chimney.

A survey of 50 households carried out by the project assessed the impact of the energy saving stoves. The study revealed that using an improved stove cuts down fuel wood use by 57%, reduces household CO2 emissions by 1.4 tons per year, saves 85,000 Tsh or up to 17 days per year collecting firewood, and reduces the risks associated with firewood collection.

The costs of stove construction is only 5,000 Tsh (half the sale price of a local chicken) which can be recouped within 22 days based on the local value of firewood saved.



Domestic biogas digesters
reduce fuel-wood use to zero

"The biogas is very useful to me. It helps me to cook tea and food quickly in the morning for the people going to graze livestock. Unlike the past, I am no longer going to fetch firewood. There is no smoke during cooking and I don't destroy the environment."

Agnes Mwalimu - Livestock keeper

Almost half of Chololo households keep cattle, with over 2,000 cattle in the village. The project has introduced 10 domestic biogas plants.

Biogas digesters converts animal dung and other organic materials into combustible biogas. Biogas can be used in simple gas stoves for cooking and in lamps for lighting. The bio-slurry left over from this process is easily collected and can be used as a potent organic fertilizer to improve crop yields.

Removing the fermented material takes place automatically as the bio slurry is discharged into a compost pit through a channel or pipe. The plant itself, when operated properly, needs minimal care.

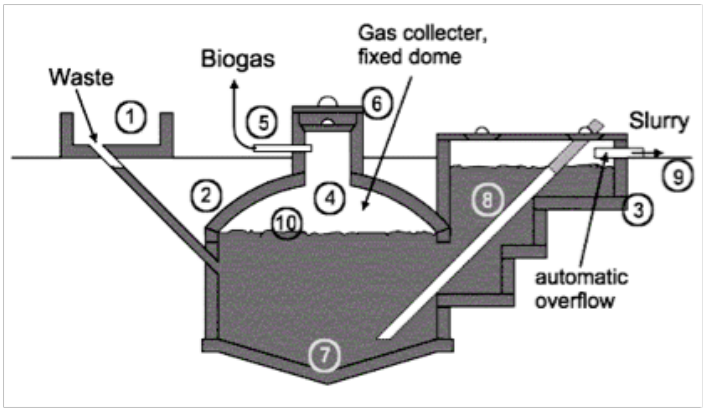
Farmers with 2-3 cows can generate sufficient gas to meet their daily cooking and lighting needs. This not only saves fuel costs, but also reduces the workload of women and children involved in fuel wood collection.

The indoor air pollution associated with cooking on inefficient wood stoves is virtually eliminated with biogas. The fertilizer closes the nutrient cycle, and reduces soil degradation and erosion. In addition, the biogas process is carbon neutral, contributing to the global reduction of greenhouse gas emissions.

The initial cost of a biogas plant is around 1,000 USD, but this can be recouped in a few years of reduced fuel costs.

Agnes says:

"I advise livestock keepers to use biogas because it conserves the environment. Continuous cutting of firewood will result in more land degradation."



Automatic weather station provides valuable information

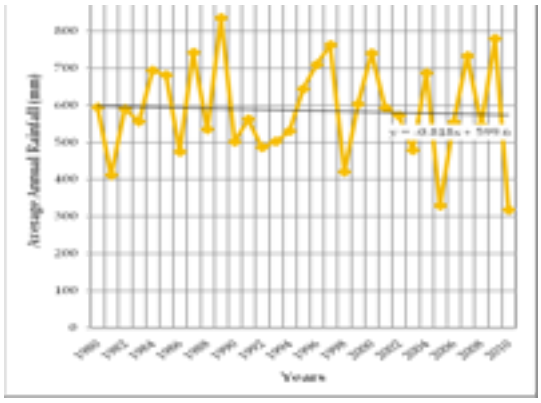
The project installed an automatic weather station, gathering data to help farmers adapt to the changing climate. The weather station records temperature, rainfall, humidity, pressure, wind speed and direction. Every 30 minutes the data is transmitted wirelessly to a receiver in the nearby dispensary, then downloaded periodically to a laptop by USB cable as a spreadsheet, enabling charts to be easily created for analysis.

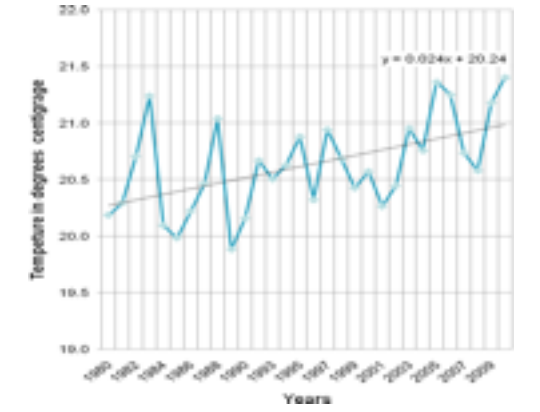
Advances in technology mean that automatic weather stations are now affordable, at around USD 100 each. In Chololo it cost more to construct a fence around it than to buy it.

Rainfall varies from village to village, so that existing weather stations at Dodoma and Hombolo can only give a general picture. The village weather station provides valuable information about the local rainfall pattern.

The data gathered supports research which shows an erratic start to the rains and the existence of a dry spell lasting several weeks during the rain season. This information has been used to advise farmers of the best time to plant their seeds, aligning their growing season with the changing rainfall pattern, helping them adapt to climate change to get the best harvest.

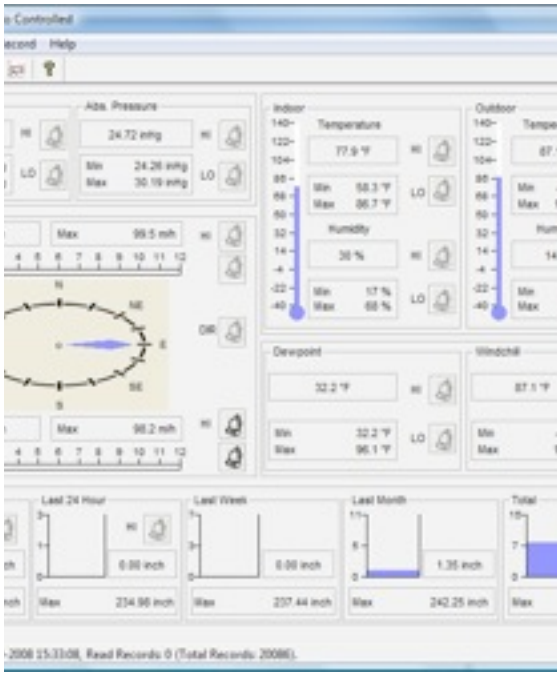
Dodoma meteorological data shows that over the last 30 years average rainfall has reduced, while mean temperature has increased. IPCC data suggests this will only get worse.





Automatic weather station

records:
- **temperature**
- **rainfall**
- **humidity**
- **pressure**
- **wind speed and direction**



Innovations assessed by the village community

A community workshop assessed the 26 innovations using criteria of effectiveness, gender friendliness, and affordability. The workshop used participatory methods e.g. community matrix ranking to assess the innovations. Altogether 55 participants took part, 60% female.

Effectiveness: Participants were first asked to indicate the effectiveness of each of the innovations, ticking the 4 most effective, using different colour marker pens for men and women.

Women's benefit: Female participants (only) were then asked to vote by show of hands whether each innovation benefitted women, and state why they were of benefit.

Affordability: Participants were asked to indicate whether they would take up each of the innovations: a) not at all, b) only if free, c) only with a loan, or d) with their own money.

Agriculture innovations ranked highly, reflecting the key role farming plays in the village. Women identified improved seeds, intercropping, good agriculture practices, ox-tillage implements, and farmyard manure as most beneficial.

In the livestock session, disease management emerged as a clear and affordable favourite innovation. Improved cocks, while effective and beneficial to women, are only affordable to around half of the farmers. Improved bulls would require major subsidies, while goat bucks would need significant access to loan finance or subsidy.

In natural resources, tree planting is the favourite, most beneficial and affordable innovation. Fuel efficient stoves are also a very popular and affordable choice. Land use planning is seen as effective and beneficial. Take up of agroforestry would be enhanced by a focus on fruit trees. Biogas is seen as a minority option for those with access to loan finance.

"When there is food, there is peace"

Female community member explaining why improved seeds benefit women

The results were aggregated to rank the 26 innovations.

The top ten innovations are:

Rank	Innovation
1	Livestock disease management
2	Improved seeds
3	Intercropping
4	Good Agriculture Practices
5	Farm yard manure
6	Tree planting
7	Soil moisture conservation
8	Ox-tillage implements
9	Fuel efficient stoves
10	Improved cocks

Community innovations assessment workshop

Then Environment Minister, Teresa Huvisa helps with the Chololo harvest

The challenge is how to scale up and share these good innovations with other communities across the region who are also facing the impact of climate change.

Scaling Up
sharing the good practice

The Chololo Ecovillage project has created a working model of good practice. The challenge is how to scale up and share these good innovations with other communities across the region who are also facing the impact of climate change.

☑ Policy makers visit Chololo and see the good practice working

☑ Farmers field days help to celebrate and share good practice;

☑ National TV and press coverage is helping to spread the word;

☑ Chololo farmers tell the story on local radio, encouraging other farmers to try the innovations;

☑ A Swahili drama and dance group explains the causes and effects of climate change, and encourages tree-planting, good agricultural practices, rainwater harvesting, and the use of alternative energy;

☑ Students visit Chololo and learn in practice

☑ Chololo farmers tell their story to other village communities, and at Nane Nane farmers week

☑ The Chololo Ecovillage website is keeping a diary of the project, in words, pictures, sound and video;

☑ Join us on Facebook: just search for Chololo Ecovillage.

"In my village everybody has benefited from the project. Nobody is going out of the village in search of food. Those who have shortage get food within the village from farmers who have enough to spare."

Michael Mbumi - Village Chairperson

The project also constructed this new eco-village building, providing a training venue, meeting space, storage, and office accommodation for the village government and leadership.

Chololo Village Chairperson reflects on the ecovillage project

"The benefits that we got from the Chololo Ecovillage project are many:

"We didn't know about good agriculture practices, but now after being trained we are using improved seeds, cultivating farms with ox-plough, applying farm yard manure, planting at the right time with proper spacing, weeding and thinning. This enabled us to get higher yields than before in almost all important crops.

"Our livestock management practices have improved. Livestock keepers are preventing disease and treating their livestock using vaccines, accaricides and various livestock drugs. They are also preserving feed for their livestock for dry season feeding.

"Rainwater harvesting through roof catchment at the school is providing water for the school and surrounding community. The solar pump has made water available every day of the year.

"Modern beekeeping provides us more honey than traditional beekeeping. Villagers are now keeping fish at home for household use

"In my village everybody has benefited from the project. This is because within the three cropping seasons everybody in the village was able to get improved seeds. Also water from the solar pump is reaching everybody in the village. Besides that, neighboring villages are also getting water from our village.

"I assure you that in the two years of Chololo Ecovillage project, our village was free from hunger and according to the good condition of the farms in this year 2013/14, my village will get more yields that in the previous two years.

"Nobody is going out of the village in search of food. Those who have shortage get food within the village from farmers who have enough to spare."

Success factors
why Chololo works

Many people ask what is the secret of the success of the Chololo Ecovillage experience. Here we try to identify some critical success factors:

Multi dimensionality – touching every aspect of village life

Working across agriculture, livestock, water, energy and natural resources, the project touches almost every aspect of people's lives. This creates buy-in from the community, as people can easily see the benefits. The multi dimensional approach also generates many synergies and feedback loops, recycling benefits and adding value to individual innovations. For example cattle dung is used to generate biogas but also produces fertiliser slurry to improve crop yields. The crop residues are collected and stored for dry season feeding.

Multi disciplinary delivery

With a partnership of experts in different fields, crossing the divide between public and private / civil society sectors, learning from each other, complementing each other, and breaking new ground in ways of working.

Working across agriculture, livestock, water, energy and forestry, the project touches every key aspect of people's lives.

Strategic fit

Aligning the project design with national policy, ensures a cohesive set of activities and results, and ensures that the lessons learnt are relevant to policy makers.

Project management

A strong governance structure with a steering committee of experts, and regular meetings of project implementing partners, help to keep a complex project on track. Using a uniform set of project documents, e.g. reporting templates, helps to share information effectively.

Participation

Working with the community, starting from what they know, building on what they have, ensures the best chance of sustainability.

Flexibility

To innovate, diversify, test, evaluate, reflect, learn, and adapt.

Success factors
- Multi dimensional
- Multi disciplinary
- Strategic fit
- Project management
- Participation
- Flexibility

CHOLOLOECOVILLAGE

I first worked as a Rural Development advisor in Tanzania in 1986. At that time, we were all searching for ways to transform agriculture – to create wealth for rural communities, to ensure food security, to provide secure long-term livelihoods for their families, and to above all give pride, respect and dignity to the poorest of the poor. This was our search for the Holy Grail.

25 years on we think we have found it. Within an incredible three years Chololo is becoming a household name for innovation and success in the world of rural development. One of the most fragile and vulnerable rural communities in Tanzania is showing the way. I feel personal pride and satisfaction in being associated with this story. The story is not yet over, but the inspirational achievements speak for themselves. I salute all those who continue to make this happen. I salute in particular all the Chololo villagers who have taken risks, changed their practices and have become true Ambassadors for rural development in Africa. Long may they flourish!

Tim Clarke, Former EU Ambassador

The Chololo Ecovillage Project is delivered by a partnership of agencies:

- Institute of Rural Development Planning (IRDP) www.irdp.ac.tz
- Agricultural Research Institute Hombolo (ARIH)
- Dodoma Environmental Network (DONET)
- Dodoma Municipal Council (DMC)
- Maji na Maendeleo Dodoma (MAMADO) http://www.mamado.org/
- Tanzania Organic Agriculture Movement (TOAM) www.kilimohai.or.tz

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