Bukonzo Organics Cooperative Union, Uganda

Climate Change Risk Assessment

November 2013

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Introduction

The aim of this visit was to carry out a climate change risk analysis with Bukonzo Organics Co-operative Union (BOCU), and to begin to develop a climate change strategy for the organisation. This strategy will then be used as a basis for BOCU's future work in this area as well as for developing collaborative proposals between Twin and BOCU, to support the implementation of key adaptation strategies. This visit was funded under the Comic Relief Great Lakes project.

The visit lasted 7 working days and was conducted by Xavier Hamon who facilitated the different elements of the assessment and analysis along with BOCU staff. Xavier was joined by Alan Tulip (from Agro Eco consulting) for the 2-day field assessment and analysis and by Emmanuel Harelimana (Twin Regional Associate) for the strategic planning workshop.

Key BOCU staff involved in the process included: Josinta Kabugho (Managing Director), Mourren Namusis (Finance Manager), Matiya Bwambale (Field Officer) and Isingoma Eryeza (Goat Project Officer).

The main elements of the programme included:

- Field assessment
- Farmer workshop
- Climate strategy development

The final outcome was the identification of priority areas of work for the organisation to tackle, in order to combat environmental degradation, reduce vulnerability to climate fluctuations, and protect natural resources. These are:

1. **Reforestation** and promotion of **alternate energies**

2. Support for **farmer field schools** to improve **soil erosion & fertility**

3. Promotion of **good agronomic practices** to improve **farm productivity**

These priorities were agreed on by the board and key staff who were presented with the outcomes from the field assessment and farmers' workshop before embarking on the strategic planning process. Work was started during the final 2 days to sketch out specific targets and activities around these priority areas; further work will need to be done to develop these 3 year project outlines more fully, and to agree on the next steps.

Climate change & coffee in western Uganda

The African continent is one of the most vulnerable to climate variability with a widespread lack of adaptive capacity contributing to low resilience (UNFCCC, 2002). Climate change poses a challenge to agriculture everywhere, but especially for farmers dependent on rain-fed cultivation in marginal, high-risk environments (ILRI, 2009). Key climatic changes likely to negatively affect agriculture in East Africa over the coming decades are; increasing temperatures, variations in rainfall patterns and increases in extreme weather events such as droughts and storms.

Future climate predictions

Temperature

Uganda is located at latitudes of 2°S to 5°N, with a tropical climate moderated by its high altitude. Average temperatures in the coolest regions remain below 20°C, and reach 25°C in the warmest, northernmost parts. Mean annual temperature in Uganda has increased by 1.3°C since 1960, at an average rate of 0.28°C per decade (UNDP 2012). Daily temperature observations show significantly increasing trends in the frequency of hot days and hot nights. The frequency of cold days and cold nights has also decreased over this period.

- Daily temperature observations show significantly increasing trends in the frequency of hot days and hot nights since 1960. The rate of increase is seen most strongly in June-July-August (JJA).
- The frequency of cold days has significantly decreased in all seasons except December-January-February (DJF). The frequency of cold nights has decreased more rapidly and across all seasons. (This is nicely illustrated by the fact that, at the start of the 20th century all houses in the area were built with fire-places, whereas now, no newly constructed buildings have them.)

The mean annual temperature is projected to increase by 1.0 to 3.1°C by the 2060s, and 1.4 to 4.9°C by the 2090s. The projected rates of warming are greatest in the coolest season increasing by 1.5 to 5.4°C in the 2090s. All projections indicate increases in the frequency of days and nights that are considered hot in the current climate, and decreases in the frequency of days and nights that are considered cold. Cold days/nights will become exceedingly rare.

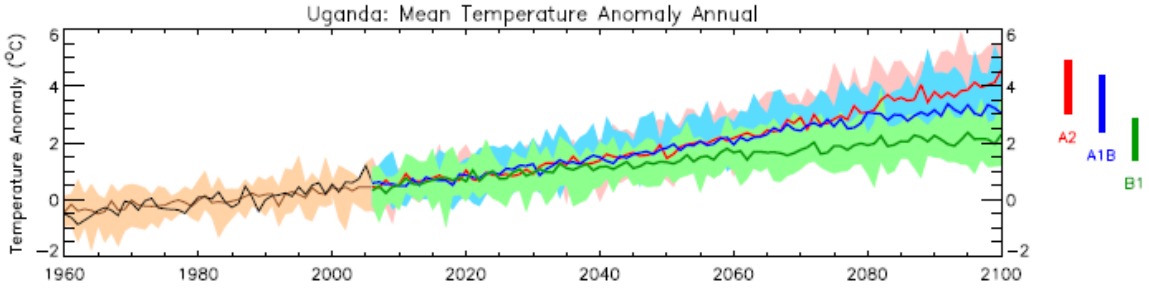


Fig 1: Trend in Ugandan annual mean temperature for recent past and projected future (UNDP 2012).

The main exposure to climate change is likely to come from changes in temperature, which in some cases could reach a 1.5° C annual average increase by 2030 (and even more for individual months). This average is higher than the temperature increase observed during the past six decades. (USAID, 2013)

Rainfall

Seasonal rainfall in Uganda is driven by the Inter-Tropical Convergence Zone (ITCZ), a narrow belt of very low pressure and heavy precipitation that forms near the equator (Kigobe, 2009). The position of the ITCZ changes over the course of the year, causing Uganda to experience two distinct wet periods – the 'short' rains from September to November and the 'long' rains in March to June. The amount of rainfall received in these seasons is generally 50-200mm per month but varies greatly (McSweeney et al., 2012). The movements of the ITCZ are sensitive to variations in Indian Ocean sea-surface temperatures, so the onset and duration of these rainfalls vary considerably.

Rainfall projections are far less uniform across different climate models due to a variety of complexities at regional and local levels. Models show wide disagreements in projected changes of El Niño events (Christensen et al., 2007) which contributes to uncertainty. No robust and significant change in average annual rainfall is projected for the 2015-2045 period with respect to current conditions (USAID, 2013). The most consistent finding is a projected potential increase in precipitation during the DJF season (dry season in all locations). This increase could have a significant impact on agriculture especially perennial crops and post-harvest activities.

Extreme events

Research on changes in extremes specific in Africa, in either models or observations, is limited. A general increase in the intensity of high rainfall events is expected (IPCC, 2007) and extreme events are likely to become more intense over much of East Africa (ILRI, 2009 and USAID 2013). Extreme events include increased frequency, intensity and severity of: droughts, floods, landslides, windstorms and epidemics (Oxfam, 2008).

Impacts on coffee production

A recent USAID report identified coffee as the most vulnerable crop in Uganda (Figure 2).

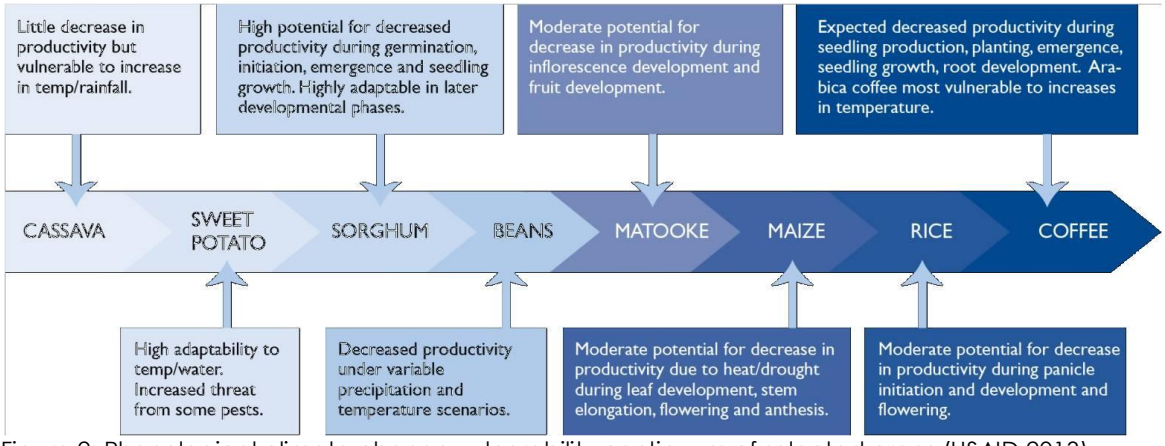


Figure 2: Phenological climate change vulnerability continuum of selected crops (USAID 2013)

Climate change will affect the crop physiology. It will have an impact on the flowering stage and fruit filling stage of Arabica coffee. The unpredictable rains will cause coffee to flower at various times throughout the year, causing the farmers to harvest small quantities continuously (Oxfam, 2013). Arabica coffee is Uganda's commodity most vulnerable to climate change. The literature reviews clearly highlight potential for a significant reduction in the viability of Arabica coffee in the face of rising temperatures. Not only do erratic precipitation, due to continued high inter-annual variability, and rising temperatures reduce productivity, they substantially increase the likelihood of diseases and pests because both multiply more quickly under warmer conditions, and are able to migrate into higher altitudes where their presence was previously unknown (USAID 2013).

A recent Oxfam research reports (produced jointly with CIAT and IITA) shows that the areas suitable for Arabica coffee production will reduce drastically by the horizon of 2030 and 2050 (*Figure 3 and 4*).

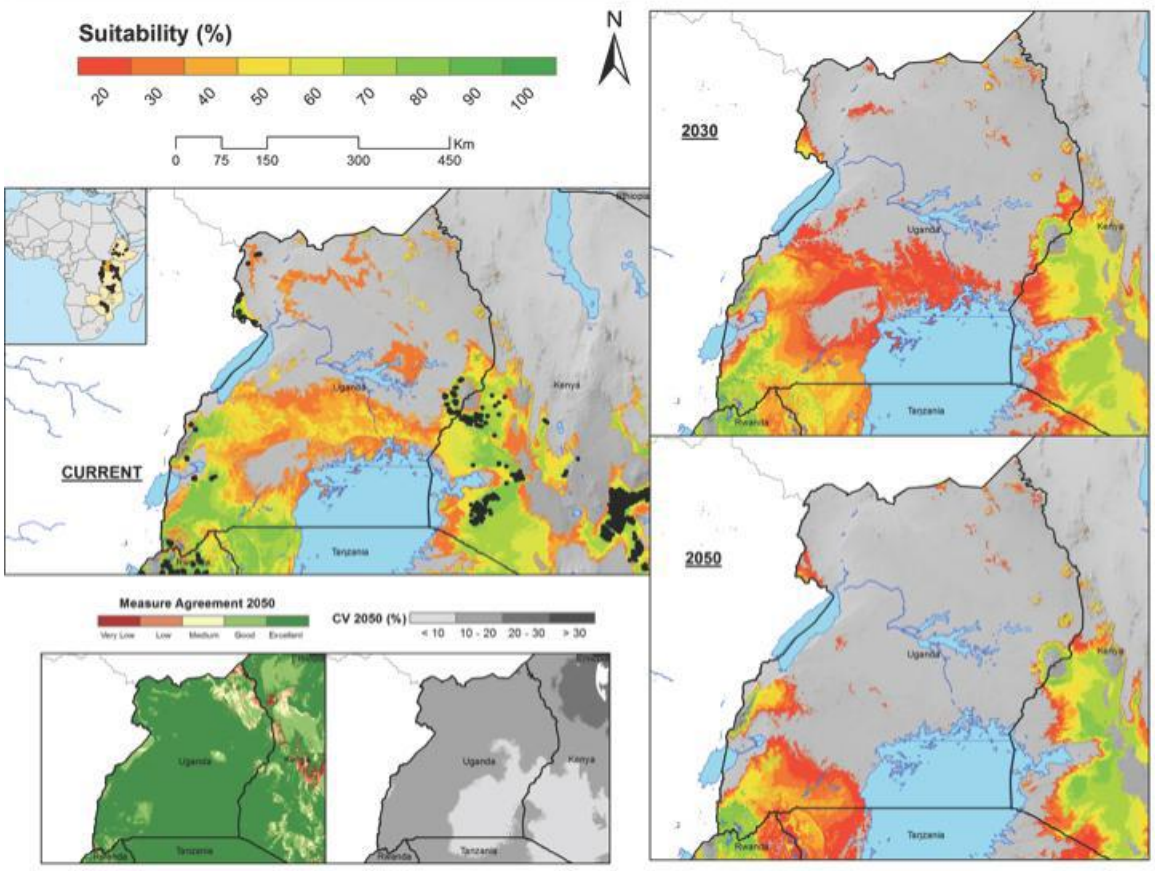


Figure 3: Predicted suitability for coffee production in Arabica coffee-producing area in Uganda today, in 2030, and in 2050 (Oxfam, 2013 - adapted from Läderach and van Asten , 2012).

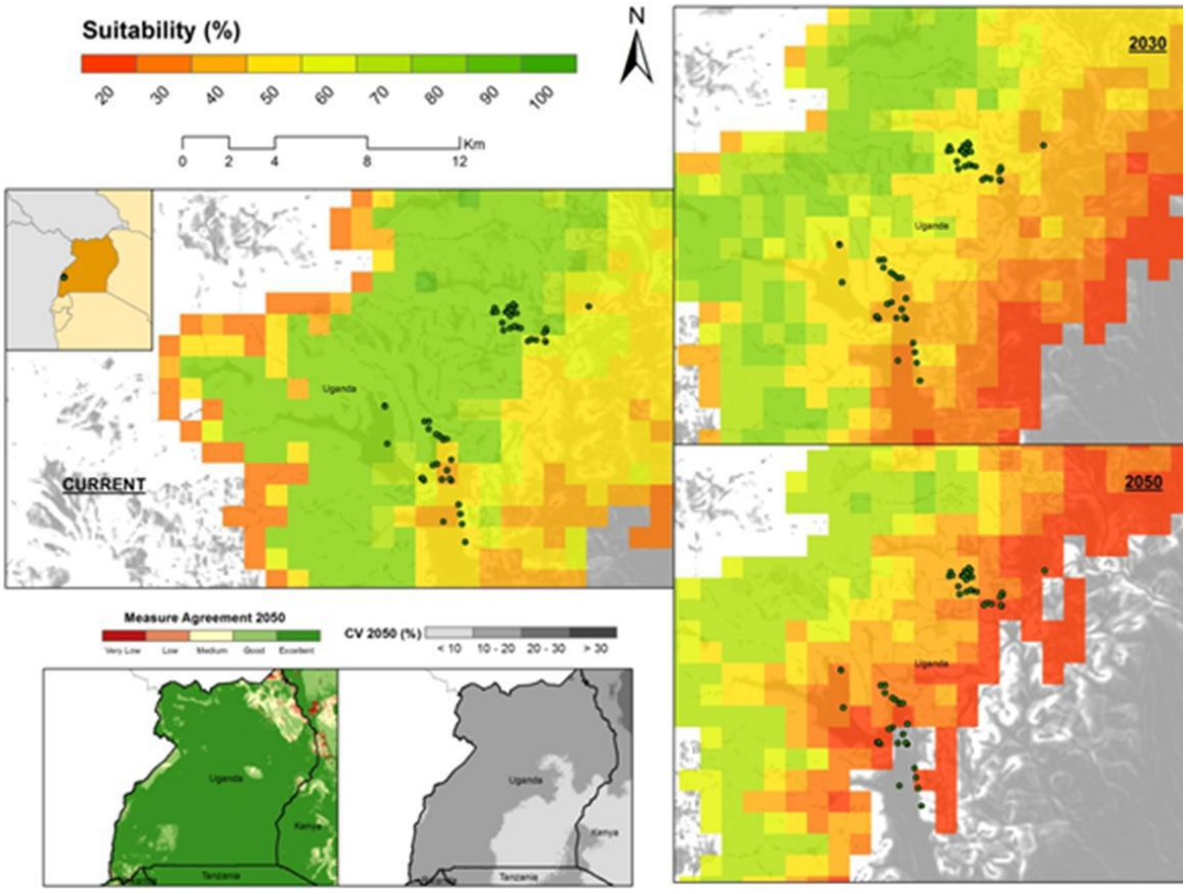


Figure 4: Predicted suitability for coffee production in Arabica coffee-producing area in the Rwenzori mountains today, in 2030, and in 2050. (Oxfam, 2013 - adapted from Läderach and van Asten , 2012).

At the micro level, projected changes in climate may affect key soil with a knock-on effect for other ecosystem functions such as carbon storage and nutrient turnover and availability. Higher air temperatures will also be felt in the soil, where warmer conditions are likely to increase the natural decomposition of organic matter affecting soil fertility (ILRI, 2009). Higher temperatures will also lead to exposed soils drying out more quickly.

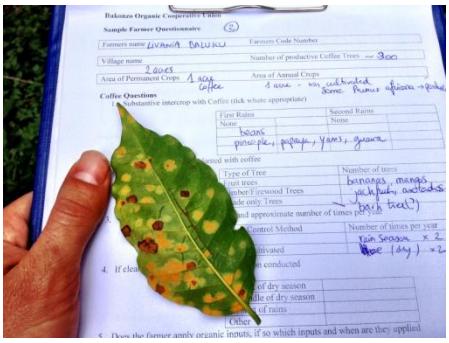
Increases in temperature will lead to greater outbreaks of pests, and the emergence of new pests and diseases. Temperature rise in cold mountain areas will enable pests to increase their ecological range to higher areas previously limited by low temperature.

The long-term impact of climate change on coffee depends on production practices. For example, intercropping coffee with *matooke* (cooking banana) or growing under shade to mitigate the impact of rising temperatures and reduce moisture loss. The development and adoption of climate-smart intercropping systems, which incorporate agroforestry, improved soil fertility management, moisture retention, and disease management, will be critical to the future of coffee production in the face of continued climate stress (USAID 2013).

Environmental Assessment

We spent two days with Alan Tulip, a local consultant in sustainable agriculture, and representatives of the BOCU field staff team. The key objectives of the assessment included to:

- Identify major areas of risk due to environmental degradation and climate change
- Understand which erosion control, soil fertility and coffee management practices are being implemented by BOCU farmers
- Understand the agronomic and environmental challenges farmers face locally
- Observe and document farmers' practices to feed in the discussion of the Farmers Workshop
- Make recommendations based on these findings



Eight farmers were visited during the field assessment. Prior to the field visit a questionnaire was developed which was then tested in the field. The survey aimed to examine: what challenges the farmers were facing, what crops they were cultivating and what farming practices they were employing, and why. The full report of Alan Tulip is in Annex 1 of this report.

Key recommendations resulting from the field assessment included to:

Erosion control	• Build 'trash lines' (from banana stems, stones or crop trashes) along contour lines • Create live erosion control bands (planting with Euphorbia for example)
Zero cultivation of annual crops in coffee gardens	• Demonstrations could be made of zero cultivation planting techniques for annual crop seed (beans, sunflower, maize)
On farm inputs	• Use erosion control bands/fences as a source of on-farm organic input • Grass over the surrounding of the houses to maintain soil and provide additional organic input
Shade	• Increasing shade will reduce climate vulnerability. • Planting trees around the perimeter of the farms would probably be a viable option (fruit trees, or trees for timber/firewood)
Annual crop production	• Making trash lines at close spacing to create terracing • Planting with zero or limited cultivation

Farmer workshop – Identifying risk & vulnerability

The key objectives of this 2-day workshop included to:

- Identify climate, natural resource and environmental threats to farmer livelihoods
- Ascertain to what extent farmers are already experiencing changes in the climate
- Sensitise farmers about climate change and environmental sustainability
- Identify and develop adaptation activities that farmers want to implement

The workshop was attended by 26 people. This included representatives from 4 primary societies plus BOCU field staff and farmer trainers. There was a good age balance ranging from 22-60 years old as well as a gender balance: women (11) / men (15).

A number of different participatory tools and activities were carried out over the course of the two days to meet these aims. For a full outline of the workshop, see Annex 2.

Day 1

Participant's expectations – Participants stated a range of expectations for the workshop. These included:

- What is climate change?
- What are the measures to be safe?
- What causes climate change (contribution from the industry, firewood/farmers)?
- How to predict climate change?
- What are the effects of climate change?
- What can we do to control/limit climate change?
- Why do we have pest and disease during the dry season?
- Why does the rainfall pattern changes?
- Why do we have landslides?

Seasonal calendar & climate impacts – Participants discussed the agricultural cycle and how changes in climate are affecting productivity.

Changes in the climate	Impacts on coffee production
Too much sunshine / prolonged drought	Most of our coffee floats Yellowing of the leaves / Shading too much leaves Coffee beans dry on branches Dries the land before cultivation
Excessive rain events / storms	Soil erosion and loss of top soil Landslides (impact on human population not just coffee). Flooding of rivers Flowering and ripening of beans affected
More thunder and hail storms	Damage to micro-station infrastructures

NB: This year was perceived as unusual by farmers who have been affected by a severe drought and floods which not only damaged villages along the river (e.g. Kyarumba) but also the main town of Kasese.

Stop / Start Practices – Participants examined activities and practices that were good and bad for the environment and discussed which are causing environmental degradation.

Stop	Start (or continue doing)
Deforestation, bush burning	Plant shade trees, planting leguminous trees, use alternative energies
Weeding at any time, stop clean cultivation with a hoe, animal grazing in coffee gardens	Weeding regularly, slashing the coffee garden Terraces, trenches, plant grass bands Mulching, cover crops
Stop removing excess branches by hand, harvesting immature cherries, strop stripping the coffee berries	Pruning, trimming, stumping Use of sharp tools when pruning Plant more coffee trees Supporting of over bearing plants ('staking') Harvest at the recommended time Wash well with clean water, dry on tarpaulins
Stop application of chemicals	Spraying using organic chemicals, application of organic medicine
Over cultivation, intercropping with heavy	Application of compost and manure

feeders, over manuring	Rear animal for manure collection
Pollution, littering plastic, clothes and tins	Start research and record keeping on data
Draining swamps	Enforcement of government policies on swamps

Prioritising challenges – From the previous exercises a total of ten challenges were identified. Participants were given three votes and asked to select those that they considered to be the most important. The following problems had the most votes and were carried forward into the problem tree exercise:

1. Deforestation
2. Soil erosion
3. Poor coffee tree management
4. Draining of swamps
5. Pollution

Problem trees and solutions – Problem trees were created for these five issues and then participants brainstormed about solutions to these problems.

Challenge	Causes	Impacts	Solutions
Deforestation	• Lack of awareness about the effects of deforestation • Use for firewood at household level • Cutting of trees for timber • Population increase • Building construction • Industrialisation • Bush burning • Land use changes (more farming) • Lack of Implementation of government policies	• Too much sunshine • More disease and pest • Poor yields • Poverty • Soil erosion • Decrease in fresh air • Landscape not attractive to tourism • Depletion of trees • Increase in temperature	• Planting more trees at farm level • Reforestation (woodlots) • Making nursery beds • Alternative energy (solar panels, biogas) • Energy efficient stoves • Extension of electricity to remote areas • Mass mobilisation • Training and awareness campaign (visits, videos shows) • Enforcement of government policies
Soil erosion	• Poor farming methods (mono cropping, poor cultivation) • Deforestation • Running water (due to the terrain on which farms are set on) • Over-grazing • Bush burning (destroying micro-organisms in the soil) • Land slides • Strong winds (as a result of deforestation) • Brick making	• Loss of soil fertility • Leaching of nutrients • Land slides • Roots exposed • Exposure of hard rocks in the ground • Coffee trees dry up • Reduced yield • Poor quality product • Low income at household level • Poor nutrition • Dispute over land attribution / conflict with neighbours • Domestic violence	• Right use of slashing and weeding • Afforestation • Establishment of terraces (planting of grass bands along terraces) • Planting of specific grasses on terraces • Agroforestry (planting of 'friendly' crops/trees like ficus, calliandra, albizia) • Intercropping with cover crops (pumpkins, bean, mukuna beans) • Mulching (different type, applied at right time) • Zero grazing • Crop rotation • Establishment of woodlots at both household and community level • Application of manure (liquid manure, animal waste, composit manure) • Plan well when building houses • Addition of compost manure
Poor coffee tree management	• Lack of extension services • Poor methods of farming • Coffee farming is not handled as business • Poor soils • Poor prices • Lack of labour and capital • Poverty at household level • Management of pest and diseases • Steep slopes • Marketing information • Land conflicts	• Poor coffee quality • Low yields • Poverty at household level • Fear of investors, buyers, exporters re-coffee quality • Abandonment of coffee gardens • Drying of coffee plants	• Training • Improved extension services • Plant trees • Cover-crop grasses • Mulching

Drainage of swamps	• Over population • Overgrazing • Urbanisation • Deforestation • Lack of awareness • Land for settlements • Large scale agriculture • Government policies	• Low yields for farmers • Drying of coffee trees • Low rainfall • High temperature • Low income generation • Destruction of habitats • Bribery • Less attractive for tourism industry	• Tree plantation (indigenous trees at farm level) • Training people around the swamps (fish farming?) • Implementation of government policies (law enforcement) • Family planning • Policy (zero grazing) • Effective participation of the local communities during the formulation of policies • Improvement of tourism policies
Pollution (air/plastic)	• Burning of waste (plastic) • Over population • Lack of awareness about the problems of burning bush • Industrialisation • Mining of minerals • Weak implementation of government policies	• Diseases (e.g. lung cancer) • Climatic change • Poor yielding • Water does not penetrate the soil • Food poisoning • High temperature • Carbon monoxide • Bribery	• Training • Reducing industries • Disposal sites • Plant more trees • Family planning • Mass mobilisation • Effective implementation of policies

Climate Resilient Farm – Each of the five groups (4 societies) grouped together to create a vision of climate resilient farm achievable within the next 5 years. These were then presented and prioritised (see below).

BOCU focus – After the ideal farm visioning exercise, a discussion was facilitated to decide which should be the key areas of focus for BOCU as an organisation. I.e. what from the previous discussion they should prioritise to support the societies to implement their visions. The 3 key areas decided on were:

1. **Training for farmers – Promotion of farmers field schools**
2. **Promotion & distribution of tree and coffee seedlings (indigenous sp.)**
3. **Promotion of alternative energies: biogas, solar panels**

Impacts of Climate Change on Business and Operations

At the end of the second day of the Strategic Planning workshop we briefly looked at how BOCU as a business could be affected by the effects of climate change in their day to day operations and how they could reduce their vulnerability.

The Board and members of staff identified that operations dependent on fuel, electricity and water could be affected by climate change.

Micro washing stations
At present the micro stations' pulpers work on generators which use fuel and the water to wash the coffee is carried in jerricans by farmers from the nearest water stream to the micro station. This present system was perceived as vulnerable by BOCU. Ways of improvements could include:

- Solid corrugated plastic sheets for the roofing of the micro-stations which could support solar panels
- Water harvesting system and tank to collect rain water

The electricity provided by the solar panels could be used for the pulper but could also power a light bulb outside the micro-station for night shifts, as at the peak of harvesting season pulping and washing activities can carry on after sunset. This was also seen as an improvement in security (dissuade theft) and safety for micro-stations workers.

Huller
The huller is located in Kasese, in the compound of BOCU office. It works on a generator but it is only used when necessary and does not consume a lot of fuel. Switching to electricity could be done if economically viable.

Transport
BOCU main office is located quite far from the primary societies. Each primary society has to hire a truck to convey their parchments to BOCU. This system could be improved if BOCU had its own vehicle and could organise a round of collection of parchments. This could reduce emissions and the cost of this operation.

BOCU Office
At the moment the office is not energy consuming and the electricity is provided by the main grid. With one desktop and a few laptops BOCU could consider using photovoltaic panels to supply its own energy, but at the moment, and without subventions, this investment is not a viable option for BOCU.

Annex 1: Environmental Assessment Report

Report by Alan Tulip – AgroEco Ltd.
20th November to 21th November 2013

Current Climatic Year Assessment

The project area was visited on 20-21st November, this is typically a wet month and the crops and coffee should look as healthy as they are likely to be. Visits during the dry season would better highlight deficiencies in the management system.

There is no weather data maintained by BOCU and thus the assessment of the current year weather will rely on data collected from Kahangi Estate (Alan Tulip's own weather station data – Fort Portal). 2013 so far has been a pretty average year. Rain fall currently is slightly above average. The mean temperature is slightly below average currently 20.1°C, the average is 20.2 °C and the highest was 2005 at 20.5 °C.

Both rainy seasons have supplied adequate rainfall the only thing that can be commented on is that the short dry period (June-July) was quite severe. The average rainfall for June-July is 134mm but in 2013 only 59mm was received during these months. The average temperature for these months was also above average by 0.4°C and 0.1°C respectively.

However it should also be noted that both the above average temperatures and the lower than average rainfall was compensated in the following rainy season months.

Examination of the records of Bukonzo Joint Cooperative (BJC), located in the same area, for the months of September and October showed an average of 300mm rainfall for September and 200mm rainfall for October. BJC has two weather stations one in the valley and one at high altitude in the mountains.

Coffee Production in 2013

Both BOCU and BJC reported that out turn of coffee was far lower than normal, bean size was smaller and numbers of defects were higher. Trees varied tremendously and some were showing that they will produce well for the first crop of 2014 (March-May). Some trees were having flowering, while this was considered locally to be a sign of good coffee management.

The normal flowering pattern of coffee as other plants should be flowering towards the end of the dry season. This allows the oncoming rains to nurture the coffee formation. The success of the coffee flowering at the end of the rains will depend mainly on the ability of the farm system to hold water during the dry season. If the soils are poor the trees will abort much/all of this coffee.

Soil profiles

Touring through the area it was obvious that the state of the soil varies tremendously even on the same farm and with apparently the same management. A few farms have maintained the original black volcanic soils but the majority had soils with many small stones and sand. Having many small stones in the soil is a strong indication of erosion, the lighter soil particles are washed away leaving only the stones. A lot of soils had a visibly

high sand content. Overall it is clear than the majority of farms had experienced severe erosion.

The farms on flatter lower areas had a very deep layer of volcanic soil, this had in all likely hood been washed down from the high areas. In these farms the coffee and other crops looked a lot healthier.

The soil profile was hard to determine. In the areas with volcanic soils the layer of volcanic soil appears to lie directly on a layer of soil with high sand and small tone content. It appeared that the volcanic soils had been deposited directly on an old river bed. Geologically this may be correct since the Rwenzori Mountains are recent geological occurrence. Initially the River Nile had exited Lake Victoria via Katonga and then crossed Congo to the Atlantic. The Rwenzori Mountains were formed by the tectonic plate movements and while there has been some minor volcanic activity the Rwenzori Mountains are the only tectonically formed mountain range in Africa. As the Rwenzori range formed from tectonic movements it blocked the previous flow of the river Nile eventually causing the Nile to exit via Jinja and onwards to the Mediterranean. Thus at some point the soils may have been old lake/river basins which were then covered by volcanic discharges.

The high sand content in most of the soils will provide a soil that will dry very quickly with lack of rain and exposure to sunlight. This will result in small fruit size and probably explains in part the poor performance of the coffee this year.

Farming Practices

Erosion Control in Coffee

Most farmers are digging trenches to catch water runoff and in most cases the trenches did seem effective at pooling water. The construction of the trenches does have a negative effect at inverting the soil structure as during the construction the soil at the bottom of the trench (sandy/stony soil) ends up on top of the soil. The trenches have to frequently been cleaned out as they fill with soil being washed down the slope. While these trenches are effectively catching most of the water, field observations shows that they are not preventing erosion. Once the soil is dug out it is then washed down the slope to fill the next trench and the process is repeated.

Frequently the roots of bananas and coffee were exposed on the downward slope this clearly demonstrates that erosion control is far from being controlled.

There was one interesting example of live fencing being used to prevent erosion. This consisted of planting a variety of Euphorbia very close together and developing a live wall to prevent soil movement. This seemed an idea which could be expanded on.

Bananas are often intercropped with the coffee and the banana stems can provide good erosion control materials once they have been harvested, if they are laid against the contours. Other materials were available to build such

"trash lines" such as stones, cassava stems, Jatropha stems and possibly maize stems. Trash lines work well as they prevent soil being washed down the slope and as they build up will reduce the gradient of the land. The reduction in gradient reduces the potential erosion and improves water harvesting ability of the soil. It does not require much labour.

Erosion Control in Annual Fields

There is far less attention played to erosion control in annual fields. At best there are a few inadequately placed bands. The frequent clean cultivation of the soils means that these fields are the most severely affected by soil erosion and a decline in food production can be expected if not already happening.

Organic Inputs

The majority of farmers did maintain some form of compost pit and did actively use the compost. The main problems in this were:

- The volume of compost produced by a homestead is very small and it will be difficult to produce enough compost to rebalance nutrient loses from harvesting and erosion.
- The timing of the application of the compost was hap hazard, being applied at any time during the season. Application during the dry season is not effective as the compost dries out and the nutrients are lost to oxidisation in the atmosphere.
- Application should be at the start of the rainy season where the weather is beneficial to keep the compost moist and wash the nutrients in to the soil (ideally compost should be dug in). However this will only be effective if erosion is controlled otherwise any compost applied is lost down the slope.
- There is not any awareness on the carbon - nitrogen (C:N) ratio of the compost. Most of the waste used is animal droppings (nitrogen intense waste) and kitchen waste (nitrogen intense waste). Without the correct carbon nitrogen ratio of 30:1 being maintained the compost will not decompose properly. The absence of carbon will lead to the formation of ammonia (NH3) and this will release nitrogen into the air. When the waste is applied the waste will "seek" nitrogen from the soil to complete the composting process. This nutrient drop will be temporary but could have adverse effects on the crops.
- In reality the compost pits seen during the visit were not composting at all and the waste was drying in the pits. This was because the pits were normally situated in the open and not covered i.e. protected from sun radiation.

Most farmers interviewed made mention of mulching, however there were no examples of mulching with outside inputs seen. All farmers reported that acquisition of mulching materials was very difficult.

The most effective source of mulching materials can come from erosion control bands within the farms. Here the bands play a dual role, reduce erosion and provide mulching material for the oncoming dry season.

Timing of application of mulch seemed rather confused. Farmers reported that the mulch was applied at the start of the rain season to prevent erosion. Applying at the start of the rains may/will have negative effects on the soils ability to harvest water from the rainfall. Normally mulch is applied at the start of the dry season to prevent evaporation of water from the soil.

One farmer was using coffee cherry skins from the micro washing station to use as fertiliser. This seemed a very good idea and could be expanded on. Care needs to be taken in maintaining a correct C:N ratio. Coffee cherry skins have a C:N ratio of 9:1, thus a source of carbon needs to be found.

Weed Control

Most farmers reported a combination of slashing and clean weeding. The impression was that slashing is conducted when workloads are high on the farm and then followed up by clean cultivation where labour is available.

Of concern was that all farmers reported that they liked to clean weed at the beginning or during the dry season. This has a very negative effect on the soil as opening up the soil at this time allows moisture to escape and inevitably the crops will become drought stressed.

Research has shown that soils exposed to direct sunlight without cover can record temperatures of 5-7°C higher, 200mm below the surface compared to covered soils.

Shade Trees

There is no systematic provision of shade and some shade is provided by isolated fruit trees. Research has shown that shade reduces leaf temperatures by up to 5°C in the dry season and 2°C in the rain season. However a balance does need to be developed with shade. On the positive side, shade will reduce water loss and this will reduce climate vulnerability and produce larger coffee beans. On the negative side shade, too much shade can reduce production, and increase number of leaf pests.

During the visit it was noted that trucks were braving the road (dirt tracks) to collect wood, it was not clear where this was from, but given the state of the road it was clear that the demand for timber must be pretty desperate. With shade trees the farmers could, if the shade is managed well, be able to harvest timber for sale and obtain another source of income.

Coffee Pests and Diseases

The coffee had little obvious pests or diseases and looked well above average in this respect. Exposed poorly managed plantations showed severe signs of nutrient deficiencies. Coffee trees with fruit frequently showed early signs of nutrient deficiencies and this situation will undoubtedly become worse once the expected dry season sets in.

It was not clear what pests had created the high defect count and is assumed to be coffee berry borer.

Intercrops with Coffee

Most farmers have some form of intercrop with their coffee, this is mainly because they lack land for annual (food) crops. Typically the coffee is intercropped with beans, cassava and sometimes maize. The soil is prepared in the dry season by digging over the field and the crop is planted at the onset of rains. The current method of cultivating intercrops does much to increase soil erosion in the coffee.

Sunshine

Most of the farmers interviewed reported that the two biggest problems on their farm were "access and cost of mulch and tools" as well as "too much sunshine". The weather data from Kahangi and the BJC weather stations indicated that rainfall had been above normal for the past two months. There are two possible conclusions from this.

1. The farmers were aware that the Twin visit was in relation to climate change and this seemed a fitting answer to give the visitors.
2. That sunshine was really perceived as a problem by the farmers. In this case as the weather as reported by the weather stations was better than average, the farmer perception of sunshine was drawn from the reality that their crops were becoming drought stressed in short spells between the rains. The drought stress would be created by the soils inability to harvest rain during the rains and the inability of the soil to retain moisture during short dry spells.

The poor water management ability of the soil would be in line with the observations regarding lack of top soil and erosion.

Conclusions

The lack of ground cover combined with the culture of clean weeding in the dry season provides a growing system which is very climate vulnerable. This seems to be already observed by the farmers, but the farmers are blaming the "sunshine".

The soil quality is deteriorating and will continue to deteriorate. Initially the annual crops will be the first to suffer low production levels leaving the farmers dependant on buying food stuffs. This already seemed to be being observed as the farmers reported poor bean production. The quality of maize being grown was very stunted and did not look healthy.

Ultimately the coffee production will decline and the farmers will be forced to migrate to the towns in search of employment.

Recommendations

Erosion Control

The farmers have to be commended for the great efforts they are making at digging trenches and this demonstrates an awareness of the farmers over the seriousness of the problem. However it would worth looking at less traumatic systems which would:

- Less disturb the soil structure
- Be more effective
- Be lower cost

There seems to be two stand-out methods:

- Trash lines (from banana stems, stoned or crop trashes)
- Live erosion control bands (planting with euphorbia).

Zero Cultivation of Annual Crops in Coffee

The planting of annual crops in the coffee probably is accelerating the rate of erosion. Here trials/demonstrations could be made of zero cultivation planting techniques. This method requires slashing of ground cover and then a very small hole is dug for the planting of the annual crop seed. The crop is initially *panga* weeded (cutting the grass around the seedling with a machete) but once it is established then normal slashing will be adequate. This currently seems to work well for beans and sunflower, initial trials with maize are rather mixed.

On Farm Inputs

Obtaining outside inputs to rebuild the soil seems not practical, thus the materials for rebuilding soils needs to come from within the farms. Potential sources are from erosion control bands.

There is a practice of clean weeding around the houses. This creates a dry dusty area in the dry season and a wet muddy area in the rainy season. The farm house normally featured as a large source of runoff water and erosion since there is nothing to contain the water in the soil. If the area around the houses was grassed over, this would:

- Reduce erosion
- Create a more pleasant environment
- Provide a source of organic material for the fields (grass cuttings)

Shade

Increasing shade will reduce climate vulnerability. The farmers have limited land thus planting trees around the perimeter of the farms would probably be a viable option. The trees can be additional fruit trees, or trees for timber/firewood this would also provide additional sources of income

Annual Crop Production

The soil is deteriorating quickest in the annual crop fields. There needs to be trials with new methods which:

- Reduce erosion
- Increase water retention
- Allow a stable productive top soil to form

Trials should be conducted at making trash lines at close spacing to create terracing and planting with zero or limited cultivation.

Annex 2: Farmer Workshop Agenda

Day 1 – 22/11/2013

Time	Activities
09:30 -10:00	Introduction, & expectations
10:00 – 11:00	Seasonal Calendar
11:00 – 11:15	*Tea break*
11:15 – 12:00	Start / Stop Practices
12:00 – 13:00	Climate Change presentation and Q&A
13:00 – 14:00	Lunch
14:00 – 14:30	Prioritising challenges
14:30 – 16:00	Problem Trees
16:00 - __	Conclusion

Day 2 – 23/11/2013

Time	Activities
09:00 -09:30	Re-cap from previous day
09:30 – 10:00	Solutions (Problem Trees continued)
10:00 – 11:00	Feedback from Environmental Assessment
11:00 – 11:15	*Tea break*
11:15 – 13:00	Climate resilient farm in 5 years time
13:00 – 14:00	Lunch
14:00-16:00	Presentation of Ideal farm
16:00 - 16:30	Conclusion, group photos outside

DAY 1

1. Introduction to the workshop and expectations

Objective: Participants get to know Twin and understand the objectives of the workshop

- Individual introductions
- Presentation of Twin's work (slideshow)
- Introduction to the workshop including the main objectives and activities.
- Present the workshop agenda and programme of the 2 days
- Ask participants to share their expectations for the workshop with the person sitting next to them. Feed this back to the main group and note in a central place.

2. Seasonal Calendar

Objective: To facilitate participants to think about changes that are already happening
Material: Flip chart paper, coloured pens, blue tack, masking tape

- Split into smaller groups (roughly 6 people per group) and ask each group to create a seasonal calendar. Draw a circle into 12 segments (this should be pre-prepared) and ask groups to mark on the following: Climate/weather; Agricultural cycle;

- When this has been completed ask each group to discuss amongst themselves what changes they are seeing in the climate and what impact this is having on their community.
- Ask each group to present their findings and discuss as a large group. Write down all the climatic changes and impacts that people have noticed in a central place where everyone can see

3. Stop / Start Practices

Objective: To facilitate participants to think about good & bad practices that need to stop or start (continue).
Material: Flip chart paper, coloured pens, blue tack, masking tape

- Split into groups and give each group 1piece of paper which either says, stop, start or continue
- Ask people to make a list of all activities which are going on in the community in relation to climate and the environment which fit on their list. They should include activities and practices which happen on the farm and at household level, but also those of the cooperative and other local institutions such government policy.
- When they have finished ask the groups to move around and work on the other lists before presenting back
- Finally present back the results as a plenary and initiate a discussion

4. Climate Change Presentation and Q & A

Objective: To develop participants' understanding of Climate Change
Material: Projector, electricity, flip chart, set of colour pens

- With support of a Power-point presentation and a flip chart, explain the main causes and impacts of climate change at global level and in particular the impacts on coffee in Uganda
- Provide an opportunity for people to ask questions and share their concerns about the global nature and impacts of climate change

5. Prioritising challenges

Objective: To systematize the community's climate change and environment-related issues and consider options that should help address them.
Material: Flip chart paper, coloured pens, blue tack, masking tape, coloured dots

- Identify a number of problems in relation to climate change and the environment which have come out of the discussion so far, or that people want to address - many of these should have been raised in the stop, start, continue exercise. Make a list.
- Ask each participant to mark the ones which they see as the most urgent or important to be addressed by the community. Give each participant a set number of 'votes' depending on the number of threats identified.
- The facilitator finalises by summarising the main problems identified by the community as a whole

6. Problem trees

Objective: To fully understand the causes and the nature of the problems
Material: Flip chart paper, coloured pens, blue-tack, masking tape, Post-it notes

- Use an example problem to explain the problem tree and define what the "cause", "effect" and "solutions" are. Explain that your tree is sick. Point out that

trees often become sick due to problems in the roots from which it feeds. Explain that to understand why the tree is sick, we must follow the problem back to the roots. Let the participants brainstorm over the causes of the problem by asking the question "why?". Draw a root for each cause and write the cause on the root.

- Repeat the question "why?" for each cause mentioned to identify secondary causes. Write these lower down on the roots, below the primary causes identified. Allow participants to continue until they can identify no more secondary causes.
- Ask the participants to identify effects or impacts of the problem by asking "what happened?"/"what could happen?". Say that the effects are transported within the tree trunk and list them in concentric circles (like tree rings).
- For each effect identified, repeat the question "what happened?"/"what could happen?" to reveal secondary effects.
- Ask the participants to identify solutions to each of the effect by drawing branches. Ask the question 'what should be done? What can we do?' to combat these effects.

DAY 2

7. Re-capture of previous day

Objective: To re-cap previous day and understand participants' expectations

- Ask participants to turn to their neighbour and highlight one thing from the previous day (either something they learnt or something they are confused about) and their expectations for today
- Ask each pair to stand up and tell the group. Ask people to avoid repeating the same points

8. Solutions (Problem Trees continued)

Objective: For participants to think about ideas and solutions for problems identified
Material: Flip chart paper, coloured pens, blue-tack, masking tape, Post-it notes

- Split participants into their problem tree groups from the previous day and ask each group to brainstorm ideas for solutions.
- After 5 min ask each group to move around to the next station to add new solutions to the next problem tree.
- Keep moving around the room until each group has looked at each problem tree.
- When everyone has finished ask each group to present back and facilitate a discussion to see if any extra ideas come up.

9. Feedback from the Environmental Assessment – Discussion on Practices

Objective: To examine the differences between problems caused by climate change and problems caused by unsustainable farming practices. Opportunity to present what was seen in the field.
Material: Projector, flip chart paper and coloured pens.

- With support of a Power-point presentation, show the photos taken from the Environmental Assessment (farming practices, environmental degradation, innovative solutions, good and bad practices).
- Discuss the problems identified during the field assessment as well as current practices.
- Provide an opportunity to discuss current, new and innovative practices.

10. Draw your Climate Resilient Farm

Objective: For each group to build a vision which captures what the ideal farm would look like in 5 years time.

- Form groups (into their societies) and ask them to start developing their vision for how they farm should look like in 5 years time.
- Ask group to list what is missing at the moment and what are the opportunities hty have and the challenges they face in achieving this 5 year vision.
- Each group then presents their vision in a plenary session.