

**Notes on Focus Group Meetings with Farmers, March 6 and 8, 2012**  
**Impacts of and Adaptation to Climate Change, Southern Province, Zambia**  
**IAPRI/Michigan State University, USAID. March 16, 2012**

**March 6; Sinazongwe, Sinazeze camp**

The research team comprised Brian Mulenga, Hambulo Ngoma, Mitelo Subakanya and Chishimba Mulenga. The team was accompanied to Sinazeze camp by Mr. Killian Muleya the land husbandry officer in the Ministry of Agriculture and Livestock (MAL), currently on long term assignment, as project officer, to Kaluli Development Foundation (KDF). We arrived at the camp at 08:30 a.m and we were met by the camp officer Mildred Mboози. Hambulo gave an introductory statement explaining, in Tonga, the aim of the discussion. Participants (farmers) introduced themselves and each provided brief autobiographical information (number of years they have lived in the area and their main livelihood strategies). Researchers also introduced themselves.

**1.0 Back ground of the group**

Number of years each farmer had lived in the area ranged from 12-53 years, and on average, the farmers present had lived in the area for 32 years. Maize and cotton are the most common crops grown in the area while groundnuts, beans, cowpea, tomato, rape and sunflower are grown on small portions of land. A few farmers own livestock mostly cattle, chickens, goats and pigs. After hearing the background of each farmer, they were separated into two groups of 8 females and 10 males.

**Men Sinazeze Camp**

Brian Mulenga, Killian Muleya and Mitelo Subakanya facilitated the discussions with the men.

**2.0 Crop productivity changes**

When asked if they have noticed any changes in crop productivity, the male farmers all agreed that the productivity of crops was declining, especially maize. Farmers also indicated that cotton was the only crop that was doing well in the area, and they are able to obtain reasonable cotton yields even during drought seasons. The decline in maize and cotton productivity was mainly attributed to frequent droughts and floods in a few seasons. There was a general consensus amongst the farmers that in the past, information on good management practices like spacing,

weeding was not available, hence maize productivity was low, but not as low as in the recent past. According to one of the farmers, in the early 1990's he planted an improved maize variety, Seedco 513, and it gave high yields, but later on in 1994 his yields started declining when the frequency of droughts increased. Most farmers cited low rainfall and soil degradation as major causes of declining maize productivity. Other than droughts, the area has experienced floods like in 2006/2007 season and also in 2009/2010 season, which also affected productivity in those years.

## **2.1 Rainfall pattern**

According to one farmer, in a normal season, the area receives about 600mm of rainfall, unlike in the past when the area would receive 600-800mm. Every 3-4 years there is a serious drought in the area. In the past rains would start in October and end in the first week of April, but now rains start in November and end around early March, with long dry spells mainly experienced in January and February, a period when the maize crop needs consistent and adequate supply of water. In some years, there is literally no rain in February. One farmer passed a comment of how droughts coincide with every election year (1991, 1996, 2001, 2006 and 2011) in Zambia.

Because of the short rain season, farmers are advised to plant early-maturing maize varieties which are planted in mid November and mature around late February or early March. Usually in February through March drought strikes. Varieties that have been adopted in the area are Pop 10 and Obatampa (from west Africa), which are open pollinated varieties (OPVs), Pan 413, MRI 594, MRI 426, ZMS 621, ZMS 521, ZMS 421 which are hybrids. All of these are early maturing-varieties. Asked which of the varieties was the most common, one of the farmers said that Obatampa was very common because of its good storage properties and can be recycled without a significant drop in yield. Farmers, however, mentioned that hybrids are avoided in the area because they are less drought tolerant compared to Obatampa and other OPVs. Thus almost all the farmers in the area plant OPVs.

## **2.2 Adaptation to changes in rainfall**

The farmers in the area are now using conservation farming such as using a ripper and use of pot-holing. Most farmers explained that when using a ripper you can finish a big piece of land in a short period of time, and the little moisture available is conserved around the plant. However, the problem comes in when weeding, because it requires a lot of labor. Farmers stated that with a

ripper you can work on the land even if it is dry. The farmers said that this technology of using a ripper was of added advantage for those who had herbicides because ripping increases the weed population, which might not be possible to manage using hand hoes.

### **2.3 Wealth differences**

Concerning wealth differences and productivity changes, farmers stated that the poor were most affected because if both the rich and the poor are using the ripper when it comes to weeding the rich farmer will be able to use herbicides while the poor cannot afford to buy herbicides, resulting in the poor obtaining lower yields than the rich despite both groups experiencing the same environmental conditions.

### **3.0 Labor and land**

When asked which activity was the most labor intensive in their farming system, farmers unanimously stated that weeding was the most labor intensive. Amongst all the crops grown in the area, cotton was cited to be the most labor intensive, requiring a farmer to weed at least 6 times. Harvesting and picking also require a lot of labor in cotton production. Asked if labor was a constraint in their farming system, all the farmers responded in the affirmative. They explained that it was relatively easy to prepare a large portion of land using animal draught power (ADP), but weeding requires human labor, which most of them indicated to be in short supply both family and hired. The labor constraint is further compounded by cattle diseases such as lumpy skin disease (LSD), which is very prevalent in the area. As most farmers use ADP, when animals are sick, land preparation becomes a very big challenge.

Regarding land size, farmers were asked what they felt was the minimum land size that would enable a small scale farmer to grow enough food and increase income. The farmers indicated that two hectares (2 Ha) would suffice, and only one farmer said 5 hectares. On average, farmers cultivate about 2 hectares in the area. Most farmers use up all the land for cultivation. When asked if there was still land for expansion within their area, farmers unequivocally stated that there was no land for expansion in the area. Those who need more land for cultivation have to rent fields from nearby areas.

#### **4.0 Water availability**

The problem of water in the area was acknowledged by all participants. The only stream (Sikalamba stream), which most farmers relied upon as source of water, is being polluted by Collum Coal Mine, a Chinese company. The continued pollution of the stream, according to the farmers, has adversely affected livestock production because farmers' animals used to drink water from this stream but now water from this stream is a hazard to the health of the animals. About half of the farmers indicated having lost their cattle due to the animals drinking polluted water from the stream. One farmer even commented that even the frogs and fish that used to be seen in the stream are no longer there due to pollution of stream water.

According to one old farmer, who has lived in the area for over 40 years, in the 1980's, water was readily available. The streams and wells had enough water and reeds could also be seen in the streams. The decrease in water availability occurred around 1992. Farmers mentioned that one of the factors contributing to reduced water availability in the stream was some farmers ploughing on the stream bank, which causes siltation of the stream.

The decrease in the amount of water available has caused a high death rate of livestock which affects crop production since most farmers in the area use ADP for land preparation. Farmers are now walking longer distances just to get water for their livestock. Farmers used to make their livelihood from gardening which they used to engage in during off –season, on the stream banks but now since levels of water have gone down it is not possible to grow crops like tomatoes and rape which help them to earn extra income. Some farmers indicated that if you want to have a garden you will need to go to other areas. It was also said in the discussion that boreholes in the area are few so sinking more boreholes could help farmers fetch water for their livestock within short distances. Farmers also suggested that a dam be constructed in the area to ease the challenges faced by livestock producers.

#### **5.0 Climate change and adaptation**

When farmers were asked if they have noticed any changes in temperatures, they indicated that temperatures in all drought years are very high. The high temperatures experienced were also related to the opening of the Maamba coal mine in 1968. One farmer had stated that temperatures started heating up when the mine began its operation in 1968. So it was concluded that mining and drought had contributed to the increase in temperature. It has been noticed that day time

temperatures have increased more than night time temperatures. One farmer said that it was impossible for a person to even step on the ground with their feet during the day in a hot season. Even under a tree, the heat can be felt. In the night, temperatures are only high up to 01:00 a.m hours and start dropping after that. As for rainfall, farmers stated that they noticed some changes in rainfall patterns. According to most farmers in the group, rains used to start on the 24<sup>th</sup> of October in the past up to April. Of late rains are only there in November and end in early March. Low rainfall and high temperature experienced in the recent past to date have greatly contributed to reduction in crop yields, resulting in farmers having less or no marketable surplus.

Selling livestock is also not possible for most of the farmers as their livestock has been wiped out by diseases and lack of water. When asked how they have adapted to changes in rainfall and temperatures (climate change), farmers said that conservation farming has been a way to go. Pot-holing, for example, improves moisture retention and soil erosion is also reduced. With pot-holing you may not need to weed and you can just slash and the weeds that you slash assists in conserving moisture. The only setback with pot-holing is that it is labor intensive hence cannot be done on a big piece of land. Some farmers commented that farm researchers should develop technologies that could make pot-holing less labor intensive. Farmers also pointed out that ripping is a good technology, but the only set back is that weeds grow very fast, thus a farmer has to rely on expensive herbicides, which most of the small scale farmers cannot afford.

Climate change has caused some farmers to go work in the mines just to earn a living. An elderly man pointed out that at his age he has to work at the mine because of crop failure in the area as a result of low rainfall and high temperatures. Some have gone into selling of second hand clothes but this is not allowed by the local council. Some have gone into charcoal burning, knowing very well the environmental consequences of doing so, but it is the only option they have to earn a living. A suggestion was put across that if a credit company would give loans to farmers who wanted to go into business it would help the farmers a lot in terms of income generation since farming in the area was not doing so well and wages in the Chinese mines were very low coupled with unsafe working environment. Some of the farmers in the area sale their livestock to ZAMBEEF but prices are very low. One farmer said that ZAMBEEF was offering a price of ZMK 12,000per Kg of live weight. So, for farmers in Sinazeze, selling cattle does not provide them enough income to enable them meet their basic needs.

## **5.1 Wealth differences**

According to the farmers, climate change affect the poor and the rich differently. One farmer explained that rich farmers can engage in other business activities when there is crop failure and make ends meet. Most farmers gave an example of the rich going to urban areas to buy mealie meal (maize meal) in bulk at ZMK 35,000 per 25kg bag and resale at ZMK 50,000 but if you want to get the mealie meal on credit, a 25 kg bag would cost you much more, about ZMK 80,000. A 25kg bag of mealie meal in some cases would be exchanged with 3 very big goat or a cattle with four 25kg bags of mealie meal.

## **5.2 Gender differences**

In terms of gender, females are affected more than males in that even if crop production is not good, the men can go and work in the mines and fishing while the women cannot even be allowed to do that. If there is cattle to sale, the female needs assistance from a male when selling the cattle. Another example was given of how a man can go and work in Mazabuka and the wife can remain to take care of the children. Now if the house is headed by a woman, she cannot go out to work and leave the children alone. The other difference is in terms of distances that women have to walk to collect water for home use since most wells in the area have dried up. Water collection is predominantly a woman's task, so women have been more affected by climate change than men.

### **Women, Sinazeze camp**

Interviewers; Hambulo Ngoma, Chishimba Mulenga and Mildred Mbuzi (Sinazeze camp officer)

#### **1. Crop productivity changes**

When asked about crop productivity changes over the past 20-30 years, women farmers unanimously agreed that crop productivity had changed over the years; it had improved for some crops and declined for others. Farmers recounted how in the early 1980s they were only able to harvest about 5 oxcart of maize per hectare but this improved to about 10 oxcart per hectare by the year 2000. This figure had doubled by the year 2010 with some farmers getting as much as 23 oxcart per hectare. This increase in yields over the years was attributed to agricultural production knowledge acquired from Ministry of Agriculture field workers. One participant explained that farming was difficult in the early 80s because of limited agricultural knowledge

farmers had but this had changed significantly in the 2000s. Farmers added that improved agriculture tillage methods such as pot-holing and ripping introduced by the Ministry of Agriculture around 1998 also helped improve their yields. Additionally, farmers were now able to follow recommended agronomic practices such as crop rotation, use of hybrid seed and fertilizers.

However, the 2011/12 season wasn't looking promising because of dry spells experienced during the growing season. Unlike for maize, farmers felt that cotton yields had been declining over the years. For example, during the period 1996 and 1998 they were able to harvest an average of 85 bells per hectare. In 2010 they only managed to harvest an average of 25 bells per hectare due to too much rainfall. This decline in cotton yields was expected to continue into the 2011/12 season because of scant rain and higher temperatures experienced in the area. Farmers also mentioned that the rainfall pattern in the area had never been consistent with some years having normal rainfall and others having below normal rainfall amounts.

When asked about when the above changes occurred and the causes, farmers said that for maize, yields started improving around 1998 when better tillage methods suited for low rainfall areas (such as Sinazeze) were introduced and agricultural extension education intensified in the area. For cotton, yields started declining around 1996 due to turbulences in the rainfall patterns and a shift to growing more maize by farmers.

On the question of changes made, farmers indicated that they had shifted from cultivating drought resistant crops such as millet and sorghum (which are the traditional local staples) to maize because of the knowledge acquired on maize production. Farmers also changed from planting local maize using recycled seeds to planting hybrid seed. When asked about why farmers did not buy hybrids in the past, they explained that with limited agronomic knowledge, buying hybrid seed was considered as a cost in the past and farmers did not want to depart from their "usual" ways of farming.

When asked why maize yields had improved, farmers said this was so because they were now practicing conservation farming methods such as pot-holing and ripping. They also cited the use of improved seed varieties from seed companies such as MRI and Seedco which are drought resistant and high yielding. Use of fertilizers was also cited as one driver of improved maize

yields. They also mentioned that the area usually experiences intra-seasonal droughts of varying durations and magnitudes in the months of January and February.

### **1.1 Wealth differences**

When asked about whether wealth differences influenced how individual farm households are impacted by crop productivity changes over the years, farmers explained that there was a difference between rich farmers (those who own oxen) and poor farmers because the former can afford ADP which enables them to cultivate larger parcels of land with the first rains and thereby plant early. This enables wealthier farmers to get better yields than poorer farmers who use hand hoes to cultivate their fields.

### **2.0 Labor and land**

On land availability and labor requirements, farmers said that the most labor intensive activity in farming system is weeding as it is done several times in one season and requires to be done within a short period of time. Cotton among all the crops in the area was cited as the most labor intensive crop. Farmers explained that cotton requires more labor when spraying for pesticides and harvesting which is done several times. But for maize, farmers felt that it does not require much labor for weeding anymore because alternatives such as use of herbicides are available.

Average land holding size in the area was less than six hectares but farmers felt a minimum of 7 hectares of land would be required per household for them to ensure household food security and have surplus for sale. When asked whether more land was available in their respective areas to increase farm sizes, farmers said land was no longer available for purchase but for rent from other farmers with excess land.

### **3.0 Water availability**

On water availability farmers reported a close relationship between annual rainfall patterns and water availability in rivers/streams. They explained that water levels in rivers drop significantly during low rainfall years and water is plentiful during good rainfall years. For drinking water, farmers said that they initially obtained drinking water from wells whose water levels would drop to very low levels in the dry season. They said by 1996, the situation had become so bad that women had to wake up as early as 2am and cover distances of over 10km to fetch drinking water from wells. At such critical times, farmers explained that wells would dry up as early as

4am on each day. To remedy this problem, government and donor funded programs started sinking boreholes in surrounding areas around 1996. Livestock usually drink from the nearby streams but once the streams dry up; their water is also sourced from the bore holes. During years with little rainfall farmers are unable to do gardening because of lack of water for irrigation and this result in hunger at household level.

#### **4.0 Climate change impacts and adaptations**

The farmers have not really noticed any changes in temperatures over the years as it is generally very hot in the valley. The months between September and November are the hottest in the area. Day and night temperatures vary sometimes it could be very hot during the day and cooler at night and vice versa but usually it gets cooler after midnight and there are no significant changes in temperatures between different seasons.

The onset and offset of the rain season had changed over the years in the area. While first rains were received in October in the past, nowadays, the onset is in mid November. Rains stop much earlier in March now than in the past when the offset was in April. Farmers noticed most of these changes around 1995 and 1997 when the area experienced a severe drought that resulted in total crop failure. The drought was so severe that farmers were exchanging one full grown cow for a 25kg bag of maize meal. Intra seasonal floods are less common except for farmers who cultivate on the river banks.

#### **4.1 Adaptations to climate change**

Farmers in the area employ the following as adaptation strategies; pot-holing and ripping in response to water stresses; use of hybrids which are suited to the area and are higher yielding, practicing crop rotation, mixed cropping and crop diversification, fertilizer application in response to soil degradation and gardening. Gardening helps farmers raise income which they can use to address other household challenges such as buying food and meeting other household bills.

Other non-farm adaptations used include diversifying into small businesses such as trading in both dry and fresh fish and vegetables, second hand clothes and groceries. Others yet, have also engaged themselves in the charcoal burning business.

Out migration was common practice in the past due to the fact that Sinazongwe area is drought prone by nature.

#### **4.2 Wealth differences**

Farmers felt that wealth differences do make a difference in terms of the impacts of climate change and household responses. Generally, farmers universally agreed that rich farmers are usually well off in drought years because they have livestock and other assets which they can sell and buy food while poorer farmers have nothing to fall back on.

#### **4.3 Gender differences**

On the question of whether there are gender differences in the impact of and response to climate change, farmers in Sinazongwe felt that women were more affected by climate change, because they are faced squarely with the responsibility to feed the family. Women are the ones who have to ensure that the children have food and in drought years this burden becomes heavier as food is scarcer and difficult to find.

### **March 8**

The second set of FGDs was in Siavonga district in Lusitu area. Siavonga was, until February 2012, a district in Southern province, but was recently realigned to Lusaka province. The research team comprising Brian Mulenga, Hambulo Ngoma, Mitelo Subakanya and Chishimba Mulenga was accompanied to Kayuni camp, where the FGDs took place, by the camp officer Mr. Lengwe and the block officer Wiseman. Mulenga. The research team arrived at the camp at 10:05 am. Hambulo gave an introductory statement, in Tonga, explaining the aim of the FGDs. The group was then divided into two, 6 men and 5 women.

#### **1.0 Background of the group**

On average most of the farmers had farmed in the area for over 30 years. The main crops grown in the area are sorghum, millet, maize and cotton. The farmers also have gardens where they mainly grow tomatoes onions and green leafy vegetables like rape, cabbage and amaranths'. Livestock such as cattle, goats and chickens are also kept.

#### **Men, Kayuni camp**

Interviewers; Hambulo Ngoma, Chishimba Mulenga and Mr. Lengwe (camp officer)

## **2.0 Crop productivity changes**

Male farmers in Siavonga observed that over the past 20-30 years, maize, sorghum and millet productivity had been declining. Despite the area being drought prone, farmers noted an increase in the incidences of both intra seasonal and fully blown droughts in the area. Apart from insufficient rains especially at critical stages such as germination and silking, farmers identified increasing incidences of bird and insect attacks on crops and increasing temperatures as other drivers of declining crop productivity. Another somewhat “quire” driver of declining crop productivity was departure from traditional beliefs. In the past, local people turned to their traditional shrines to pray for rains in times of drought and they would also pray against pest attacks. Farmers emphasized that then, any such problems prayed for would be solved, but the current departure from these traditional beliefs was cited as one of the major reasons for the problems besetting Siavonga district. They also added that despite the decline in yields at present, farmers feel that another reason that negatively affected their productivity in the past was the lack of agricultural production knowledge.

Asked when farmers started noticing these changes, they indicated that this was around 1992 adding that this also coincided with the time when Ministry of Agriculture extension workers intensified their work in the area.

## **2.1 Wealth differences**

On the question of whether wealth differences influenced how different farmers were affected by crop productivity changes, male farmers in Siavonga said richer farmers were less affected because they have access to draught power which enables them not only to plant early and on larger parcels, but also to sell their livestock and meet their household food requirements even in drought years.

## **3.0 Labor and land**

Male farmers in Siavonga said that cotton is the most labor intensive crop as it requires a lot of weeding and spraying for pests adding that weeding is the most labor demanding activity.

The average farm size in the area is 2 hectares (ha), but farmers consider having 10 to 15ha as being ideal to feed their families and earn an income from agriculture. Asked whether there was

still land available for expansion of farm sizes, farmers explained that the area no longer has virgin land to expand except from those farmers who have excess land and they can sell it out.

#### **4.0 Water availability**

Male farmers said the flow of water in the Lusitu stream (one major stream in the area) has reduced and this problem started in 1995. Even though water availability is seasonal in this stream, farmers said that it was now becoming increasingly evident that water levels were reducing. They explained that in the past, i.e., before 1995 they could only dig less than 2 meters in the dry Lusitu stream to make wells for gardens but now they have to dig over 4 meters to find water. For drinking water, the local council pumps water from the Zambezi river, but water availability is usually problematic in the dry season. This is because the local council rations water supply from June until December of every year. Water for livestock is obtained from the Lusitu and Zambezi rivers and because of the seasonality of the former, for example, livestock have to move longer distances in search of drinking water. In response to these water problems, government tried to address the problem of water shortages by providing piped water for irrigation in the area, but the problem is that smaller pipes were used as such there isn't sufficient water pumped through to enable locals do any serious irrigation activities.

#### **5.0 Climate change impact and adaptations**

Farmers explained that temperatures are generally high in the area ; it is hot throughout the day and night but its cooler during the period between May and June. In the 1980s and 1990s the area used to receive much rainfall but in recent years the area only records rainfall of between 600mm and 700mm. The onset of the rain season is now in November compared to October. The offset is also sooner in March compared to May or April in the past. The rainfall pattern has become more variable with frequent intra seasonal droughts and increasing differences across different geographical locations within the district.

Floods are less common in the area except for a major recent one in 1995 which forced some people to move out of the area. Droughts are more common in the area with the frequency of intra-seasonal droughts on the increase.

Apart from the impact of reducing crop yields, climate change (seen as reduced rainfall and increased droughts) has also led to an increase in the disease burdens for cattle, goats and

chickens. Farmers explained that lately, the burden of livestock diseases has become a major issue in the area because of increasing temperatures and reduced rainfall.

### **5.1 Adaptation to climate change**

When asked about their responses (adaptations) to climate change, farmers said that for crop production they are now following recommendations from Ministry of Agriculture field officers. Some of these recommendations embraced by farmers include practicing crop rotation, inter cropping (cereals and legumes), conservation agriculture (pot-holing and ripping), shift from local to use of hybrids seeds (i.e., early maturing maize and sorghum varieties), leaving crop residuals in the field and gardening.

### **5.2 Wealth and gender differences**

On wealth differences, male farmers said that rich farmers are less affected by climate change as they have many assets such as livestock which they can fall back on to reduce the effects of climate change. But in terms of gender, farmers said that there is no difference in the way climate change affects women and men in the area.

### **Women, kayuni camp**

**Interviewers: Brian Mulenga, Mitelo Subakanya and Wiseman Mulenga**

#### **1.0 Crop productivity changes**

In order to establish if there is a change in crop productivity, farmers were asked to state if they have observed any changes in productivity for all the crops they grow. It was unanimously agreed by all the farmers that productivity for maize, sorghum, millet and cotton was declining. Farmers explained that sorghum used to do very well in the area despite the droughts, but its productivity started to decline sharply in 2006/2007 season. Of all the crops grown in the area, maize was the hardest hit, with cases of not flowering in some seasons due to low rainfall and high temperatures. These trends are more pronounced in the upland areas, whilst farmers cultivating along the Zambezi river bank and Lusitu stream are better off because they benefit from the river and stream moisture.

When asked about the common maize varieties grown in the area, the women stated that hybrid varieties do not do well in this area. The Women talked of a local variety Kampeliya which does

quite well in the area, because it is a drought tolerant and early maturing variety. This variety produces spotted grains, usually with purple, yellow and white grain on the same cob. One woman narrated that before 1999 maize productivity was reasonable as one could harvest about 20 ox-carts of unshelled maize in 2 hectares but from 2000 onwards you can only get about 4 ox-carts of unshelled maize from the same 2 hectares. The decline worsened in 2005/06 season. In the uplands, maize productivity drastically dropped in 2005, with shortening of the rainfall season, low rainfall, high rainfall variability and high temperatures cited as the main reasons. Rains are very erratic at the critical time (i.e., January and February) when water is needed in the production cycle of maize. The women also explained that soil fertility was not a problem in the area, but inadequate rains and high temperatures.

### **1.1 Adaptation to changes in rainfall**

When asked how they have adapted to changes in rain and temperature, the farmers explained that they have adapted by adopting early maturing sorghum variety (Kuyuma). In the past they used to grow a traditional long maturing sorghum variety (Longo), but this cannot perform well in the current environment. It was also stated that some farmers in the area have adopted pot-holing and ripping in order to adapt to the changes in rainfall and temperatures.

### **1.3 Wealth differences**

Regarding the differences in impact of the above changes and adaptation strategies between the rich and the poor, it was clear from the discussions that the impact was more on the poor than the rich. From the discussions, it was pointed out that the most hit farmers are the poor, because they use hand hoes for land preparation (which only scratches the surface) while rich farmers are now using ADP which helps them plough deeper in the soil and conserve moisture, so their yields are better. Farmers further explained that if the rains do not come on time, those that used hand hoes will have their seeds scorched by the sun (since the seed is not planted deep enough in the soil), while those who planted deeper (prepared land using ADP) are better off because their seeds will be protected from the sun. Hand hoe farmers have a problem of digging deeper because the land is very hard and dry during land preparation.

## **2.0 Labor and land**

Of all the farming activities performed by farmers in Lusitu, weeding was pointed out to be the most labor intensive. The crop that requires the most labor is cotton because of weeding and

picking. Weeding is a continuous activity, while picking is a very time conscious activity and thus has to be completed within the recommended time period. Regarding the minimum land size necessary to support a family and increase income, the farmers stated that 2-3 hectares was enough provided one has all the necessary inputs and rainfall is enough. Farmers cultivate farm sizes ranging from 2-5.5 hectares and own land sizes ranging from 2-8 hectares. Asked if land was a constraint in the area, farmers responded in the negative, but were quick to state that rainfall was the biggest problem followed by lack of inputs.

### **3.0 Water Availability**

Water for household use is not a problem in this area because the government sunk boreholes and there are also communal water taps in certain locations. However, water for crops and livestock is increasingly becoming a problem in the area as the few streams that are in the area dry up quicker than before. In the past, Lusitu stream would flow with a lot of water from the onset of the rains in October all the way to October the following year. But since 2004, streams start flowing in December and dry up by August, and this is a challenge for both crop and livestock production. Due to inadequate water in the stream, most farmers have stopped growing vegetables along the stream. Those who are still growing vegetables can only do so in certain months of the year unlike in the past when they could grow vegetables throughout the year.

In the past (before 2004), farmers said that they could dig shallow wells of about knee high to find water along the stream, whereas nowadays, one has to dig up to the shoulders to find water along the stream during the dry season. Because farmers cannot grow vegetables (which they used to sell for income) they are compelled to hire out their labor to commercial farmers in banana plantations along the Zambezi river. They are paid bananas which they later sell for cash.

With regards to livestock, the shortage of water in the stream compels households to take their animals about 12 km to the Zambezi river to drink water. Taking animals to the Zambezi river is dangerous because the river is infested with crocodiles, and some farmers have lost their animals as a result of crocodile attacks. Sharing tap water with animals is a challenge because the taps are only opened for a few hours in a day and everyone wants to draw water, so we only draw enough for household use. Grazing grass for animals has also been affected by inadequate rains, so there is little grass for animals to graze on.

#### **4.0 Climate change**

Farmers acknowledged that climate has changed, because the rains are inadequate and very unpredictable; temperatures are becoming too high but last year was an exception, because it was cooler. According to the farmers, day time temperatures have not changed much, but night time temperatures are now hotter. People even sleep outside because the heat in the house is unbearable, said one of the women.

In the past, the area used to experience droughts every 3-4 years, but since 1999, we experience droughts more frequently (every after 1 year). Floods are not a problem in the area, farmers could not even accurately remember when the area last experienced floods. According to the farmers, the area last experienced floods in 1997, and one of the main bridges (Lusitu bridge) connecting Siavonga district to Lusaka province was washed away. In the past around the 24<sup>th</sup> of October it was very possible to plant but now you would lose out because rains only start around December and end by February or early March. In the past, it would rain sometimes up to May. The changes in rainfall pattern and an increase in temperatures were observed in 1999.

#### **4.1 Climate change impacts and adaptation**

The main impact of climate change is the decline in crop productivity due to change in rainfall pattern and amounts. Livestock production is also a challenge due to lack of good quality grazing grass and lack of drinking water. Jokingly, one farmer stated that people have become less kind, explaining that in the past if a group of people (e.g., from church, or cooperative) work for someone, the farmer would kill goats and everyone working for that farmer would benefit. Nowadays this is not the case. Farmers cannot slaughter a goat for the workers because goats are a source of income since crops are failing. Nowadays, most farmers are engaging in commodity trading such as livestock, second hand clothes, artifacts, which they mainly sell in a nearby district (Chirundu). A number of people have migrated to Chirundu either for work or trading. In terms of farming, farmers have adapted by practicing mixed cropping, crop rotation, ripping and pot-holing despite having limited resources.

#### **4.2 Wealth differences**

In terms of wealth differences, climate change has compelled the rich to sale off their assets, for example, cattle, goats, to buy food for the family. For the poor they just have to hire out their labor to earn a living. In terms of farming adaptation, the poor are failing to do that because they

lack resources to purchase implements such as rippers or ploughs, or hire labor to assist them with pot-holing. The rich can easily adapt by using ripping and pot-holing, because they have the resources to purchase implements and hire labor. Pot-holing as observed by the farmers is a very good technology because the pot-holes retain moisture, however, the technology is very labor intensive thus can only be adopted by the rich farmers. Thus, poor farmers are more affected than the rich.

### **4.3 Gender differences**

Regarding gender differences in terms of climate change impacts and adaptation, farmers noted that climate change has greater impact on women than men. They gave an example that if there was crop failure in the area, the men do craft work and sell craft products in Chirundu, but the women cannot do that. The farmers explained that it is very difficult for women to find other sources of income than farming, because they cannot travel to Chirundu to sell commodities for days, since they need to be at home to take care of their families.