

Notes on Focus Group Meetings with Farmers, March 12 and 14, 2012
Impacts of and Adaptation to Climate Change, Northern Province, Zambia
IAPRI/Michigan State University, USAID

March 12; Mpulungu

The research team comprised of Brian Mulenga, Hambulo Ngoma, Chishimba Mulenga and Mitelo Subakanya. The team was accompanied by Mutale Kangwa and Andrew Mvula. Mutale Kangwa is a social Economist at Lake Tanganyika Integrated Regional Development Programme National Coordinating Unit. Andrew Mvula is programs officer at Misamfu Research Station. Brian Mulenga gave an introductory statement explaining IAPRI activities and the aim of the discussions. A verbal consent was obtained from the farmers to participate in the discussions. Each farmer was then asked to introduce themselves by stating their name, number of years they have lived in the area and their main livelihood strategy. Following the introductions by farmers, researchers also introduced themselves, after which the farmers were divided into two sub-groups comprising 15 men and 10 women.

1.0 Background of the group

The main crops grown in the area are maize, finger millet, soya beans, mixed beans, cassava and rice. In terms of livestock, the majority of farmers keep chicken and goats, and very few own cattle. Fish farming stood out as the most common livelihood strategy, with a number of farmers stating that they own fish ponds, whilst others fish from Lake Tanganyika. About half of the farmers are engaged in gardening, an activity they said is carried out mainly during the dry season.

Men, Mpulungu

Interviewers; Brian Mulenga, Mitelo Subakanya and Mutale Kangwa.

2.0 Crop productivity changes

Farmers were asked if they have noticed any changes in productivity of all the crops they grow, and they all stated that productivity of all the crops, with the exception of mixed beans, has declined. Maize and cassava are the crops whose productivity has reduced very much, according

to the farmers. When further asked to rank the two crops (maize and cassava), in terms of productivity decline, the farmers ranked maize first and cassava second, implying that maize productivity has declined more than cassava.

In quantifying productivity changes for maize, farmers stated that in the past they used to harvest about 100-120 by 50kg bags of shelled maize per hectare, but now, one can only get 35-60 by 50kg bags of shelled maize per hectare. Farmers also mentioned that the size of the cobs of maize is smaller than what they used to harvest in the past. However, farmers could not quantify the decline in cassava productivity, since cassava is not harvested at once (like maize and other crops). Asked when these changes in productivity occurred, farmers explained that the changes started between 1986 and early 1990s.

2.1 Causes of crop productivity changes

Regarding the causes of the decline, farmers mentioned four main factors and these are; change in rainfall pattern, soil degradation, use of unsuitable seed varieties for their area and increased incidence of cassava pests and diseases. On rainfall pattern, farmers explained that nowadays, rainfall starts late and stops early. In the past this place would receive rains from September/October-May, but since early 1990s, rains start in November and stop in March/April. Rainfall in the area has become very unpredictable, and it does not rain continuously like it used to and the amounts of rain have also gone down as is evidenced by low water levels in Lake Tanganyika and some rivers and streams in the area. Hailstones are more common now which is not good for crops, as the stones damage the crops. One farmer said that in the past you could predict the harvest in a hectare just when you are planting but nowadays you cannot do that because of the change in the rainfall patterns.

Soil degradation came out strongly as a cause of productivity decline. Farmers explained that in the past it was possible for one to grow crops and obtain a good yield without fertilizer, but that is not the case anymore. Regarding maize seed varieties, farmers complained that wrong seed varieties are distributed in their area, under the Farmer Input Support Program (FISP), and because most of them are poor, they just receive the seed since it is subsidized and thus affordable. One farmer complained that the area now receives short varieties (which according to the farmers is synonymous with early maturing varieties) instead of the tall varieties

(synonymous with late maturing varieties) suitable for the area, since the area is a high rainfall zone. Farmers also complained that there were too many varieties on the market and that this was very confusing. When asked which varieties they preferred, farmers mentioned MRI 744, Seedco 627 and another variety which they could only refer to as “DK”.

When asked how they have responded to the above changes, farmers said they were very much confused especially with the rainfall pattern, which is now unpredictable. So farmers have resorted to planting maize in stages. Farmers indicated that it has become an experiment so as not to lose out completely in case you plant at a wrong time. Farmers plant some of their maize at the beginning of the rain season, some after a few weeks and so on, so that if the first planted maize dies out you will still have the other maize that you planted at some other dates. Farmers are also applying fertilizer and practicing crop rotation to deal with the soil degradation problem.

2.2 Wealth differences

These changes have affected the poor the more than the rich. The rich can easily take care of the soil degradation problem by applying fertilizer, since they (the rich) can afford to purchase fertilizer. When it comes to planting in different phases, the poor cannot manage to do that because it is labor intensive. Also the rich can purchase the right seed varieties from commercial sources, but the poor only rely on FISP seed, which is usually a wrong variety for this area. So the poor are the hardest hit.

3.0 Labor and land

Weeding cited to be the most labor intensive activity in the farming system because it is an activity that should be completed within a short period of time. The crop that requires the most labor is maize. In this area, the farmers said that maize gave them more income of all the crops they grow, even if it is not the best crop for the area. Farmers explained that mixed beans and cassava were very suitable for the area, but there was no market for these crops. Food Reserve Agency (FRA) only purchases maize, so everyone wants to grow maize, because without market, there is no incentive to produce a crop. Farmers also indicated that people from the research station mentioned that *Jatropha* was suitable for the area, so they want to start growing *Jatropha*.

Regarding the minimum land size for a household to support a family and increase income, most farmers indicated between 7 and 10 hectares. The farmers further stated that growing maize will never lift them out of poverty, because it is labor intensive, requires heavy use of fertilizer and fetches a low price. Asked if land was a constraint in the area, the farmers responded in the negative, and explained that they would like to increase their farm sizes but inputs limit how much land they can cultivate.

4.0 Water Availability

Water levels have been decreasing in the streams year by year. Before 1996, water could even reach the roads but now this is not the case. A change was observed in 1996. In 1998/1999 season there was a water problem as well as in 2003/2004 season. Wells now have to be dug at least 12 meters down because of this change in the water levels. With gardens, the impact was felt after 2000, when some streams could not flow throughout the year. Rice production was also reported to have declined following reduction in water availability. In terms of livestock production, farmers mentioned that they now have to walk relatively long distances (2km on average) just to get water for their animals. In the past, all the streams used to flow throughout the year, but now it is only a few that flow throughout the year. However, it was clear from the discussions that water is not yet a big problem in the area, but is progressively becoming so.

5.0 Climate

According to the farmers, climate in the area has changed; both in terms of temperatures and rainfall. Temperatures have been rising since 2005/2006 and continue to do so. One farmer who said he has a thermometer at home, said that last month (February) his thermometer recorded a temperature of 38 degrees (too high for the area). Asked to compare daytime and night time temperatures over the years, the farmers have noticed an increase in daytime temperatures than night time. One farmer who resides in the plateau area said that it used to be very cold in the night but now it has become very hot, but not as much as day time. In the rain season, if it becomes very hot, the rains that come are full of thunderstorms and lightning, but very little water.

When asked to compare the rainfall distribution between now and in the past, the farmers mentioned that in the past, it used to rain a little at a time. One farmer commented that “ in the past rains were spread out but nowadays if it rains, it is like it is raining on one day for the whole week” (i.e., it rains too much in a few days). Rains start late around mid-November and stop early around March/April, with dry spells becoming longer and more frequent than in the past. Even a week or two can pass without rains. In the past it used to rain almost every day in January and February. It used to shower lightly in the early morning, which was very good for crop production.

Asked when the changes occurred farmers stated that changes in rainfall pattern was observed in the early 2000s. A drought in the area was last experienced in 1998/1999 season which resulted in widespread hunger in the area.

5.1 Climate change impact and adaptation

On the impact of climate change, the farmers said that the change in rainfall amount has affected fish breeding in water bodies, because with little rains there is limited flow of nutrients into the water bodies, resulting in insufficient food for the fish. Changes in rainfall and temperature have led to a decline in crop productivity and adversely affected livestock production, and so a lot of people have gone into fishing to earn a living, so fish in the river is not given enough time to breed.

Low crop productivity, mainly as a result of change in climate compelled some farmers in the area to start trading in commodities such as second hands clothes and groceries. Farmers, however, complained that it is very expensive and time consuming to go and purchase commodities from Tanzania for resale in Zambia. Some farmers have gone into carpentry while others are now burning charcoal, despite being aware of the negative environmental consequences of doing so.

5.2 Wealth differences

The rich are adapting well to climate change compared to the poor in the area. According to the farmers, the rich can go and buy maize from other areas if crops did not do well in a particular season, while the poor has no source of income to go out there to buy maize. When it comes to

gardens, the rich can put up an irrigation system to water their crops while the poor just has to lose out. With a short rainfall season, it is important to plant early. However, the poor has to wait for inputs from FISP, which are distributed rather late, but the rich can easily purchase all inputs from commercial sources and plant in good time.

Farmers recalled that in 2006/2007 and 2009/2010, FISP distributed Urea (top dressing fertilizer) at the beginning of the farming season and D-compound (basal dressing fertilizer) much later in the season. This affected maize production, because farmers had to wait for D-compound to come so that they can apply both urea and D-compound at once, rather than starting with urea then D-compound. Sometimes, both types of fertilizer are distributed when the maize is half way through to maturity, complained some farmers. What farmers do is to mix both types of fertilizer and apply to the crop. But the rich farmer can easily purchase all the fertilizer that is needed and apply in good time. A good solution to the suffering of farmers would be to open up a market for other crops like mixed beans and cassava.

In terms of changing farming methods in response to climate change, the farmers said that both the rich and the poor use same methods, which mainly involve making ridges. Cattle rearing is not common in the area, as a result not many farmers use animal draft power (ADP). In the plateau area, Chitemene system (shifting cultivation) is still being practiced by both the rich and the poor.

5.3 Gender differences

According to most of the farmers, women are somehow more affected by the change in climate than men, since men can easily go and work in the fish industry, or catch fish on their own and sell it, which the women cannot do. What the women do is to buy fish from men and resale it at the market, but this is not as profitable as when you do the fishing on your own and sell. So when there is crop failure the women suffer more than the men, because the men have other good sources of income. In general, the gender difference in terms of impact and adaptation is negligible, since men and women are interdependent, explained the farmers.

Women, Mpulungu

Interviewers; Hambulo Ngoma, Chishimba Mulenga and Andrew Mvula

1.0 Crop productivity changes

Women farmers in Mpulungu said that productivity for all crops in the area has gone down over the last 20-30 years. But overall production has increased because more people are now engaged in farming. For maize production farmers explained that in the 1970s to 1980s they used to obtain 90 ×50kg bags per hectare but this reduced to about 50 ×50kg bags per hectare starting from the 1990s to date.

1.1 Causes of crop productivity changes

When asked about the causes for this reduced crop productivity, farmers felt that limited knowledge on crop production (farmers failed to keep pace with developments in agricultural technologies), soil degradation, variations in rain patterns (both seasons and intensity). Soil degradation and rainfall variability were ranked as the top major drivers of the observed crop productivity changes. Farmers further added that soil degradation was so rampant that in the absence of fertilizers, maize yields are terribly affected at present. Farmers in the district are totally dependent on government subsidized inputs (under the Farmer Input Support Programme-FISP) such that any delays in delivery of inputs negatively affect their productivity. Asked further how this works out, farmers explained that when inputs are delivered late, they plant late and hence yields are affected. When asked whether farmers had changed anything in terms of their farming systems in view of declining crop productivity, female farmers in Mpulungu explained that they had no capacity to change the way they planted their crops because they have limited or no knowledge of alternative farming methods and they have no control over the type of seed they receive under the government FISP. One farmer reminded her colleagues that one thing that had changed was the increase in cassava production over the years because of access to improved cassava cuttings. However, farmers complained that most of their cassava goes to waste as there is no market for the crop. In this regard, they appeal to government to intervene in cassava marketing just as they do for maize.

1.2 Wealth differences

When asked whether there was a difference or not in terms of how wealthier farmers are impacted by crop productivity changes, farmers responded to the affirmative. They explained

that wealthier farmers' productivity is higher than the poorer farmers because the former are able to stagger their planting dates thereby spreading the risk of crop failure due to variable rains over a wider horizon. Because of this, farmers felt that wealthier farmers are able to obtain higher yields even in poor rainfall years.

2.0 Labor and land

On the question of the most labor intensive activity and crop, female farmers felt that weeding is the most labor intensive activity and cassava is the most labor intensive crop. They further explained that cassava takes two years to mature and before that it requires to be weeded at least six times. The average land holding size in the district is about 4 hectares but farmers feel that at least 8 hectares would be required to enable farm families attain household food security and have surplus for sale. On the question of land availability in the area, female farmers said that the area still has plenty of virgin land for expansion but farmers are unable to increase their farm sizes because they do not have financial capacity to expand their farm sizes.

3.0 Water availability

On water availability, farmers explained that the quantity of water in the rivers has reduced over the years. They said that in the past rivers used to be full to such an extent that bridges used to be washed away. However, rivers nearly dry up during the dry season nowadays. The main source of drinking water is from boreholes sunk by government and NGOs in the 1990s while water for livestock is from rivers and Lake Tanganyika. Asked whether they have experienced any significant changes in water availability, female farmers said that despite the reduced volumes, water for any purpose is not a major problem in the district.

4.0 Climate Change impact and adaptations

On the question of observed changes in temperature and rainfall, female farmers in Mpulungu district said that temperatures are now lower than they were 20-30 years ago. In the past there was no difference between summer and winter temperatures but now winter is cooler. They added that both day and night temperatures have dropped over the years. From what female farmers said, climate change is seemingly "smoothing" seasons in the district.

On rainfall patterns, female farmers said that the onset of the rain season is now sooner with an earlier offset, thereby shortening the rain season. They added that the onset of the rain season is now in November compared to October but ends in April compared to May in the 1970s and 1980s. In terms of inter season rainfall patterns, farmers explained that rainfall quantities have reduced at the moment compared to the 1980s. However, the intra seasonal rainfall variations have increased over time. Farmers also reported an increase in intra seasonal droughts that last for about 1-2 weeks. Farmers also explained that the district has experienced some weather extremes in the recent past. They cited 2001/02 and 2003/04 as recent major drought years and 2007/08 and 2009/10 as major flood years, respectively.

On other impacts of climate change in the area, female farmers explained that climate change has resulted in unexplained diseases among the farmers. They cited an increase in malaria cases as a result of climate change. Asked for the link between climate change and malaria, farmers explained that in the past people only suffered from malaria in the rain season but now it is throughout the year because the climate is favorable for the malaria vectors to thrive throughout the year. Farmers also said that there is an increase in animal diseases due to climate change, e.g. lump skin disease.

Asked what adaptations or responses they had instituted in the wake of climate change, female farmers said they had no capacity to change their farming systems to cope with climate change because most of them are poor and depend on the government subsidized FISP for their inputs. They also said that more extension services from the Ministry of Agriculture and Livestock (MAL) would help them get acquainted with technological developments in the sector. When asked further about why they can't change the types of maize seed varieties (as an example) they are using, farmers explained that because of their dependence on FISP, they have no option but to plant whatever varieties are delivered to their district. Some of them added despite knowing that they are supposed to plant 700 series varieties, they still plant whatever is given to them by FISP because they can't afford to buy their own seeds. They said 700 series hybrids cost around ZMK 200, 000 per 10 kg bag.

4.1 Wealth differences

On the question of wealth differences and the impact of climate change, they explained that wealthier farmers are better able to adapt to climate change (thus less affected) because they have enough resources to stagger planting and thereby spread risks of crop failure. Wealthier farmers also have enough resources to cultivate larger pieces of land and thereby increase production. They also said that wealthier farmers have more assets to fall back on and hence they are less affected by climate change.

4.2 Gender differences

Asked whether climate change impacted differently across gender, farmers said women are more affected by climate change because they are responsible for overall household welfare. For example, in years with poor harvest, women face the brunt of having to fetch food for their families.

March 14; Mungwi district, Malole south camp

The team comprised of Brian Mulenga, Hambulo Ngoma, Chishimba Mulenga and Mitelo Subakanya. The team was accompanied by Emilio Bwembya, Kelly Mpundu (both of Cinci wa Babili Rural Development Project¹) and Andrew Mvula (Programs Officer at Minsmfu research Station). The introduction was done by Brian Mulenga. After hearing the autobiography of each of the participants the group was separated into men and women. The group was composed of 27 women and 9 men. There was some miscommunication between ZARI and Kelly Mpundu concerning the number of participants to be invited. Despite the big crowd of farmers, the discussions were focused on the issues at hand, and the farmers provided very useful and information.

1.0 Background of the Group

On average most of the farmers had stayed in the area for 17 years. The main livelihood strategy for all the participants is agriculture. The main crops grown in the area are maize, soya beans, mixed beans, cassava, groundnuts, finger millet, sweet potatoes and sunflower. Some even have

¹ Cinci Wa Babili is a local NGO that helped organized farmers for the focused group discussions. It is run by catholic brothers.

gardens which they concentrate on off the main farming season, with rape, tomatoes, onions and chinese cabbage being the main crops grown. Most of the farmers in this area keep chickens, with a few of them keeping cattle, pigs, goats. A good number of them are involved in fishing, some have fish ponds whilst others fish from streams and rivers.

Men, Mungwi

Interviewers; Hambulo Ngoma, Chishimba Mulenga and Emilio Bwembya

2.0 Crop productivity changes

The male farmers in Mungwi district have recorded an increase in maize productivity from 2009. Previously, they were obtaining less than 15 ×50kg bags of maize from 1 lima but they are now able to obtain an average of more than 17 × 50kg bags of maize from 1lima. The increase in maize productivity has been attributed to the availability of inputs such as improved maize seed and fertilizers provided by the government through the Farmer Input Support Program (FISP). They further added that the new farming techniques they have been introduced to such as conservation farming and crop rotation have helped them better maize yields. Asked when they noticed these changes, farmers explained that this started in 2007 when MAL and other donor funded programmes such as Cinci Wa babili intensified extensions and demonstration plots in the area. Poor crop management and resistance to change were cited as the major causes of low maize productivity in the past.

Although maize productivity has increased over the years, mixed beans productivity has been declining. This is because mixed beans is planted after maize (major crop) has been planted and this is usually late in the season. Late planting results in low yields for the farmers. Rainfall variability where the crop is exposed to too much rainfall during flowering stage in some seasons was also cited as the cause of declining mixed beans productivity in the area. Another reason given for declining mixed beans productivity was that farmers are now devoting more time and efforts to maize production because of the support from FISP and a “ready market” from FRA.

When asked how these crop productivity changes have affected their farming systems, male farmers said that for maize, they are now using hybrid seed and follow recommendations from MAL extension in terms of spacing, planting dates and general crop management. They also

added that learning by seeing from demonstration plots in the area has helped them improve their farming practices. On wealth differences and crop productivity changes, male farmers in Mungwi felt that differences existed in the wealth levels of farmers as some farmers have more resources than others which allow them to perform timely field operations and cultivate larger fields. And because of these differences, some well off farmers have the influence which enables them to acquire more than one pack² from FISP at the expense of the truly intended beneficiaries for the program. Male farmers in the area also said that they have seen an increase in cassava production over the years but the crop goes to waste because there is no market for the crop. They added that if the new improved cassava varieties are to be well accepted, government should also consider organizing the market for cassava just like it is for maize.

3.0 Labor and land

On the question of labor requirements, male farmers felt that the most labor intensive activity is land preparation because most farmers rely on hand hoes to prepare their land in the area. Farmers further said that the most labor intensive crop is maize because it requires to be planted early and require frequent weeding since farmers in the area can't afford herbicides.

Average land holding size is around 10 hectares in the district but the majority only manages to cultivate an average of 2ha. Asked on the optimal cultivated land for household food and income security, farmers said that 7-8hectares would be desirable. The farmers are unable to expand to this sustainable hectarage due to lack of resources such as fertilizer, inputs and labor to cultivate. When further asked about labor availability in the area, farmers said that hired labor is available but most of them can't afford it due to lack of finances.

4.0 Water availability

Male farmers said that water levels in the rivers/streams had reduced over the last 20-30 years because of a reduction in total rainfall received each season at present. They said water levels are at their lowest in rivers around September/ October of each year. Asked when they started noticing these changes, farmers said that they observed these changes from as far back as the

² Comprises 4 × 50 kg bags of fertilizer (50% top dressing) and 10 kg bag of maize seed

year 2000. This applies to water for household use and livestock since they all fetch from the same source.

5.0 Climate change impact and adaptations

On the question of observed changes in temperature the last 20-30 years, farmers said that temperatures are generally rising in the area, adding that months which used to be cooler like May, June and July are not as cold as they used to be. One farmer added that they don't even need warm clothing or blankets in winter anymore. They also reported varying daytime and night temperatures with some days cooler and other hotter and vice versa. But yet still, there are days when there is no difference between the night and day temperatures. On rainfall changes, farmers said that the onset of the rain season is in late November to December compared to October in the past. Rains end in March compared to April in the past. There are also more frequent intra seasonal droughts (lasting about 2-3 weeks) now than in the past. Asked when they observed these changes, farmers cited the year 2000 as the turning point. However, the farmers said that the area had not experienced any floods or droughts of wide spread economic importance in the recent past.

On other impacts of climate change in the area, farmers explained that climate change has resulted in a lot of animal diseases in animals that are considered disease free animals like goats and chickens. The area is also experiencing an increase in malaria incidences even in months that were traditionally not known as malaria months. There has also been an increase in diarrhea diseases such as dysentery and cholera. The farmers also attribute the increase of diseases such as diabetes and heart problems to climate change as these diseases were not common in the past. One farmer added that such diseases like heart attacks, high blood pressure, strokes were traditionally known to be associated with the rich and urban city dwellers but these are now common even in their area.

Asked what changes farmers have made to their farming systems in view of climate change, they said that due to low rainfall and a shortened rain season, farmers prepare their land early and plant early. Others also said they plant late for other crops like mixed beans. Land preparations start as early as March when the grass is buried (locally known as Fundikila) and spread in November. The farmers in the area have also stopped practicing Chitemene system, a traditional

farming system in the Province. They have also reduced on the cutting down of trees for charcoal. The farmers also started planting hybrid maize seed varieties suitable to the area in 2007; one example is SeedCo 627 variety.

In order to cushion the impacts of having varying rainfall amounts, some farmers have diversified away from crops only to livestock rearing, gardening and fish farming. And some farmers own grocery stores and are involved in fish trading.

5.1 Wealth differences

On wealth differences and climate change impacts, male farmers in Mungwi said that wealthier farmers are better off even with the shortened planting season because these farmers have enough resources to hire labor to help them in cultivation and planting and some use livestock thus they are able to plant large fields in time.

5.2 Gender differences

On gender disparities and climate change, male farmers in Mungwi said that they do not observe any differences between male and female in as far as the impact of climate change is concerned as both groups suffer together. They added that men and women are now working together and sharing roles equally.

Women, Mungwi (Malole south Camp)

Interviewers; Brain Mulenga, Mitelo Subakanya, Andrew Mvula and Kelly Mpundu.

1.0 Crop productivity changes

A two case scenario was given when it came to the issue of whether the farmers in the area had seen an increase in their crop productivity over the past 20-30 years. In the first scenario, a decrease in crop productivity was reported by farmers. According to the farmers, if you have no fertilizer you will definitely see a decrease in your yield. A good example was given of what a farmer could get on a 0.25 hectare (1 Lima) of land in the past without fertilizer and now when that farmer did not apply fertilizer. In the past you could get 4 by 90 kg bags of shelled maize without fertilizer, but now you can just get 20kg if you do not apply fertilizer. In the other

scenario, an increase in crop productivity has been seen. Most farmers have seen this in maize, groundnuts, cassava, mixed beans and soya beans.

1.1 causes of crop productivity changes

The main reason given for this increase in crop productivity is that the farmers now have knowledge on how best to grow all these crops. A Catholic based NGO (Cinci wa Babili Rural Development Project) played a very important role in equipping farmers with the necessary agriculture skills and knowledge. Also CUSA and Programme Against Malnutrition (PAM) taught farmers good management practices such as crop rotation, which they never used to do.

When asked to quantify the productivity change of maize, farmers gave an example that; in the past they used to harvest 10-12 by 90 kg bags of shelled maize on 1Lima, compared to 15-18 by 50kg bags of shelled maize they are getting now on 1Lima. According to the farmers, this is an increase, but a simple computation indicates a slight decrease.

When asked to explain further on the causes of change in productivity, the farmers stated that everyone in the area now knows that farming is a business and is very profitable, so most farmers are motivated to improve productivity. Farmers also mentioned that they now know that the local maize variety (Kalimwa) does well when land is prepared using Chitemene system (a farming system where tree branches are cut and grass is slashed which are burned so as to get ash which acts as manure). The field that has been burnt will then be abandoned after five years in order to replenish fertility of the soil. But nowadays, trees in the area are not completely cut. Branches are collected from tree around and burnt in one field. Farmers also mentioned that they do not shift fields these days like in the past due to scarcity of land.

1.2 Wealth differences

When farmers were asked if there were differences in crop productivity between the rich and the poor, they all said there was a difference. Farmers said that it all depends on management practices, which the rich did better than the poor, because the rich have the necessary resources to practice good management. For the rich everything is done on time and have enough labor which they can hire if need arises.

2.0 Labor and Land

For the female farmers in Mungwi, land preparation (involving making ridges) was the most labor intensive farming activity. Maize was said to be the crop that required the most labor. Regarding the minimum land size to support a family and increase income, the women farmers stated that 10 hectares would do at a minimum, although this depends on the family size. Currently in the area, most farmers own about 5 hectares and a good number of them only cultivate about 2 hectares. Asked if land was a constraint, the women farmers responded in the affirmative, stating that nowadays they even go across the stream into another village in search of land.

3.0 Water Availability

When asked if they have noticed any changes in water quantity in the past 20-30 years, the farmers unanimously agreed that water levels have gone down during the reference period. One farmer commented that there is no longer water in the places where they used to soak their cassava in the past, indicating that water levels have gone down. Farmers recalled that in the past they would find pools of water in areas quite distant from the streams and they would soak cassava there so that it ferments, but such pools are no longer there. Streams are not getting as full as they used to in the past.

This change, according to the farmers, was observed in 1998. Farmers also mentioned that the area was experiencing longer dry spells during the rain season than before. However, they said that the rainfall period has not changed much, only the rainfall amounts have changed. Wells have to be dug deeper these days than before. You cannot find water these days at very shallow depths. What is the impact of this change? 1) Gardening has become difficult because the wells are now drying up quicker than before and streams do not flow throughout the year like before; 2) Cattle are now dying because of an increase in disease incidences, lack of water (during few months when streams dry up) and lack of good quality grazing grass as a result of changes in rainfall patterns; 3) fish population in river/streams is on the decline; 4) malaria cases are on the increase

4.0 Climate change impact and adaptation

According to the farmers, temperatures are on the rise, with night time temperatures rising more than day time temperatures. Some farmers stated that they do not even cover themselves in the night most times of the year due to the heat experienced during night time. The change in temperature was observed around 1998/1999 season, almost the same time when rainfall pattern changed. As for the rains, farmers explained that the main change they have noticed is the increase in frequency and length of dry spells within the rain season. Sometimes these dry spells are as long as 2 weeks, a feature that was unthinkable before 1998/1999. In the past, rains used to start by the 24th of October but now it can even start around late November and stops in March/April compared to May in the past. One farmer also added that since 1998/1999 rains have become destructive because nowadays the area is experiencing more hailstones than before. “These days it can be raining in one part of the area but walking for just about 5-10 minutes away it may not be raining” explained some farmers.

When asked about the impact of the changes in temperature and rainfall, farmers explained that ever since the temperature started increasing and rainfall pattern changed, there has been a decrease in caterpillar harvest. Caterpillars reproduce and “fall” if it is raining, but nowadays, as the caterpillars are reproducing and start to “fall”, rains disappear and so they die. This has resulted in loss of food and income for most farmers in the area. Mushrooms are no longer there, because the area has started experiencing dry spells just when mushrooms are beginning to “come out of the ground”.

What are farmers doing in response to these changes? Some farmers are now planting drought tolerant crops (e.g., finger millet and sunflower) and are practicing more of mixed cropping so as to spread the risk of crop failure.. Farmers are also rearing more chickens to cope with this change in climate so as to sale off the chickens and have an alternative source of income when crops fail. Some farmers have decided to move closer to the streams just so as to make gardening possible.

4.1 Wealth differences

The change in climate has affected the poor more than the rich. Farmer explained that the rich can hire labor to enable them plant early, hence less affected by the short rain season. However, the poor have no resources to hire labor to enable them plant in good time, thus the shortening

rain season has significantly reduced their yields. Even if the poor farmers want to plant on time, it will not be possible if they do not have enough family labor. Poor farmers find themselves in a dilemma of having to work in other people's field to meet immediate needs and work in their own fields.

4.2 Gender differences

Climate change has impacted women and men differently. The greater impact has been felt by the women. Women are now walking longer distances just to fetch water. Women are the ones who look for food when there is crop failure. Caterpillars and mushrooms have disappeared, worsening the food situations in homes and increasing the burden of women to look for other types of food.