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BUILDING THE RESILIENCE OF FOOD PRODUCTION SYSTEMS OF SMALL SCALE FARMERS IN THE CONTEXT OF CLIMATE CHANGE IN RURAL ZAMBIA: THE CASE OF KAFWAMBILA VILLAGE IN SINAZONGWE DISTRICT, SOUTHERN ZAMBIA

By

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ABSTRACT

The paper contends that the vulnerability of food production systems of small scale farmers in semi-arid areas of rural Zambia can be mitigated against climate change impacts such as droughts, by building their resilience through interventions that can interface indigenous and scientific knowledge systems. These food production systems are vulnerable to droughts because they depend on rain fed agricultural practices.

Data that were collected from Kafwambila village and its catchment area using semi-structured interviews with 32 household heads, through in-depth interviews with five key informants and through two Focus Group Discussions (FGDs) or village meetings, showed that in this drought prone region, cereal production of the staple bulrush millet, sorghum and maize is very low. However, the indigenous valley Tonga people have over the years devised a livelihood circuit coping strategy that incorporates farming, livestock raising, fishing and trading, to mitigate and cope with the impacts of drought. In order for the food system in Kafwambila (and probably elsewhere) to adapt to the climate change impacts, it requires interventions by the government, the private investors, and by the scientific community and other stakeholders, to provide infrastructure like roads, irrigation, markets for livestock and fish, and propagation of hybrid seed varieties of the indigenous cereals, that are drought tolerant, early maturing, high yielding and are palatable.

1.0 INTRODUCTION

The paper attempts to contend that food production systems of small-scale farmers in rural Zambia are vulnerable to climate change impacts. To achieve this it first presents definitions of vulnerability and resilience and the concept of a food system, the contextof the problem and briefly reviews the relevant literature on climate change and vulnerability of food production systems of small-scale farmers in Zambia in section 2.0.

The description of the study area is done in section 3.0 and methods used in the collection of data are briefly explained in section 4.0. The results and discussion are presented in section 5.0. The suggestions on building the resilience of the food system in the context of broader rural transformations are given in section 6.0; then the conclusion is done in section 7.0.

2.0 THE CONTEXT OF THE PROBLEM AND LITERATURE REVIEW

According to Adger(2006), vulnerability is the state of susceptibility to harm from exposure to stress associated with environmental and social change and from the absence of capacity to adapt(Adger, 2006. p.268).

He goes further to state that there are multiple stressors and multiple pathways of vulnerability and it is important to understand the stress to which a system is exposed, its sensitivity or response of the system and its capacity to adapt.

Kodamaya (2007) is of the view that although the concept of vulnerability has been used in many research traditions, there is no consensus on its meaning. However, the concept generally refers to the exposure of groups to stress due to the impacts of environmental change. Such shocks invariably lead to the disruption of livelihoods and loss of security.

While vulnerability is exposure of a system to stress, resilience on the other hand is a somewhat positive concept, as it refers to the capacity for adaption to emerging circumstances. Thus, social resilience may be defined as "the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change (Adger, 2002, p.347).

With respect to the concept of a food system, Ericksen (2006) is of the view that it comprises four sets of activities which include: food production, processing, packaging, distribution, retail and consumption. In the case of small scale farmers in Zambia, food systems focus more on food production and consumption, with limited purchase and sale of food in emerging rural markets.

According to Global Environmental Change and Food Systems (GECAFS, 2005), a food system is a "set of dynamic interactions between and within the bio-geophysical and human environments that results in the production, processing, distribution, preparation and consumption of food (GECAFS, 2005, P.9). Thus, the system encompasses food availability (in the community and at household level); food access (in markets if individuals can afford to purchase the food) and food utilization or consumption).

According to Staff Writer (2008), the earth is surrounded by greenhouse gases such as water vapour and carbon dioxide which act as a natural blanket to retain some of the solar radiation. This keeps the earth warm with the context of the earth's energy balance. Climate change therefore, is about the fact that this energy balance is being altered due to the increase in greenhouse gases, resulting from the burning of fossil fuels and emissions of carbon dioxide, methane, hydro-fluorocarbons (HFCs) and other gases over a long period of time since the Industrial Revolution that started in Europe around 1750.

The Encyclopaedia Britannica Guide to Climate Change (2008) states that the more recent assessment reports by the Intergovernmental Panel on Climate Change (IPCC) have stated more clearly that the warming of the climate system is unequivocal. This is shown by increases in global average air and ocean temperature, widespread melting of snow and ice and rising global seal level (Encyclopaedia Britannica Guide to Climate Change, 2008.p3).

In the sub-tropics such as in Southern Africa, the warming of the climate system is likely to cause a significant decrease in precipitation but an increase in temperature, leading to frequent and more severe droughts (Staff Writter, 2008, p.6).

It is therefore, being predicted in the assessment report by the IPCC that in Africa between 75 and 250 million people could be exposed to increased water stress by 2020; and that in some countries yields from rain-fed agriculture could be reduced by up to 50 percent by 2020; and that agricultural production (and access to food) in many Africa countries will be generally compromised resulting in food insecurity that will exacerbate malnutrition.

According to Hachileka (2007) climate variability is not new to Zambia, as the country has a history of droughts and floods. These extreme events are expected to become more frequent and severe due to the impacts of climate change.

A study by Sichingabula and Sikazwe (1999) on Kafue and Zambezi river droughts shows that there is persistent occurrence of droughts. These extreme events are taking place under increasing water demands for agriculture (and other uses) and also under increasing threat of global warming. They go on to contend that in Zambia droughts go back as early as 1908 and since then drought years have been more frequent that wet years.

According to Niang et al (2007)," Africa is highly vulnerable to climate change because of its weak adaptive capacity which is linked to widespread poverty, inequitable land distribution, conflicts and dependence on rain-fed agriculture" (Niang et al, 2007. p.227).

Kajoba (2008) has contended that the food system in Zambia which has developed since the colonial period and has persisted even after the attainment of political independence in 1964, is characterised among other things by over dependence on rain-fed agriculture in which hybrid maize is the major staple cereal. Infrastructure development by the government has focused on creating an enabling economic environment for small scale, emergent and commercial farmers to grow maize as both a cash and food crop for the country. This has been done at the expense of other food crops. Traditional cereals like sorghum, bulrush, and finger millet and root crops like cassava and sweet potatoes, have not been emphasized in the past.

The Zambia Vulnerability Assessment Committee (ZVAC) has observed that when maize and fertilizer subsidies reached their peak in the late 1980s, the area planted under maize was about one million hectares accounting for about 70 percent of total cropped area (ZVAC, 2005, p.9). This food system has increasingly become vulnerable to environmental shocks resulting from climate variability and global climate change because maize is more susceptible to drought, unlike sorghum, millets and cassava that are more drought tolerant.

As a matter of fact, vulnerability assessment has shown that in more recent years and especially in the drought years of 1991/1992, 1994/1995, 1997/1998, 2000/2001, and 2001/2002, the share of maize in terms of both cultivated area and production has declined significantly (ZVAC, 2005, p9). It may be argued further that despite the commendable bumper maize harvest of 2.7 million metric tonnes that was harvested in the2009/2010 agricultural season, and was attributed to prudent government agricultural policies involving targeted subsidies to small scale farmers under the Fertilizer Input Support Programme and the Food Security Pack to vulnerable but viable farmers, and despite subsequent bumper harvest that Zambia continues to record while some neighbouring countries have experienced deficit in maize production due to rainfall variability caused by climate change, dependency on one cereal still leaves the food system vulnerable if rains fail.

3.0 THE KAFWAMBILA CASE STUDY

A brief description of the study area will now be made.

The data that are presented and discussed in this paper were collected though field research in the Kafwambila area village and its catchment area in Sinazongwe District in Gwembe Valley, in chief Mweemba's area of the Southern Province (fig 1 and 2), from 20th June, 2009 with a research grant that was awarded by the Research Institute for Humanity and Nature (RIHN) of Tokyo, Japan.

Although the data were collected eight years ago, they are still valid and reliable in the same away as national census population data can still be usable within a ten-year period, and are supported by relevant literature about related recent developments in the district and province concerning rural transformations.

Figure 1: Location of Sinazongwe District, Southern Province, Zambia

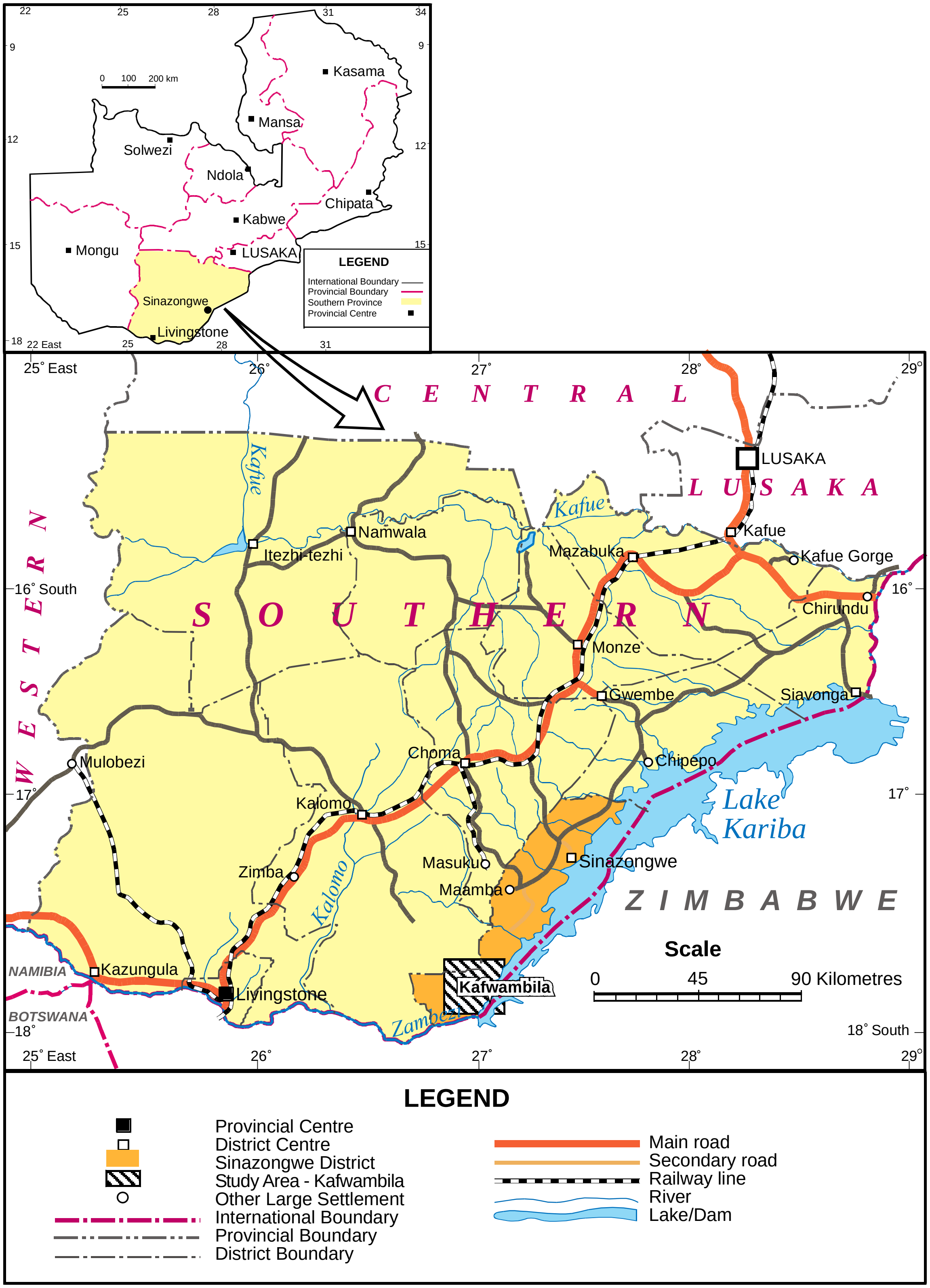
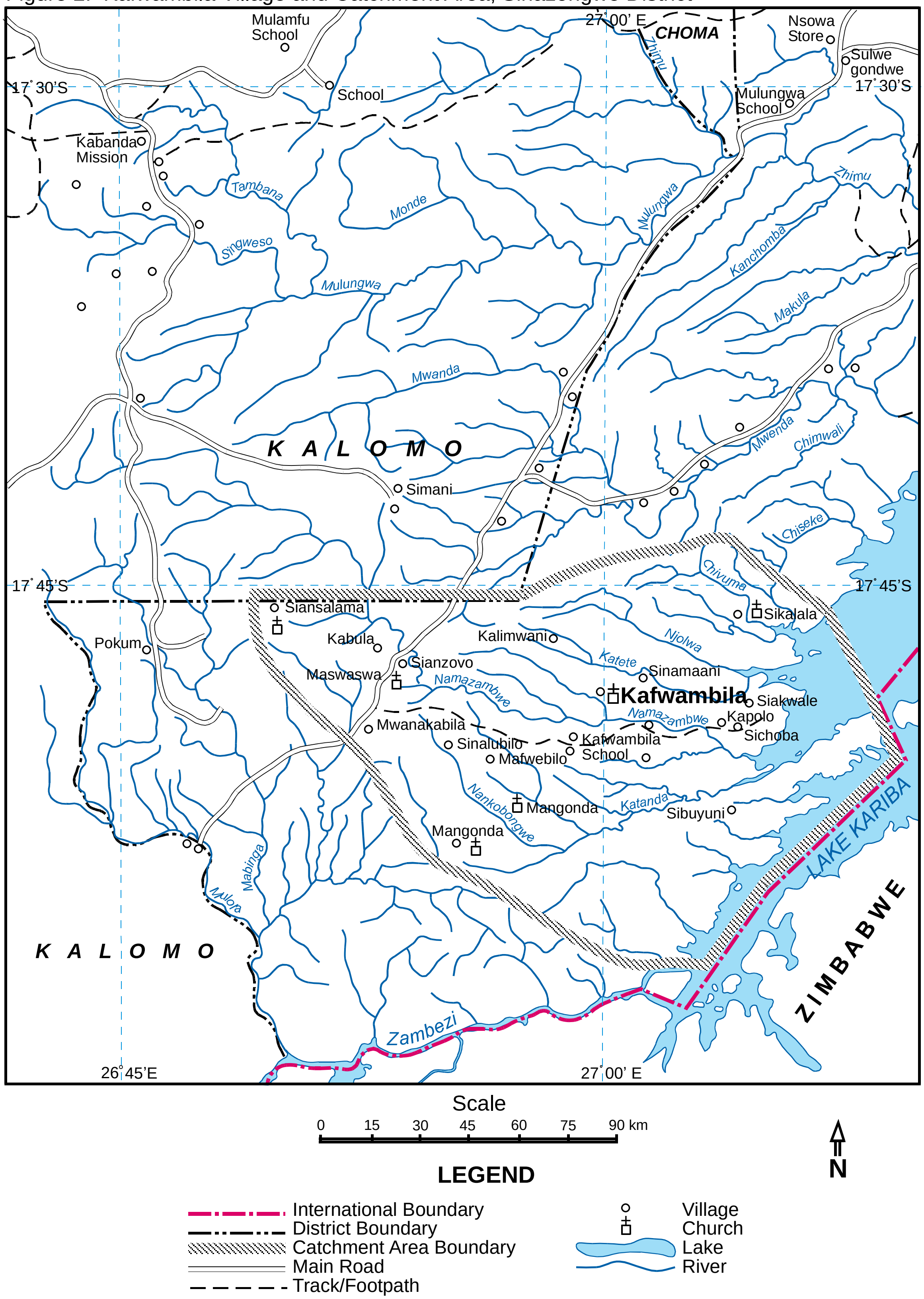


Figure 2: Kafwambila Village and Catchment Area, Sinazongwe District



The study area is located in Region I of Zambia's three Agro – Ecological Regions (Fig.3). This Region (I) which covers about 42% of the total land in Zambia experiences unpredictable rainfall of less than 800mm per annum, and recurrent droughts. The National Adaptation Programme of Action to climate change indicates that Region I has become increasingly prone to droughts and that this trend is projected to continue (IUCN,2007).

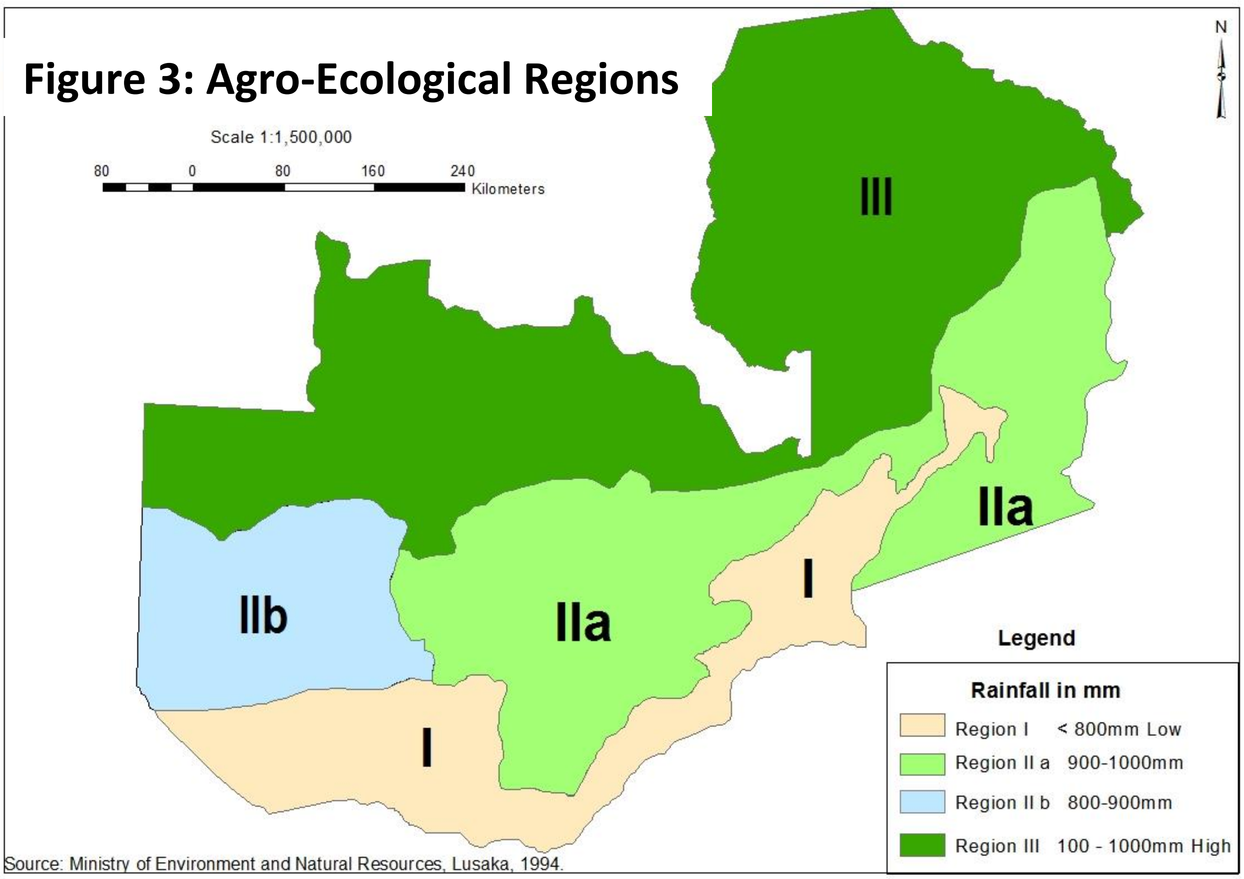


Figure 3: Agro-Ecological Regions

The study area has shallow escarpment sandy loams, which according to Chipungu and Kunda (1994), are of marginal agricultural value ad are cultivated for sorghum and millet on a subsistence basis.

As a semi-arid region, the area is grown with secondary miombo woodlands and scanty thorn bushes with donkeys, goats and donkeys are probably more adapted to this dry and drought prone region than cattle.

The village and its catchment area or hinterland had an estimated population of about 4,705 people according to records at the village clinic, while the ward councillor put the population at about 4,835 people.

4.0 METHODS

The data were collected using semi-structured interviews with 32 small-scale farmers who were heads of households from Kafwambila village and from seven other villages within the catchment area or hinterland of Kafwambila. The sample was captured through purposive or availability sampling and was drawn from a sampling frame of 503 households.

Interviews were also held with five key informants including the representatives of local government, department of Agricultural extension, Community Department, the local primary school and the village clinic.

Two Focus Group Discussions (FGDs) or village meetings were also held. The first was attended by 23 men from Kafwambila village and from other five villages, and the second was attended by 21 men in Sinalubilo village. Unfortunately, women did not attend any of the FGDs, although they were captured in the household interviews in which 13 or 40.6% were women, while 19 or 59.5% were men.

The data on the food system were collected and analysed by considering the following categories: -

(i) Crop types
(ii) Estimates of Crop harvests
(iii) Estimates of sizes of fields or landholding size in hectares
(iv) Livestock assets and
(v) Crop combinations, and narratives were collected on the impacts of droughts, floods, perceptions of climate change and on coping and adaptive strategies.

The rest of the data were qualitative but also figures were deduced and are presented in tables and percentages.

5.0 RESULTS AND DISCUSSION

The results were as follows: -

(a) Crop Types

The main staple cereals that are grown by the small-scale farmers, in descending order of preference and priority are: Bulrush millet (*Nzembwe*), Sorghum (*Maila*) and Maize (*Mapopwe*).

All those that were interviewed (32 or 100%) indicated that they cultivated both Bulrush millet and sorghum. These two cereals were preferred as they are more adapted to this semi-arid or drought prone area, which is a rain shadow in Agro-Ecological Zone I. A total of 23 respondents or 71.9% indicated that they also grow maize as their third cereal and staple. Those who stated that they do not grow maize were 9 or 28% of the sample and they explained that they did not grow the crop because of low rainfall which makes the cereal unsuitable in this area that is characterised by drought conditions.

(b) Estimates of crop harvests

The small scale farmers were asked to give estimates of how much they were able to harvest on average for each staple cereal in what they considered was a "good" or "normal" agricultural season and in what they perceived to be a "bad" year, depending on their historical experiences.

Estimates of crop harvests in a normal or "good" rainy season are shown in table 1 and estimates of crop harvests in a "bad" season are given in table 2.

Table 1 Estimates of Crop Harvest (in good season) x 90Kg bags

Respondent	Millet X 90 Kg Bags	Sorghum X 90Kg Bags	Maize X 90Kg Bags
No. 2	**7**	4	-
No. 4	5	-	-
No. 5	2	-	-
No. 7	3	1	-
No. 8	5	-	-
No. 10	10	-	5
No. 11	11	-	-
No. 12	4	-	-
No. 13	6	8	21
No. 14	4	4	10
No. 15	1	1	-
No. 16	5	2	4
No. 17	8	3	4
No. 18	6	5	4
No. 19	5	-	-
No. 20	6	-	-
No. 21	6	-	-
No. 22	2	-	-
No. 25	1.5	-	-
No. 26	4	1	-
No. 27	20	-	-
No. 28	-	25	-
No. 29	9	12	47
No. 30	5	3.5	-
No. 31	9	5	3
Total	**144.5**	**74.5**	**97**

(Source: Field Data, 2009)

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Table 1 shows that a total of 24 small scale farmers indicated that the estimated amounts which they produced in an average "good" agricultural season with normal rainfall totalled 144.5 x 90 kg bags of millet.

For sorghum, a total of 13 farmers estimated harveststotaling 74.5 x 90 kg bags, giving an average of 5.7 x 90 kg bags per farmer; while the estimated 97 x 90 kg bags of maize were only produced by 8 farmers and maize production was dominated by two farmers (respondents no 29 and no. 13). Respondent no 29 indicated that he was able to produce many bags of maize because he uses cattle to plough a large field of about 4 ha.

Table 2. Estimates of Crop Harvests (in bad season) x 90kg bags

Respondent	Millet X 90 Kg bags	Sorghum X 90 Kg bags	Maize X 90 Kg bags
No. 2	3	-	-
No. 8	3	-	-
No. 11	3	-	-
No. 27	1	-	-
No. 29	3	-	7
Total	13	0	7

(Source: Field Data, 2009)

Table 2 shows that respondents who did "well" in a "good" season as shown in table 1, especially with respect to estimated production, suffered big losses in bad season or year. For instance, respondents no. 2 whose estimated harvest was 7 x 90 kg bags of millet and 4 x 90kg bags of sorghum in a "good" year produced only 3 x 90 kg bags of millet and zero for Sorghum in a bad season, experiencing a reduction of 57% and 100% for millet and sorghum, respectively. Also, respondent no. 27 whose estimated production of 20 x 90kg bags of millet in a "good" year, harvested only 1 x 90kg bag of millet in a bad year (season), suffering a big loss of 95%! In other words, these crop estimates seem to suggest and confirm the perceptions of the small-scale farmers that in an average "good" agricultural season, millet performs better seconded by Sorghum, while maize is less suited to or less adapted to the local environmental conditions of poor rainfall or frequent droughts.

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That data on crop estimates also suggested that the few bags that were harvested are basically for mere subsistence rather than for the market, and do not meet the basic requirements for household food security. Information from the Heath centre indicated that he catchment area had about 4,800 people, and that under five child malnutrition cases were increasing. By the time when field work was undertaken in 2009, the world Food Programme was providing High Energy Protein Supplements (HEPS to 293 children – an increase of 173 children or 144% from 2007, when there were 120 cases.

(c) **Land holding size.**

With respect to how much land on average each farmer cultivates, estimates are shown in Table 3.

Table 3. Estimates of Size of Fields in Hectares

Respondent	**Size of Field**
No. 7	1.5 (on average about 2 ha)
No. 12	0.25 (one Lima)
No. 13	3.0
No. 14	3.0
No. 18	2.0
No. 9	0.25 (one Lima
No. 20	1.5
No. 28	5.0
No. 29	4.0
Total	**28.5**

(Source: Field Date, 2009)

Table 3 shows that the nine farmers had an estimated total of 28.5 ha. of land, giving an average of 2.3 ha. per farmers or household. This figure compares favourably with the mean for small holder landholding size per household in Southern Province which was 2.64 ha. by 2002/2003, accordingly to the Food Security Research project (Jayne, et al, 2008, p9 table 1). The Community Agricultural Worker (CAW), who was respondent number 18 stated that the average field size in the Kafwambila catchment area was about 1.5 ha, although the farmers who have access to draft power are able to cultivate about 3 ha.

Given the fact that average field size was about 1.5 ha. and was lower than the provincial mean for small holders per household which stood at 2.64 ha as stated above, the amount of land that the respondents cultivated was rather small and coupled with the fragile rainfall pattern in this Agro-Ecological Zone, it is no wonder that estimated harvests of the staple cereals are also very low implying that the local people faced a precarious existence, with respect to household food security, in the prevailing food system.

(d) **Livestock Assets**.

With respect to livestock assets the summary that follows presents the picture with respect to types and numbers that 32 respondents owned. The respondents had one type of livestock or another or a combination of livestock assets: -

- A total of 181 herds of cattle were owned by 22 or 68% of the interviewed farmers. The animals are used for ploughing by those who have them; as well as by those who don't have but are able to hire them. The use of cattle for ploughing was given as a contributing factor to the ability by some farmers to cultivate what they referred to as 'large fields'. In addition, cattle provide meat and milk and are a source of income if sold.

- Goats numbering 262, and were more numerous than cattle, were owned by 20 or 62.5% of the respondents. It was observed that goats which are also a source of meat and income if sold, were more adapted than cattle to this semi-arid area, as they were able to feed on shrub since there is no grass.

- Sheep were also available in the study area. There were 103 sheep owned by 5 or 15.6% of the respondents. It was indicated that these animals were also adapted to the area, and were used for carrying or transporting goods such as maize meal from the grinding mills.

- A total of 170 chickens were owned by 17 or 53.1% of the respondents; plus 28 guinea fowls owned by 3 or 9.4% of those interviewed. The birds are a major source of relish and also of income, since they are readily sold.

- Only one respondent indicated that he owned four pigs, which are also a source of meat and income.

(e) Crop Combinations

When the research was conceived, it was assumed that under crop combinations, it would require obtaining qualitative data on whether inter-cropping land usage systems were still being practiced or not. Such systems in the past, allowed a wide variety of crops such as cereals, tubers, legumes and cucurbits to be grown on the same piece of land or field. The variety of crops grown was a useful rick management strategy, aimed at avoiding total crop failure under adverse weather conditions.

Thus, the statements which follow, captured the responses and summarized the narratives of some small-scale farmers: two men and seven women (or 28% of the sample); four of whom were elderly widows, who were able to recollect what transpired when they were younger women. The responses suggest that crop combinations or inter cropping is to some extent still a surviving land usage practice which is part of indigenous knowledge systems.

The two men were respondent's No. 2 and No. 18. Number 2 explained that he is aware of inter-cropping and is able to mix millet, sorghum and pumpkins. Number 18, the Community Agricultural Worker (CAW), was of the view that inter-cropping (which he practices) also "help to provide food, since some crop may fail but others may reach maturity".

With respect to the views of women, respondent number five stated that some farmers still practice inter-cropping cereals and cucurbits; adding that "this helps us to some extent. But, we need seed for grain."

Another elderly widow, respondent No. 8, stated that when she was younger and able to cultivate the land, she used to practice inter-cropping, mixing millet with cucurbits like melons and pumpkins. She indicated further that crop combination was a good strategy especially if one did not have enough land; and added that her recommendation was that small-scale farmers should continue to use this strategy.

A 74-year-old widow (respondent No. 11) also stated that when she was much younger and even now, she practices inter-cropping in one field. She added that "this strategy is good because if one crop fails, then you can depend on the other that may survive."

Another elderly widow, responded No 27, also stated that she used to inter crop when she was young. She explained that this was a risk management strategy in that if one crop failed, she could harvest the other that survived."

However, she rather exposed her limited appreciation of indigenous knowledge by concluding that "we inter cropped on a trial and error basis", and wondered whether the practice should be continued even now!

Two younger women, both in polygamous marriages, also indicated that they practice inter cropping. The younger woman who was interviewed, aged 19 was respondent no 32. She stated that "we intercrop; it helps with food security". The other 34-year older respondent No 31, also indicated that she practices inter-cropping. However, she qualified her practice of inter-cropping by stating that "it helps only to provide early food; whilewaiting for the cereals to ripen."

The statements recorded above suggest that knowledge about the practice of and the advantages of inter-cropping or crop combinations, is not only confined to elderly people, especially women, but

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can also be passed on to the younger generation as well. Furthermore, crop combinations enhance household food security and the resilience of the food production systems of small-scale farmers, in view of the climatic variability in the study area.

In this regard, Emeagwali (2003, p5) is of the view that “the most significant information gathering exercise for Indigenous Knowledge (IK) is oral tradition, namely, the collective testimonies and recollections of the past, inherited in various forms of verbal testimonies”.

She adds further that “tapping into the intellectual resources associated with IK is not cost effective but also relevant and indispensable for environmentally and ecologically sensitive activity” (Emeagwali, 2003, p3).

In the same vein, Lalonde (1991, p.30), is of the view that “Africa may be an ideal continent to learn about and begin seriously integrating indigenous knowledge with development planning techniques,” as there are remote or sparsely populated areas that have the rich diversity and number of indigenous cultural groups whose traditional or cultural practices are ingeniously designed to address local ecological limitations.

(f) Impact of Droughts and Floods and Perception of Climate Change

When the researcher asked farmers to state the impact of extreme weather conditions especially drought, on crop production, a total of 16 or 50% of the respondents indicated that droughts lead to crop failure, as cereals wilt before reaching maturity; and when asked about production, another 21 or 65.6% responded that crop production or harvests are reducing instead of increasing.

For instance, respondent No. 23. a 31-year-old male disclosed that “crops die at flowering stage due to lack of rain”, while respondent no 22, a 36-year-old female stated that “crops wilt before maturity; when crops are about to flower, the rains stop; so, crops don’t mature.” On the whole, the scenario was summarized by respondent No. 15, a 29-year-old male who remarked that “droughts are causing hunger". Participants in the first focus group discussion (FGD) also remarked that "droughts bring hunger".

With respect to the impact of droughts on livestock, respondent No 2, a 40-year-old male stated that "when there is drought, there is no water and therefore no grass for livestock- so, animals become thin and eventually die"

Respondent No. 5, a 46-year-old female, indicated that in times of droughts, "animals are adversely affected in that there is no pasture for grazing". In the same vein, participants in the first FGD also observed that during drought, "there is no grass for animals, so they die."

Although floods are rarely experienced in the area, respondent No. 2 explained that in the 2007/08 season, he lost 21 goats and sheep due to floods. Respondent No. 10, a 38-year-old male even remarked that "drought is better than flooding because floods wash away everything-but during drought, some crops survive"!

In attempting to assess if farmers were aware of climate change, the researcher did it indirectly, by asking questions on whether they had experienced droughts and floods.

So, when the question, 'have you experienced drought as a farmer' was posed, the responses were affirmative. All those that were interviewed individually said: "Yes, I have experienced drought".

Then, a follow up question was posed: How often have you experienced droughts? In answering the question, a total of 28 or 87.5% of the sampled farmers stated that "droughts are quite often or droughts are frequent". Only 4 or 12.5% of the farmers responded that "droughts come in a while".

Farmers were then asked the question: why are droughts frequent? A total of 29 or 90.63% of the sample responded that they were not aware of the causes of frequent droughts in their area. However, 3 or 9.3% of the sample attempted to give an explanation. Respondent No. 9, a 41-year-old male teacher explained that droughts were frequent because the Gwembe Valley is a rain

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shadow; while the other one said that wind causes the droughts and the third said that he had heard something on radio about climatic variability.

The farmers were then asked the question: have you experienced floods in the area? In answering the question, 28 or 87.5% of the sample said "yes", and they went on to explain that they had experienced it in the 2007/08 agricultural season. Another 2 or 6.25% responded that they had experienced "part drought, part flood" in the 2008/09 season; while another 2 or 6.25% responded in the negative that "there are no floods here", or floods were not common".

Thus, the small-scale farmers unanimously stated that droughts were more frequent in their occurrence, in comparison to floods, although they were not aware of the cause of the extreme weather conditions. This lack of awareness could be due to low levels of education in the community and also probably due to the remoteness of the area.

In other words, the respondents were not aware of the concept of "climate change". Hence the researcher attempted to sensitize the farmers individually and in the FGDs about the concept; and about the worst scenario predictions as indicated by the IPCC as shown in section 2.0 above.

When the concept was simplified and explained, the respondents were very anxious about the state of the environment and even asked: "how are we going to survive"? One female respondent asked the question: "when is climate change going to start"? Furthermore, another male participant in the second FGD posed a question in anger that "why should we suffer from the effects of the predicted scenarios when the major causes of climate change lie elsewhere outside Africa"?

(g) Coping Strategies

After assessing the impact of droughts and floods on their agricultural/food production, small-scale farmers were then asked to explain their coping/livelihood strategies. The respondents gave their coping/livelihood strategies as shown in table 4 and figure 4 for the livelihoods circuit that has been constructed.

Table 4: Coping/Livelihood Strategies

	Livelihood Type	**No.**	**%**
1	Selling Livestock to raise cash	17	53.10
2	Catch and sell fish	8	25.00
3	Sell baskets and help from well wishers	2	6.30
4	Work for food	1	3.12
5	Look for piece work	1	3.12
6	Work as a Teacher	1	3.12
7	Husband has a grocery	1	3.12
8	God feeds me through my children	1	3.12
	Total:	32	100.00

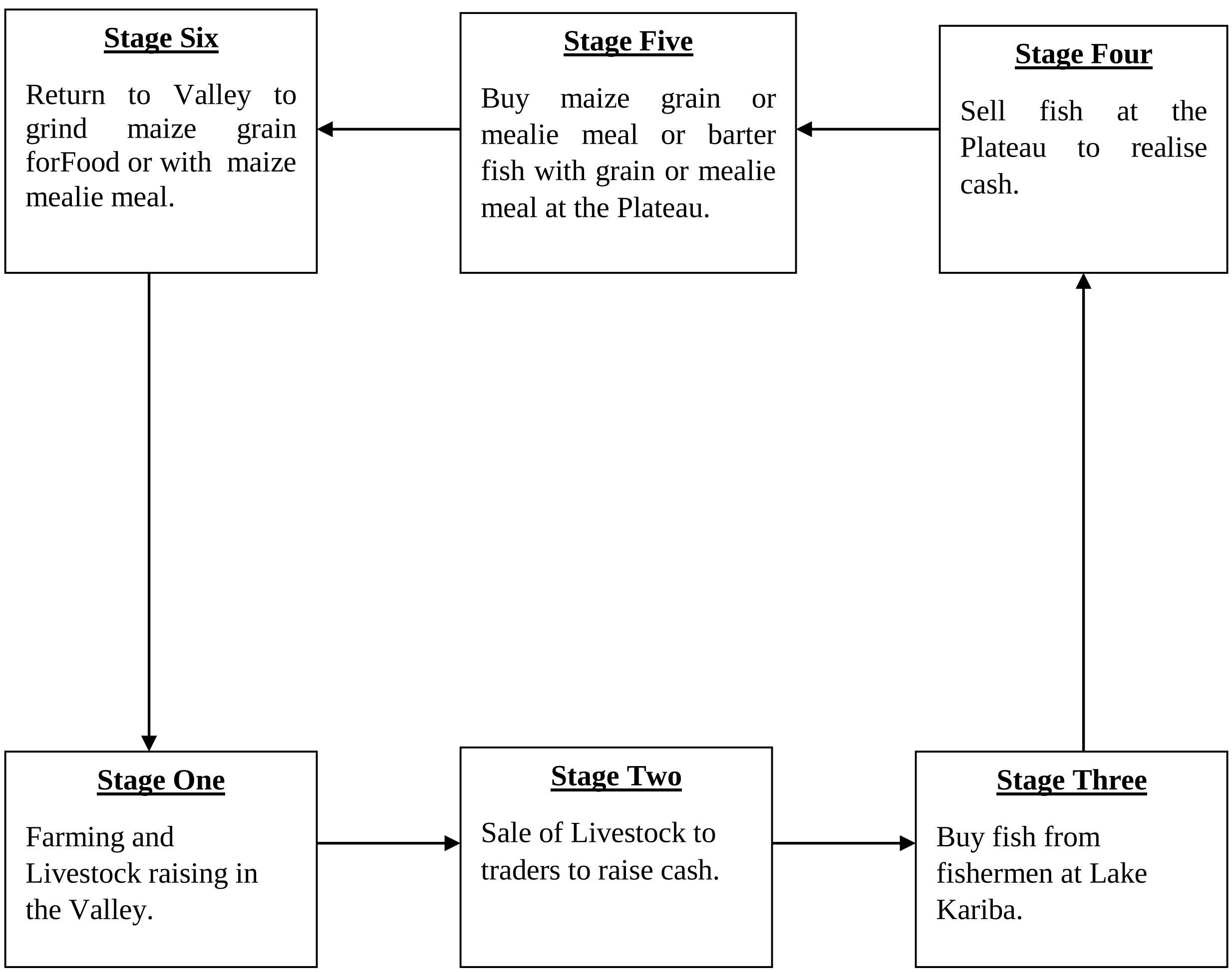
(Source: Field Data, 2009)

Table 4 shows that the major coping or livelihood strategy given by the respondents was their ability to sell one or two of their animals – whether cattle, goats or chickens, in order to by fish from Lake Kariba; and then travel to the plateau (Maamba Coal Mine or Mapatizya and even Kalomo) to look for maize grain which was bought after selling the fish or bartered or exchanged with fish. Then, the farmers would return to the valley with maize grain which they took to the grinding mills to obtain maize mealie meal for food. The majority of the respondents (17 or 53.1 %) indicated that this was their strategy of coping with climate variations, especially drought.

Those who indicated that they combine farming with fishing (i.e 8 or 25% of the sample) also exchanged their fish with maize grain or sold the fish to buy grain at the plateau, before returning to the valley.

Thus, if we combine the first and second livelihood types, a total of 25 or 78.1% of the respondents rely on the relationship between farming and livestock raising in the valley, catching and selling/buying of fish from the late; and exchanging fish with grain at the plateau or selling fish and then repeat the cycle when necessary. Figure 4 shows the stages that constitute this livelihood circuit or pattern and coping strategies.

F*igure 4: Livelihoods Circuit and Coping Strategies*



(Source: Field Data, 2009)

One key informant, respondent No.13 (the Ward Councilor) indicated that he sold six animals at K1.2 million Kwacha per animal, in order to raise cash to buy grain from the plateau in different areas of KalomoDistrict. Another farmer, respondent No.20, a village headman, started that he sold 5 cattle in 2008, at K350, 000 per animal as they were small, but the bigger ones were sold at

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K600,000 each. In the same year, he sold 3 goats at K35, 000 and K40, 000 per animal. (Before Rebase)

However, respondent No.20 also indicated that when there is a drought, the price of livestock on the rural market comes down and therefore, farmers are made to sell their animals at depressed prices.

In the case of fishermen, respondents No.23 stated that if he has a good catch of fish, he can raise about K1.5 million – K2.0 million per month if he goes to sell the fish at the mine on the plateau. If he sells within the valley, he can raise about K600, 000 per month.

The two respondents, who indicated that they cope with the effects of drought by making and selling baskets, were elderly widows. They seemed very vulnerable as they raised very little, about K10,000 per basket. Respondent No 4 stated that she is able to make only 2 baskets per month. She lamented that in the past the government brought relief food, but this was not the case now. So, she depends on well-wishers! The other widow, respondent No.11 summed it up when she said that "God feeds me through my children".

6.0 ADAPTIVE STRATEGIES AND INTERFACE TO BUILD RESILIENCE

After sharing with the farmers during which effort was made to simplify the meaning of climate change, the researcher then asked them to state what they thought they could do in order to adapt to climate change. The responses are shown in table 5

Table 5: Adaptation Strategies

	Response	No.	%
•	We don't know what to do if extremes of droughts (and floods) come in future	10	31.25
•	We need irrigation	9	28.12
•	We need new seed varieties	1	3.13
•	Emigrate to the plateau	2	6.25
•	The government should teach us new farming methods	1	3.13
•	We need good roads to facilitate trading (in food and fish)	1	3.13
•	The government should help us; otherwise we will be in serious trouble.	2	6.25
•	We will start/continue fishing as a livelihood.	3	9.37
•	We need to intercrop as was the case in the past.	3	9.37
	Total	32	100.00

(Source: Field Data, 2009)

The data in table 5 show that 10 or 31.25% of the farmers stated that they did not know what to do in trying to adapt to climate change and the worst scenarios that scientist are predicting.

However, 9 or 28.12% of the respondents suggested that what is needed is that government should intervene to provide an irrigations scheme(s), so that farmers do not continue to depend on rainfall for agricultural activities. Participants in the FGDs also emphasized the need for irrigation as a more sustainable adaptation strategy to climate change that was causing frequent droughts. Furthermore, it was suggested that farmers in the area need to access new seed varieties that are early maturing, tolerant to drought and high yielding.

In this regard, respondents No.4, a widow from Kafwambila Village recalled that in the past, the local people had different types of local/traditional or indigenous varieties of seeds. One such type was a bull rush millet called *Katokoloshi*. It was early maturing. However, the variety was short and had very small grains. As a result, the yield per planted area was very low. So, farmers did not like it despite the fact that it was early maturing.

Thus, when farmers were asked to indicate whether they had different seed varieties, 28 or 87.5% responded that "no, we need seed", and 3 or 9.5% indicated that they had seed in the past, but not now.

It is apparent that the indigenous knowledge which the farmers have accumulated over the decades needs to be interfaced with modern knowledge from the scientific community including government experts, and the private sector in order to help farmers adapt to climate change. So, when farmers were asked to indicate what stakeholders should do to help them, the following responses were given.

- Stakeholders should come to help small-scale farmers find solutions to this problem of climate change, especially by teaching new methods of farming that are adapted to the changing environment.
- Interventions should include the introduction of early maturing and high yielding varieties of seeds that are suitable to the changing rain pattern. These hybrids should include seed for millet, sorghum and maize, and cassava sticks (at the right time for planting).
- Stakeholders should establish an irrigation scheme to tap water from Lake Kariba. This should include the promotion of Treadle Pumps (through a loan scheme) that farmers can use to engage in small-scale irrigation of maize and vegetable gardens by the lake shore.
- The government and other relevant stakeholders should provide information (especially weather forecasting) to help farmers strategize in agriculture.
- Stakeholders should (continue to) provide relief food in order to mitigate the impacts of climate change that will manifest in terms of frequent and severe droughts and floods.

It was therefore reassuring to learn from the Block Extension Officer that the Scientific Community with the support of the Japanese International Cooperation Agency (JICA) was currently working on improving seed varieties of millet and sorghum at Mt. Makulu Agricultural Research Station now Zambia Agricultural Research Institute (ZARI) and that these early maturing and high yielding varieties were to be introduced in the 2009/2010 agricultural season.

The building of resilience of the food production systems of small scale farmers should also incorporate interventions by the state, the private sector and other stakeholders such as the inoculation of livestock to prevent livestock diseases and also restocking. Since livestock are tradable item, they can continue to be a source of household income as well as a source of animal protein to ensure food security and nutrition.

In addition the provisions of infrastructure like roads, irrigation systems, inputs, provision of connectivity to crop and livestock markets and to sources of micro-finance, education for the youth, etc , can promote economic growth and broader rural transformation that is linked to the regional and national economy. The existing links between the small scale farmers and the centres of rural industries such as coal mining in Maamba (where they travel to in order to sell or exchange their fish to buy grain as indicated earlier), and the commercialization of cattle markets by Zambeef in the district, can create conditions for long term structural changes.

For instance, Kalapula et al (2012) have shown in a study conducted in Namwala's Baambwe and Maala areas (within the southern province), that the introduction of cattle markets by Zambeef and Star Beef, has triggered social economic transformation. Cattle markets have led to an increase in demand for money in the rural economy, and traditional cattle keepers have experienced a major change in production goals for keeping cattle; they are now using the money to acquire consumer goods such as solar panels to light their homes, television sets, motor vehicles, dip tanks, building modern houses and retail shops.

The implementation of the Nzenga Irrigation scheme in chief Sinazongwe's area within the District where the Kafwambila study was conducted, is reported to have the potential to benefit 400residents mainly women and the youth. As land owner's the 67 males and 33 female farmers in the scheme will benefit through contract farming of cotton and as employees, and another 100 will be shareholders. It is reported that this scheme which is being implemented by an Agri-business company, North West Cooperative in partnership with government is intended not only to reduce rural poverty, but also to transform the rural economy as the raw materials will be processed within the region and the country as part of rural industriliazation (Tembo, 2017),involving the creation of wealth and jobs with the possibility of the surplus rural population eventually earning incomes outside agriculture (Kajoba,2013).

7.0 CONCLUSION

The study has shown that the food production system in Kafwambila village and its catchment area is vulnerable to frequent droughts as it is located in low rainfall Agro-ecological zone. This vulnerability is demonstrated by very low estimated harvests of the three staple cereals which the small scale farmers are able to harvest in what they consider as good agriculture seasons. These harvest are obtained on small holdings which comparatively are not very different from those for farmers in the province.

However, the small scale farmers have demonstrated resilience by devising a livelihood coping circuit or strategy in the valley in which they engage in fishing, livestock raising and trading or barter exchange to obtain maize grain from the plateau and then return to grind the grain in the valley to obtain maize meal for food.

The narratives of order female farmers gave an indication that crop combinations was one of the strategies which was employed in the past to reduce risks of total crop failure, and farmers were of the view that the resilience of their food production system to the frequent droughts which were resulting from climate change, could be enhanced if the state, together with the private sector and other stakeholders could intervene by providing an irrigation scheme and make it possible for them to access improved varieties of seeds that were more drought tolerant, early maturing, high yielding and were palatable to eat.

Such interventions should also ensure that the small-holder farmers in the valley are linked to the plateau markets by constructing passable roads and other infrastructure to promote broader rural economic transformation, in which an interface is created between indigenous and scientific knowledge systems to deal adequately with the climate change impacts of frequent droughts in the study area.

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