



Smallholder Household and Farming Practices under Climate Change Pressure: A Case of Gusha Shinkurta Area, Awi Zone, Ethiopia

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Abstract – The present study examined rural household practices under climate change pressures in Gusha Shinkurta locality, Awi Zone, Amhara regional state, Ethiopia using structured questionnaire and house-to-house observation and FGD methods. The results indicated that farmers are not practicing any adaptive and resilience strategies to reduce vulnerability to climatic shocks and stresses at household level. It was also found that there are no well-designed production diversification and intensification approaches to help them. There is no water harvesting practices to avert the problem. Since their living is hand to mouth, the storage system is found poorly organized. The energy system of the household is not supported by fuel saving stoves. Household energy is totally dependent on firewood which aggravates deforestation and soil loss. Chemical fertilizer price is found the highest expenditure in the rural household and there are no alternative strategies to enable farmers fully engaged in legume, alfalfa, cow manure practice to increase soil fertility; or to practice fallowing and mulching. The preparation of compost by rural households is challenged by inputs deficiency and was not able to fulfil households demand for chemical fertilizer (Urea and DAP). Potato which is dominantly produced in the locality is not preserved or stored well; or there is no any value chain system to increase its market value. The agriculture and health extension packages designed by the government to gear the rural transformation process are practiced fragmentally and they didn't witness real change to avert climate change pressure impacts at rural household level. Even, it was found in this study that climate change pressure effects and coping mechanisms were not included in both the health and agriculture extension packages. Therefore, there is a need to increase the competence of both agriculture and health extension agents on the one hand and farmers themselves on the other hand to boost rural households' resilience capacity for climate change.

Keywords – Climate Change, Mitigation, Potato Production, Smallholder Household.

I. INTRODUCTION

Food security of rural households' is getting one of the most newsworthy focuses of the world today. According to Bot & Benites (2001), the number of hungry people is estimated to reach 925 million. It is also reported that 75% of the worst affected people by hunger reside in the rural areas of developing countries whose livelihood depends directly or indirectly on agriculture (Mann, et.al 2009). To improve the food security situation of these rural people, therefore, strengthening their agricultural production system is believed to be very critical (Bank, 2006;

Ravallion & Chen, 2007). According to Conant (2009), cited in (Branca, McCarthy, Lipper, & Jolejole, 2011; Metz, 2007; Adger, Huq, Brown, Conway, & Hulme, 2003), improving the resilience of agricultural systems is of paramount significance for climate change adaptation since agriculture is the main economic sector of most low income developing countries. It is substantially pointed out that the potential to provide effective sources of mitigation by maximizing carbon stocks in terrestrial systems as well as emission reduction through increased fuel consumption efficiency is possible through improvements in agricultural production systems (Mann, et.al, 2009). Findings by Bruinsma (2009) also reported that out of the total 6 billion world population, nearly 1 billion live in persistent hunger . And most of the livelihoods of these victims who suffer chronic hunger are directly or indirectly dependent on agriculture. It is also remarked that population growth is increasing alarmingly and is expected to increase pressure on the small holder agricultural sector. Particularly, South Asia and Sub-Saharan Africa (Schmidhuber & Tubiello, 2007) will be challenged by food insecurity and their high dependence on agriculture will be strongly frustrated by climatic changes. Still Metz (2007) reported that certain regions of the world will be challenged by drop of average production and many more are likely to face increased climate change effects like rainfall variability and extreme weathers shocks which will worsen livelihood challenges.

According to Lobell et al. (2008), climate change will considerably affect agricultural production and food security up to 2030 particularly parts of South Asia and Sub-Saharan Africa due to both changes in mean temperatures and rainfall as well as increased variability associated with them. It is further stated that changes in pest and disease patterns because of climate change impacts will significantly affect livelihoods in Sub-Saharan Africa. South Asia and Sub-Saharan Africa are expected to be the hardest hit regions with the likely decreases in agricultural productivity between 15-35 percent (Cline, 2008). It is further confirmed that these are exactly the same regions that already exhibit high vulnerability to weather shocks and stresses which is followed by degradation and depletion of livelihood assets and food insecurity. Briefly, many research findings confirmed that the climate is changing and giving serious attention to empower small holder farmers' mitigation and adaptation to climate change must be the concern of researchers, politicians, and policy makers or world leaders. In relation with this, De Wit and Stankiewicz,



(2006) and IISD (2007) cited in (Hassan & Nhemachena, 2008:84) stated:

Adaptation is therefore critical and of concern in developing countries, particularly in Africa where vulnerability is high because ability to adapt is low. Climate change is expected to affect food and water resources that are critical for livelihoods in Africa where much of the population, especially the poor, rely on local supply systems that are sensitive to climate variation. Disruptions of the existing food and water systems will have devastating implications for development and livelihoods and are expected to add to the challenges climate change already poses for poverty eradication.

Kandlikar & Risbey (2000) also stated adaptation helps farmers achieve their food, income and livelihood security objectives in the face of changing climatic and socioeconomic conditions, including climate variability, extreme weather conditions such as droughts and floods, and volatile short-term changes in local and large-scale markets. They further argued that empowering farmers can help them to reduce the possible climate change related risks particularly by making strategic responses to these changes. Therefore, analysis of rural household practices under climate change pressure is of supreme importance for finding ways to help farmers be able to mitigate and adapt the risks at household level.

According to CSA of Ethiopia (2004), the level and distribution of poverty in Ethiopia is extensive. The 1995/96 and the 1999/2000 Household Income, Consumption and Expenditure Survey and Welfare Monitoring Survey of the (CSA) show that about 44 percent of the total population (45 percent in rural areas and 37 percent in urban areas) are living below poverty line. In this context, low adaptive and mitigation capacity of rural households in Ethiopia is worsened by climate change related risks. Many empirical studies measuring the socio-economic impacts of climate change on agriculture in Africa (Kurukulasuriya & Mendelsohn, 2006; Seo & Mendelsohn, 2007; Mano & Nhemachena, 2007; Benhin, 2006) showed that such impacts can be significantly reduced through adaptation and empowering rural households through encouraging local innovations and provision of training that maximizes farmers' competence so that they can adjust themselves to live in the prevailing scenario: change of climate.

Following the observations of cited investigations, our study was, therefore, devised with the objective of analysing smallholder household and farming practices under the prevailing conditions of climate change pressure in the rural households of Gusha Shinkurta locality, Awi Administrative Zone, Amhara Regional State, Ethiopia; which was assumed to deepen our understanding of the socio-economic impacts of climate change in the rural households.

II. DESIGN AND METHODOLOGY OF THE STUDY

2.1 Description of the Study Area

This study was undertaken in one Kebele Administration (lower administrative unit in Ethiopia),

Gusha Shinkurta of Guagusa Shikudad district (Woreda), in Awi Zone of the Amhara Regional State, Ethiopia. This zone is selected by the research team since it dominantly produces potato, the selected crop to see climatic change effects on it and farmers' practice of value addition. Awi Zone is situated between 10°23'N and 10°85'N latitudes and 36°35'E and 36°57'E longitudes with an altitude ranging between 1800 to 3100 meter above sea level. It has a mean annual rainfall of 1,750 mm and a mean monthly temperature that ranges from 17°C to 27°C. The zone has a nitosol soil type which mainly allows crop growing. Major staple crops grown in this district include potato, teff, maize, wheat, barley, millets, peas and beans. In this zone, animal husbandry is dominated by sheep followed by cows, oxen and horses respectively. Mixed farming system is largely practiced as the main means of farmers' livelihoods. The zone is characterized by small landholdings supporting the ever-increasing populations. Farm size distribution is not uniform and smallholders own minimum of 0.5 hectare and maximum of 1.5 hectares (Fig.1).

2.2 Research Design

This study is being conducted with the objective of conceptualizing the rural household practices in relation to potatoes that is the most relevant crop in the region, the overall household conditions and their opportunities to adapt the practices to climate change like water harvesting or improving storage systems. The methodology employed here is innovating households which are mainly concerned about household analysis and ongoing reflection process on identification and stepwise integration of modified farmer household techniques and innovations which includes the technical sector: techniques for storage of seeds and harvest product, energy system; social sector: migration, generations/family structure, knowledge and education; health sector: health status, hygienic status, water availability and sanitation; food sector: cooking and eating habits; economic sector: farm income, off farm income and labour distribution.

2.3 Sampling Technique

Since the present research was a qualitative research design, purposive sampling technique was used to select both the studied district Gusha Shinkurta taking into account its dominantly potato production and 30 farmers (6 females and 24 males) to fill the structured questionnaire and to allow this researcher conduct house-to-house observation of their practices under the prevailing conditions of climate change (Teddlie, C., & Yu, F. 2007).

2.4 Data Collection:

Primary data on the farming practices of smallholder households under the prevailing conditions of climate change were collected using structured questionnaire with farmer groups, conducting house-to-house-observation of the smallholder households, and FGD methods and case interview. In this context, house-to-house observation refers to visiting the smallholders' houses (with their informed consent), the family, their eating habit, sleeping room, storing system, the way they cook, the energy they use, etc. Secondary data was also collected through documentary analysis and review of unpublished reports

from different local, Woreda (District), zonal and regional institutions.

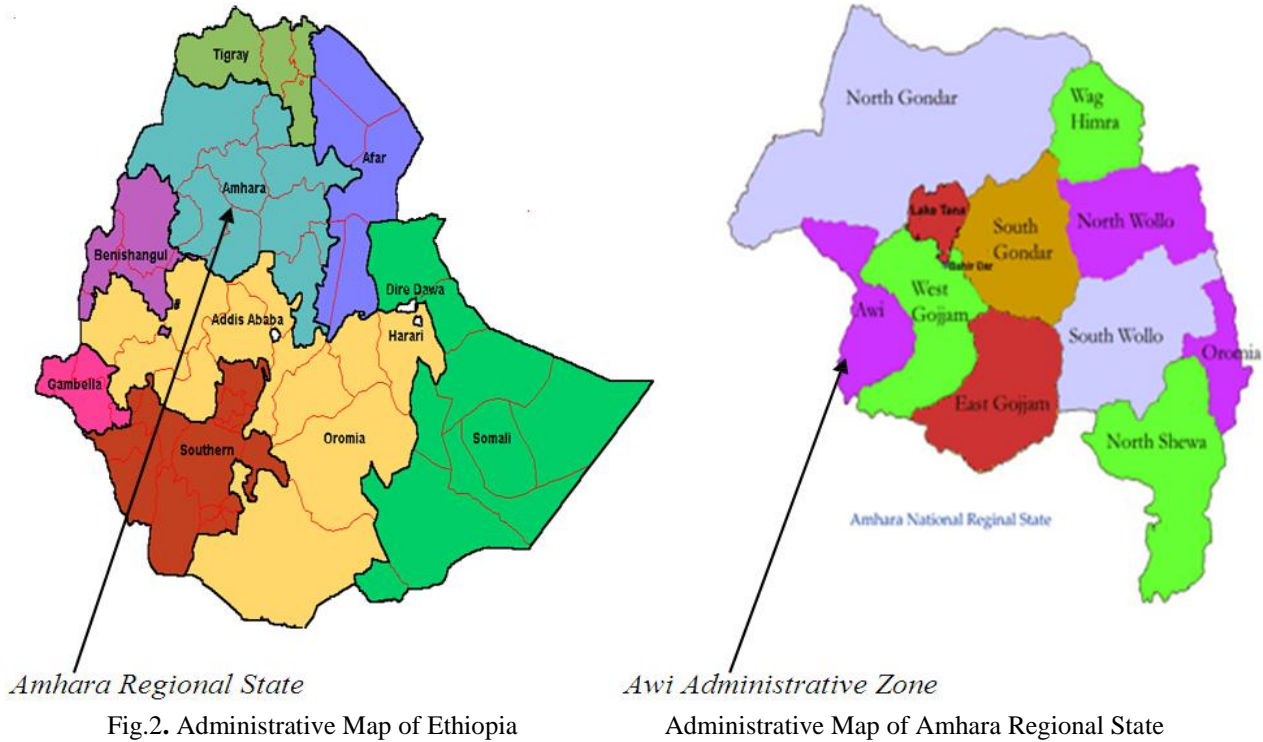
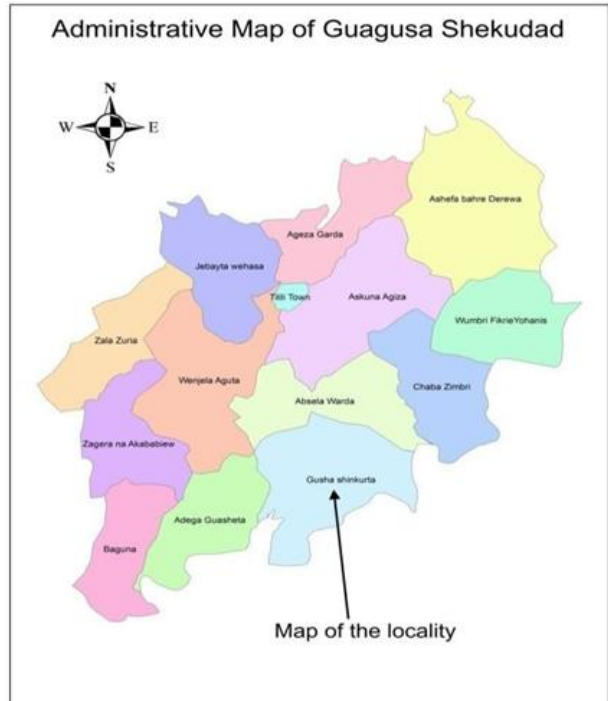


Fig.2. Administrative Map of Ethiopia

Administrative Map of Amhara Regional State



Source: Amhara National Regional State Bureau of Finance and Economic Development

2.5 Data Analysis

The collected qualitative data were analysed using discourse analysis followed by thematically organizing (categorizing) concepts into the technical sector: techniques for storage of seeds and harvest product, energy system; social sector: migration, generations/family structure, knowledge and education; health sector: health status, hygienic status, water

availability and sanitation; food sector: cooking and eating habits; economic sector: farm income, off farm income and labour distribution. Descriptive statistics (percentage) was also employed to analyse the data that need statistical manipulation. In addition, smallholder households' and their farming practices under climate change pressure was also validated from the view of rural households' practices approach.

III. RESULTS AND DISCUSSIONS

3.1 Technical Sector

3.1.1 Techniques for Storage of Seeds and Harvest Product

From the respondents, it was found that farmers did store seeds and their harvests. Around 80% of the rural households which were included in this study stored seeds and their harvests using sacks or a similar material made from leather called “akumada”. The remaining 20% of the farmers did store using a device made from dried mud which is locally known as “Gota”. Respondents clearly stated that each storing device has its own advantage and disadvantages. Storing seeds and harvest products using sacks or “akumada” is highly exposed for fire accidents if fire is going to break out in the household. However, the traditionally made material from dried mud which they called it “Gota” is very protective to fire accidents. Furthermore, respondents remarked that teff and millet can be stored for longer periods of time while potato and onion are found to be perished easily. The innovative approach practiced by farmers is to sell perishable items in exchange for teff and millet. It was also reported from 100% of them that their storing was for few months since their living is hand to mouth survival. If rain didn't fall for one year, they believed, all of them would migrate. Related to challenges encountered during storage, 100% of the respondents replied that ants, moths, and similar rodents

are creating a problem. Sometimes, the DDT they bought to kill moths is found expired and fail to protect their harvest products of maize, barely, wheat, beans, peace and chickpeas.

3.1.2 Rural Household Energy Consumption

When asked to tell what is/was the household's main source of energy, all of them reported that firewood is/was their main sources of energy. Still, participants were asked whether they used fuel saving stoves or not. Except three farmers (10%), the remaining 27 (90 %), eloquently explained that they didn't use. Farmers who used fuel saving stoves were also asked during the house-to-house observation about the importance of fuel saving stoves. And, they clearly stated that it is good to avoid smoke during cooking, to save firewood, and avoid scorching by fire heat. This researcher observed a woman while baking ‘injera’ using fuel saving stove and has seen her comfortable as compared to others observed by the researcher who are baking without it. This researcher observed sweating and tears in the eyes of those who are not using and no sweating and tears in the eyes of a woman who is using fuel saving stoves. It is known that Ethiopia's energy consumption is predominantly based on biomass energy sources. An overwhelming proportion (94%) of the country's energy demand is met by traditional energy sources such as fuel wood, charcoal, branches, dung cakes and agricultural residues.



Fig. 2. Scattered and Broken Fuel Saving Stoves

(Photo: Chalachew Tarekegne)

The balance to meet by commercial energy sources such as electricity and petroleum is very far for the rural people to reach. It is a recognizable fact that the most important issue in the energy sector is the supply of household fuels which is highly associated with massive deforestation and the resultant land degradation and environmental depletion. It was also learnt from this study that the increasing scarcity of fuel wood is compounded by Ethiopia's alarming population growth rate. Within this prevailing scenario, rural households in Ethiopia are still heavily engaged in heavy destruction of trees to meet their firewood demand. The attempt to distribute fuel saving stoves was found ineffective. Very surprisingly, fuel saving stoves were distributed for 20 farmers (66.67 %) of the respondents. Yet, the number of respondents who properly used it was found very limited; that is, 3 farmers (15%). During the house-to-house visit, it was observed, that most of the fuel saving stoves distributed to rural

households was broken, misplaced somewhere, scattered spare parts, or else is put at the backside of the house or dwelling (fig.2).

In relation with the fuel saving stoves, a woman was asked about its advantages.

My eyes used to bring tears before I started to use fuel saving stoves. At this time, I am using it and my eyes had stopped bringing tears. I advised our neighbouring fellows to practice it. It is very good. “Quoted from a woman who is using fuel saving stoves (source: Own translation from Amharic to English)

She stated that firewood is getting scarce and scarce from year to year since the numbers of trees planted are growing less, cow dung is getting shortage, and kerosene price is increasing which usually is followed by household energy deficit (fig.3)



Fig 3. Woman Baking “Injera” Using Fuel Saving Stoves

(Photo: Chalachew Tarekegne)

3.2 Social Sector:

3.2.1 Migration, Family and Social Networks

Respondents were asked about whether any member of their household left the area for over a month in the last one year or not. And, 13 (43 %) of them responded that they migrated for temporary job employment opportunities. The migrants reported that they migrated temporarily when the household was suffering food shortage and cash to cover household expenses; which could be engendered by climatic shocks and stresses. In

addition, they stressed that the decision to temporarily leave the area was highly influenced by high chemical fertilizer price (Urea and DAP) and failure to pay back the credit. The migrant was expected either to come back with money or send it so that the household food deficit is covered or the chemical fertilizer taken by credit is paid back to government. As it was learnt from respondents, most of the migrants were working on jobs of collecting dried sisam in Metema and Humera (other parts of Amhara region), ripped coffee in (Wellega, Oromiya Region), ground nuts and maize (Jawi, other part of Awi



zone), etc. Further, it was learnt that some migrants were also involved in works of daily labour in the nearby towns like Finote Selam, Debre Markos and Bahir Dar.

Another important point provided by respondents was whether they have relatives in the village or not. And, 100% of them replied that they had. In relation with this, they were also asked to evaluate the status of mutual aid during the times of food deficit or shortage of cash; and it was found that it had declined rapidly. Yet, it was found that “Edirs” (institutions concerned about death and funeral), “Ekubs” (traditional saving institutions), and “Mahibers” (religious institutions) are the most important social protective local institutions that are contributing much as a shock absorber to rural households in the locality. It was found that these institutions have their own financial capital which can be borrowed for those who need with the interest of 10 birr per each 100 birr. This interest rate, actually, is greater than the bank interest rate which is 6% per 100 birr.

Respondents were asked to rank the important institutions in their relative order of significances in the context of climatic change stresses and shocks on the one hand and during different social and economic problems on the other hand (table 1).

Important Institutions in the Context of Climate Change Stresses and Shocks: Three FGD Groups in the Locality

Table 1

Types of Institutions	Ranking in their relative order of significances
Indigenous Local Institutions (Edirs, Ekubs, Mahibers)	1
Places of Worship	2
Schools	3
Clinics and Health Stations	4
Markets	5
Amhara Credit and Saving Institution (ACSI)	6
Cooperative Unions	7
Banks	8

Note: 1 (most significant); 8 (least significant)

3.2.2 Education and Literacy Status of Rural Households of the Locality

It is already known that attendance at primary and junior secondary schools in Ethiopia is assumed to be compulsory and free. Yet, it was observed that the number of illiterate people in rural households’ is still high. For instance, in this study, it was found that out of 142 rural households who were matured enough to attend education, 50 (35%) of them were illiterate. It was also found that temporary migration of parents in search of job opportunity because of food insecurity or shortage of cash in the household was followed by child school dropout. The house- to-house observation revealed that poor households with many children were more prone to climatic changes, shocks and stresses and were challenged

by difficulties of covering educational expenses for their children. Furthermore, as compared to their annual income which was not more than 100 dollar per year, rural households were found large in family size (the smallest being 3 and the larger being 8; the average family size being 5; which has implication to the family planning program launched by the government let alone introducing climate change adaptive and resilience strategies. Though the primary and junior secondary school is located in less one kilometre, rural households now and then commented on the low quality of education offered to their children (table 2).

Table 2

Total number of households in this study	Literate household members	Illiterate household members	Infants (not mature enough to go to school)
157	92	50	45

Source: Own

3.3 Health Sector: Health Status, Hygienic Status, Water Availability and Sanitation

Physical health is fundamental for the types of livelihoods on which rural households’ ultimately depend on. 95% of the respondents regarded malaria and waterborne diseases as frequent incidences which are difficult to avoid. In addition, it was also stated that cardio-respiratory diseases and foot diseases or “elephantiasis kind” of new diseases were found recent phenomenon. Furthermore, TB, blood pressure, infection of kidney and urinary system sickness cases were observed. Though there were health centres in the locality, it was also reported that they were challenged by shortage of skilled manpower and drugs to help the famers get treatment. Similar finding were also reported from (NAPA, 2007). The usual incidences of climatic shocks and stresses affected their surplus production and farmers were not able to afford to go to towns for better medication and 90% of them reported that they used human labour and pack animals to take the patient to clinics or nearby hospitals. This study confirmed (Keller, 2009) findings which stated that projected increases in the inter-annual variability of precipitation in combination with the warming air will be followed by increases in the incidence of droughts, heavy rains and floods in Ethiopia; which in turn, will be followed by waterborne diseases and incidences of malaria in areas of the highlands where malaria was previously not endemic.

In the house-to-house visit of rural households in the locality, it was also discovered that they are vulnerable to illness, hunger, impure water supply except few who were using wells and springs, poor sanitation and room ventilation, promiscuity, unprotected sex, HIV/AIDS, and unclean sleeping room mixed with harvest products stored in sacks. The clinic was located in less than one kilometre though the quality of services it provides to the rural households was found poor. In this study, it was explored that both men and women are found victims of HIV/AIDS and other sexually transmitted diseases. Rural households in the locality came to recognize that those in better well-

being are more prone to such diseases because of their extra incomes.

It was also discovered that birth attendants and traditional healers are still active in the rural households; and yet, most rural communities in the studied locality prefer going to clinics and hospitals to them. When the

family member was sick, 95% of the respondents replied that the first priority to medication is to take her/him to clinics or hospitals. During the house-to-house visit, it was observed that rural households are attempting to practice the usage of toilets though their management was found poor except 3% of the respondents (Fig 4 & 5).



Fig.4. Poorly Managed Rural Toilet

(Photo: Chalachew Tarekegne)



Fig.5. Model Rural Toilet Built by a Farmer under Close Supervision of Researchers and Farmers' Visit

(Photo: Chalachew Tarekegne)

3.4 Food Sector: Cooking, Eating Habits and Nutrition

Cooking food is the responsibility of women. No man was found with cooking habit. It seems important to note that food consumption and nutrition are important aspects of food security which can serve as indicators of the level of food security. It also seems important to remind that food security is not only about obtaining sufficient food but also about obtaining food that does not conflict with local food habits which satisfies nutritional requirements. Nevertheless, the two requirements, that is, foods which are culturally acceptable and nutritionally adequate bifurcate in some cases in the studied locality.

The local staple food is “injera” dominantly made from teff and sorghum and rarely from maize and barely. It was served with sauces made with either with a mix of vetch (shuro) or potato and edible oils and in few households with meat and milk products on normal days except fasting days (Wednesday and Friday). It was discovered that vegetables are not considered as “real food” that satiates the stomach or are sources of getting balanced diet. Furthermore, it was investigated that because of the climatic shocks and stresses which are usually followed by production failure and food insecurity in the rural households, 95 % of them stated that they consume meat thrice per year; particularly, at new Ethiopian year, Christmas, and Easter. In the house-to-house visit, it was learnt that, “injera” is accompanied by, “wot” which is pottage made from potato or coarsely milled pulses such as peas, beans, lentils, betch (in Amharic kik) or it might be well grinded powder of them (in Amharic shuro duket); most frequently supplemented by edible oil and very rarely in 5% of the households with butter. It was found

that in some very poor male-headed households who used to migrate in search of job opportunities to maximize income and female-headed households, sometimes, the “injera” is used to being eaten dry or with pepper.

Based on the house-to-house observation, the diet in 5% of the rural households was to some extent more mixed in varieties. Hence, it seems reasonable to deduce that most rural households under the pressure of climate change are suffering a more nutritious deficient eating habit. In relation with this, children and pregnant women are expected to be the most vulnerable group. Few relatively better-off rural households got vegetables from small-scale irrigation and dairy products from their livestock. However, it was surveyed that these products has a comparatively better market value and will be sold if the house hold needs cash to cover domestic expenses or chemical fertilizer (Urea and DAP) price. Furthermore, the possession of domestic animals was not a guarantee to secure nutritional demands of the household since these animals were reserved as indemnity for shocks or stresses aggravated by climatic changes. As it was learnt from the respondents, the rate (frequency) of selling live stocks by smallholders was found to increase from June to September. This was mainly attributed to two essential rationales: Firstly, since the rain season starts in May/June, farmers wanted to buy chemical fertilizer by selling their livestock, and secondly, most farmers faced shortage of storage from June till September and wanted to buy cereals for household consumption. This implied that livestock did benefit rural households if they were not sold to get cash to cover household expenses or if there were no climatic changes or pressures imposing impacts on the rural households’ subsistence living (fig.6).



Fig.6. “Injera”, pepper, and boiled potato in the rural household’s diet
(Photo: Chalachew Tarekegne)

3.5. Economic Sector

3.5.1 Farm Income

Farmers own about 0.5 to 1.5 hectares of land. Almost 85% of the rural households' farm land which they did not own under arrangements of share-cropping equally and lump-sum payment contractual basis. The problem of fodder to feed their livestock was a challenge in the studied locality and farmers were obliged to crop-free their small plots of land for grazing purpose which is another cause for harvest and yield amount decline. Rural households were also requested to tell the long-term changes over time of the following crop harvests and yield amounts: potato, maize, barely, teff, wheat, beans and peace. 95% of them reported a decrease because of climatic shocks and stresses on the one hand and the

failure to afford the escalation of chemical fertilizer price on the other hand.

Significant numbers of (90%) rural households were found highly dependent on rain-fed agriculture in their locality; which was mostly, surrounded by problems of climatic shocks and stresses. For instance, this production year (November 2013), 90 % of wheat was destructed by torrential rainfall which was accompanied by hail stones. Not only wheat, but ripped and piled up bean harvest was damaged by the heavy rainfall and it was germinated which could not serve for food purpose later. On this ground, most of them believed that their yield amount will decline and forecasted the probability of food shortage in the household (fig 7).



Fig.7. Germinated Bean Harvest after Damage by Unseasonal Heavy Rainfall

(Photo: Chalachew Tarekegne)

Small- scale irrigation was practiced in limited number of households (6.67%) and attempts were made to maximize cash income by selling potato and onion. Almost 95% of smallholders have shown a willingness to engage in small-scale irrigation. Nevertheless, they claimed the shortage of river water around their small plots of land which is quite recently getting source of conflict among farmers themselves.

The number of animals possessed by rural people at present and ten years ago on average was found three and eight respectively. Accordingly, it was inspected that the benefits earned from animal products like that of milk and butter were evaporated from the memory of rural households of the locality. Yet, within these challenging circumstances, there were rural households whose experiences could be taken as a bench mark, especially, related to water harvesting and growing vegetables around the backyard of the dwelling. Unfortunately, the material was found expensive for rural households to afford. It was learnt that it cost around 8000 Ethiopian birr (fig 8).

3.5.2 Non-farm and off- farm Income

According to the FGD participants, climate change pressure in the locality was followed by migration of young boys and girls to nearby towns; particularly, to generate income and send back money to their parents. As it has been discussed while the house-to- house observation was held, the trend of migration from rural to urban areas is increasing alarmingly. Off-farm income generation was practiced in limited (10%) number of households. Seasonal agricultural labour migration to other parts of Amhara region like Meterma and neighbouring regions like Benshangul Gumuz and Oromiya was found common. According to case interview held with seasonal migrants, they made good money and bought heifer, oxen, horse, and build their house with corrugated sheets of iron. According to the FGD participants in Gusha Shinkurta locality, approximately out of 150 farmers, 20-30 farmers migrate to Metama, Humera or Jawi, mostly, in June and July and turn back to home in September/October. On average, it was learnt, they used to get from 3000-3500 birr in a single trip. It was explored that the time of migration, of course, varies

in its nature. If the migrant is going to the nearby towns, the seasons of migration cannot be predicted. He migrated when the need to cash arose. However, if the migrant is going to Metema and Humera, the time to migrate is in

line with the seasons of weeding and collecting. Moreover, the time lapse may take three, six, nine months. Or sometimes, it may go beyond one year.



Fig.8. Woman operating to get water around the backyard of the dwelling

(Photo: Chalachew Tarekegne)

Likewise, the shortage of income to cover household expenses was followed by other non-farm activities like involvement in petty-trading, pottery, weaving and carpentry. Yet, it seems reasonable to remind that the number of farmers involved in such kind of non-farm activities is very limited and only found in 3 households out of 30; who were involved in carpentry and sewing clothes. The other important observation in this study was that farmers were generating cash by selling charcoal. The paradox, however, is that preparing charcoal was heavily followed by deforestation and soil erosion. All in all, generating off-farm and non-farm incomes to shield themselves from prevailing effects of climate change was not practiced very well except few households.

3.5.3 Chemical fertilizer and Compost Preparation

From respondents point of view, chemical fertilizer (Urea and DAP) price increase is found the highest expense in the rural households life. It was found minimum of 1370 birr for the poor households and 6000 birr for relatively better off households. It was discovered that it is beyond their annual household income. Almost, 67 % of the farmers' expense is found between 3685 to

4000 birr per year. It was also discovered that heavy and unseasonal rainfall in the locality was followed by loss of crop harvest and increase rural households' seasonal migration to get employment so that the chemical fertilizer price taken by credit can be paid back. In such prevailing scenario; however, farmers' attempt to supplement their chemical fertilizer demand with compost was found poorly practiced. Smallholder households attributed their poor practice to compost preparation to two mainly essential justifications: shortage of input to prepare compost and a

sickness followed during its preparation; particularly, which they locally call the sickness of "mitch". They believed that "mitch" has killed their donkeys and made their families sick when they were carrying compost to the farm yard. In relation with "mitch", many of the rural households were found frustrated to prepare compost. Almost, 95% of the respondents felt that their capacity to buy chemical fertilizer is getting poorer and poorer because of their hand to mouth survival and heavy shocks and stresses followed by unpredictable rainfall. Respondents believed that they alternative strategies provided to them by developments agents (DAs) like compost preparation, crop rotation, and mulching, fallowing and increasing soil fertility with legumes were not addressing their grave problems. They felt that this is because of the small plot of land they possessed, shortage of firewood, increase population, and financial constraint to diversify or intensify their farming activity.

IV. CONCLUSION

Based on the study, it seems essential to conclude that climate change is affecting rural households in the studied locality. Its effect, in turn, is followed by high household expenditure which is difficult to afford by them. There is no storing for future demand and hand to mouth survival is the experiences of smallholder households. The energy consumption of the smallholder households is still dependent on fire wood collection which is usually followed by deforestation and soil loss. Depletion of assets and food insecurity at household level are followed by nutritional deficiency. Health problems associated with



cardio-respiratory systems, kidney, diabetes, malaria, waterborne diseases, and foot diseases which shows symptoms of itching were not uncommon. Smallholder households are feeling desperate for chemical fertilizer (Urea and DAP) price increase and lack of sustainable approaches to help them escape from it. The alternative strategies to meet their chemical fertilizer demand by preparing compost and other soil fertility increasing techniques were not registering significant changes in the context of shortage of land, increased population, and high firewood usage. The ramifications of climate change are shown further by high rural to urban migration which worsens urban problems like housing and unemployment. Potato which is dominantly produced in the locality is not preserved or stored well; or there is no any value chain system to increase its market value. Yet, it is found that farmers at this time are found extremely dependent on traditional local institutions to shield themselves from the unexpected shocks and stresses of climate change.

RECOMMENDATIONS

Capacitating rural households to mitigate and adapt climate change effects so as they can secure their well-being requires commitment from policy-makers, advisors and extension services providers on the one hand and farmers themselves on the other hand. There is a need to design, implement and communicate climate adaptation and mitigation strategies into local level through both the agricultural and health extension packages since the packages are silent of climate change and its effects at this time. Furthermore, there is a need to create synergy among different stakeholders and mobilizing them should be the prior responsibility of policy makers. There is a need to deploy experts who have conceptualized the consequences of climate change and can inculcate knowledge and skill into smallholder households. Similarly, smallholder households should be trained well and achieve attitudinal changes by increasing their competences. For this to happen, policy makers need to reach smallholder households through both formal and informal educations. The deployment of agricultural and health extension agents should be followed by close monitoring and evaluation of their performances. Farmers (smallholder households) should be taught and evaluated to practice well about storing, energy saving stoves, prevention of diseases, nutrition and balanced diet, crop/animal diversification and intensification to maximize their income and value chain approaches. In addition, they should be trained and judged about how they can increase soil fertility to reduce chemical fertilizer price through preparation of compost and avoiding related health risks with it, usage of legumes, alfalfa, fallowing, mulching, crop-rotation, inter-cropping, and circumventing free-grazing. Policy-makers need to solve farmers problems related to financial or credit accesses. Finally, the formal and informal educations provided by both agricultural and health extension agents should be reviewed by policy-makers to maximize farmers' resilience and adaptive capacity to climate change.

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REFERENCES

- [1] Adger, W Neil, Huq, Saleemul, Brown, Katrina, Conway, Declan, & Hulme, Mike. (2003).
- [2] Adaptation to climate change in the developing world. *Progress in development studies*, 3(3), 179-195.
- [3] Bank, World. (2006). World development report 2007: development and the next generation: World Bank.
- [4] Benhin, James KA. (2006). Climate change and South African agriculture: Impacts and adaptation options. Centre for Environmental Economics and Policy in Africa., Pretoria, South Africa.
- [5] Bot, Alexandra, & Benites, José. (2001). Conservation agriculture: case studies in Latin America and Africa: FAO.
- [6] Branca, Giacomo, McCarthy, Nancy, Lipper, Leslie, & Jolejole, Maria Christina. (2011).
- [7] Climate smart agriculture: a synthesis of empirical evidence of food security and mitigation benefits from improved cropland management. *Mitigation of Climate Change in Agriculture Series*, 3.
- [8] Bruinsma, Jelle. (2009). The resource outlook to 2050. Paper presented at the expert meeting on How to Feed the World in 2050.
- [9] Cline, William R. (2008). Global warming and agriculture: Impact estimates by country.
- [10] CSA. (2004). Welfare Monitoring Survey, Statistical Report Indicators on Living Standard, Accessibility, Household Assets, Food security and HIV/AIDS. Addis Ababa, Ethiopia.
- [11] Hassan, Rashid, & Nhemachena, Charles. (2008). Determinants of African farmers' strategies for adapting to climate change: Multinomial choice analysis. *African Journal of Agricultural and Resource Economics*, 2(1), 83-104.
- [12] Kandlikar, Milind, & Risbey, James. (2000). Agricultural impacts of climate change: if adaptation is the answer, what is the question? *Climatic Change*, 45(3), 529-539.
- [13] Keller, Marius. (2009). Climate Risks and Development Projects: Assessment Report for a Community-Level Project in Guduru, Oromiya, Ethiopia, Bread for All/HEKS.
- [14] Lobell, David B, Burke, Marshall B, Tebaldi, Claudia, Mastrandrea, Michael D, Falcon, Walter P, & Naylor, Rosamond L. (2008). Prioritizing climate change adaptation needs for food security in 2030. *Science*, 319(5863), 607-610.
- [15] Mann, Wendy; Leslie Lipper; Timm Tennigkeit; Nancy Maccarthy; and Giacomo Branca. (2009).
- [16] Food Security and Agricultural Mitigation in Developing Countries: Options for Capturing Synergies (pp. 1-80). Rome: FAO.
- [17] Mano, Reneth, & Nhemachena, Charles. (2007). Assessment of the economic impacts of climate change on agriculture in Zimbabwe: A Ricardian approach: World Bank, Development Research Group, Sustainable Rural and Urban Development Team.
- [18] Metz, Bert. (2007). Climate Change 2007-Mitigation of Climate Change: Working Group III Contribution to the Fourth Assessment Report of the IPCC (Vol. 4): Cambridge University Press.



- [19] NAPA. (2007). Climate Change National Adaptation Program of Action (NAPA) of Ethiopia.
- [20] Report of the Federal Democratic Republic of Ethiopia, Ministry of Water Resources and National Meteorological Services Agency: Addis Ababa, Ethiopia.
- [21] Ravallion, Martin, & Chen, Shaohua. (2007). China's (uneven) progress against poverty. *Journal of development economics*, 82(1), 1-42.
- [22] Schmidhuber, Josef, & Tubiello, Francesco N. (2007). Global food security under climate change. *Proceedings of the National Academy of Sciences*, 104(50), 19703-19708.
- [23] Seo, Sungno Niggol, & Mendelsohn, Robert. (2007). Climate change impacts on animal husbandry in Africa: a Ricardian analysis.
- [24] Teddlie, C., & Yu, F. (2007). Mixed methods sampling a typology with examples. *Journal of mixed methods research*, 1(1), 77-100.