Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.9, No.3, 2018

Title-Rural Female Headed Households´ Perception and Adaptation to Climate Variability in the Amhara Region, Ethiopia

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Abstract
This study investigated female headed households´ (FHHs) perception and adaptation to climate variability in the selected areas of the Amhara region. Descriptive statistics and multi-nominal logit model were employed to analyze the collected data. It was found that the major climatic related hazards experienced in the area were drought (40.8%), followed by crop pest and disease (23.7%), hailstorm (20%) and livestock epidemic (15.5%). In response to this, FHHs (71%) used diversification of income, soil and water conservation (10%) and seasonal migration (8%) as an adaptation strategy while 11% of the respondents did not take any measures due to limited right to access and control over land, socio-cultural barriers, limited access to credit and extension services. The Multinomial logit model shows that age, family size, farm size, land ownership, access to climate information positively and significantly correlated with FHHs' choice of various adaptation strategies.
Keywords: adaptation, perception, determinants, female headed households

1. INTRODUCTION

In Ethiopia rain fed agriculture, which is the foundation of the national economy and constitutes the primary source of livelihood for the overwhelming majority of the population. main stay of the population, is one of the most vulnerable sectors to the impacts of climate change and variability (USAID 2007; Dorosh *et al.* 2011; NAPA 2007). Drought occurs anywhere in the world but its damage is not as severe as in Africa in general and in Ethiopia in particular, which has been major causes of the country's food shortage and famine, human sufferings, deaths and migrations (NAPA 2007; NMSA 2007). The *Amhara* region is not an exception in this regard, where crop-pest, livestock epidemic, hailstorm, drought, and flood are the most frequently occurring climate related hazards (Misganaw *et al.* 2014). In response to this, farmers used various adaptation measures. However, the limited right to access and control over productive resources, socio-cultural practices and other factors made female headed households more vulnerable to the effects of climate change and unable to respond to its effects. In spite of this, however, there is no study conducted so far in Ethiopia in general and in the region in particular on FHHs perception and adaptation strategies to climate variability, in which this article tries to fill this gab.

Methods of research

Considering the frequent and periodic prevalence of climate variability, purposive sampling procedure was used to select the three *woredas* (*Awabal, Lay Gaint* and *Meket*) of the Amhara region. Out of the total *kebeles* (smallest administrative unit) of the *woredas*, six *kebeles* were randomly selected. Consequently, the sample size for the FHHs was determined. Probability random sampling procedure was employed to obtain the required number of respondents because of the difficulty to get proportionally equal number of FHHs in each target *kebeles*. To undertake this research, key informant interview, focus group discussion (FGD) and household survey were used to collect data from the local communities such as the elderly, FHHS (married, divorced, widowed, single) of different ages, *woreda* and *kebele* agricultural extension workers and government authorities at *kebele* and *woreda* levels. In order to substantiate the data, secondary sources were referred through reviewing reports from various government offices in the district, and reviewing relevant published/un-published sources. For the analysis of qualitative data information from the individual interviews were written as quotations to comprehensively understand differences on perception among FHHS. Finally, the data were subsequently analyzed using documentations, descriptions, interpretations and comparisons. For the quantitative data analysis,

descriptive and inferential statistics were used. Demographic, socio-economic characteristics, perception and adaptation strategies of FHHs were analyzed descriptively. Frequency distribution and percentages were used to describe and report the findings and are presented in tables, graphs and charts. Multinomial logit model was also employed to analyze the determinant factors which influences FHHs' choice of adaptation. In this study, the dependent variable is adaptation, which has more than two outcomes such as diversification of income, soil and water conservation (SWC) and livestock diversification.

Results and Discussion

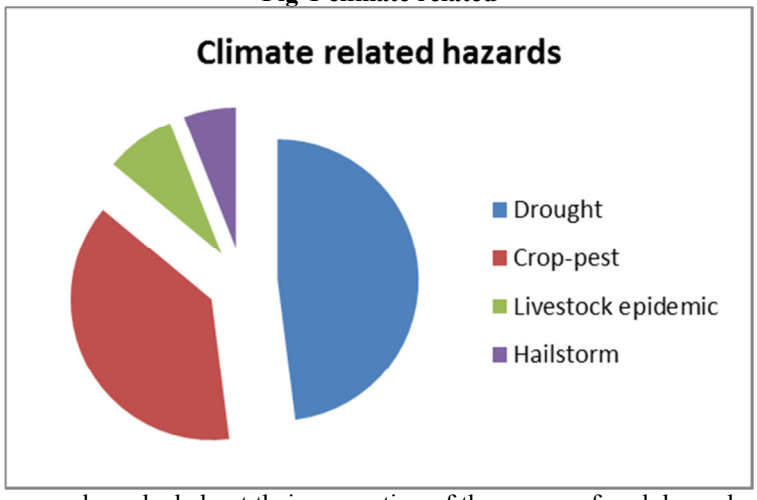
Based on the results obtained from household survey and qualitative information, this section briefly presents female headed households' socio-economic and demographic characteristics, perception, adaptation strategies and the determinant factors which influences FHHs decision of choosing adaptation strategies. The descriptive statistics shows that 80% of the respondents were illiterate and the main economic activity practiced by the respondents was agriculture. Though 72% of the respondents have their own land, their farm size was estimated to be 0.75 ha. In addition to farming, FHHs practice petty trading such as selling of local drinks, firewood, and charcoal, as sources of income. Such diversification of income is complemented by the availability of credit services. Thus, 56% of the respondents have got this service to make their life better.

Perception to climate variability

Understanding the perception of FHHs to climate variability influences their decision to adapt. The descriptive statistics shows that 62% of the respondents perceived variability in the amount of rainfall, its timing and distribution while the rest 21% perceived an increasing trend. The rest did not observe any changes. Similar to this, studies undertaken in different parts of Ethiopia (Misganaw *et al.* 2014; Deressa *et al.* 2009) noted that farmers have a clear understanding of the changing climate. Loss of livestock and crop (28%), increased frequency of drought and flood (23%), shortening of growing period (18%), erratic rainfall (20%) and scarcity of water (11%) were reported to be indicators of rainfall variability over the past years. This was substantiated by Temesgen *et al.* (2009) who reported such indicators of rainfall variability in the Nile Basin of Ethiopia. 65% of the respondents in all *kebeles* observed that the pattern of the temperature has changed and shown an increasing trend in intensity over the last some years.

The emergence of human and livestock epidemic (30%), the outbreak of crop pests and disease (29%), increasing hot days (21%) and drying of rivers and streams (20%) are reported to be some of changes resulted from an increasing temperature over some years. The result obtained from the household survey is also in agreement with the report of the National Meteorological Service Agency which shows a trend of increasing and decreasing temperature and rainfall in the study area. Similarly, (Bendicta *et al.* 2010; Misganaw *et al.* 2014; Yibekal *et al.* 2013) reported such changes in Ethiopia. On the other hand, despite differences in education, age, and social roles FHHs perceived the emergence of major climate related hazards such as drought (48%) as the most frequently and periodically occurring climate related hazards in the area followed by crop-pest (38%), livestock epidemic (8%) and hailstorm (6%). Such changes is reported to affect their livelihoods. The study of Temesgen *et al.* (2009) revealed that the frequency and spatial coverage of the hazards are increasing at an alarming rate, the already existing hazards are intensifying and new types of human, livestock and crop diseases are emerging with damaging effects on livelihoods.

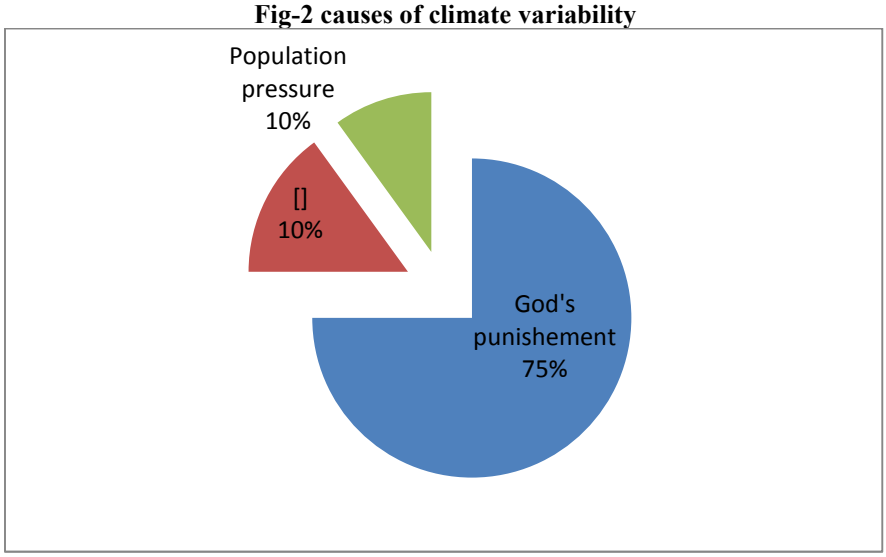
Fig-1 climate related



The respondents were also asked about their perception of the causes of such hazards. Accordingly, 75% of the respondents attributed climate variability as 'God's punishment' to sins people have been committing. This

result is in agreement with the findings of Farauta *et al.* (2011) who noted that community disobeying of God was ranked the third major causes of climate variability. Few households' (20%) also mentioned deforestation and population pressure as the underlying causes of climate variability, while the rest did not trace any cause. Global Water Initiative (2014) in the Amhara region reported that the cause for the increase in temperature, with a rise in crop pests and disease was the increasing dependence and destruction of natural resources. With the growth of population and decline in livelihood resources and assets, more and more households were resorting to plowing marginal lands and terraces.

Fig-2 causes of climate variability

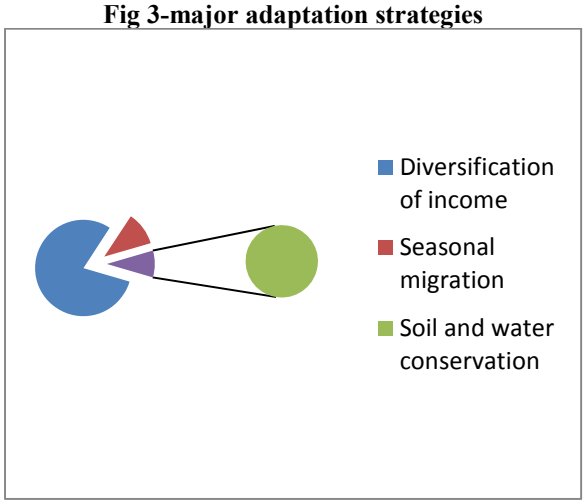


Such climate related hazards, according to the informants, has seriously affected agricultural production, loss of livelihood assets, food scarcity, livestock death, dependency syndrome on food aid, displacement and migration and increases conflict over the remaining natural resources. The assessment report of Global Water Initiative (2014) in the Amhara region also noted that climate induced hazards have caused increased vulnerability to poverty, food insecurity and loss of productive assets which further aggravated by poor infrastructure, services and market access as well as lack of responsive early warning system.

Adaptation to climate variability

The study of (Nabikolo *et al.* 2012) conducted in Eastern Uganda noted that FHHs were less likely to adapt to climate change compared to their male counterparts. FHHs limited access to land and other resources, according to (Tenge *et al.* (2004 as cited in Nabikolo *et al.* 2012), negatively affected female headed households' role in using adaptation strategies. However, the study of Nhemachena and Hassen (2008) conducted in the Nile Basin of Ethiopia put a contrary finding that FHHs were more likely to adapt. From such arguments, one can understand that the influence of gender on adaptation varies spatially and socio-cultural settings. In the study area, the descriptive statistics shows that 89% and 11% of the respondents employed at least one adaptation strategies and no adaptation at all, respectively. Resource constraints such as land, credit access, limited extension services, limited climate related information, limited farm inputs, too much burden of household responsibility and shortage of labor as the cause for failing to adapt. From those adaptation strategies, 71% of the respondents identified diversification of income sources such as working in public work in exchange for in kind or cash, petty trading (selling of local drinks, firewood, charcoal and working as a daily laborer) were the dominant and most frequently strategies pursued by FHHs. Seasonal migration (10%) and soil and water conservation (8%) were ranked as the second and third most important strategies to their livelihood and agricultural activities. Such types of adaptation measures were also identified by numerous researchers (Belaineh *et al.* 2004; Woldeamlak and Dawit 2011; Guto *et al.* 2012).

Fig 3-major adaptation strategies



Determinants of adaptation strategies

Table 2 indicates the explanatory variables that are hypothesized to affect the dependent variable as; age, land ownership, family size, farm size, access to climate information and access to credit service.

Results of Multinomial Logit Model

DIVERSIFICATION OF INCOME			SEASONAL MIGRATION			WATER AND SOIL CONSERVATION			
VARIABLES	**B**	**Sig**	**Exp (B)**	**B**	**Sig**	**Exp(B)**	**B**	**Sig**	**Exp(B)**
AGE	-0.027	0.052	1.027	0.009	0.846	1.010	-0.125	0.096*	0.882
FAMSIZE	0.139	0.042**	1.150	0.501	0.011**	1.650	0.145	0.068*	0.865
LANDOWN	-3.140	0.082*	23.102	2.501	0.133	12.195	2.463	0.021**	11.734
FARMSIZE	-2.921	0.033**	18.551	3.368	0.524	29.031	3.155	0.048**	23.461
EXT-SER	-2.060	0.238	0.128	-0.021	0.099	.979	0.423	0.083*	0.655
CREDIT-AC	1.778	0.012**	5.917	1.789	0.190	5.982	0.744	0.045**	2.104
CONS	-6.739	0 .074		9.968	0.031		-0.410	0.937	

Table-2 *, **, *** indicates levels of significance at 10, 5 and 1 % respectively, dependent variable-adaptation; reference category: no adaptation

Age of the female headed household (AGE)

The results of the MNL model shows that age of the household was found to be negatively and significantly correlated with diversification of income and SWC at p < 10. In this case, a one-unit increase in the age of the household decreases the probability of such adaptation strategies by 1%, and 0.8%, respectively. Older FHHs are less likely to involve in diversification of income and SWC due to low physical capacity exacerbated by high burden at household including taking care of children, feeding the family, fetching water, collecting fuel wood and so on. Thus, younger households' are active and energized than older households'. This finding is in agreement with Madison (2006) who noted that older households are less likely to use some adaptation strategies compared with younger ones.

Family size (FAMSIZE)

The MNL model shows that family size is positively and significantly correlated with FHHs decision to take diversification of income, seasonal migration and SWC strategy at p <5, and p<10, respectively. A one person increase in the family can increase the probability of using the above three major adaptation strategies by 1%, 1% and 0.8%, respectively, relative to the reference category. Thus, the larger the family size, the higher the probability of pursuing various adaptation options in the face of climate variability. This argument is repeatedly raised in the studies (Deressa *et al.* 2009; Fatuase and Ajibefun 2013; Menberu and Yohannes 2014) noted that family size is associated with higher labor endowment which would enable a household to accomplish various agricultural activities.

Land ownership (LANDOWN)

As it is clearly indicated in the table, land ownership is negatively but significantly correlated with diversification of income at p value < 10. A one-unit increase in the ownership of land decreases the probability of using diversification of income by 23%. On the other hand, it has shown positive and significant correlation with SWC at p value <0.05. A one-unit increase in land ownership more likely increases the probability of SWC

by 11%, since such activity requires land.

Farm size (FARMSIZE)
The results of this study reveals that farm size has negative but significant correlation with diversification of income at p value <0.05. Despite farmland ownership, the socio-cultural practices against women's plouging forced them to participate in a share cropping arrangement, in which the adaptation process of FHHs might be affected. In such arrangements women have limited bargaining power and no voice to decide the type of crops to be planted, and the fertilizers to be used which eventually led to low income and forced them to look into another sources of income. Such norms and traditions brought a division of labor between male and female in that farming knowledge and skills (productive activities) as male's domain and reproductive activities and entirely as female's domain (Azeb and Frank 2016). Such division of labor prohibited women to practice on diversification of income. A study conducted in Ethiopia by (Azeb and Frank 2016) noted that "the power imbalance in sharecropping arrangements makes on-farm adaptation almost unattainable for women household heads since the right to decide on types of crop, timing and farming management is taken away from them. On the contrary, it creates opportunity for men to rent land, diversify their adaptation and get additional income." The more households' have larger farms, the more they tend to work more intensively on their land instead of going for another alternative to adapt to climate variability. On the other hand, farm size positively and significantly correlated with SWC at p value <10. A one-unit increase in the households' farm size increases the probability of using SWC as an adaptation strategy by 23%, respectively. A study (Misganaw *et al.* 2014) in the Amhara region noted that an increase in one hectare per household would increase the probability of using land related adaptation strategies and are more likely to diversify their crops especially under dry seasons. FAO (2005) also indicate that though women often have indigenous knowledge to various adaptation strategies, however, because men have more secure access to land, they have more incentive to contribute to effective natural resources management.

Access to extension services (EXT-SER)
Access to extension services showed both positive and significant correlation with SWC at p value <10. On the other hand, neither diversification of income nor seasonal migration was found to be correlated with access to extension services. The descriptive statistics also shows that 70% of FHHs did not get advisory services from government agricultural extension workers on how to diversify their income such as petty trading and seasonal migration. However, the importance of providing climate related information for the farmers is mentioned (Maddison 2007; Guto *et al.* 2012; Nhemachena and Hassan 2007). Azeb and Frank (2016) witnessed that while male reported their day to day experiences of contacting agricultural extension workers in their on-farm adaptation, the majority of women were ignored in the process of providing extension services on technical support on farm-land management, and the provision of farming inputs and livestock health services. The only extension service given to women was training mainly on reproductive and community roles (child nutrition, sanitation and hygiene, family planning and compost and biogas).

Access to credit services (CREDIT-AC)
Credit service has appeared to be positively and significantly correlated with diversification of income and SWC at p<0.05. A one-unit increase in accessing credit services increases the probability of FHHs to employ such adaptation strategies by 5% and 2%, respectively. When they access credit services, they are likely to more engaged in diversification of income and protecting their land from erosion and the like.

CONCLUSION
Despite differences in sex, however, there are no significant differences in perceptions and varying insights among rural households' observing climate variability over the last decades. Flooding, hailstorm, crop-pest, livestock epidemic and drought were identified to be the most frequently occurring climate related hazards. Farmers' who perceived fluctuations in climate pursued at least one adaptation measures compared with households' who do not perceive any variability. Diversification of income, seasonal migration and soil and water conservation were the three most frequently used adaptation measures used by FHHs. Some of the constraints for effective adaptation were shortage of agricultural input, scarcity of land, limited access to market, scarcity of water and socio-cultural practices against women.

Recommendation
Policies and programs should be designed to reduce vulnerabilities through;
- ✓ Increasing FHHs awareness on the potential impacts on agricultural production
- ✓ Providing reliable, on time and up to-to-date climate and weather forecast information to reduce the risks of climate variability.

- ✓ Improving or upgrading indigenous knowledge in relation with weather forecast and adaptation options
- ✓ Promoting less-costly adaptation options, which requires less labor and recognizes vulnerable groups
- ✓ Provision of credit with low interest rate
- ✓ Provision of agricultural inputs such as improved seeds, modern fertilizer and drought resistant crops
- ✓ Creating better access to markets and transportation facilities.

Competing interests

"The author and the co-authors declare that they have no competing interests."

Acknowledgment

We would like to thank Bahir Dar University for funding this research. We are also highly grateful for the hospitality of the informants in the study area.

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