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Farmers' Perception on Climate Change and their Adaptation Strategies in Assosa Zone of Benishangul Gumuz Regional State, Ethiopia

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ABSTRACT

Climate change is one of the greatest environmental, social, economic threats to humankind. However, developing countries are the most adversely affected by the impacts of climate-induced events because of their low levels of adaptation. This study assessed farmers' perception of climate change, their adaptation strategies, and the factors that influence their perceptions to climate change. The study was conducted in the four districts of Assosa zone of Benishangul Reginal state. It relied on qualitative and quantitative methods of data collection. The primary data were collected using a household survey, focus group discussions (FGDs), field observation, and key informant interview (KII). Two-stage sampling techniques were applied for household surveying and data were analyzed using SPSS and Microsoft Excel. Major adaptation strategies identified in the study area include; crop diversification, use of fertilizer and pesticides, growing shortly seasoned/early maturing crops variety, and traditional small-scale irrigation. Regardless of the use of the adaption mechanisms by smallholder farmers in the study area; shortage of farm inputs, absence of modern climate forecasting techniques, use of inflexible cropping calendar, and inadequate choice of crop varieties has limited their adaptive capacity. Hence, the study recommends the use of climate forecasting technologies, adjusting planting dates along with the onset of the rainy season, developing drought and diseases resistant crop varieties, and encouraging farmers to use efficient irrigation technologies to be prioritized by policymakers and pertinent stakeholder to make smallholder farmers resilient to climate change in the study area.

Keywords: *Climate Change, Hazards, Adaptation Mechanism, Farmer's perception.*

INTRODUCTION

Climate change is already happening and negatively impacting development progress and the situation will continue to undermine the socio-economic wellbeing of the people [23]. According to [18], rain-fed agriculture is among the sector that is the most sensitive to climate change and consequently, smallholder farmers are highly vulnerable to the impact of climate change. Unless appropriate steps are taken to build resilience, climate change will reduce GDP growth by up to 10% by 2045 [49].

Climate change and agriculture are interrelated processes [44]. Due to its sensitivity, any change in the climate can have significant alterations in the crop yield [32, 33]. In developing countries, 11% of the arable land could be affected due to climate change and there will be a reduction in cereal production [19]. Climate extreme events such as drought and extreme heat (heat waves), especially in the growing season, might lead to the decline of above-ground biomass, the disappearance of palatable grass species, and further loss of nutrients. It will lead to a serious reduction in the availability of forage [27].

There are many types of research conducted regarding climate change and adaptation strategies in Ethiopia; some of which include: Falco [20] studied perception and adaptation process in the Nile Basin of Ethiopia. They were able to identify factors that affect perception, adaptation decisions, and also identified the main barriers to adaptation. Bryan [8] compared the adaptation process in Ethiopia with other African countries. However, the adaptation strategy of farmers to climate change and variability in eastern Ethiopia. Moreover, the process of adaptation to climate change by smallholder farmers in the east Hararghe zone of Oromia. These studies are limited to some parts of the country and findings of the aforementioned researches showed the existence of significant variation on climate vulnerability level and adaptive strategies used in the perspective of different agro-ecology and socio-economic practices of a given area[14]. Hence, the study was conducted to respond to the existing gaps through assessing climate change-induced hazards and adaption strategies of smallholder farmers in the context of the Bullen district ecological setting. The findings of the study can help policymakers and other interested parties to better understand the impacts of climate change and adaptive strategies that have been used in the local context and consequently help to design appropriate adaptive mechanisms that enable farmers to resilient to climate change hazards.

MATERIAL AND METHODS

This study followed mixed research approach to collect both quantitative and qualitative data. The mixed approach is preferred over others due to its merits to cross-validate the findings within a single study as the research under consideration is required to be examined from various angles. In addition, the study employed diverse data collection instruments that enabled the research in capturing data related to climate change vulnerability and adaptive strategies of smallholder farmers. The FGDs were formed by having both male and female participants that comprise different levels of age and economic groups.

Concerning data types and sources, the researcher used both primary and secondary sources. The primary sources for this were the household heads dwelling in the study area, from key informants of the kebele residences, woreda environmental protection and land administration office, health office, and agricultural office experts as well as from DAs.

The population for this study was household heads of smallholder farmers living in the sampled districts and the samples were determined by using [44].

Table 1: Sample size

Sampled Districts	Sample Size	Percentage (%)
Assosa	28	20
Bambasi	26	18
Homosha	40	28
Kurmuk	48	34
Total Sample Size	**142**	**100**

As was described in table 1 above, a total sample size of 142 households was interviewed and all of the targeted respondents (100%) responded to the interview during the household survey.

Data analysis

Both collected qualitative and quantitative data were analyzed through different techniques. Data collected from FGDs were immediately summarized by discussing with enumerators. Outstanding and prominent issues were screened by checking how many of the speakers and which category of households have reiterated the same issue in the process of the discussion. Both diverging and converging issues on particular aspects were identified and used for analysis, in the context of the specific research objectives. The other qualitative and quantitative data were analyzed by using descriptive statistical tools such as t-test and chi-square and frequency by using SPSS version 21 and excel sheet; whereas the results of the study were presented in tabular and figurative forms.

RESULTS AND DISCUSSION

Households characteristics of respondents

As it is described in Table 2 below, about 43 (30.3%) and 99 (69.7%) of sampled respondents were female and male, respectively. Similarly, results of the household survey revealed that 8 (5.6%), 128 (90.1%), and 6 (4.2%) of an interviewed households were single, married, and Divorced, respectively. Regarding religious affiliation of the study area, survey results showed that 81 (57%) were Muslim, about 31 (21.9%) were followers of the Christian and 30 (21.1%) of respondents were others (Table 2).

Similarly, results of the household survey regarding

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the educational status of respondents were presented in Table 2, and findings of the study revealed that 41 (28.9%) percent of respondents were illiterate and can't read and write. Those who can read and write constitute 95 (66.9%) percent and about 6 (4.2%) percent of respondents attained primary and secondary education. From this finding, we can understand that majority of respondents didn't attend formal education.

As it can be also a sense problem in Table 2, the majority of sampled respondents (59.6%) were aged below 65 years old. From this result, we can understand that more than half of the population in the study area is economically active age groups.

Table 2: Characteristics of Respondents' Sex, Marital Status, Religion, and Educational Status

	Particulars	Frequency	Percent
Sex	Female	43	30.3
	Male	99	69.7
	Total	142	100.0
Marital Status	Single	8	5.6
	Married	128	90.1
	Divorced	6	4.2
	Total	142	100.0
Religion	Muslim	81	57.0
	Christian	31	21.9
	Others	30	21.1
	Total	142	100.0
Educational Status	Illiterate	41	28.9
	Read and Write	95	66.9
	Primary and Secondary	6	4.2
	Total	142	100.0
Age of Respondent	25-35 Years	18	12.7
	36-65 Years	68	47.9
	>65 Years	56	39.4
	Total	142	100
Family Size of Respondents	Small (1-2)	27	19.0
	Medium (3-5)	83	58.5
	Large (>5)	32	22.5
	Total	142	100

Source: own construction (2020)

Regarding family size, results of the household survey revealed that 19%, 58.5%, and 22.5 of respondents have 1-2 (small family size), 3-5 (medium family size), and >5 (large family size), numbers of families. According to the information obtained from FGDs and KII, the occurrence of a long dry season accompanied by erratic and variable rainfall distribution leads to the lesser occurrence and availability of pasture for animal feed put great pressure upon the existence of animal grazing and ecosystem distraction. To cope with the unavailability of animal feed, local communities in the study area often utilize sedentary livestock management. The mean monthly temperature is about 21.7°C and the highest mean monthly temperature record is about 31.6°C which occurs during February, March, and April [40, 41]. According to the information obtained from FGDs, the onset and duration of rainfall, as well as rainfall intensity and annual quantity vary considerably inter-annually.

This study also made a household survey to compare the current weather conditions with that of 30 years back and the results of the survey showed that all of the respondents (100%) have perceived the existence of drastic differences in climatic conditions over these years. As can be seen in Table 4; the majority (92%) percent of respondents have indicated that the total rainfall amount has decreased, the rainfall pattern has become irregular and the temperature has increased. A significant number of households confirmed that early onset of rainfall, late onset of rainfall, and early cessation of rainfall have become evident features of climate change and this situation has been affecting crop production in the study area. On the other hand, all of the respondents replied that; poor distribution of rainfall, increase in temperature, high runoff, and soil erosion has become frequently observed in the study area.

According to the information obtained from FGDS and household surveying, extension workers, radio, and tradition knowledge/ from elders, respectively were sequentially ranked as the key sources of climate information in the study area.

As it was shown in Table 6, about 92 percent of respondents perceived that the total rainfall amount has been decreased. This perception was similarly shared by the discussants of FGDs. They also revealed that rain that used to come during planting season was becoming more erratic and whenever it came it was often in heavy bursts and caused high runoff and soil erosion with very little infiltration. As it was illustrated in Table 6, all (100%) of respondents in the study area perceived that there is an increase in temperature over the last three decades years.

Major Climate-Induced Hazards Identified in the Study Area

As it was described in Table 7, focus group discussions

Table 3: Past and Current Onset and Offset of Rainy Seasons in the Study Area

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Past time/ 30 years ago,	Shorter Dry season			Long rainy season							Shorter Dry season	
Current	Longer dry season					Shorter rainy season				Longer dry season		

Source: Own construction, 2020

Table 4: Respondents' Perceptions of Climate Change Indicators

Indicators of Climate Change	Yes Response		No Response	
	Frequency	Percentage	Frequency	Percentage
Total rainfall amount has increased	11	8	131	92
Total rainfall amount has decreased	130	92	12	8.5
Total rainfall amount is the same	0	0	142	100
Early onset of rainfall	112	79	30	21
Late onset of rainfall	120	85	22	15
Early cessation of rainfall	112	79	30	21
Poor distribution of rainfall	142	100	0	0
High runoff and soil erosion	142	100	0	0
Temperature has increased	142	100	0	0
Temperature has decreased	0	0	142	100

Source: Own construction (2020)

Table 5: Pair Wise Ranking for Major Climate-Induced Hazards in the Study Area

No.	Major Climate-Induced Hazards	1	2	3	4	5	6	7	8	9	10	Score/ Point	Severity Rank
1	Erratic Rainfall		1	1	1	1	1	1	1	1	1	18	1
2	Disease (animal, crop, human) and Weed and pest infestation	1		2	2	2	2	2	2	2	2	16	2
3	Hailstone and Strong Wind	1	2		3	3	3	3	3	3	3	14	3
4	Land degradation & Soil Erosion/high runoff	1	2	3		4	4	4	4	4	4	12	4
5	Late on Set of Rainy Season	1	2	3	4		5	5	5	5	5	10	5
6	Shortening Rainy Season	1	2	3	4	5		6	6	6	6	8	6
7	Non-Seasonal Rainfall	1	2	3	4	5	6		7	7	7	6	7
8	Rainfall Variability	1	2	3	4	5	6	7		8	8	4	8
9	Incidence of Drought	1	2	3	4	5	6	7	8		9	2	9

Source: Own construction, 2020

were made with the representatives of households in the selected kebeles and about ten major climate-induced hazards were identified along with their respective rank of severity. Results of pairwise ranking made by FGDs in Table 5, describes that the severity of increased incidence of erratic rainfall, disease (animal, crop, human) and weed and pest infestation, and hailstone accompanied by strong wind ranked first to the third rank among the major climate-induced hazards that occur in the study area whereas (Table 5).

As it was described in Table 8, respondents were presented to make scoring and ranking on the severity of major climate-induced hazards identified during household surveying and results of the survey revealed that both male and female respondents ranked increased incidence of erratic rainfall, disease (animal, crop, human) and Weed and pest infestation, and hailstone accompanied by strong wind as the three leading climates induced hazard and characterized it as the most severe and disastrous in the study area. On the other hand, increased incidence of non-seasonal rainfall took the next rank by female respondents whereas; high runoff/soil erosion and land degradation took the

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Table 7: Climate-Induced Hazard Scoring and Ranking by Respondents in the Study Area

No.	Major Climate-Induced Hazards	Male Respondents		Female Respondents	
		Score	Severity Rank	Score	Severity Rank
1	Erratic Rainfall	20	1	10	1
2	Disease (animal, crop, human) and Weed and pest infestation	16	2	8	2
3	Hailstone and Strong Wind	15	3	7	3
4	Land degradation & Soil Erosion/ high runoff	12	4	5	5
5	Late on Set of Rainy Season	10	5	4	6
6	Shortening Rainy Season	9	6	2	7
7	Non-Seasonal Rainfall	7	7	6	4
8	Rainfall Variability	6	8	1	8
9	Incidence of Drought	4	9	0	9

Source: Own construction (2020)

Table 8: Climate-Induced Hazards and its Respective Impacts as identified by FGDs & KII

Climate-Induced Hazards	Impacts
Erratic rainfall, Late-onset, Rainfall variability, Non-seasonal rain rainfall, and Shortening of the growing season	-Over-Lapping Of Sowing Time -Changing Of Crop Growing Calendar -Favoring Of Crop Pest Incidence/Eruption/Outbreak -Decreased Long-Period Growing Crops -Decreased Human Labor Productivity -Formation Of Stagnant Water That Favors Vector Breeding
Disease (animal, crop, and human) and weed and pest infestation	-Weeds Like “Striga” Competes With Crops Like Sorghum And Maize Causing Loss Of Productivity And In Some Cases Complete Damage -Crop Failure Due To Invasive Worms That Damage Teff And Sorghum -Decreased Livestock Prices Due To Weight Loss - Weight Loss And Draft Power -Death Of Livestock - Increased Human Diseases -Decreased Human Labor Productivity -Financial Limitation To Buy Pesticides
The occurrence of Hailstone and Strong Wind	- Destruction Of House, Road, And Crop Damage -Decrease In Productivity -Damage Of Fruit Trees Like Mango, Banana, Etc -Value Loss Of Social Assets
High run off/soil erosion and land degradation	-Destruction/Damage Of House And Road -Decreased Percolation Due To High Run-Off -Decreased Ground Water Table Because Of Less Infiltration -Loss Of Soil Fertility And Low Crop Production / Productivity
Incidence of Drought	- Poor Harvest -Crop Failure And Food Insecurity -Decreased Productivity Of Livestock And Crop -Decreased Water Availability For Domestic Use And Animals -Insufficient Pasture/Decreased Pasture -Decreased Livestock Prices Due To Weight Loss - Decreased Draft Power Due To Weight Loss -Livestock Mortality -School Dropout - Rural-To-Urban Migration

Source: Own construction (2020)

Table 9: Pairwise ranking for existing adaptation mechanisms used in the study area

No.	Adaptation Mechanisms Used	1	2	3	4	5	6	7	8	9	10	Score/ Point	Rank
1	Crop Diversification		1	1	1	1	1	1	1	1	1	18	1
2	Use of Fertilizer and Pesticides	1		2	2	2	2	2	2	2	2	16	2
3	Growing Short Seasoned Crops /Replanting Early Maturing Crop Varieties	1	2		3	3	3	3	3	3	3	14	3
4	Animal Vaccination	1	2	3		4	4	4	4	4	4	12	4
5	Small Scale Irrigation/Traditional	1	2	3	4		5	5	5	5	5	10	5
6	Use of Improved Seeds	1	2	3	4	5		6	6	6	6	6	6
7	Use of Crop Residue for Animal Feed	1	2	3	4	5	6		7	8	8	4	7
8	Soil and Water Conservation	1	2	3	4	5	6	7		8	9	2	8
9	Use of Compost/ Organic Fertilizer	1	2	3	4	5	6	7	8		9	1	9
10	Alluvial Traditional Gold Mining	1	2	3	4	5	6	7	8	9	10	0	10

Source: Own construction (2020)

next rank by male respondents (Table 8). From this finding, it is possible to understand that male and female smallholder farmers do not perceive all types of climate-induced hazards to an equal degree of severity. In Table 8, it was also possible to visualize that climate-induced hazard rank made by the male respondent and that of FGDs were more or less the same.

Perceived Impacts of Climate-Induced Hazards

Based on information obtained from FGDs and KII, major types of climate-induced hazards and their respective impacts on the livelihood of smallholder farmers in the study area were summarized in (Table 8).

Erratic rainfall: Shortening of rainfall as a result of increased dry spells day prevents grass growth and propagation which is significant for livestock resources of the community in the study area. This can also result in decreased crop productivity, overlapping of sowing time, changing of crop growing time of the year, favoring of crop pest emergence and gregarious worms infestation, decreased long-period maturing crops, increased breeding environment for insects causing vector-borne disease, and decreased human labor productivity.

Diseases and pest outbreak: Occurrence of strange or uncommon crop disease (locally called "adireq") and infestation pests and gregarious worms, American ball worm, that damage sorghum, maize, teff, and niger seed were reported by FGDs and KII and this was attributed to a change of weather pattern as well as increased water stress. Human diseases such as malaria and diarrhea have also been reported as increasing in the study area, especially amongst children, during warmer months and drought years as a result of milk scarcity, malnutrition, and lower disease resistance. This finding concedes with the findings of Agrawala *et al* (2003) which says that climate change is expected to affect both pathogen and vector habitat suitability through changes in temperature, precipitation, humidity, and wind patterns and also drought is likely to have further negative impacts on animal and human health and disease resistance (IPCC, 2013).

Hailstone Accompanied by Strong Wind: According to discussants of FGDs and KII, the occurrence of hailstone accompanied by the strong wind made the destruction of house and road, absolute damage of crop, and fruit trees in the study area. This leads to food insecurity.

High runoff and soil erosion: According to the discussants of FGDs, high runoff and soil erosion affect crop production in the study area through washing away soil fertility and destruction of crops and then reduction in yield or crop failure. In recent days heavy rainfall has been accelerated soil erosion and land degradation and then reduced soil fertility. According to FGDs, it was difficult to expect crop production/yield in the absence of fertilizer particularly in the settlement areas of the study area.

Shortening of the growing season: Focus group discussants have reported that smallholder farmers in the study area have been experiencing unpredictable and unreliable onset and retreat of rains and shrinking of the growing season (Table 4). According to them,

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the shorting of the growing season increased the risk of crop failure.

Incidence of drought: According to information obtained from FGDs and KII, drought which frequently occurs within the growing season leads to wilting, drying, and scotching of crops and then ultimately retards crop growth and reduce yield and mostly complete damage of crops. According to FGDs, whenever drought occurred, it usually led to complete failure of crop harvest or low yield.

Non-seasonal rainfall: According to information obtained from FGDs, smallholder farmers were frequently tempted to sow seeds with the early rains which were scorched during the dry spells. This condition made farmers undergo several rounds of sowing seeds which were scarce and limited. According to the discussants of FGDs, farmers who plant after the first or second rain usually exposed to huge loss when dry spells were prolonged due to climate variability. Farmers could predict the rain accurately and because of climate change variability and facing difficulty in determining when to plant and when to harvest precisely. Generally, smallholder farmers have been losing control and initiative to climate change. Hence, there is a need to support the local community in their efforts to adapt to climate change.

High temperatures: According to FGDs, smallholder farmers perceived that high temperatures particularly at the beginning of rains and long spells during seed sowing and germination usually burn germinating seeds. Focus group discussants said that rains were readily evaporated by high temperatures emphasizing that few hours after rain must have fallen; the soil would appear dry because of high temperatures in the study area. According to them, high temperatures resulted in the dryness of soil which always resulted in poor germination, crop failure, and even low yield. The rain-fed crops are close to their critical temperature beyond which yield may drastically reduce [23, 24, 25, 26].

Major Adaptation Mechanisms of Smallholder Farmers in the Study Area

In addition to household surveying, focus group discussions were made with the representatives of the local community in the study area to identify the existing adaptation measures/strategies in use by farmers. Results of pairwise ranking as replied by household survey and FGDs that were presented in Table 9, explained that crop diversification, use of fertilizer and pesticides, growing short seasoned crops/replanting early maturing crop varieties, animal vaccination, small scale irrigation/traditional, use of improved seeds, use of crop residue for animal feed, soil and water conservation, use of compost/ organic fertilizer, and alluvial traditional gold mining were, respectively practiced as adaption mechanisms/ practices in the study area.

According to the information obtained from FGDs and KII, despite the existence of some adaption technologies, the availability of resources and services was very limited in the study area and has been challenging, the adaptive capacity of smallholder farmers in the face of climate change in the study area. This finding is also supported by [23] that reported a range of factors, processes, and structures such as income, literacy, institutional capacity, social networks, as well as access to information, market, technology, and services are the determinants of adaptive capacity.

As you can see from the table 10, less than half of the sampled respondents have a habit of using adaptation mechanisms in the study area. The results of the study revealed that even though, some farmers have a habit and an interest to use adaptation mechanisms; farmers have limited capacity to access improved crop varieties and other farm inputs to adequately use adaptation mechanisms. The other limitation of using adaptation mechanisms in the study area is that the existing government institution has limited capacity to scientifically strengthen farmers' indigenous knowledge of using adaptation mechanisms. Hence, demand interested individuals and organizations who give financial and technical to improve farmers' adaptive capacity in the study area.

Test for a mean, and frequency differences to selected variables

The mean values of continuous variables in both adaptor (farmers have a habit and those who used adaptation mechanisms) and non-adaptor (farmers have no habit, noninterest, and limited capacity to access use adaptation mechanisms) groups were compared using group mean comparisons test (t-test). This test was used to identify the mean difference between adaptor and non-adaptor respondents (adopters, they tried to practice to mitigate and not). The t-value for one continuous variable (farm

Table 10: Frequency distribution on farmers' use of adaptation mechanisms of the study area

No	Adaptation Mechanisms Used	No Response		Yes Response	
		Freq.	%	Freq.	%
1	Crop Diversification	64	45.1	78	54.9
2	Use of Fertilizer and Pesticides	59	41.5	83	58.5
3	Growing Short Seasoned Crops /Replanting Early Maturing Varieties	25	17.6	117	82.4
4	Animal Vaccination	120	84.5	22	15.5
5	Small Scale Irrigation/Traditional	30	21.1	112	78.9
6	Use of Improved Seeds	64	45.1	78	54.9
7	Use of Crop Residue for Animal Feed	64	45.1	78	54.9
8	Soil and Water Conservation	64	45.1	78	54.9
9	Use of Compost/ Organic Fertilizer	64	45.1	78	54.9
10	Alluvial Traditional Gold Mining	20	14.1	122	85.9

Source: Own survey data, 2020

Table 11: T-test (group mean comparisons test) for Mean Differ. of Continuous Variable

Variable Category	Adaptors		Non-Adaptors		t-value	Total	
	No.	Mean	No.	Mean		No.	Mean
Households farm size in Hectare	64	0.94	78	0.69	12.019***	142	0.801

Source: Result of t-test data, 2020. ***, Statistically significant at 1% probability level

Table 12: Chi-Square Test for Frequency Difference in Selected Ordinal Variables

Characteristics	Category	Adaptors		Non-Adaptors		Chi-Square (X^2)	Total	
		No.	%	No	%		No	%
Sex	Female	8	12.5	35	44.9	17.45***	43	30.3
	Male	56	87.5	43	55.1		99`	69.7
	Total	64	45.1	78	54.9		142	100
Monthly Income of Household in Birr	<500 Birr (Poor)	27	19.0	70	49.3	36.77***	97	68.3
	≥500 and <1000 (Medium)	26	18.3	6	4.2		32	22.5
	≥1000 and <1500 (Rich)	11	7.7	2	1.4		`13	9.2
	Total	64	45.1	78	54.9		142	100

Source: Own Survey data, 2020. ***, statistically significant at 1%, probability level

size in hectare) was calculated. The mean difference of variable farm size in hectare was found to be statistically significant at a 1% probability level (Table 12). From this finding, we can understand that households who have relatively larger farm sizes used more adaptation measures than those households that have smaller farm sizes. This finding coincides with [39] which says the growth of different crop varieties require more land.

The X^2 (chi-square) distribution is used to test whether the observed frequencies differ significantly from expected frequencies when more than two outcomes are possible; hence, this study used the chi-square test to examine the existence of statistically significant differences between the adaptors and the non-adaptors groups. The result of the chi-square test was presented in (Table 11).

Two variables (sex and monthly income of households) were considered for the chi-square test and the result revealed that both sex and monthly income of respondents showed a statistically significant difference between adaptors and non-

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Table 13: Pairwise ranking for existing coping strategies used in the study area

No.	Major Coping Strategies Used	1	2	3	4	5	6	Score/ Point	Rank
1	Selling of Livestock and Other Assets		1	1	1	1	1	10	1
2	Borrowing Grain and Cash from Relatives	1		2	2	2	2	8	2
3	Selling of Fuel Wood and Charcoal	1	2		3	3	3	6	3
4	Reducing household food Consumption	1	2	3		4	4	4	4
5	Migrate to Nearby Urban Areas for Daily work	1	2	3	4		5	2	5
6	Wild Food Collection/Forest Food	1	2	3	4	5			6

Source: Own Survey data, 2020

Table 14: Coping strategies used to reduce exposure to climate change impacts in the area

No.	Frequently Used Coping Strategies	Yes Response		No Response	
		Frequency	%	Frequency	%
1	Selling of Livestock and Other Assets	133	94	9	6
2	Borrowing Grain and Cash from Relatives	129	91	13	9
3	Selling of Fuel Wood and Charcoal	90	63	52	37
4	Reducing household food Consumption	122	86	20	14
5	Migrate to Nearby Urban Areas for Daily work	86	61	56	39
6	Wild Food Collection/Forest Food	118	83	24	17

Source: Own Survey data, 2020

adaptor groups at 1% probability level (Table 12). The results of this study revealed that male-headed households used adaptation strategies more readily to climate change strategies than female-headed households. This finding was consistent with [25] who argued that having a female-headed household may have negative effects on the use of adaptation strategies because women may have limited access to information and other resources due to traditional barriers. Concerning households' monthly income, findings of this study showed that the higher the monthly income of households the more households used adaptation strategies in the study area as reported by [19]

Coping strategies that were frequently used in the study area were identified through FGDs. Results of pairwise ranking made by FGDs on coping strategies that were presented in Table 14, revealed that selling of livestock and other assets, borrowing grain and cash from relatives, selling of fuelwood and charcoal, reducing household food consumption, migrate to nearby urban areas for daily work, reducing household food consumption, and wild food collection/forest food, respectively were practiced as the major coping strategies of the study area (Table 13).

According to the information obtained from focus groups discussion and key informants interview, some efforts were made to cope with the adverse effects of climate change, however; lack of capital, land degradation, and high-interest rate of microfinance credit service become a barrier to cope with the adverse impacts of climate change. As it was described in Table 14, about 94 percent of respondents' use; selling of livestock and other assets, borrowing grain and cash from relatives, selling of fuelwood and charcoal, reducing household food consumption, migrate to nearby urban areas for daily work followed by wild food collection/forest food, respectively were used as the major leading coping options in the study area. This idea is also supported by [42].

Results of the household survey revealed that smallholder farmers in the study area have a tradition of helping each other in times of adverse climate change, particularly borrowing grain and cash to relatives affected by the hazard was common by the rich to do and get back the grain and cash when the poor get good harvest (Table 15). Respondents replied that this tradition is gradually weakening partly because resource-rich farmers were decreasing in number and the number of people seeking help is increasing. All respondents (100%) replied the frequency of climate-induced hazard occurrence is increased and consequently crop harvest failed usefully and the situation lead smallholder farmers' food insecurity. This finding is similar to the study

reported by [38] which says that when agricultural activities are impacted by climate change, it may have serious consequences on smallholder farmers' crop harvest and food security.

Regarding institutional support, (41%) respondents said that they didn't get institutional support and the rest 59% of respondents replied that they get institutional support like access to credit and extension services but the support was not enough. The majority (40%) of respondents' access credit from cooperatives but the capacity of cooperatives was very limited to give the required amount of credit to the farmers as replied by respondents whereas about 60% of the interviewed respondents replied that they get credit access from microfinance. However, its interest rate is high and it was become difficult to return the credit. The result of the study revealed that about 80% of respondents took credit mostly to buy farm input and the rest 20% of the respondents replied that they used it as initial capital to start petty trade.

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