

Development Agents' perception about the effect of climate risk on livestock production

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Abstract

Climate change is driving the call for smart agriculture within the African context. In Ethiopia, at national level policy makers recognized its importance; but it is not clear whether the national feeling is trickled down to the grass root and the effect of climate risk on small holder livestock owners is unknown. The objective of this study was to assess experts' perception of climate related risks on the livelihoods of small livestock keepers.

The results show experts have perceived that climate change has posed risks to small holder farmers and livestock herders. It was evidenced from this study that despite good levels of experts' awareness about climate change, and high levels of risk perception expressed by experts, climate change adaptation measures are not sufficiently supported at grass roots level. Enhancing awareness about the effects of climate change, its adaptation and mitigation strategies should be cascaded at all level.

Key words: adaptation, agricultural agents, animals, awareness, climate change, mitigation

Introduction

Climate change is one of the greatest challenges of this century (Botterill & Mazur 2004). Climate change is a major challenge for agriculture, food security and rural livelihoods for billions of people including the poor in Africa. According to Gillis (2014), climate-change impacts are projected to slow down economic growth, make poverty reduction more difficult, further erode food security, and prolong existing and create new poverty traps.

Climate risks are risks caused by climate change, which impact the environment, people and society (AXA 2012). Risk perception is the subjective evaluation of the probability of hazard occurrence and concern about its consequences. Risk perceptions can contribute to informed policy level decisions and actions. It also influences mitigation and adaptive responses to climate change (Patt and Schröter 2007).

Climate change has effects on dairy, beef, and wool production due to its impact on grazing land. Changes in climate and climate variability will affect livestock production systems in all parts of the world, and will inevitably impact the 1.3 billion poor people whose livelihoods are wholly or partially dependent on livestock (Thornton et al 2013). Currently, over 2.8 billion people live in

areas of the world prone to more than one type of the physical manifestations of climate change: floods, storms, droughts, sea level rise (GHF 2009). Increased frequency of droughts and floods negatively affects agricultural production, demonstrating agriculture's sensitivity to climate change (Temesgen et al 2008). Every year climate change leaves over 300,000 people dead, 325 million people seriously affected, and economic losses of US\$125 billion. Four billion people are vulnerable, and 500 million people are at extreme risk (GHF 2009). The poor are hardest hit by the impact of climate change impacts due to their over reliance on climate sensitive economic activities (USAID 2012). Households dependent on livestock keeping are vulnerable to changes in climate and climate variability, with the potential for increased poverty and decreased food security (ILRI 2014; Thornton et al 2013).

Climate change is expected to have direct and indirect impacts on African livestock. Direct impacts include increased ambient temperature, floods and droughts. Indirect impacts are the result of reduced availability of water and forage and changes in the environment that promote the spread of contagious diseases (Bossche and Coetzer 2008).

The role of cattle in developing countries is as a source of high-quality food, as draft power, and as a source of manure and fuel (Lunde and Lindtjorn 2013). Ethiopia is heavily dependent on rain-fed agriculture, and its geographical location and topography in combination with low adaptive capacity entail a high vulnerability to adverse impacts of climate change (IDS 2014, NCAP, 2007). Impacts of climate change are not new phenomena to Ethiopian history. It is already evident in a number of ways. The effect from drought alone has irremovable image to the country's development. The stories of three major famines (during 1950, 1970s, and 1980s) are the result of severe drought that is part of climate change (Berhanu 2001).

Livestock agriculture is vulnerable to climate change due to its reliance on rainfall for pasture. Numerous scientific findings on climate change impacts have been presented so far (Keller 2009; IDS 2014); however, the risk brought by climate change on livestock production and livelihood of small livestock holders have not been investigated in detail.

Despite the central importance of farm animals to Africa's poor and the magnitude of the changes expected to be fall Africa's more than 160 million poor livestock keepers due to climate change, scant attention has been paid to issues of livestock and climate change (ILRI 2014). Potential direct and indirect impacts of climate change on livestock production have not been thoroughly explored like that of crops.

At national level policy makers have recognized climate related risks. But it's not clear whether the national feeling trickled down to the grass root level experts or not. Understanding experts' perceptions of climate change risks is a critical component for motivating local support for future policy action. If these experts misperceive or disagree with the fact that climate risk is inducing severe challenges to the livelihood of small holder farmers, the effectiveness of attempts to empower community efforts will fail. Moreover, among all actors, Development Agents (DAs) are the closest advisors of farmers to help them improve their livelihoods. Therefore, this study was intended to clarify the existing climate change risks from DAs perspectives.

Materials and Methods

Primary data was collected from development agents (DAs) attending on job training at Jimma University College of Agriculture and Veterinary Medicine. The experts joined the university from different parts of Oromia regional state (Figure 1), Ethiopia, to continue their Bachelor of Science degree in different programs of agriculture.

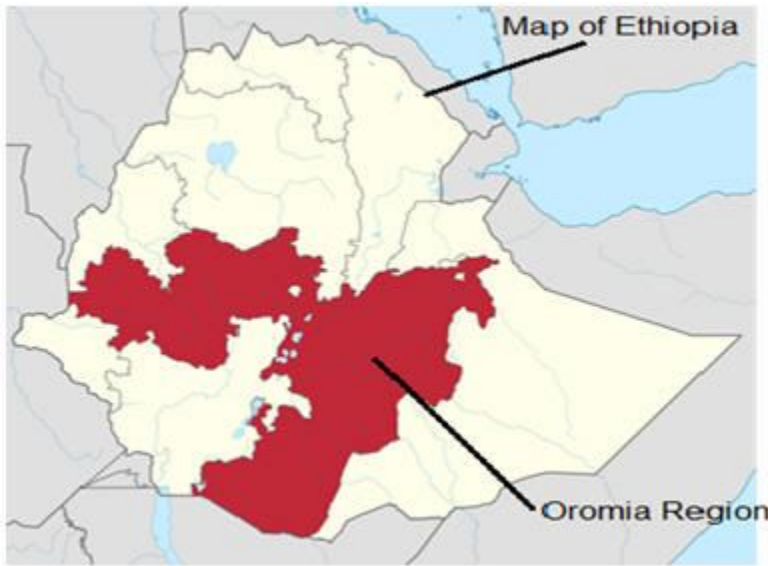


Figure 1. Map of the study area

Two stage sampling technique was used to select the respondents. First, the respondents were listed by profession and ranked by their Cumulative Grade Point Average. Second the top 20 lists were selected. The main reason behind ranking by their Cumulative Grade Point Average is the fact that DAs with highest score would have better understanding of both the questionnaire and climate factors. Accordingly, 40 DAs of various educational backgrounds were selected (Table 1). After drawing the final lists of respondents, primary data was collected using structured questionnaire of lickert scale form. Accordingly, respondents were asked to rate the occurrence of climate related risks as increasing, decreasing or not changing. Data on an expert perception which covers the process from climate change, impacts assessment to adaptation has been investigated. The prospective risks, adaptation options, and issues to be examined to progress the development of practical and effective adaptation options have been shown (figure 2). Data was analyzed using SPSS version 20 and simple descriptive statistics like percentage and frequencies used.

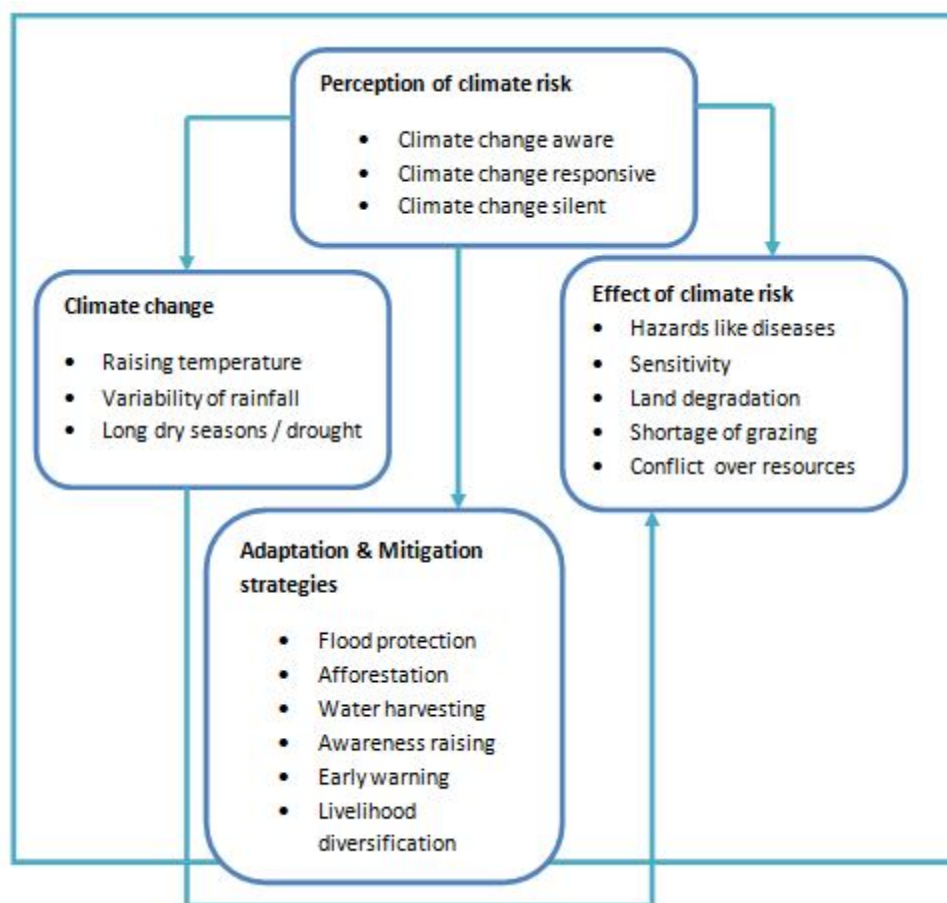


Figure 2. Conceptual model of the study

Results

Respondents' profile

The professional mix of respondents is indicated in Table 1. The majority (77.5%) of them have more than six years of professional experience in addition to the fact that many of them grew in rural environment. Thus, this assessment have benefited from the professional experiences and background of the respondents.

Table 1: Respondents' profile in the study area

Educational background	Frequency	Percent
Animal Science	7	17.5
Animal Health	5	12.5
Natural Resource Management	10	25.0
Plant science	12	30.0
Horticulture	6	15.0
Total	40	100.0
Years of experience	Frequency	Percent
4-6	9	22.5
6.5-7.5	16	40.0
8-10	15	37.5
Total	40	100

Respondent's perception of climate change and climate related risks

Table 2 indicates that all respondents (100%) regardless of their professional background reported that they have noticed that climate is changing, while Fig 3 indicates the perception of respondents about climate related risks and consequences. More than three-fourth of the respondents witnessed that the frequency of drought, flood, rainfall variability, and land slide and extreme heat were increasing. About 76.3% of the respondents perceived local temperature and livestock disease prevalence are increasing; while nearly half of respondents indicated forest cover is decreasing due to deforestation as one cause of climate change. Similarly, nearly three fourth of the experts disclosed productivity and yield of crops, livestock productivity (74.4%), water availability (78.9%) has been declining due to climate risk. As a consequence, less food is directly available to the households. About 80% of them indicated frequency of flooding has been increasing. Experts also reported that income sources (53.8%) are declining due to climate induced risks. Moreover, the prevalence of conflict becomes an alarming problem of society these days (Fig 3).

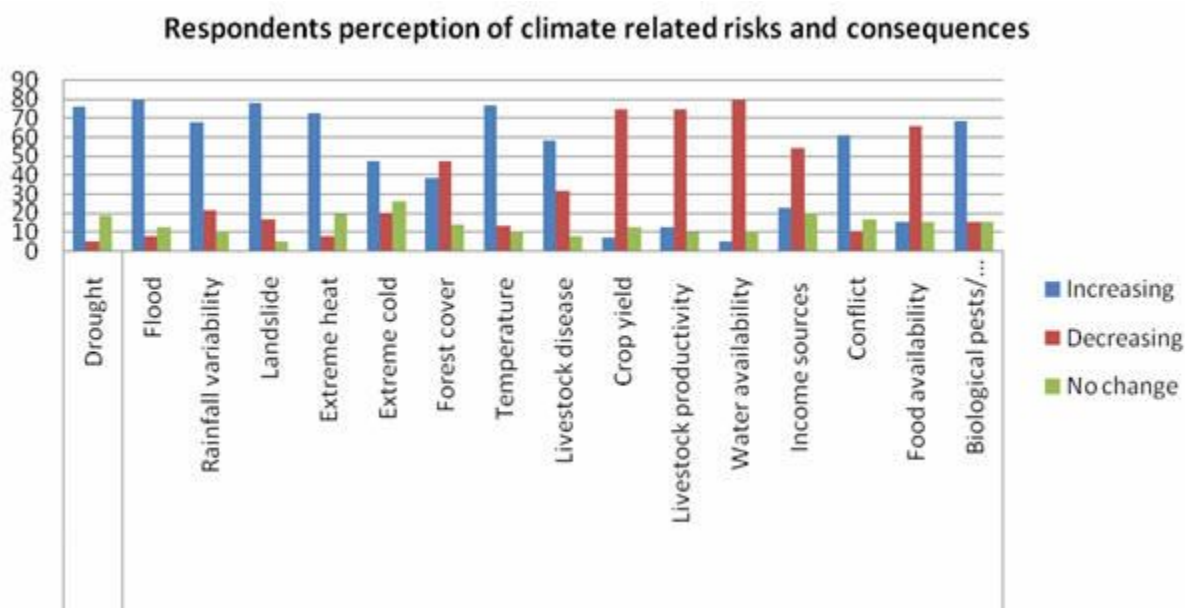


Figure 3. Respondents' perception of climate related risks and consequences

Sensitivity of rural livelihoods and effect of climate risks

Tables 2 indicate experts' perception on sensitivity to climate risk and possible impacts from climate change. According to their opinion, most of livestock species are very sensitive to the adverse effects of climate change and the extremes of climate change had a very negative impact on different livestock species. Majority of the experts (over 80%) showed that among livestock, cattle are more sensitive to climate related risks than small ruminants. There are modest changes across the response on sensitivity perception among experts.

Table 2: Sensitivity and possible impact of climate change as perceived by development agents

Sensitivity to climate change	VS	S	SS	NS	DJ
Sheep & goat	25	22.5	27.5	7.5	-
Cattle	30	52.5	5.0	2.5	-
Grazing land	35	32.5	17.5	2.5	-
Agricultural land	35	37.5	12.5	-	-

Climate related risks	Extremely negative	Negative	No effect	Positive	Very positive
Forest resources	50	17.5	10	-	2.5
Human beings	30	32.5	20	2.5	2.5
Water resources	52.5	15.0	15.0	-	-
Decreased precipitation	45.0	40.0	2.50	12.50	-
Increased rainfall variability	57.5	27.5	2.50	10.0	2.50
Increased livestock diseases	57.5	22.5	5.00	12.5	2.50
Increased feed shortage	52.5	25.0	5.00	12.5	5.00
Declining water quantity	40.0	37.5	10.0	10.0	2.50
Declining water quality	50.0	27.5	7.5	12.5	2.50
Declining grazing land	50.0	30.0	7.5	10.0	2.50
Increased risk of drought	41.0	38.4	7.8	7.80	5.10
Increased risk of livestock death	47.5	37.5	15.0	-	-

VS=very sensitive; S=sensitive; SS=Slightly Sensitive; NS=Not sensitive; DJ=Difficult to judge

Adaptation to climate change

Fig 4 and 5 shows the institutional responses and interventions to address the impact of climate related risks. Nearly 60% of the respondents indicated that the implementations of integrated watershed management activities like flood protection, tree planting/ plantation are implemented in a good manner. Similarly, early warning services and awareness raising programs are conducted in many areas. However, less attention is paid on restriction of settlement, water harvesting, and reliable weather forecasting.

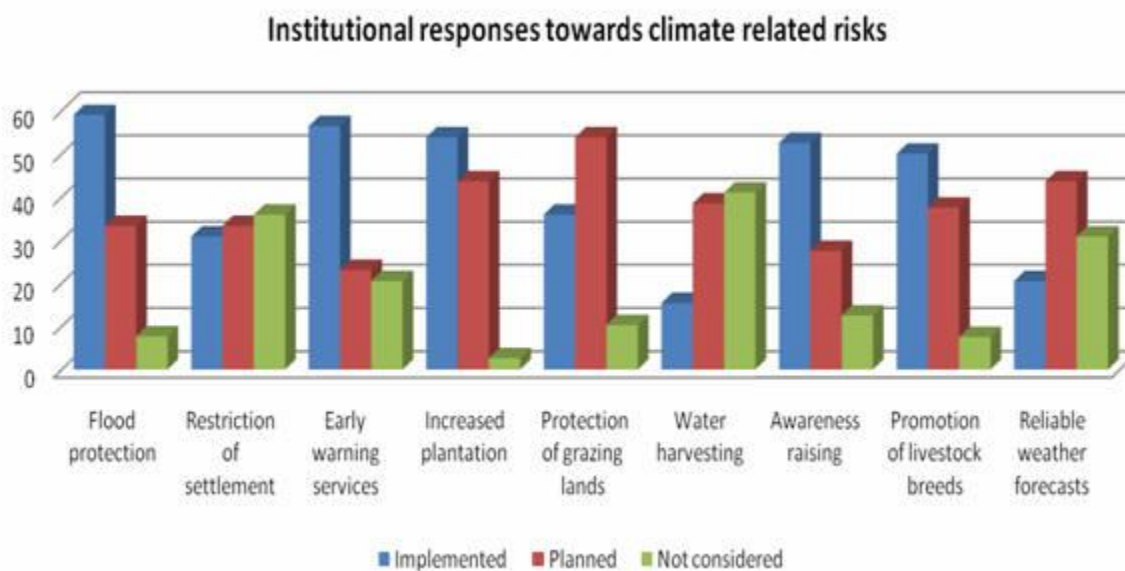


Figure 4. DAs perception on Institutional Responses to climate related risks

In spite of implementing and having planned activities, respondents perceived that the existing plans and operational frameworks are adequate or not positive, but their response varies from very poor to very good scales (Fig 5).

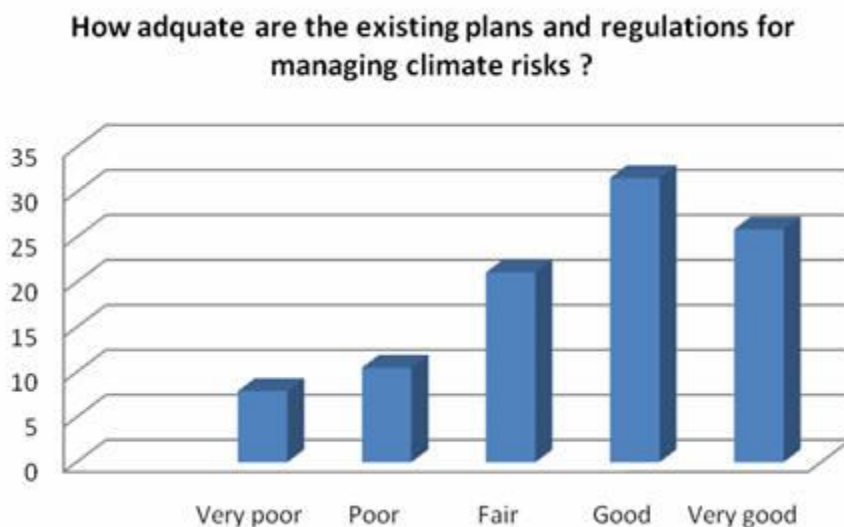


Figure 5. Respondents' opinion about the existing climate adaptation plans

Economic opportunities to adapt to climate change

Table 3 presents economic opportunities used to adopt climate change. About 45% respondents rated possibility of livelihoods diversification into nonfarm options as low, while 37.5% as moderate. Similarly, over 70 % of the sample indicated that access to credit and market by the poor are low to moderate level.

Table 3. Perceived economic opportunities to adapt to climate change

Economic opportunities	Low	Moderate	High
Nonfarm income	45.0	37.5	17.5
Remittances	40.0	27.5	7.50
Market access	30.0	47.5	17.5
Access to credit	35.0	37.5	17.5
Cash cropping	42.5	27.5	25.0
Livestock sale	37.5	50.0	10.0
Honey production	62.5	27.5	7.50
Fire wood and charcoal	27.5	25.0	47.5

Discussions

In spite of the difference in their professional background, all experts are climate aware. Identically, all respondents have felt in the future agriculture/ livestock husbandry is likely to be challenged by more frequent and more severe extreme weather events because the climate is changing.

The change in climate is explained by the respondents by such factors like temperature and rainfall patterns are changing hitherto while temperature rises rainfall declines and often erratic. DAs witnessed this leads to increment in frequency of droughts and floods of which both impacted livestock and crop production. According to GHF (2009) given the current trends, temperature extremes, heat waves and heavy rains are expected to escalate in both frequency and intensity. Beyond livestock and livelihood impact the consequences from climate change resulted in social problems like water scarcity, conflict and food shortage. There are evidences indicating that an increase in temperature and changes in rainfall pattern increases the likelihood of droughts and ultimately causing problem of water scarcity and an increased spread of existing vector-borne diseases and macro parasites of animals as well as the emergence and spread of new diseases (Barnett and Adger 2007; Bossche and Coetzer 2008; Gillis 2014; UNEP

2012). Concurrent to this study, livestock production and husbandry will be more difficult than ever since grazing land, water availability and forest cover are decreasing.

According to experts' opinion, climate change increasingly undermines human security in the present day, and will increasingly do so in the future. Study conducted by FAO (2012) in Ethiopia and Uganda pastoral community indicated that conflict over rangeland and water is at increasing rate following dry spells. Similarly, Dejene and Abdurahman (2006) reported that conflicts occurred during drought years. Second, the probability of occurrence of conflict is high during long and short dry seasons. The most far reaching impact of the conflicts is that they undermine livelihoods and opportunities for social and economic transformation. IPCC (2014) witnessed that all aspects of food security are potentially affected by climate change, including food access, utilization, and price stability.

Although, majority (three-fourth) showed negative consequences of climate change are increasing, there is lack of uniformity among respondents. The pattern of responses reported here are broadly non-consistent with the overall picture that the extreme events from climate change are increasing. For instance, few respondents indicated the occurrence of climate risks as decreasing or not changing which implies that there are still misperceptions among those experts. The argument of this study is that DAs who reported "climate change is not happening" have inadequate climate awareness or "climate unaware". Thus, we argue that unless experts have proper perception of climate change, it will be difficult to undertake appropriate and timely measures to mitigate climate risk.

This study also assessed experts' perception on sensitivity of livestock and livelihoods to climate related risks like drought. According to Temesgen et al (2008) sensitivity is the degree to which a system; in this case livestock; is affected—whether positively or negatively—by extreme weather conditions and associated climatic variations. The respondents indicated that most livestock types kept were vulnerable and sensitive to climate risk. A third of respondents indicated that sheep, goats, cattle, human beings, grazing and agricultural lands are very sensitive to climate related risks, while more than half of them showed that water and forest resources are highly sensitive to changes in temperature and rainfall patterns. According to the majority of respondents cattle are more sensitive to climate change, which is in agreement with the findings of Ayana and Oba (2007) where rainfall variability strongly influenced the dynamics of cattle population, calving rates and mortality on communal rangelands and ranch systems. The negative consequences result in alteration of ecosystems, disruption of food production and water supply (Barnett and Adger 2007) and result in morbidity and mortality of livestock. This affects poor livestock keeper's lives directly through impacts on livestock productivity.

While stating the seriousness of climate risks and the potential negative consequences of each hazard, more than half indicated that rainfall variability, livestock diseases, feed shortage are increasing with extremely negative consequences from climate risks. Similarly, more than 40% of the respondents indicated increased risk of drought with very negative consequences. Decline in water quality and quantity, and diminishing in grazing land has a very negative livelihood consequence. Studies conducted on livestock also indicated livestock production require more watering with higher temperatures. Temperature can influence cattle through direct heating, through vector borne diseases, and by modulating evaporation (Lunde and Lindtjorn 2013). Considering the specific characteristics of the most important African livestock production systems, and their high dependence on the environment, the majority of African livestock seems to be highly exposed and sensitive to climate change (Bossche and Coetzer 2008). Similarly; rising temperatures alter the distribution of parasites and their vectors, allowing them to move into new areas, many communities already in poverty traps will have to cope with new human as

well as livestock disease burdens (IRLI, 2014).

The respondents revealed the existence of institutional responses to climatic risk adequately mainly through plantation, flood protection, early warning system, and promotion of adaptable livestock breeds. Rural people have century's adaptation strategies to the risk of climate change. Studies made in Tanzania (Tylor 2011) and Borena area of Ethiopia (Coppock 1994; Ayana and Oba 2008) indicated that small scale local associations and leaders have a potential to facilitate collective experimentation and risk management, contributing to the resilience and sustainability of the ecological system.

Effective strategies and plans for adaptation to both climate change and climate variability are of central importance to countries (CARE 2011). Adaptation to climate change is transitioning from a phase of awareness to the construction of actual strategies and plans in societies. Effective adaptation to climate variability and climate change is dependent on access to climate information for the coming seasons and years, to enable communities make decisions for now and the future (CARE 2011; Kuruppu and Willie 2014). Thus, ensuring access to climate information such as seasonal forecasts and early warnings will support their farmers to manage their livelihoods in a context of uncertainty. However, this study investigated that reliable forecasting of climate related information was given less attention.

Similarly, in spite of the fact that water availability is declining due to climate risks, less attention was given on water harvesting which entail there is a need from policy makers to attract the attention of local authorities on this activity. In support of household and individual level adaptation, efforts must be made to ensure that local plans and policies provide opportunities for action by target groups.

There are many potential supportive options available for adapting to existing climate risk. A key element of future adaptive capacity is for people to have a range of options available to them to sustain their livelihoods under different conditions. Respondents explained that diversification within agriculture like crop, livestock and honey production were also from low to moderate. One of the challenges faced by communities, and particularly vulnerable groups within communities, is simply a lack of access to credit and market that would facilitate risk coping.

Conclusion

- All the respondents have witnessed that climate change has happened as being manifested by changes to rainfall patterns leading to delayed rain, long dry seasons, a rise in temperatures, and drought. With the current study, a third of respondents perceived that sheep, goats, cattle, human beings, grazing and agricultural lands are very sensitive to climate related risks. As adaptation strategy to the risks emanating from climate change, implementation of integrated watershed management activities such as flood protection and plantation have been suggested. Similarly, early warning services and awareness raising programs are conducted relatively in many areas. However, restriction of settlement, water harvesting, and reliable water forecasting were not considered yet. Ensuring that communities are able to access critical information such as seasonal forecasts and early warnings will support their efforts to manage their livelihoods in a context of uncertainty.
- It was evidenced from this study that despite good levels of experts' awareness about climate change, and high levels of risk perception, climate change adaptation measures are not sufficiently supported at grass roots level.

Recommendations

A continued awareness raising schemes should be devised to farmers, experts, DAs and different leadership groups to use and conserve the existing resources, then plan and implement rehabilitation. In addition, forest utilization through fire wood, and charcoal making should be discouraged through provision of alternative fuel sources and income earning opportunities, like bee keeping, and processing of agricultural commodities so as to mitigate climate change. It is also important to use media which reaches every part of the community,

Conservation of natural resources, plantation, and water harvesting and improving animal feed, improving livestock breed are crucial steps to minimize sensitivity of livestock to the ills of climate change. It could be imperative to look into the indigenous knowledge of farmers in adaptation and mitigation to climate changes like area enclosure, culling of their livestock based on priority use, renting grazing lands, etc. Moreover, access to services that support adaptation of livelihoods is a key factor to be considered. For example, accessing credit for start up costs can make the difference for people in diversifying their livelihoods.

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