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Local Knowledge and Perception of Smallholder Farmers on the Impacts of Climate Change and Their Adaptation Strategies in Shashogo District, Central Ethiopia

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Abstract

This study aims to address the knowledge intelligence for local practices related to climate change forecasts and adaptations by exploring community mechanisms for rainfall prediction and coping strategies for minimising the effects of climate change. Data on livelihood practices of climate change/variability prediction, how respondents realise climate change and its impacts, and what mechanisms were practices for rainfall prediction, and adaptation strategies of climate change/variability were collected by using household head survey, which was conducted in a sample of four Kebele Administrations of Shashogo district. Data collection methods included key informant interviews, focus groups, field observations, and household surveys. Exploratory, descriptive, and critical methods of data analysis were used. The coming of rainfall and the season are predicted by communities using a variety of meteorological, environmental, and social factors. The forecasting and predicting techniques that the household head respondents identified include wind direction, the presence of lightning or a rainbow, and cattle behaviour. In response to climate change and variation, the indigenous group uses a variety of climate adaptation approaches, including tree-planting, mutual borrowing, and the adoption of regulations through social mechanisms. Predictive ability differs across Indigenous communities according to livestock behaviour, lightning occurrence, wind direction, and rainbows. A key component of wise climate adaptation is the validation of local area precipitation forecasting by the integration of scientific research with native precipitation forecasting. Politicians would additionally take into account the local practices of prediction mechanisms.

*The second and third author have equal values.

Subject Areas

Environmental Sciences, Philosophy

Keywords

Adaptation, Climate Change, Indigenous, Prediction, Traditional Knowledge

1. Introduction

Global problems like uncertainty and climate change impact many aspects of people's life globally. Significant impacts of climate change and variation on agricultural productivity, gravely endangering the farming community's capacity to feed themselves [1] [2]. Climate change has a serious economic impact on poor nations whose economies depend heavily on agriculture [3]. Many impoverished people in Africa rely heavily on agriculture that is susceptible to climate change and fluctuation, which makes them much more vulnerable [4].

Indeed, climate change will negatively impact Africa's agricultural production and productivity, creating significant obstacles to the continent's sustainable development [5] [6]. Among the countries of East Africa that are particularly susceptible to the effects of climate change is Ethiopia. Ethiopia's economy depends heavily on rain-fed agriculture, hence the negative effects of climate change and fluctuation are severe there [7].

Farmers' perceived climate change/climatic variability, based on their experience through observation of certain of climate parameter as rainfall, temperature and drought [8]. Incorporating the expertise of local and indigenous people is highly suited for climate change adaptation strategies, as scientific knowledge alone is no longer sufficient to overcome difficulties related to climate change [9] [10].

A developing body of knowledge, a reiteration of experiences and ideas formed by an established community in a particular location, is what is referred to as local or traditional knowledge. According to [9], traditional knowledge is also defined as knowledge that is transmitted culturally from generation to generation and pertains to the interactions between living things and their surroundings. Traditional knowledge is information that has been passed down through time by indigenous and local peoples and was obtained via first hand interaction with the environment and local population [11]. Although local and indigenous knowledge are synonymous, they may have different levels of understanding since they are derived from different experiences, observations, cultural beliefs, and values. According to [12], indigenous knowledge is the same as local knowledge but reflects a synthesis of cultural beliefs and values. Local knowledge is understanding that is generated locally based on experience and observation.

In the idea of climate change impact the practice of adaptation aims to miti-

gate the effects of climate change [1] [13]. Generally speaking, adaptation is the process of modifying human or natural systems in response to the effects of climate change, whether they are already occurring or not, in order to lessen their negative effects [11]. Various types of response mechanisms and understanding of climate change impacts are currently involved in Ethiopia, which differ according to the opportunities and limits in specific district [7] [14].

As a result, this study provides opportunities to close the knowledge gap in the community regarding how understanding climate change and variability influences the effects and responses of climate change on food security. This study also fills in gaps about the value of indigenous/local knowledge, which has not been sufficiently investigated in Ethiopia or in this study area. The perception of the possible effects of climate change, an examination of local communities' indigenous methods for adapting to the changing climate, and the identification of the variables impacting community adaptation to climate change are the specific goals of this study.

The data base on how the climate is affecting food security and how people are responding to those changes may benefit from this study. The results highlight obstacles to food security responses to climate change. Finally, the scientific community has an interest to generate scientific knowledge with integrating local knowledge.

2. Concept of Local Knowledge on Climate Change

The concept of local ecological knowledge as defined is a shared system of knowledge or another expression about the environment and ecosystem relationships, developed through direct experience within a specific physical setting, and transmitted between or among generations. The definition of traditional ecological knowledge (TEK) is defined as a cumulative body of knowledge, practice, and belief about the relationship of living beings (including humans) with one another and with their environment, evolving by adaptive processes and handed down through generations by cultural transmission [12]. Local ecological knowledge emphasizes practical skills, incorporating scientific and relevant technical knowledge when it is available [15].

It can be difficult to distinguish between indigenous and local knowledge that is developing inside larger indigenous knowledge systems [16]. The IPCC proposes that small holder farmers focus their livelihoods on agricultural techniques that enable sustainable adaptation to climate change and food security challenges by utilising indigenous/local knowledge systems [1]. In response to the complexity of the ecosystem brought on by concerns about climate change, the local population upgraded their knowledge system with new scientific understanding (Nandi *et al.*, 2021). At the level of smallholder farmers, incorporating scientific methods with their traditional knowledge is a smart way to promote sustainable development and boost food production by building resilience against climate change [17].

Although it is difficult to define, indigenous knowledge has occasionally spread throughout the society in response to ecological and socioeconomic changes in both the natural and man-made surroundings [17]. Indigenous communities at every local level are the source of indigenous knowledge on climate change (IFPRI, 2019). Furthermore, indigenous knowledge is the evolving understanding that local and indigenous people have accumulated over many years by their experiences with various environmental and climatic conditions [11].

Communities have maintained a close link with ecosystem dynamics throughout history and gathered knowledge, institutions, and practices to adapt to recurring disturbances in nature to secure their livelihood [18]. All forms of ecological knowledge are believed borne out of the experience [19]. Traditional ecological knowledge co-evolved with social and ecological systems and can strengthen the capacity of human societies to accommodate disturbances and maintain ecosystem services [18]. Local ecological knowledge comes off as cost-effective ecological data, very useful in making environmental decisions, offering information about the presence of species and population trends and helping to understand ecosystems and ecological processes [20].

Local ecological knowledge has gained prominence among developing countries and international community's [18]. Farmers have a reputation for responding to climate changes and the associated unpredictability for a long time [21]. Indigenous communities are socially and culturally distinctive compared to the mainstream societies; thus, policies and decisions intended for the larger population, although intended for a good purpose may prove insufficient for these communities [22].

Local ecological knowledge enables farmers to handle the challenges associated with the current variability in the climate and prepare them to cope with future challenges [23] [24]. In the rural communities, the community dwellers analyse the changes in the environment by observing changes in the physical characteristics of trees, changes in the weather phenomena and how certain animal species behave [25].

In this study focus on local knowledge thus clarifies the actual impact of the climate change and variability impacts, guides policy direction while reflecting the actual concerns of the local people, and broadens the understanding around the various factors underlying the different livelihood adaptation measures. [8] argues that perceptions of local ecological knowledge and perceptions of weather and climate should form the basis of agricultural policies as a bottom-up approach and not merely acknowledged by policymakers. There is a gap in research concerning the effectiveness of these local adaptive strategies employed by local people.

Climate change, with its associated changing rainfall patterns, poses a challenge to the traditional means by which farmers adjust to the periodic changes that occur in their farm activities [26]. Farmers' adaptation to this challenge and risks is the planting of different crops, especially crops that will survive under

the changing conditions [27]. These farmers use different off-farm and on-farm adaptation mechanisms to limit the damaging ecological and climate change effects on their livelihood [28]. Most resort to soil conservation strategies, growing drought-resistant crops and growing plants with different maturity dates [29].

Local ecological knowledge is needed in planning, understanding impacts, and adapting to climate change by the government, communities, and academics as they build their understanding of climate change [30]. Discovery of changes in the environment, the building of strategies to adapt to the changes, and putting in place of sustainable land-management activities are all items of climate action that can be informed by traditional ecological knowledge [30]. In this study researchers have started identifying ways in which science and local ecological knowledge can collaborate in research related to climate change. Indigenous people come up with creative ideas in reacting to and interpreting climate change; they draw on technology and traditional ecological knowledge, which helps cope with ongoing challenges [31]. Traditional measures for adaptation to climate change have been put into two categories by [32], short term responses to environmental changes and adaptive responses and cultural practices to the broader environment.

3. Description of Study Area and Methods

3.1. Description of Study Area

Location of the study area found in the Hadiya Zone, central Ethiopia, which lies between latitudes 7˚23'6.5"N to 7˚23'33"N and longitude 36˚51'24"E to 37˚17'18"E. The district is 54 km from Hossana town which is the capital of Hadiya Zone, and 226 km south of Addis Ababa city the Capital of Ethiopia. Relative location of District is bordering on North and North-East by Silte Zone, South by KembataTembaro Zone, the East by Halaba Zone, the West by Lemmo Woreda and South-West by Anni Lemo Woreda.

The woreda includes 36 kebeles and two small towns. Bonosha is an administrative town of Shashogo Woreda. According to the 2007 National Population and Housing Census, the population of Shashogo Woreda is approximately 116,287, of which 56,167 (48.3%) are males and 60,120 (51.7%) are females.

Agro-ecologically the Shashogo Woreda is classified a slow land and mid lowland. Average annual rainfall ranges from 557 mm minimum to 1535 mm maximum, while average annual temperature varies between 17˚C to 20˚C with a mean of 18˚C. The usual rainfall pattern in this district is bimodal, meaning that the short/Belg rainy season falls between March and April while the main/Kiremt rainy season falls July to September. Precipitation is a bimodal in nature with the months March to May and June to September being characterized by relatively higher rainfall records; while the months of November to February are dry. The region's long rainy season lasts from Junes to September, during which time crops are grown in the region. The total annual rainfall is 1005.1 mm [33].

The altitude varies from at least 1876 m up to a maximum of 2257 m above sea level. Shashogo woreda is one of the suitable areas for agricultural activity but extreme climate event pose the greatest challenges especial the frequency of flooding is high as the land surface has flat topography [34]. Agricultural activity is the main economic activity in Shashogo woreda, which includes animal husbandry and crop production [35].

3.2. Source of Data and Its Collection Methods

Primary data, which also covers the environmental and livelihood issues in the research region, has been gathered based on survey questions. In addition to these causes of the environmental challenges, the perception of climate change, the community observation of climatic changes, associated consequences and community response mechanisms to the changes. Data were gathered by field observation, eight focus group talks, twelve chosen person interviews with key informants, and a household survey of 229 smallholder farmers. In order to gain a basic understanding of the community's opinions of climate change, precipitation prognostic indicators, and various coping and adaptation strategies, focus group discussions (FGDs) were held. The goal of KII was to gather detailed data on local climate prediction processes and indicators and their significance for precipitation forecasting. Both descriptive and narrative analysis was done on the data. Every piece of data gathered through the various techniques was narrative examined.

3.3. Sampling Techniques

In this study, multi-level sampling strategies were employed for sampling. First, out of fourteen districts in the Hadiya zone, the Shashogo district was specifically chosen because it is most vulnerable to the extreme hazards associated with climate change and includes two distinct agro-ecological zones: lowland and midland. Using a stratified sample technique, the next four rural kebeles were chosen from a total of 36 rural kebeles situated within the agro-ecological zones already in use. In the third stage, a basic random sample technique was used to select households in each AEZ Kebele based on socio-economic categories. After classifying all of the households in each kebeles into three categories poor, middle-class, and better-off this has been completed. For each AEZ in the sample, the probability proportional to sample size technique was applied to draw the sample households.

The sample size here refers to the number of participants required to conduct the survey process and achieve the goal of the manuscripts. The formula of [36] was used to determine the sample size. This simplified formula was applied to determine the number of sample sizes at a 5% variability level, a 95% confidence level, and a 6% precision level.

$$n = \frac{N}{1 + N(e)^2}$$

Where n is size of sample, N is total population in sampled kebele and e is acceptable error. In this study, a total of 229 sample heads of households were selected and interviewed in March and April 2022 see details in Table 1.

3.4. Data Analysis

Qualitative data were gathered for this study, and their analysis methods were used. The following five phases are the interpretation of data that was gathered using qualitative methodologies. See Figure 1.

Using descriptive statistics, the information gathered from a household survey was examined. There were tables, charts, mean values, percentages, and frequencies. For the investigation, SPSS version 24 software was employed.

4. Results and Discussions

4.1. Socioeconomic and Demographic Characteristics of Respondents

The result described in Table 2 is about the demographic characteristics of respondents includes sex, marital status and educational status household.

Based on Table 2, the general characteristics of the respondent households with a predominantly male than female. The proportion of male-headed households

Table 1. Distribution of sample size based in Agroecology and Kebele.

Agro-ecology	Kebele	Total population in Kebele	Sample size	% of sample at precision level 0.6
low land	Ajacho Boyo	282	50	21.67
lowland	Kamacho Barare	323	57	24.82
Mid highland	Hule Gutancho	275	48	21.13
mid highland	Alage	421	74	32.35
	total	1301	229	100

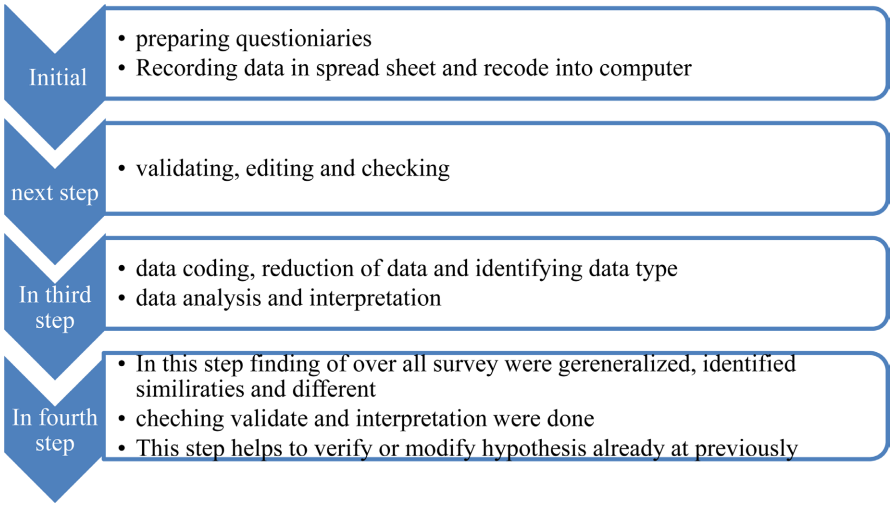

Figure 1. The analytical framework.

was estimated at 72.5 percent, while the remaining 27.5 percent were female-headed households. The wealth status, on the other hand, tends to dominate the middle income level. Most of the sample households were literate meaning they had primary and secondary education. Statistical expression of educational status: 45% attended primary school and 41.5 % had no education at all.

Demographic and socio-economic status of the respondents

In order to assess the socio-economic status of the respondents, different related questions were asked household head which discussed in details in Table 3.

The youngest head of household was 27 years old, the oldest 70 years old. The mean age of the sample heads of household was 49.8 years, showing that most households are of productive and active age. According to Ndobo (2004) in most African countries single heads of household aged between 19 and 40 represented the highest percentage estimated at 54%.

The average household size of the respondents was estimated at 4.6 people per head of household. The average household size for male-headed households was

Table 2. Description of socioeconomic summary of respondents (discrete variables).

General characteristics		Number	Percentage
Gender of HH	male	166	72.5%
	Female	63	27.5%
marriage status	Singe	3	1.3%
	Married	188	82.1%
	widowed	32	14.0%
	divorced	6	2.6%
wealth status	rich	47	20.5%
	medium	105	45.9%
	poor	77	33.6%
education status	not followed	95	41.5%
	primary	103	45.0%
	secondary	31	13.5%

Source (Survey, 2022).

Table 3. Demographic and socioeconomic characteristics of respondents (continuous variables).

	Minimum	Maximum	Mean	Std. Deviation
age	27.00	70.00	49.8646	6.51409
total number child	0.00	12.00	4.6201	1.99115
land size in hact	0.20	5.00	1.4352	0.94527
Household annual income	1000	120,000	22,412.2	27,273.5

Source (Survey, 2022).

5 people and for female-headed households it was 3 people per householder. This study line with [18] his finding that the average household size in the study district was calculated to be 4 people per householder. This large family size lends itself well to adjustment purposes with to application of great forces in agricultural activity, moreover, in the in case of consumption it led to negative effects on the heads of families.

Smallholder farmers in the study area own land, which is a component of their natural capital. Nearly all responders, regardless of size, own a piece of property. The estimated land holding ranged from 0.2 ha to 5 ha, with an average of 1.4 ha. According to a poll, the majority of inhabitants in the Shashogo district make their living mostly from agricultural products. Eighty-five percent of the population works in agriculture, thirteen percent raises livestock, two percent works as day labourers, while the remaining individuals do a variety of jobs and receive remittances. The sample households had an average annual income of slightly over EB22, 000. Livestock farming, the sale of livestock products, and other livestock-related activities are the sources of revenue. Grain sales, livestock products, and livestock farming are the main sources of income. But revenue from non-agricultural sources was not as important. This result is consistent with World Bank report [3].

4.2. Smallholder Farmers Perception on Change in Climate Parameters

Different perspectives were held by respondents on the variables and climate change. The extending of the dry season, the beginning or shortening of the rainy season, and the intensity of the precipitation all changed in response to variations in precipitation variability. In response, a few key informants provided the following explanation: "Nowadays, the dry season is frequently extended to 10 months per year; when I was younger, it rained for more than 6 months per year."

They went on to say that it is now difficult to forecast when the dry and rainy seasons would start and conclude, and that the rainy season is no longer short and predictable. It is claimed that the rainy season started in March and ended in September 10 to 25 years ago. These days, though, it's hard to tell where it starts and finishes. The rainy season may begin in May or June or may terminate altogether during the Belg season. This indicates that it arrives late, which is why bigger and later rainstorms frequently cause floods. Landslides, livestock losses, and home evictions have all caused devastation as a result of this. The most dangerous weather conditions in the area, according to those questioned, are drought, flooding, and damaging wind.

Through related effects, this study region was also affected by changes in precipitation characteristics, intensity variations, and irregular precipitation. Based to key informants, the district did not receive enough rainfall for Belg's land preparation and sowing. Ten years ago, during the rainy season, it would rain on average four to seven days a week. However, it rains one day every two weeks,

one day every month or not at all during the Belg season. Belg seasonal fruit losses, either partial or total, were therefore common in the district. This suggests that food insecurity has escalated into a significant issue in the district.

Farmers' perceptions of long-term rainfall and temperature variations are displayed in Table 4. We asked smallholder farmers to explain how they interpreted the 20-year trends in temperature and precipitation. The majority of respondents (89.5%) to the study indicated that they have already encountered temperature shifts and variations. Notably, a significant majority of respondents about 85% agreed that they had observed rising temperatures, and a majority of respondents about 73% agreed that precipitation had decreased during the previous 20 years (Table 4).

The findings indicate that smallholder farmers stated that they were more of a shift in temperature than in precipitation. The results of the FGD are added to the household survey results in Table 4. Based on rainfall data, the most frequent event that has been seen is irregular rainfall, which is characterised by intense downpours that occur quickly. Due to floods downstream and drainage in the mid-highland agro-ecology, lowland crop output was eventually impacted by damaged crops and cattle fodder. This result is consistent with that of [9], who discovered that a district was severely affected by flooding, particularly in relation to immature crops. His examination of a flood hazards analysis map revealed that Shashogo Woreda included places with over 90% of land.

The sufficiency of the rainfall in terms of providing livestock with fodder, agricultural growth, and forest productivity also accounted for the variation in rainfall amounts. The amount of rainfall determined the agricultural yield, which is why the majority of respondents relied on rain-fed agriculture. Local communities recognise the effects of climate change, according to [22], provide several indicators of it, such as dwindling precipitation totals, unpredictable

Table 4. Perception of smallholder farmers' on temperature and precipitation.

Variables	Percent of response
Have you heard about climate change/variability in your district?	
Yes	89.5
No	10.5
Temperature	
Increasing	85.2
Decreasing	8.3
No change	6.6
Rainfall	
Increasing	3.5
Decreasing	72.9

Source (Survey, 2022).

precipitation patterns, unpredictable start and end times, and an increase in the frequency of droughts.

4.3. Climate Change Impacts

Indigenous people use their understanding skills to define impacts of how climate fluctuate and are unpredictable. The incidence of plant and animal diseases, soil erosion, landslides, livestock mortality, low productivity, low growth and declining agricultural yields, and a loss in the quantity and quality of forest species are among the perceived effects of climate change, according to the respondents. Since KII depicts the emergence of plant and animal disease, it has recently happened in ways that are unexpected and deviate from what is usual. Due to feed shortages brought on by climate change and fluctuation, livestock mortality and low production were frequent issues. Furthermore, a result of climate change and variability include declining food yields and declining numbers and quality of forest species.

4.4. Climate Change and Food Insecurity

Different techniques are used by respondents to express the effects of climate change. They clarified that enhanced varieties had not been produced in the area for a long time and that in the past they had only grown native kinds to satisfy household food needs. The yields were adequate even though the majority of the time just two types of crops were cultivated. Currently, nevertheless, smallholder farmers have adapted to the inconsistency by introducing improved crops and planting a variety of crops because it is uncertain when the rainy season will come and end. According to FGD, they were unable to continue using conventional crops and methods because of unpredictability and change. Without input and appropriate management, agricultural productivity is challenging in this region due to its very variable and unpredictable circumstances of climate.

Additionally, according to FGD, there were strong agricultural productivity levels and consistent rain patterns fifteen years ago. However, life is currently precarious due to the lack of rain. Many years ago, according to one of the primary informants, we would cultivate and harvest 20 to 30 quintals per "kertu", which is the local term for half a hectare. But these days, we are forced to wait for food assistance because the dry season is lasting longer and there isn't any seasonal rainfall in Belg.

An elder in the neighbourhood stated that although agricultural productivity was high both before and during the Derg era, the current drought as well as wind damage our crops. It's not excellent productivity that keeps us eating at home because there hasn't been enough rain. Starvation and production losses are the immediate results of the difficult-to-plow terrain. Moreover, Hule-gutanch and Kemacho-Barara Kebele key informants said that "the main challenges of our poverty are nothing other than the lack of rainfall and the variability of climate change".

Climate variability and change have an impact on animal productivity and production in addition to crop productivity, as was highlighted at FGD. Livestock productivity was in danger in addition to how climate change and variability affected the availability of water and the quality and amount of fodder. There is currently a shortage of feed and drinking water, which is killing livestock. In this context, sheep and oxen continue to be extremely fragile among lactating cattle, although goats and donkeys are comparatively hardier than other livestock species. Furthermore, the respondents believed that the paucity of water and pasture brought on by recurrent droughts had reduced the number of cattle and their life expectancy. The depletion of stocks that cannot withstand the harsh season is the other factor contributing to the fall in livestock.

An increase in crop and livestock diseases was also mentioned and reported by the community as another significant effect of climate change. This is because the most suitable environmental conditions that favour the pathogenic host or pest have been created by climate change and variability. The respondents stated that the following times are common for animal disease and plant pest/disease 1) when rain starts to fall, 2) when it stops (dry spell), 6) during an extended period of drought, and 4) when it rains during either an extended period of the dry season or an extended "bega" season.

In addition to the severity of the scarcity of water resources, the length of time they last fluctuates with the arrival of rain. Water scarcity typically lasts for five to six months during the months of October through February, April, and June in typical years. Different months and times of year have severe fodder shortages. Additionally, if the dry season continues, it will rely on the rainy season and the availability of harvested crop wastes for animals. Lack of access to drinking water is a major cause of livestock mortality. The output of milk has decreased at the moment in the mid-lowland agro-ecological area. The scarcity of fodder causes a general decline in animal productivity, which is exacerbated or intensified from January to June. There is not enough water downstream when there is not enough rainfall upstream. Reduced output and livestock deaths have been caused by drought. One respond cited this from KII, saying, "Now we get milk from five cows, whereas twenty years ago we got milk from one cow."

4.5. Observation Causes of Climate Change/Variability

The causes of climate change and variability, as well as their effects, were perceived by smallholder farmers. Based on conduct survey from household head to the level of estimation the amount, unpredictability and qualities of precipitation explain climatic change and variability. They noted that people's departure from their religious and cultural norms because they prediction is not fit with actual phenomenon. In this context, the KII explains that when the rainy seasons approach, we pray to God, and the rain eventually falls. However, this custom is currently eroding on occasion.

Furthermore, the findings of the FGD indicate that the community views the primary causes of climate variability and changes as a curse from God, which is brought about by disobedience on the part of humans, hatred amongst people, judges' lack of fairness, disregard for the rights of every individual, corruption, and the rise of new religious movements. Traditionally, key informants blamed rising temperatures and a lack of rainfall on deforestation and tree-felling.

4.6. Adaptation the Impacts of Climate Change

According FGD report essay that in the study area community uses a variety of adaptation techniques to response such climate change impacts, such as using traditional methods to forecast temperature and rainfall.

4.6.1. Indigenous Rainfall and Season Prediction

As discussed FGD, the Shashogo District community practices various climate change adaptation strategies, including forecasting precipitation amounts and temperature using indigenous approaches. Local/indigenous community predict climate change/variability, using various methods including animal behaviour, tree phonology, cloud cover, wind circulation and other social and environmental indicators. These are used to predict when the rain fall is coming and to identify season types (**Table 5**). They observe animals, plants, wind direction and cloud conditions to predict climate/weather. Indigenous people predict the coming of rain by observing the characteristic of their environment (animals, plants, bodies of water, etc.).

Communities forecast future rainfall on daily and seasonal basis, showing weather conditions are either good or bad. A bad season is a season of drought and limited rainfall whereas the name suggests, a season of sufficient rainfall is good and suitable for both crop production and livestock. The wisdom of the local community on precipitation forecasting is essential for multipurpose such as for land preparation, indicate rain either limited or strong rain will come etc.

As discussed with the focus group, around 90% of indigenous communities were in favour of evidence of instructed the indigenous weather forecast; however there are potential challenges and limitations to project the forecast of climate changes/variability. In their group discussions, some of the challenges of forecast were identified such as criticisms of religious people, lack of trust from the young generation, the deterioration of the natural environment, that serve as indicators and lack of written documentation. According to [37] lack of trust from the young generation/modernization and lack of documentation are the main problem in actual acceptance of local knowledge.

4.6.2. Indigenous Climate Change Adaptation Practices

In the study, many response mechanisms are applied to the effects of climate change, which are backed up with a scientific finding. During the focus group discussion, it was revealed that communities/indigenous peoples are employing

Table 5. Rainfall prediction wisdom by the local community

Indicators	wisdom of prediction	Significance
Onset of rain/coming of rain	Presence of cloud with high wind pressure	for land preparation
Wind direction	Winds move from left to right /from south to North indicates good season	Indicate rain will be coming
Wind direction	Winds move from North to South indicates good season	Indicates no rain
cloud	Presence of cloud but not windy	Indicate strong rain will come
Smog and cloud in morning	Observation grasses leaf and sky	Indicates no rain
Moon	Moon hides when it is going to rain	Readiness for receiving coming rains
Sound of heaven/guga	If the sound goes from North side it will rain	indicate good rainfall
lightening in the sky	implies the coming of rain	Shows raining
Colour of sun	red colour when sunrise indicates coming of rain	
Rain in nearby area	If it rains to the right side then rain is expected in the area	
Stars	Bigger and many for prediction of rainfall for 28 days	interpreted by special traditional expert
cattle	Smell if it going to rain or towards to heaven	
Bird	Sound and dancing/movement	indicates coming of rainfall
Frog	Sound	shows coming of rain
Colour of rivers/lakes	Black	shows good season
	light/clear	shows bad season
Cattle behaviour	Cattle refusal to get out, doesn't want to come back to home, they eat wood instead of forage	Indicates no rainfall and bad season
	Stand ,not interested to graze and drink	bad season is expected
	Eat and drink normal	well good season is expected
Rainbow	Occurrence indicates bad season	
Timing of rain	If it rained in the morning and again in the night	It is believed that the season is good. in noon, the season is predicted to be bad

Source (Survey, 2022).

different climate change adaptation strategies planting trees and protecting existing forest to mitigate climate change. In addition, near the Bilate River/Boy Lake farming and collecting crop residues for livestock feeding better adaptation practices in region. This finding is consistent with [37] his finding informal that collecting crop residues for livestock feeding during drought season and migrating toward river banks is common practice, among smallholders in Ethiopia. In addition, the community uses the longstanding tradition of requesting support from relatives, borrowing from each other, sharing together, selling livestock to buy food, migrating to the city for search of work for daily income, eating small

amount of food for saving, ask for support from government and selling of fuel wood and charcoal, and etc.

The local community has a short term early warning system and if they see a sign of heavy rain upstream, they call out to the community downstream as this means they are provided with other materials and personal resources based on this evidence. There are informal local institutes in the community that play a large role in their livelihood. Task of this informal local institutes to support each other in different situations for instance "Edir" serves for at funeral occasion, "ekub" serves for economic development, youth association does teamwork and "Wiijoo" is a traditional women's association that provides livestock products to its members when threatened, animal products such as milk, cheese and butter. The same applies to [27] informal and formal social groups support each other in difficulty times.

On the other hand, there are planned climate change adaptation strategies that are presented to the community by government and non-governmental organizations. The Productive Safety Net program is part of the government planned climate change adaptation strategies and NGOs' and calls for government food support.

5. Conclusions

The change in rainfall was reflected in the suitability of feed for livestock and a lack of available water for livestock, lack of rainfall for crop cultivation and a reduction in forest productivity. Crop yield depended on rainfall, which lowered produce. Indigenous people perceive the change and variability of climate variables through their impacts. Some of the impacts were: the emergence of animal and plant diseases, soil erosion, landslide, death and poor productivity of livestock, low growth and yields of crops and the extinction of forest species.

The indigenous people express their opinions for the sake of climate change. Traditionally, the reason for these is forgetting the prayer culture, deforestation and the felling of trees. The community in Shashogo District has their own prophecy mechanisms. These are animal behaviour, tree phonology, cloud cover, wind circulation, and other social and environmental indicators that help predict the coming of rainy season and identify season either good or bad.

There are some forecasting mechanisms which challenged and criticized by religious people that means they do not accept it in recently: the modernization of their perspective in a scientific way by young generation and the deterioration of indicators due to environmental and climate change. Indigenous practices respond to climate change by protecting existing forests and planting trees to mitigate climate change. In addition, these smallholders' farmers are adapting through resettlement

6. Recommendation

Stakeholders should better to share ideas about predicting and responding of

climate change with the local community. Community acceptance of local knowledge by linking to scientific analyses would be better to improve climate change prediction and response.

Conflicts of Interest

The authors declare no conflicts of interest.

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