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*Full Length Research Paper*

**Indigenous Knowledge Practices on Weather Forecasting and Drought Disaster Management: The Case of Borana Zone, Oromia Region, Ethiopia**

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**Abstract**

*Indigenous knowledge is knowledge that is unique to a given society. It is the foundation for local-level decision-making in various situations such as in weather forecasting, agriculture, health care, food preparation, education, natural resource management, etc. The main aim of this study was to explore the indigenous knowledge practices of Borana community in predicting weather and managing drought disasters. Tools such as interview questions, focus group discussion and observation checklist were used. In selecting the study site, the researchers used purposive sampling technique and hence selected two kebeles: Did-Yabello from Yabello woreda and Haro Bakke from Gomole woreda. The result revealed that Borana people make forecasts by using the readings of intestines of slaughtered animals, observation of celestial bodies and changes of part of plants and animal body languages which indicate the occurrence of drought. The finding also showed that biological, atmospheric and astronomic indigenous weather forecasting practices which indicate the coming of drought are very important knowledge for the Borana community as weather information is vital information in preparation and prevention of disaster which is caused due to drought. Based on the information, they use coping strategies to reduce its damage. Problems of unreliability, poor documentation, oral-based knowledge transfer system, the influence of religion and modern education, ageing and extinction of traditional experts were identified as the challenges of Borana traditional weather forecast. Documenting the indigenous knowledge of weather forecasting and integrating it with the meteorology data is recommended in order to reduce the disaster that a drought causes.*

**Key Terms:** *drought, indigenous knowledge, weather forecasting, disaster management*

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### Axareeraa

*Beekumsi ganamaa beekumsa aadaa ta'ee kan hawaasni tokko qabaachuu maludha. Haalota garaagaraa keessatti, fakkeenyaaf, tilmaama qilleensaa, qonna, eegumsa fayyaa, nyaata qopheessuu, barnoota, to'annaa qabeenya uumamaa fa'iif murtee kennuudhaaf bu'uura. Kaayyoon gooroo qo'annaa kanaas hawaasa Booranaa keessatti haala qilleensaa tilmaamuufi balaa goginsaarraa ka'e mudatu to'achuuf beekumsa ganamaafi barteewwan adda baasuudha. Walitti qabiinsa ragaa qorannoo kanaaf, afgaaffii, marii garee xiyyeeffannaafi daawwannaan dhimma bahameera. Qorannoo kanaaf, Godina Booranaa keessaa, gandoonni lama, jechuun gandi Did-Yabelloo kan jedhamu Aanaa Yabelloo irraa, gandi Haroo Bakkee ammoo Aanaa Gomolee rraa filatamaniiru. Argannoowwan qorannoo kanaa akka agarsiisanitti, uummatni Booranaa haala qilleensaa kan tilmaamu bineensota qaluun mari'imaan isaanii dubbisuun, gara samii ilaaluun, jijjiirama qaama bineensotaafi amala isaanii, akkasumas jijjiirama qaama biqilootaa garaa garaa irratti mul'atan kan dhufaatii goginsa ibsan ilaaluudhaani. Argannoon biraa, beekumsa ganamaatiin goginsaarraan kan ka'e rakkoo qaqqabu malu hiri'suuf, yookan ittisuuf odeeffannoon haala qillensaa murteessaa kan ta'e, akkasumas goginsi dhufaa jiraachuusaa kan agarsiisan wantoota baayiloolojiikaalaa, atimoosfeeriifi astiroonoomiitti dhimma bahu. Odeeffannoo qabatamaan akka ibsutti, miidhaa jiru hir'isuuf qophii barbaachisaafi murteewwan adda addaa nigodhamu. Rakkoowwan tilmaama qilleensa, mala aadaa Booranaa keessatti kan ta'an kan akka amanamummaa dhabuu, jiraachuu dhabuu bifa barreeffamaa, beekumsi afaaniin daddarbuu, dhiibbaa amantii, barnoota ammayyaafi dulloomuu ogeessota aadaa fa'i ta'uun adda baafamaniiru. Beekumsi tilmaama qilleensaa akka hinbadneef, beekumsi ganamaa kun barteewwan barreesuun odeeffannoo meetiroloojii waliin qindeessanii fayyadamuun nigorfama.*

**Jechoota Ijoo:** *Goginsa, beekumsa ganamaa, tilmaama qilleensa, balaa to'achuu.*

## 1. Introduction

In International context, the term 'indigenous' is understood (mostly by Europeans) as being similar or synonym to 'traditional', 'aboriginal', 'vernacular', 'African', 'black', and 'native American' (Loubser, 2005). The phrase 'indigenous people' also refers to a specific group of people occupying a certain geographic area for many generations. They possess, practice and protect a total sum of knowledge and skills constitutive of their meaning, belief systems, livelihood constructions and expressions that distinguish them from other groups (Dondolo, 2005).

Indigenous knowledge (IK) is the knowledge possessed by local people that enables them to make a living in a given environment (Dinucci & Fre, 2003; Ghorbani *et al.*, 2013; Abate, 2016). This knowledge is well adapted to the requirements of local people and conditions. Indigenous knowledge is typically owned by indigenous people who are defined as people whose social, cultural and economic conditions make them stand out from other sections of the national community (Emery, 2000). The IK is unique to a particular culture and society. It regulates customs, traditions, and local decision making in agriculture and resources management. Berkes *et al.*, (2000), defined traditional (indigenous) ecological knowledge as a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings, including human beings, with one another and with their environments. Indigenous Ecological Knowledge (IEK) is the knowledge and insights acquired through extensive observation of an area or a species (Huntington, 2000).

There are about 350 million indigenous people living over 70 countries across six continents, which are approximately 5% of the total world population, who represent more than 5000 languages and cultures (UNESCO, 2015). Indigenous people include Native Americans, Aboriginal and Torres Strait Islander people in Australia, the Maori People of New Zealand, the Sami of Northern Europe, indigenous minorities in Africa, as well as various tribal people throughout Asia (Dyson & Underwood, 2006).

Throughout the world, indigenous people are among the most valuable with respect to food production, conservation and management of critical ecosystems (Verschuuren *et al.*, 2008). Indigenous communities living in different parts of the world have adapted and attached their lives with the surrounding physical world (Jafari & Kideghesho, 2009). They are interacting with natural ecosystems (such as soil, water, land, forest, trees and wildlife) for various socio economic aspects. Indigenous people's relationships to their lands, territories and natural resources carry unique social, cultural, spiritual, economic and political dimensions and responsibilities (Adu-Gyamfi, 2011).

The idea and practice of indigenous weather forecasting is inherent in many cultures and has been established after long years of observation (Ziervogel, 2010). Different cultures make use of biotic indicators to predict future weather conditions. For example, in Zimbabwe, plant, human and animal conditions are used for weather forecasting (Shoko, 2012) whereas, in Nigeria and Kenya, observation and interpretation of animals body conditions and behaviors are used to provide information about future weather conditions (Shukrat *et al.*, 2012). Roncoliet *al.*, (2012) demonstrated that indigenous knowledge on rainfall forecasting can form an important part of the scientific forecasts in Burkina Faso. It was urged that understanding how local communities perceive and predict rainfall variability is key to communicating scientific weather forecasts.

Over the course of history, and up to this day, traditional local communities have continued to rely heavily on indigenous knowledge to conserve the environment and deal with natural disasters. The communities, particularly those in hazard-prone areas, have generated a vast body of indigenous knowledge on disaster prevention and mitigation, early warning, preparedness and response and post-disaster recovery. This knowledge is the sum of facts that are known or learned from experience or acquired through observation and study and handed down from generation to generation. According to Intergovernmental Authority on Development (IGAD, 2006), indigenous knowledge can be summed up as the knowledge of an indigenous community accumulated over generations of living in a particular environment. It is a broad concept that covers all forms of knowledge, technologies, know-how, skills, practices and beliefs that enable the community to achieve stable livelihoods in their environment. Communities identify themselves easily with indigenous knowledge systems which have enabled them to live in harmony with their environments for generations. The systems are important tools in environmental conservation and natural disaster management.

According to Langill & Ndathi (2001), pastoral communities have a number of coping strategies which they use during times of droughts. Some of the coping strategies applied by pastoral communities include movement with their livestock to other regions. According to Kagunyu *et al.*, (2008), pastoral communities move long distances along and across the borders to save themselves and their livestock.

Borana Zone is a disaster prone area like any other desert areas in Ethiopia. It is vulnerable to disasters such as drought unless enough preparation is done by the community as well as the government. As a result of the drought, there has been migration to the areas where water and grass are available for their livestock which can cause environmental degradation from one location to another due to excess competition of scarce resources; often leads to conflicts regarding grazing rights in the area. Therefore, the knowledge of weather forecasting information is very important for the Borana community which informs the occurrence of drought, the knowledge which the Borana community rely on.

## **Objective**

The objective of the study was to explore the indigenous weather forecasting practices, and the preparation and prevention mechanisms done by the community in order to manage the disaster of drought.

## 2. Materials and Methods

### 2.1 Description of the study area

Borana Zone is located in the southern part of the Ethiopian lowlands occupying a total land area of about 95,000 km<sup>2</sup> (Kamara *et al.*, 2000). It is located between 3°36'N - 6°38'N and 33°43'E - 39°30'E, sloping slightly from 2702 meters above sea level in the northeast to about 496 meters above sea level in the extreme south that borders northern Kenya. The climate of the area is arid and semi-arid. Rainfall is bimodal with the long rainy season occurring during March-May and the short during October-November. Spatial and temporal variability in both the quantity and distribution of rainfall characterizes the area with an average annual rainfall varying from 353mm to 873mm per annum (Kamara *et al.*, 2000).

### 2.2 Study design and sampling technique

#### Study Design

For this study an exploratory research design (quantitative and qualitative approaches) was used. Qualitative research approach was employed in the study because of its appropriateness. Qualitative approaches to research are concerned with the subjective assessment of attitudes, opinion and behavior (Kothari, 2004).

### 2.3 Data Collection Instruments

In this study, both the primary and the secondary data collection techniques were used. This include interviews, focus group discussion, observations and document analysis. In doing this, the English version of the interviews and focus group discussions were translated into the study area community language, which is Afaan Oromoo with moderators in order to be in touch easily and gain full information from the respondents.

## 3. Results and Discussion

### 3.1 Biological Weather Forecasting Indicators

Intestinal reading is used to forecast the timing and severity of drought, peace, conflict, the time of livestock mass death, and the timing and the place where good pasture can be available. Weather forecasting, based on a reading of the behavior and body language of animals and parts of plants or observation of weather conditions is largely known by many people in the study area. The reading of intestine of slaughtered animals, the reading of animal behaviors and their body conditions and the reading of plants conditions and are discussed under this sub-section.

#### 1. Reading the Intestine of Slaughtered Animal

According to one of a well-known elderly, 78 years old, who is knowledgeable in reading the intestine of slaughtered animal, the technique of reading the slaughtered animal intestine can take about 2 years of training. A person who completed the training and started to make weather forecasts based on intestinal reading is known as *Uusaa*. Intestinal exploration is used to forecast the timing and intensity of drought, peace, conflict (war), the time of livestock mass death, and the timing and the place where good pasture can be available. *Uusaas* claim the intestinal features that are used for weather forecasts are mirrors of the future weather conditions. The intestines of cattle, sheep, and goats are used to forecast about the magnitude, severity, and duration of drought, drought-affected places, disease outbreak, the prospect of peace, and/or conflict. No special ceremony is needed before the animal is slaughtered and after the forecast is done, the meat of the animal used for forecasting purpose is eaten by the family and the neighbors. The figure below illustrates when the elderly person stated above was reading the intestine of a slaughtered goat.



Figure 1: The reading and interpretation of animal intestine by *Usaa* (photo taken during the study).

The system of reading the intestine of slaughtered animal is full of secret, as shown in figure 1. *Usaa* read and interpret slaughtered animal organs such as the large intestine (*qechuma*), small intestine, lymph node (*Kabello*) and blood vessels (veins) are used to forecast weather condition. *Usaa* look at the amount of food substance in the intestine, the color and amount of blood, and lymph node size to forecast the small and main rainy season drought condition. For example, the more the amount of food substance in the small intestine and large intestine, the forecast translates into normal rainfall season. But, the drought season is expected if they observe small amount of food substance in the digestion process in the small and large intestine. The intestinal weather forecasting system also used to predict the magnitude of drought. Mild, moderate, severe and extreme drought conditions are forecasted when *Usaa* see small, smaller, and very small food substance respectively in both the small intestine and large intestine.

When *Usaa* observe uniform lymph node thickness entirely and the node is covered by darker color tissues, the normal rainy season is forecasted, and rainfall onset will begin on the right time. Forecast for drought is made if a thin and very thin lymph node is observed. A very thick lymph node and large intestine are signs to predict that rainfall will start in two weeks' time and two months, respectively. Regardless of its thickness, if a marked swells is observed at the end of the lymph node that is regarded as the right sign to forecast an outbreak of livestock disease. In Borana, intestinal reading of weather forecasting system is done during the month of January and February which is expected to be applied in the next 2 to 3 months. These help herders to send scout to the areas which will be affected by drought. The amount and color of blood in the blood vessel on different parts of the intestine are also indicators for weather forecasting. If the blood filled stretch the vessel and its color is darker, *Usaa* forecast drought for both small rainy season and main rainy season. But if the blood is smaller and yellowish in color at the joint of blood vessel in the small intestine and large intestine, the forecast for the next season would be normal rainy season. The severity of the drought is inferred in indirect proportion to the amount of blood contained in the vessel; if the amount of blood in the blood vessels is small and yellowish in color, normal year is predicted. However, the absence of blood in the vessels is an indication of extreme drought condition. During data collection, the researchers confirmed that *Usaas* used the same signs and sign interpretation procedure and made similar forecast.

## Reading of Animal Behaviors and Body Conditions

### A. Cattle

The informants believed that particular body conditions and behaviors of cattle during abundant resources are indications for future weather conditions. Cattle behaviors that are interpreted as signs of a future drought are calmness, sleeping/lying down in the barn very close to one another, unwillingness to go to the nearby pasture, unwillingness to go away from water points after drinking, and poor appetite for grass and salt. Besides, the bull would isolate itself from the herd, go to the forest, and refuse to return to the herd. Moreover, cattle body conditions that are considered as indicators of a future drought are there,

which include: loss of body weight, erection of skin hair, swollen stomachs, which do not get raise even when they have eaten much, urinating and excreting while sleeping and decreasing of dung amount even when they eat enough and lack of desire for mating. On the other hand, informants believe that in view of a prospective normal rainy season, cattle lick each other's body, wander around villages, eat any bone found, leave water points immediately after drinking and show a relaxed mood.

### **B. Ground squirrels (*Tuqaa*), Ants, Termites and Bees**

As most respondents of interviews and FGD suggested, in addition to livestock, in Borana, weather forecasts are made using the behavior of other wild animals. If ground squirrels (*Tuqaa*) are busy in digging holes and the ants move along a sequence of nearly a straight line, a normal rainy season is expected and the vice versa, when drought is forecasted if squirrels are passive and ants are dispersed in search of food. The swarm of bees during the time of resource abundance season in their locality from north to south is regarded as a symbol for a future drought, while normal rainfall will be forecasted if they swarm in the opposite direction.

The activity of termites, two months before the beginning of small and main rainy season is also another indicator for the forthcoming season. When termites are actively engaged in gathering and storing of food, it is regarded as normal rainy season. In the contrary, if termites do not show any activity to gather and store food and build their home, drought will be expected. It seems clear that the above behaviors and activities of animals confirm that the forecast is derived from a belief that those animals act in a way that ensure their survival in the face of forthcoming season.

## **Reading of Plants Behaviors and Body Conditions**

### **A. Girar/Xaddachaa (acacia) and Eret/Hammeessa/ (aloe tree)**

In Borana, the phenology of *Xaddachaa* (acacia flowering tree with narrow leaves and black fruit pods, *Acacia tortilis*) (fig. 2) and Eret (aloe tree, a plant with fleshy-toothed leaves) (fig. 3) are used to forecast the main and small rainy season rainfall situation. In both cases, the community in the study area expect rainfall a month after the date of flowering of these trees. If the trees have small amount of flower and shed it early, that is regarded as a sign for a future drought.





Fig. 3 Calanqaa/Eret (Aloe tree)

### 3.2 Atmospheric Weather Forecasting Indicators

As most interviewees and focus group discussants replied, the condition of weather and climate elements such as sunlight, cloud cover, temperature, and wind are important not only to forecast weather but also to strengthen forecasts based on other biotic and abiotic indigenous weather forecasting methods. If a solar radiant with reddish color is observed at sunrise, Borana experts believe that the next season will have normal rainfall. A cloudy and white sky at sunrise is equated to the future drought.

When a strong and fast wind is blowing from east to west, in the month of March and February, they expect that drought is forthcoming. However, if the wind blows slowly raising the dust upward, people expect normal rainfall at the right time. The appearance of a whitish feather-like column of cloud (in a vertical position) in the sky is regarded as indicator of rainfall which is about to fall. If the sky is dominantly covered by light cloud, herders do not expect rainfall shortly.

### 3.3 Astronomic Weather Forecasting Indicators

In Borana, people who are skilled in reading of celestial body are locally called *Urjii Ilaaltuu*. (The man called Ibren Jilo is a known *urji ilaaltuu* who lives in Haro Bake kebele and he is 79 years old). According to this elderly, the morning star locally called *Bakkalcha Bari* (star at dawn east direction) and *Bakkalcha Galchuu* (in the west) is used for forecasting of extreme drought conditions. If it is seen in the West 70 (seventy) days after it has been observed in the East, and if it is seen in the East 7 (seven) days after it is appeared in the West, it is expected that the coming future will be normal. But, if it is not observed in the East on the seventh day after its appearance in the West and is observed again in the West after 140 days, it is assumed that as an indication of extreme drought in the future.

### Traditional preparation and prevention mechanisms for disaster caused by drought

There are activities which are done by Borana community as soon as the indigenous weather forecasting indicates that there is a drought in the future and the information is provided to people in market places, water points, and village settlements. The following are mechanisms which are done individually, as a family and as a community in order to minimize the damage of a disaster which can be caused due to drought. Since the cause of drought is the absence of rainy water or the water in the wells, Borana community takes a great care for the management of water. Borana pastoral water resource management involves all community members regardless of gender and age. In accordance with this, there are certain rules that direct the community in managing water resources. The first and the most prominent figure is *Abba Herregaa* (an appointed officer who takes a leading role on water resources management). Therefore, *Abba Herregaa* is appointed with the responsibility to manage water resources particularly the wells. Water resource management among Borana community is based on the existing indigenous rules and everyone obeys to the rules. In case, if problem appears against the rule, *Abba Herregaa* title holder requests to the council of elders for the enforcement of the rules of the community on water resource management.

Taking livestock to a location where there is a better pasture lands in times of drought (mentioned by all respondents); migration of young men to nearby towns and across borders (e.g. to Kenya) to find

employment; for contraband trades and temporary migration of young men to mining sites are some of the actions taken by Borana community when drought is forecasted. Respondents in all focus group discussion suggested that the young's assist their families in hay making and pasture enclosure activities. As some interviewees replied, herders sell livestock which are old and weak and cannot resist the coming drought period and they purchase the medicine for the rest of the livestock and buy grains when grains are cheaper. They also change the schedules of social and cultural festivities such as wedding. As suggested by kebele officials, development agents and many respondents, the existing coping strategies are not enough to resist the drought and thus additional external aid is needed from the government and non-governmental organizations during such a crisis. The finding indicated that the community eagerly expects the indigenous knowledge of weather forecasting information from the experts and willingly performs every preparation and prevention activities in order to minimize the disaster of drought.

### **Challenges in indigenous knowledge practices of weather forecasting**

Among 56 focus group discussion participants and 24 interview respondents, 51 of them replied, Borana indigenous weather forecasting knowledge is being influenced by the factors discussed below.

#### **A. Reliability problem of indigenous weather forecasting practices**

The revealed data stressed that herders are increasingly losing confidence in some methods of indigenous weather forecasting in its applicability. As kebele officials and development agents (DAs) replied, the precision and popularity of indigenous weather forecasting have become declined. However, it is reported that few individuals with exceptional weather forecasting skill indicate the timing and nature of rainfall accurately. There has been a public reaction to the negative consequences people suffered due to the faulty indigenous weather forecasting. Most importantly, people are frequently affected by the faulty forecasted information which shows a normal rainy season, but drought comes without preparation. According to the four selected DAs and 13 kebele officials, the Borana indigenous experts repeatedly failed to tell the exact timing and intensity of rainfall and drought. The proverb of Borana Oromoo says "*Raagi torba beekee torba wallaala*" which means the forecast of indigenous experts has seven rights and seven faults indicates that the indigenous weather forecast has its own strong and weak side.

#### **B. Expansion of religion**

According to the suggestion of focus group discussion, the younger (educated) generation seems to have lacked attraction with the wisdom of their forefathers, thereby undermining interest to learn the difficult technique of weather forecasting. The introduction of new religions would stand negatively to the respect and acceptability of indigenous experts, thereby making them to shy away from their indigenous practice.

#### **C. Poor documentation system/oral knowledge transfer of indigenous knowledge**

It was found during FGDs with elders across the study indicate that indigenous weather forecasting knowledge and use are inhibited by a number of factors: lack of documentation which means that the knowledge is individually owned in peoples' minds and shared only through oral traditions, and without recording the reference events and patterns; the information flow pathways are slow and do not reach all community members on time; some of the reliable biological indicators used in indigenous knowledge have disappeared or are at the point of extinction.

#### **D. Aging and extinction of traditional experts**

The people who are famous in interpreting the intestine of slaughtered animal and reading celestial bodies are called *usaa* and *urjii ilaaltu* respectively. They are known as a family called *usaa* family (*warra uusaa*) or family of celestial body readers (*warra urjii ilaaltu* or *warra argaa dhageettii*). There are only one or two families which are known for having the skill in one kebele. Even there are kebele's where there are no such experts at all. When the head of these families die accidentally without transferring his knowledge to the family members, not only the family but also the community loses such knowledgeable experts.

## Discussion

The finding of indigenous weather forecasting practices indicates that Borana community has many indigenous knowledge of weather forecasting practices which indicate different natural and man-made phenomena like the time of normal rain, the upcoming time of rain, time of drought, flood, famine, conflict (war), the time of livestock mass death and the timing and the place where good pasture can be available by using biological, atmospheric and astronomic weather forecasting indicators. As the main objective of this study is to identify the indigenous weather forecasting practices which indicate the occurrence of drought and take the necessary measures to minimize the disaster, the finding shows that, biological, atmospheric and astronomic indigenous weather forecasting practices which indicate the coming of drought are very important knowledge for Borana community as weather information is a vital information in preparation and prevention of disaster which is caused due to drought in order to reduce the risk of drought. Biological weather forecasting indicators which are done by reading the intestine of slaughtered animal and the reading of celestial bodies are the weather forecasting practices which are mostly accepted by the community in their reliability. The biological weather forecasting practices which are done by reading the animal's body and behavior and parts of plants and the atmospheric weather forecasting practices are familiar and practiced by everyone in the community. The weather forecasting practices of the reading of slaughtered animal and the reading of heavenly bodies are only practiced by knowledgeable experts which are locally called *usaas* and *urjiii ilaaltus* respectively.

The proverb of Borana Oromo community says “Raagi torba beeke torba wallaala” which means the forecast of indigenous experts has seven rights and seven faults. The proverb indicates that the Borana indigenous weather forecasting knowledge has its own weak side as it has a strong side. Even though the Borana weather forecasting knowledge has some faults in its application, the community still relies on it. The finding about the challenges of Borana indigenous weather forecasting practices reveals that reliability problems, expansion of modern religion, poor documentation system and aging and extinction of indigenous experts are seen as a challenge for indigenous knowledge practices and its continuity. The finding about prevention and preparation mechanisms done by the community in minimizing the risk of drought indicated that the community eagerly expects the indigenous knowledge of weather forecasting information which is informed by the experts and willingly perform every preparation and prevention activities in order to minimize the risk of drought. The repeated errors of indigenous weather forecasts and the erosion of indigenous values by modern education and modern religions, the oral transmission of indigenous knowledge and the pass-away of knowledgeable experts are challenging the long living of indigenous weather forecasting knowledge. Therefore, the future of building herders' resilience to climatic shocks depends on a better way of managing and integrating modern and indigenous weather forecasting.

The finding of Desalegn (2017) mainly focused on the steadily declination of the precision and credibility of traditional weather forecasting and the cause for this to happen is poor documentation and knowledge transfer system, influence of religion, premature death of forecast experts and expansion of alcoholism were the causes undermining the reliability of Borana indigenous weather forecast. But, this finding indicates that the challenge for Borana indigenous weather forecasting knowledge is not only the reliability problem but also the combination of many factors discussed above.

The finding of (Desalegn *et al.*, 2019), the case study titled “Indigenous knowledge for seasonal weather and climate forecasting across East Africa Climate”, done on farmers and pastoralists in East Africa (Ethiopia, Tanzania & Uganda) shows that farmers and pastoralists are using the combination of meteorological, biological, and astrological indicators to forecast local weather conditions. But as the finding of this study, still Borana community is not using the meteorological system.

The journal article entitled “Opportunities and challenges of indigenous biotic weather forecasting among the Borana herders of southern Ethiopia” studied by (Ayal, *et al.*, 2015) shows the extent how public confidence in the accuracy of indigenous weather forecast skills has been gradually eroded overtime due to faulty forecasts. But as the finding of this study shows Borana community still uses and relies on the forecast of indigenous experts.

## Conclusion and Recommendation

The study focuses on how indigenous knowledge is used for weather forecasting and drought disaster management by the Borana people of Oromia Region, southern Ethiopia. The purpose of this study was to explore the indigenous knowledge practices of Borana communities in predicting weather and managing drought disaster activities. Accordingly, Borana has many indigenous weather forecasting knowledge practices which indicate different natural and man-made phenomena like the time of normal rain, the upcoming time of rain, time of drought, flood, famine, conflict (war), the time of livestock mass death and the timing and the place where good pasture can be available by using biological, atmospheric and astronomic weather forecasting indicators. Among these, the indigenous weather forecasting practices which indicate the occurrence of drought are the reading of the intestine of slaughtered animals, the behavior of animals' body and plant parts condition, atmospheric and astronomic weather forecasting indicators.

When the weather predicted indicated that there is a drought in the future, the members of the community undertake different activities which helps to minimize the risk of drought such as, strengthening water management activities, migration with livestock to the areas where there is enough grass and water available, selling livestock which are old and weak and cannot resist the coming drought period, purchasing the medicine for the remaining livestock, cancelling the schedules of social and cultural festivities like wedding and requesting the government and non-governmental organizations for aid. Reliability problem of indigenous weather forecasting practices, the expansion of modern education and religion, poor documentation system/oral knowledge transfer of IK and aging and extinction of traditional experts are challenges of Borana traditional weather forecasting knowledge in preserving and keeping its reliability.

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