

Capturing Fading Indigenous Knowledge of Forecasting Rainfall and Drought, A Case of Makonde District, Zimbabwe

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Abstract: The study focused on the cultural ways of forecasting rainfall and drought in rural Zimbabwe through indigenous knowledge in Mashonaland West Province of Zimbabwe with reference to Makonde District. This study specifically probed into the part played by indigenous people in forecasting rainfall and drought in their local communities, through observing and interpreting celestial, biotic and physical environmental indicators. In order to achieve the purpose of the study, the researchers opted for a case study methodological approach that allowed the researchers to obtain detailed information about the study at hand. This is supported by Taylor (2003) who asserts that “a case study gives one the ability to obtain the causes and effects of research data”. In conducting this case study, qualitative methods were employed to explore the cultural methods of forecasting rainfall and drought in rural Makonde district of Zimbabwe using indigenous knowledge. The study employed face to face interviews and focus group discussions to collect data. The findings of the study revealed that in Makonde district, traditional cultural methods of forecasting rainfalls and droughts have proven to be effective in most cases, with limited cases of flaws that are also inherent in scientific climate forecasts methods used by Zimbabwe Meteorological department. Thus, for example heavy rains are sometimes reported late by the Meteorological office in Zimbabwe, long after the rains have destroyed crops, livestock, and people. Masara (2017) observes that the Meteorological department in Zimbabwe has become popular for dishing out misleading weather forecasts that have often left many farmers counting their losses. The study recommends that, there is need to document these cultural methods of rainfall and drought forecasting using indigenous knowledge in Makonde villages in order to cascade the knowledge and practices to future generations in our Zimbabwean communities. There is also need for reviving community meetings (dare raMambo) with the intension to share such vital indigenous knowledge to village representatives. Through such information sharing platforms, tacit cultural knowledge embedded in the village elders can be cascaded to the present and future generations of the Korekore and Zezuru clan. These, tacit cultural knowledge refers to the undocumented or unrecorded knowledge held by individuals in a community.

Key words: Indigenous knowledge, Climate forecasting, Droughts, Rainfall, Villagers, Religion.

I. INTRODUCTION

Makonde district is in Mashonaland West province of Zimbabwe. The province is in agroecological region II where rainfall is above 900mm per year and small-scale farming is the major activity in the area. Mashonaland West Province has seven districts and has an estimated total population of 193,906 (Zimbabwe National Statistics Agency, 2021). The study area has two main tribes. These are: the Korekore and the Zezuru clan. The area of study focused on the cultural modes of forecasting rainfall and droughts in Mashonaland West Province of Zimbabwe with reference to Makonde district villages, which are: Hombwe, Chipfuwamiti, Chigaro, Muvhami and Mukohwe valley.

This study was prompted by the need to renew interest in the use of traditional knowledge for weather forecasting by local communities. Traditional knowledge and practices in climate forecasting are slowly fading away in the rural communities due to contemporary education, scientific climate forecasts, locals' attitudes towards ethno-science, not documenting, monotheistic religions and other factors. These traditional practices are said to be reliable sources of climate forecasting as they can predict weather patterns at local level and provide solutions to the local people (UNISDR, 2015). This study seeks to confirm or reject the above assertion. Therefore, it is necessary to study and document the Makonde area's traditional knowledge and practices of predicting rainfall and drought before they vanish beyond possible recovery.

Statement of the Problem

Before Christianity, modern education and these sophisticated technologies came into existence, Zimbabwe rural communities banked their trust in cultural modes of forecasting rainfall and drought spells through indigenous knowledge. However, all this trust and practices are now a thing of the past in many Zimbabwean rural communities due to vast existing contemporary sources or bodies of knowledge being used to forecast rainfall and drought. Ayal et al. (2015); Makwara 2013; Shoko 2012; Nakashima et al. 2012; Speranza et al. 2010; & Chang'a et al. 2010 articulated that in many nations, the precarious survival of indigenous knowledge and

practices of climate forecasting is further being undermined by poverty, lack of clear knowledge transfer mechanisms and poor documentation.

The study was guided by the following objectives:

- i. Identify the indigenous ways used by indigenous people of Makonde district to forecast rainfall and drought.
- ii. Find out if there is documentation or recording of cultural ways of forecasting rainfall and drought in Makonde district.
- iii. Establish the accuracy of forecasting rainfall and drought through indigenous knowledge.

II. RESEARCH METHODOLOGY

The researchers opted for a case methodological approach because it allowed them to obtain detailed information pertaining the study at hand. This is supported by Taylor (2003) who asserts that “a case study gives one the ability to obtain the causes and effects of research data”. In conducting this case, qualitative methods were employed to explore the indigenous modes of forecasting rainfall and droughts in rural Makonde district of Zimbabwe. This research used face to face interviews and focus group discussions to gather data. A total of five villages (Hombwe, Chipfuwamiti, Chigaro, Muvhami and Mukohwe Valley) were sampled. The selection of villages was not systematic; it was mainly based on the accessibility to the respective villages.

The first step involved organising meetings with the traditional leadership, the ward councillor, extension agents and other civil society organisations already working in the area to explain the study’s objectives as well as seeking authority. Mapping was also key at this stage. Then after seeking permission the researchers organised a focus group discussion, which was attended by representatives of the five villages as well as traditional leaders, climate specialists, local government, specialist departments, faith representatives, farmers, school teachers and community elders.

The second step involved conducting of interviews. Interviews enabled collection of data from elders of the five villages (Hombwe, Chipfuwamiti, Chigaro, Muvhami and Mukohwe Valley) as a general technique to tap into the existing wealth of experiences that have been enriched through generations. Elders were, thus, treated as key informants and helped to generate specific technical and social indigenous knowledge on weather forecasting. Specific data categories collected through this method included a description of changes in behaviour by animals, flowering patterns of fruit trees, interpretation of the movements of winds and the general body feelings of the elders in relation to weather and climatic elements. In addition, interviews served as means of gathering data through probing the perceptions, attitudes, beliefs, and feelings of the elders about the critical role of traditional methods into forecasting rainfalls and droughts.

III. LITERATURE REVIEW

Traditional knowledge is known by other names such as: indigenous ways of knowing, rural knowledge, indigenous knowledge, or ethno-science. According to Kumar (2014) indigenous ways of knowing are acquired over a time through direct experience, as well as interacting and understanding the meta-physics or surrounding environment and its biological nature. This traditional knowledge is deemed to be unique, to a particular society. Through traditional knowledge, traditional ways of weather forecasting have been developed which assist the locals in planning for their farming activities. Traditional forecasting methods are cheaper to transmit information and can be applicable at community level. The Makonde district community still believe and utilizes indigenous knowledge in planning for their farming activities and disaster preparing decision making.

The practice of forecasting rainfall and drought is inherent in many cultures across the globe. The cultural practices of forecasting rainfalls and droughts in continents such as Asia, Africa, North America, South America, Antarctica, Europe, and Australia have been established after long years of observation by the locals (Ziervogel and Opere,2010). According to Joshua et al. (2012), different cultures in different countries make use of biotic indicators, for example plants, human and animal conditions are used in Zimbabwe for weather forecasting. Ayal et al. (2015) quoted (Shukurat et al. 2012; Speranza et al. 2010; Ziervogel and Opere 2010; Joshua et al.2012) who shared the same sentiments that in Nigeria and Kenya observation and interpretation of biotic indicators such as insects, plants, human, animals’ body conditions and behaviors are used to derive information about climate prediction. Literature reviewed has shown that there are similarities of indicators used by indigenous climate forecasters in African countries, as indicated on Table 1.

Table 1. Indicators used by indigenous climate forecasters.

Authors/studies	Indicator	Significance of indicator
Basdew et al. (2017)	Peach (<i>Prunus persica</i>) tree flowering, Grass grows fast and very green	Approaching of summer
	Half-moon facing east	Rain not expected
	Increase in pests	More rains expected
Kolawole et al. (2014)	Brandy or Raisin bush (<i>Grewia flava</i>) bearing fruits from November to early December	Low rainfall expected
	Brandy or Raisin bush (<i>Grewia flava</i>) bearing fruits from February/March	Plenty of rainfall expected
	Brandy or Raisin bush (<i>Grewia flava</i>) bearing no fruits	Drought expected
Chengula and Nyambo (2016)	Flowering of <i>Amorphophallus abyssinicus</i> , <i>Acacia drepanolobium</i> and <i>Myrica msaliciifolia</i> in January	Evidence of long rains expected during March– May
	Shading of leaves of <i>dioscorea asterius</i> trees in November, December, and January	

	Flowering of <i>Amorphophallus abyssinicus</i> , <i>Acacia drepanolobium</i> and <i>Myrica msaliciifolia</i> in August and September	Onset of short rains in October–December
	Shading of leaves of <i>dioscorea asterius</i> trees in August and September	
	Singing of rain bird, sunbird, and the red-winged starling after prolonged drought	Imminent onset of good rainy season
	Thunder and lightning	Impending rainy season
	Sighting of natural fires and heavy dark clouds over the Eastern side of Pare and Ugweno mountains	
	Blowing of wind from East to West in the upper and mid-upper zones in January and from west to east in early February	Looming rainy season in the months of February or early March
	Appearance of rainbow	Momentary stoppage of rainfall or gradual end of rainy season
	Appearance of crescent-shaped moon	Impending rainy season
	Solar eclipse	
	Presence of spittle bugs (<i>Machaerotidae</i> spp.) on trees	
	Movement of safari ants (<i>Dorylus wilverthi</i>)	
	Occurrence of large numbers of big black ants	Abundant rainfall expected
	Appearance of large amount of snow cover on Kibo and Mawenzi peaks of Mount Kilimanjaro	
	Migration of crabs to the higher grounds from the streams	Impending rainfall
	Croaking of frogs	
Making of noise by billy goats and dogs at night		
Sighting of bush baby		
Increase in volumes of water in streams during the dry seasons in the months of December and January.	Onset of rains	
Onyango (2019)	Timing, intensity, and duration of cold temperatures in the months of February and March	Abundant rainfall for March–May season
	Cultural and spiritual practices: Divination, visions and/or dreams by respected elders	Predict rainfall
	River water – warm	Rainfall expected very soon
	River water – cold	Rainfall not expected within the near future
	Pot full of water and herbs placed on three traditional cooking stones. Using a special reed, an expert blows into the concoction in the pot while other elders read and interpret the color changes	Black-abnormal rainfall expected (too much or too little) White – normal rains expected Red – destructive rains expected NB: The elders have the

		ability to invoke rains that are normally violent accompanied by strong winds, thunder, and lightning
	Appearance of whirlwinds or strong winds	Pending drought or dry spell
	Winds blowing predominantly from North to South	
	Winds blowing predominantly from South to North	Wet spell
	Observation of soot or behavior of smoke from burning grass – scattered soot in the air, direction of smoke movement, and rate of scattering	Wind direction and speed
	Formation of morning dew	Rains expected
	Observation of the water storage pots – coldness	Onset of rainfall expected
	Presence of blank ants, green, and yellow-striped grasshoppers	Looming drought
	Army worms	Expectation of bumper harvest
	Spotting of white quails	Signaled onset of long rains
Muriithi (2018)	Fruiting of the fig tree	Severe dry season expected
	Sighting of the male star is above the female star	Rain expected
	When the female star is above the male star	Dry spell expected
	Winds blowing Southwards	Prolonged drought
Salite (2019)	Presence of mist or fog in the atmosphere	Thunderstorm expected
	Moon turns to the top with its back facing the earth or the moon appears clear without a circle	Drought expected
	Fog disappearing by 7 am and not lasting up to 10 am	
	Change in behavior of animals by becoming quiet and not active in running or playing as usual	
	Numerous, radiant, and/or dispersed stars in the sky that brighten up the earth	Signs of no rains

Source: Ochieng’ et al. (2021)

In Makonde district the expansion of Christianity religion, modern teaching as well as technological aspects have brought about a twist in the practice, existence, and acceptance of cultural modes of forecasting rainfall and drought using indigenous knowledge in the area. In view of the Christianity religion, forecasting of rainfalls and droughts can only be revealed to the Priest or so called “Man of God” and not to everyone. They say it is a gift and only the chosen ones of God can have privilege to such intuition. Furthermore, Kipkorir et al. (2010) stated that, amid other factors, the dwindling popularity of cultural ways of rainfall and drought forecasting using indigenous knowledge in most countries is explained by the extinction of some biotic species that were used for weather forecasting by indigenous people. The

expansion of present-day education and monotheistic religions are other factors believed to be undermining the claimed rationality of indigenous knowledge (Joshua et al. 2012).

Challenges of forecasting rainfall and drought using traditional methods

Githungo et al., (2009); Kijazi et al., (2012); Makwara, (2013) bewail that the skill of forecasting rainfall and drought using traditional methods is under threat of disappearing due to lack of systematic documentation of the knowledge and lack of coordinated research to investigate the accuracy and reliability of these forecasts. This knowledge is also being endangered by occurrences such as climate change, population growth and urbanization (Masinde and Bagula, 2012). Another challenge in using traditional forecasting methods is what is considered to be a bench mark (normal). Consequently, it is imperative that more research be conducted to quantify the norms (Makwara, 2013). Just how many fruits, flowers and butterflies are considered to be ‘many’, normal’ or ‘too little’ is not actually defined by numerical values which are used by scientific methods. Indicators used in weather prediction are localised and communication is mostly oral, limiting the applicability of Indigenous knowledge system over large areas (IDRC, 2010).

IV. DISCUSSION AND FINDINGS

Most of the people in Makonde district are mainly Korekore and Zezuru. They have resided in the area for quite some time. They are of similar origins, with similarities in knowledge and ways of interpretation of the physical environment.

A total of 6 traditional prediction categories were identified in the study sites (see Table 1) and grouped into four categories of indicators. These include: celestial bodies; weather and climate; physical environmental; biological and trees. As shown in Table 1, the indicators serve to predict the rainy season, the imminent possibility of no rain during the following day, night, and season. However, when these indicators become recurrent for long periods of time, then they become signs of possible drought for upcoming agricultural season.

Celestial Indicators used by Indigenous Weather Forecasters.

The celestial body indicators farmers have been observing around the rainy season to predict drought include the moon’s appearance and position, the sun’s appearance and the stars’ appearance and quantity. According to these farmers, the main signs from the moon of upcoming drought are: when it rises ‘the other way around,’ like turned to the top with its back turned to earth; when it rises in a perpendicular or inclined position; or, when it is clear, without a circle which gives the appearance of rain or heavy clouds. Similar findings were described by Basdew et al. (2017) in relation to the moon’s appearance, shape and position, but not concerning the inclined position. The study established that signs of no rain include: when the sun is clearly visible, without clouds around or a circle that looks to have water on it; or when the stars are

numerous and radiant in the sky and brighten up the earth, or when the stars are dispersed in the sky. All the five villages concurred that the moon appearance, the sun, star quantity and appearance can predict drought. When there is no circle of clouds (or dziva remvura) on the moon it means that there is no rainfall in the coming day. A moon surrounded by clouds (or dziva remvura) reflects imminent rainfall. In most of the cases the elders are more than convinced that during the rainy season the new moon must come with a wet spell. Once the new moon is there ‘in the skies and no rains have been received then a prolonged dry spell is expected. When this occurs, elders in the area encourage that drought resistant crops with short term maturity such as sorghum, millet, rapoko, ground nuts, round nuts and beans be grown as maize can easily give in to the heat and associated moisture stress before maturity. A clear sun without clouds also represents no rainfall. The same also applies in situations when the stars are clear without any shadows around them.

Table 2. Celestial indicators used by indigenous weather forecasters.

Auth ors	Catego ry	Indicator	Description of indicator	Interpretatio n
Mak wara (201 3)	Celesti al bodies	Moon appearance and position	When the moon rises clear, i.e., without a circle with rain or heavy cloud appearance inside it (<i>dzivaremvura</i>)	No rain
			When the moon gives signs of rain, but it does not rain	drought
		When the moon is not surrounded by clouds during the night	No rain	
	Sun		No rain	
Star quantity and appearance	When the stars are clear, without any cloud shadows around	No rain		

Source: Author

Weather /Climate Indicators used by Indigenous Forecasters

Most of the respondents (96%) agreed on rainfall forecasting using the weather and climate. The air temperature, clouds, wind direction, thunder and lightning are used to predict heavy rains, moderate, little or no rainfall. Regarding weather and climate, despite farmers having mentioned using indicators such as very hot temperatures throughout the year, and the occurrence of thunder and lightning without rain, to predict drought, signs from wind were the most cited. According to these farmers, the main signs of forthcoming drought are: when there are no clouds; or when the clouds are clear and dispersed in the sky during the rainy season; or when they have been showing this behaviour over a long period during the year; or when during the morning the clouds are dark and showing signs of rain, but then they start to clear during the day until the sky becomes completely clear and no rain falls. The appearance of the clouds was also reported as being used in different parts of the world as a short-time

predictor of rainfall, such as in India and Mexico (Santha et al., 2010).

Table 3. Weather /climate indicators used by indigenous forecasters.

Authors	Category	Indicator	Description of indicator	Interpretation
Salite (2019);	Weather and climate	Air temperature	When it is very hot throughout the year	drought
Onyango (2019);		clouds	When there are no clouds, or the clouds are clear and dispersed in the sky during an extended period in a year, or during the season considered as rainy	drought
			When during the morning the clouds are dark, showing signs of rain but then they start clearing up through the day and become clear and it does not rain	drought
Chengula and Nyambo (2016);		Wind direction	When the wind blows in only one direction (e.g., West) without response (blowing) from the opposite direction (e.g., east)	drought
Makwara (2013).			When the wind blows in two opposite directions as if one direction was responding to the other (e.g., West and East directions)	Rain coming soon
			When there is a whirlwind during the morning period	Rain coming soon.
		Thunder	When there is thunder but no rain	Little rain
		Lightning	When there is lightning but no rain	No rainfall

Source: Author

Physical Environment Indicators used by Indigenous weather Forecasters.

The use of physical environmental indicators such as dew and fog to predict drought was reported in all the five villages. According to villagers, signs of upcoming drought occur when there is dew on the field early in the morning, or when the fog disappears by around 7 a.m., rather than persisting until around 10 a.m. as is usual when the rainy season is approaching or underway. Spontaneous fires in sacred mountains around Zumbara, Chipfuwamiti and Chakaboora villages is a sign of early rains and above average season. These signs are not unique to Makonde District as they are also witnessed in Hurungwe, Wedza and Zaka Districts. It is a well-known phenomenon in most districts of Zimbabwe.

Table 4. Physical environmental indicators used by indigenous forecasters.

Authors	Category	Indicator	Description of indicator	Interpretation
Makwara (2013); Onyango (2019); Salite (2019).	Physical environmental	Dew	When there is no dew in the field early in the morning	Rainfall imminent
		Fog	When the fog disappears by 7 am and not by 10 am as happens during the rainy season	No rain
		Fires	spontaneous fires in the sacred mountains	early rains and above average season

Source: Author

Biological Indicators used by Indigenous Weather forecasters.

Animal behavior being frequently reported as a biological indicator to predict the weather in different parts of Africa

(e.g., Ayal et al. 2015; Chang’a et al. 2010; Speranza et al. 2010). The animals were explained to predict drought when they change their behaviour, becoming quieter and not running or playing as much as usual. Another good example of animal ability to predict disasters could be what happened recently when the Tsunami struck. Despite the loss of 24000 people, wild animals seemed to have escaped the Indian Ocean tsunami, adding weight to the notion that they possess a “sixth” sense for predicting seasonal quality and impending disasters (Planet ark, 2004).

One of the most important animal indicators is the behaviour of insects. When a lot of crickets are observed on the ground, a poor rainy season is expected. In contrast to this, is when sun spiders (dzvatsvatsva) are visible in the area, they signal the imminent arrival of a wet spell. The elderly male farmers formulate hypotheses about seasonal rainfall by observing natural phenomena, such as the appearance of certain birds, mating of certain animals and flowering of certain plants, while cultural and ritual specialists draw predictions from divination, visions or dreams (Roncoli et al., 2001). The appearance of black and white stork bird (shohori/shuramvura), hornbill (*dendera*), swallows (nyenganyenga) are associated with a good season and eminent rain. The singing of some birds is said to be a good omen as far as rainfall is concerned. In particular, if hornbill (*dendera*) birds are heard singing, it is believed to be a very good sign of an approaching good rainy season. Equally, if a lot of swallows and white stork are seen in the locality, they are indicative of the onset of a promising rainy season. Indeed, a stork flying at a very high altitude is associated with a good season. In Makonde district the behaviour of animals, appearance and movement of birds and insects are frequently used by elders in the area to predict weather and climate in their communities.

Table 5. Biological indicators used by indigenous weather forecasters.

Authors	Category	Indicator	Description of indicator	Interpretation
Makwara (2013); Onyango (2019); Salite (2019).	Biological	Insects	Insects' hasty spiders struggling to get indoors or into hiding places	an indication of the starting of heavy (<i>manhuruka</i>) rains
			black and brown ants collecting food in the houses in large numbers	impending rains and long wet spell
			black and brown ants bring out the dead and damp food after a wet spell	short dry weather after which the rains will resume
			cicada singing in large numbers in September	marks the beginning of a normal to above normal season
			(<i>mbalavala</i>) butterflies (black bordered charaxes)	wet conditions approaching
			charaxespollux appearance of many butterflies	indicates early rainfall onset and give a prospect of a good season
			appearance of black butterflies in a particular area	signals a very good rainfall season over that area.
			appearance of red ants (<i>madumbwi</i>)	indicates imminent rainfall onset and signifies a prospect good season
			appearance of many termites, when flying ants are seen during rainy season termite (<i>majuru</i>) ancistrotermesp.	this shows the sign of having more rainfall in the year. indicates near rainfall onset
			appearance of armyworms (<i>mhuturu</i>) spodopteraexempta	signifies abundant rainfall in the upcoming season as they multiply when there is plenty of food
appearance of army worms on trees during October	signifies abundant rainfall in the upcoming season as they multiply when there is plenty of food			
appearance of grass-green grasshoppers (<i>madhumbudya</i>), occurrence of more grasshoppers in a particular year	indicates less rainfall and hunger			
			When ants came out of their holes in large numbers to collect food.	Heavy rains within the next 24 hours
		birds	Build their nests in the dry season near the riverbank.	means they are anticipating low rainfall and therefore confident that their nests will not be swept away by heavy rains; when they build their nests, high up farmers know for sure heavy rains will fall that season.
			a black crow builds a nest in an area, swallows and waterfowls lay eggs on raised patches in river valley, waterfowls breed on the ground under cover of grasses and reeds	it is an indication that that area would not receive rains because the birds would not risk its eggs going bad so low rainfall to drought conditions will be expected
			large numbers of white and black stock bird (<i>mashohori</i>) in October and November.	indicates imminent rainfall onset and a good rainfall season normal to above normal season, a lot of insects (birds' food) will be anticipated
			Hornbill (<i>dendera</i>) singing especially during dawn	rains are going to fall within a day to a week's time
			cuckoo bird (<i>kohwera</i>) singing of the bird especially in the afternoon from around 1400 hours in October and November	sign of imminent rainfall onset and a good rainfall season, its sound resembles the clattering rainfall.
			swallow (<i>nyenganyenga</i>) flocks seen flying all over in the area or appear in November/ appearance of large swarms	indicates heavy rain to come at that particular time. When they it indicates imminent rainfall onset. a lot of insects (birds' food) will be anticipated

Source: Author

Trees as Indicators used by Indigenous Weather forecasters

All the six villages associated heavy production of tree leaves with a good season while high fruit production is a sign of a poor season. The reasoning behind this observation is that high fruit production implies that people will be living on fruits for lack of alternative foods. Other indigenous signs of

an eminent drought include heavy infestation of most tree species by caterpillars (masondya, harati, magandari, manhemeteme - all edible worms) during springtime through to summer; late bearing and lack of figs in July-September of fig (muonde) and water berry (mukute) trees and the late maturing of acacia trees along valleys. As for the cuckoo /rain bird (kohwera, in the local language) to start calling, or particular hills/mountains to catch fire in the intense heat. If a

cuckoo bird is heard signing, rains are said to be just about to fall.

Table 6. Trees as Indicators used by Indigenous Weather forecasters

Authors	Category	Indicator	Description of indicator	Interpretation
Muriithi (2018);	Trees	Water berry (mukute)	significant flowering	starting from July through October is a signal of good rains in the coming season
Salite (2019);		Fig tree (<i>muonde</i>) and Water berry (<i>mukute</i>)	flowering and generation of new leaves.	indicates near rainfall onset
Chengula and Nyambo (2016);		Kagelia (<i>mumveve</i>)	when it gives a lot of sap during the dry season	it indicates abundant rainfall in the coming season
Basdew et'al (2017).		Bean pod (<i>musekesa</i>) tree <i>brachystegiaspeci formis</i>	significant flowering starting from July through October	is a signal of good rains in the coming season
		Sausage tree (<i>muchakata</i>)	The shooting of the sausage tree:	onset of the rainy season

Source: Author

Documenting and sharing of Indigenous Weather forecasting Knowledge in Makonde District

In this study interviews and group discussions revealed that indigenous knowledge and practices of weather forecasting in Makonde district were not being documented and shared. This study found out that the practice of passing or imparting indigenous knowledge from elders to younger generation through stories (*nyaya*) in the Makonde area was also fading away. The broken link or lines of sharing indigenous between village elders and younger generation in Makonde district is believed to have been influenced by attitude, perception, technology, values, and urbanization. It was noted that the young generation in Makonde village was now preferring to entertain themselves on social platforms such as WhatsApp or Facebook, rather than attending to cultural meetings (*padare*) to hear stories and to acquire traditional knowledge from their elders. During a focus group discussion 10% of the participants mentioned that given the opportunity there were willing to learn the traditional methods of predicting weather pattern in their rural community. The fading away of such practices, calls for an urgent practice of acquiring and documenting traditional knowledge (Mavhura et al, 2013).

Precision of Weather Forecasting in Makonde District using Traditional knowledge

The study found out that in Makonde district the Korekore and Zezuru clan trust their indigenous knowledge and practices of forecasting rainfall and drought. In a focus group discussion carried out, 70% of the participants agreed that their traditional weather forecasts were reliable. One of the most important indicators cited by participants was the

behaviour of insects. Thus, for example participants mentioned that if crickets (*gurwe*) are seen in large numbers on the ground, a poor rainy season is expected. In contrast to this, study participants also highlighted that if sun spiders (*dzvatsvatsva*) are visible in the area, they signal the imminent arrival of a wet spell. In addition, participants revealed that the appearance of black and white stork bird (*shohori/shuramvura*), hornbill bird (*dendera*), swallows (*nyenganyenga*) are associated with a good season and eminent rain. The singing of some birds is said to be a good omen as far as rainfall is concerned. In particular, if hornbill (*dendera*) birds are heard singing, it is believed to be a very good sign of an approaching good rainy season. In Makonde district the behaviour of animals, appearance and movement of birds and insects are frequently used by elders in the area to predict climate in their communities. Thus, for example, if a black and white stork bird (*shohori/shuramvura*) is seen flying at a very high altitude is associated with a good season. In summation the respondents agreed that the traditional rainfall and drought forecasts are reliable in predicting weather patterns to a greater extent.

Weaknesses of Traditional knowledge in Weather Forecasting in Makonde District

According to the findings traditional practices of weather forecasting have flaws. The study participants revealed that traditional methods of predicting rainfall and drought sometimes can not predict normal rainfall patterns to heavy rains leading to floods or cyclones. Thus, for instant when termites gather twigs for their nests it is a sign of prolonged rainfall (*guti*), but the volume of the rain is not known. It can be heavy downpours or cloudy days with prolonged rain showers. The western method is more accurate here as it can estimate the volume of rainfall to be received. Through, observation the study revealed that some of the birds, trees and animals used to forecast weather patterns were no longer seen in the Makonde area or were becoming very few because of deforestation and climate change.

V. RECOMMENDATIONS

- It is of paramount importance to lobby for the documentation and recording of rainfall and drought forecasting indigenous knowledge in Makonde district, so that the information can be cascaded to future generations.
- Traditional knowledge of rainfall and drought prediction should be preserved and archived at the National Archives of Zimbabwe and within all libraries in Zimbabwe.
- In addition, traditional rainfall and droughts forecasting methods should also be registered under the Copyright and Neighboring Rights Act (Chapter 25:05) for copyright protection.
- There is necessity to raise awareness on the importance of indigenous knowledge to present and

future generations in Makonde district and Zimbabwe at large.

- Traditional rainfall and drought forecasting should be presented on radios and televisions just like the scientific weather forecast by the meteorological services department. Community radio stations should play a greater role in disseminating weather forecast at local level.
- The education curriculum should also include traditional knowledge and practices of forecasting climate for awareness and publicity purposes as well as to impart the knowledge to the younger generations.
- Mobile applications on traditional rainfall and drought prediction should be designed to capture the attention of the younger generation to these issues.
- There is need for more research to determine traditional rainfall and drought forecasting methods used in all parts of Zimbabwe. The results will therefore be used for comparison to check if the methods are the same throughout the country. Future research should also compare the traditional and western methods to check which one is more accurate.

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