Indigenous Weather Forecast Systems: A Case Study of Weather Forecast Indicators for Chapo Village, Ward 17, in Matopo Zimbabwe

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Abstract

This research documents the indigenous weather forecast indicators used at Chapo Village, Ward 17, in Matobo District, Zimbabwe. Matobo District is in natural region IV which receives between 450-650mm per year and experiences frequent droughts. The objectives of this research were to identify and document the indigenous indicators used in this community, offer the meanings the villagers' attach to each indicator and establish their perception of the indigenous weather forecast indicators. The study adopted a qualitative approach. Focus group discussions and interviews were held to collect data in the village. The data was analysed using a thematic approach and this was underpinned by the afrocentric theory. The results showed that villagers used trees, birds, mammals, amphibians, reptiles and insects to predict the weather patterns. Of these indicators, trees had the largest number of species used in weather forecasting. The religious worldview of the locals also formed part of the intricate weather forecast systems used in the area. The people of Chapo Village value and rely on the indigenous weather forecast indicators which they derive from their environment. The study concludes that these indigenous weather forecasting methods are in form of intangible cultural heritage (ICH). There is therefore need to produce nomination files which will facilitate their inscription on the Representative List of Intangible Cultural Heritage of Humanity.

Keywords: Indigenous Weather Forecasts, Indigenous Knowledge Systems, Intangible Cultural Heritage, Indigenous Weather Indicators

Introduction

This study falls within the field of indigenous knowledge systems (IKS) focusing particularly on indigenous knowledge weather forecast indicators used at ward 17 Chapo Village, White-water in Matobo District. Meteorological forecasts are highly technical in nature. Most people do not understand them, and they get minimal or no benefits from such forecasts. Peculiar weather forecasts are available at a cost which rural communities may not afford. Left at the vagaries of weather that may lead to poor yields, hunger and poverty, rural communities may then rely on indigenous knowledge-based weather forecast indicators. Besides, these are the methods that have been tried and tested by their ancestors.

Even with the availability of scientific weather forecast, many rural communities still rely on indigenous knowledge-based weather forecasts indicators for them to make informed decisions on their agricultural practices. Numerous debates have arisen on the reliability of either method. The research did not seek to contrast the scientific with the indigenous weather forecast systems. Neither did it aim to enter into the polemical discourse suggesting the superiority of either method. Rather, it sought to document the indigenous weather forecast indicators used at Chapo Village and in the process create a repository for future generations.

Biotic weather forecasting indicators are a subset of indigenous weather forecasting method (Shoko 2012). Such knowledge is mostly known to the elderly. When old people who are the main custodians of the knowledge pass away, the knowledge that would have been accumulated for many years is lost (Mahoo, 2011). It becomes prudent, therefore, to document and preserve such knowledge so that it is not lost with the death of its custodian. This research intended to document this knowledge and preserve it for future generations. This is living heritage which the UNESCO 2003 Convention seeks to safeguard.

Contemporary society has a great interest in indigenous based knowledge. This research will contribute immensely to this growing global body of knowledge. Ellen and Harris (1996) posit that the priority of international indigenous resource centers is currently the codification and documentation of indigenous knowledge for general use. The indicators identified and interpreted will not only be beneficial to future Chapo Villagers, but also to other communities living under similar conditions.

Indigenous knowledge has a value and is relevant (World Bank 2010). It deserves to be treated with the same respect that is accorded to scientifically produced knowledge. Ellen and Harris (1996) maintain that knowledge produced by universities and research institutes around the world is gathered, documented and disseminated in a coherent systematic way. Such an approach is minimal in the documentation of indigenous knowledge. This research contributes to presenting indigenous knowledge in a coherent and systematic way.

Documenting the indigenous weather forecast systems used at Chapo Village contributes to achieving the Sustainable Development Goals (SDGs). These goals were adopted at the United Nations Sustainable Development Summit in 2015. They aim to end all forms of hunger by 2030. Goal number two (2) seeks to achieve ‘zero hunger’. It aims to end hunger, achieve food security and improved nutrition and promote sustainable agriculture (UNDP 2016). Agriculture in Zimbabwe is mainly rain fed. This research will provide farmers with indigenous knowledge that will equip them with enough knowledge to decide on

which crops to grow and this would improve the livelihoods and capacities of small scale farmers. This is in line with this study. If the farmers at Chapo Village are able to predict the weather correctly they would be able to select the plants to grow in a given season so as to ensure that they have access to nutritious food all year round.

Research Methodology

The research used the qualitative methodology to allow the researchers to explore the activities, behaviour and experiences of the villagers at Chapo Village in relation to traditional forms of weather forecasting. Qualitative research is aimed at gaining a deep understanding of a specific organisation or even, rather than a surface description of a large sample population (Trochim 2006). The aim of this research was to gain a deeper understanding of the traditional weather indicators employed by the community of Chapo Village and qualitative research was appropriate in gaining this understanding.

Baxter and Jack (2008) clarify that a case study facilitates exploration of a phenomenon within its context using a variety of data sources. It provides tools for researchers to study a complex phenomenon within its context and it is flexibly. It allows the researcher to adapt quickly to any situation that may arise during the study period.

Purposive sampling method was used to select the informants in this study. Purposive sampling is a type of non-probability sampling in which the units to be observed are selected on the basis of the researcher's judgement about which ones will be most useful or representative (Babbie 2008). In this study, the researchers were interested in gathering information from knowledgeable adults who have lived in this area for at least thirty years and are considered to be the custodians of the indigenous weather forecast indicators peculiar to Chapo Village, hence the use of purposive sampling. Because the residents of this village are unknown to the researcher, a key informant was identified to help in the sampling process.

Focus group discussions (FDGs) and interviews were used to collect data. Two focus group discussions, with a minimum of 6 people each, were held. In a focus group discussion a group of subjects are interviewed together, prompting a discussion (Babbie 2008:338). They give more in-depth understanding of the context and social function of the community and of how opinions and knowledge are formed in social contexts (Brick & Green 2007). These were the exact intention of this research, that is, to gain a better understanding of the context and acquired knowledge used by the Chapo community to predict rainfall patterns.

The data gathered was analysed thematically. A thematic analysis is one that looks across all the data to identify the common issues that recur and identify the main themes (Baxter and Jack 2008).The biophysical indicators were divided into different categories such as birds, amphibians, reptiles and mammals, insects and vegetation indicators. This helped in the analysis the data that was obtained during the research.

Triangulation and member checking strategies was employed to validate the data gathered. During the focus group discussions, member checking was employed as a validation strategy. Opinions expressed by others were 'fed back' to the participants and the researcher assessed the extent to which the other group members considered them reflective of the indicators peculiar to the area.

Theoretical Framework

This research was guided by the theory of afrocentricity. Molefe (2009:1) defines afrocentricity as "a revolutionary shift in thinking proposed as a constructed adjustment to black disorientation, decentness, and a lack of agency". He further expresses that one of the tenets of this theory is that it deals with the question of African identity from the perspective of African people as centred, located, oriented and grounded societies. This research put the culture, heritage and beliefs of the people of Chapo Village at the centre of understanding how the people of Chapo Village tap into their environment so as to deal with weather related challenges. Traditional ways of predicting the weather are embedded in a people's culture and place the African people at the centre of weather forecast without depending on western methods.

Afrocentricity also maintains that Africans have lost their cultural footing and have become other than their cultural origins-dislocated and disoriented. Mazama (2001) clarifies that Africa culture is primary and African cultural rebirth is necessary. This tenet guided the research in that documenting the traditional methods of weather forecasting is one way of contributing to finding the lost cultural footing. Closely related to the above is the assertion that as a pan-African idea, Afrocentricity becomes the essence of an African cultural revival and indeed survival. This research contributes to the revival of the African culture as the knowledge of traditional weather forecasting in Chapo Village might be dying with the few elders who possess it. Documenting it creates a reservoir for the revival of this culture. Application of such knowledge would lead to the people's survival as food security will be ensured.

Another tenet of Afrocentricity is that it claims that Africans are being peripheralized. The theory holds that the West's interference has resulted in Africans being considerably removed from their own cultural base to be relegated to footnote status on the periphery, the margin of European experience and consciousness (Molefe 2009). This could be true in the field of weather forecasting where scientific methods now dominate the contemporary thinking. The use of indigenous weather forecast indicators by the locals of Chapo is one of the practices that prove that Africans can tap into their culture and survive with very little influence from the west.

Chapo Village

Chapo Village is situated about 60km south of Bulawayo along the Kezi/Maphisa Road. It is in the Whitewater area of Matobo District. The area is made up mostly of the Nyubi people. History has it that when Mzilikazi fled from Zululand (present day South Africa) to present day Zimbabwe, he conquered and assimilated many ethnic groups which were part of the larger Ndebele kingdom. Ranger (1999) explains that when the Ndebele came to settle at Matobo, among the headmen were men whose authority had nothing to do with the Ndebele and some of them were Banyubi descendants. Nyathi (2008) clarifies that the Nyubi people have occupied the Matobo Hills for several centuries this makes them knowledgeable of their environment. A few of the conquered groups were, however, allowed to remain as clans under a chief but as part of the larger kingdom. The Nyubi people were part of these groups.

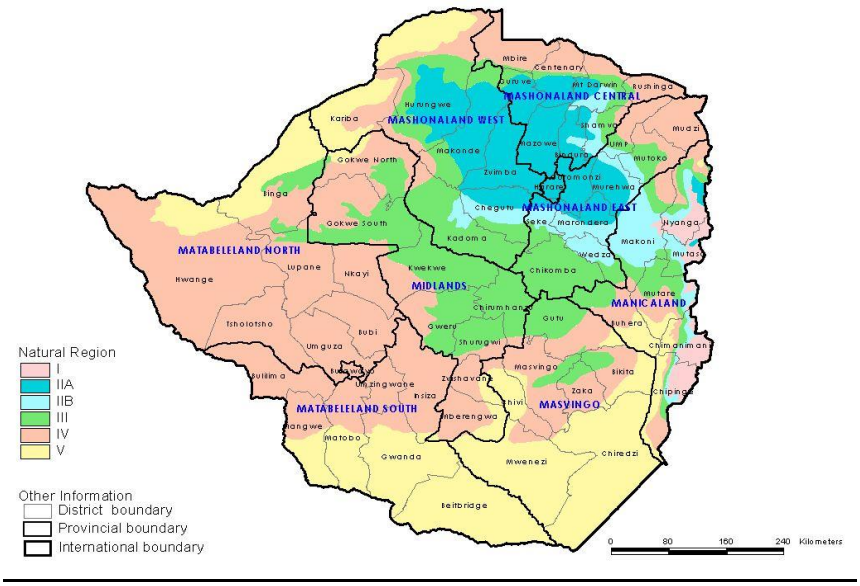
Although the Nyubi people speak Ndebele, they maintained customs including their religion (Ranger 1999). The Nyubi people belong to the Mwali/Mwari religion. The Mwali people believe in the rain-making rites. Nyathi (2008) states that among the Shona and related groups rain-making shrines abounded and Njelele is

the best-known national shrine. Njelele is found near Chapo Village and all rain-making rites are performed there. It is because of the people's strong religious belief on the spiritual realm to determine a good rainy season that the researcher gained interest in this village.

The district falls in Natural Farming Region IV (Map 1). Natural region IV is located in the low-lying areas in the North and South of the country. Rainfall in this area ranges between 450- 650mm per year. Severe dry spells during the rainy season and seasonal droughts are very common in this region. Natural Farming region IV is ideally suitable for cattle ranching under extensive production systems and for wildlife production (FAO 2010). Although the area is considered unsuitable for dry land cropping, small holder farmers grow drought tolerant varieties of maize, sorghum, pearl, millet, and finger millet.

The Village is located in a dry area and there is a great need for a reliable weather forecast system that would help the villagers plan for the year ahead in terms of what crops to plant in a given season. This would help to reduce the risks of loses in food production due to poor rainfall. Indigenous weather forecast indicators help the villagers of Chapo fill in this gap. The indigenous knowledge helps the community in making strategic decisions in as far as the planting season is concerned and ensure their survival.

Map 1: Zimbabwe Agro-Ecological Zones



(Adopted from Makwara 2013)

Most of the residents in this community do not have access to the daily and seasonal weather forecasts produced by the Meteorological Department. Those who receive the forecasts from the radio may at times fail to interpret them. The residents of Chapo Village are then left to depend on indigenous weather indicators to make farming decisions that affect their livelihood. Indigenous knowledge, therefore, plays an important role in determining the agricultural activities in this village.

Indigenous Weather Forecasting and Intangible Cultural Heritage

From time immemorial, farmers have based their decisions on crop production on indigenous knowledge of weather and climatic conditions. Farmers are usually interested in the onset, cessation and intra-seasonal variations that support decisions about what crops to plant, and when to harvest. Guided by knowledge gained from many decades of experience and observation, and the local weather pattern is assessed, predicted and interpreted by locally observed variables and experiences using combinations of plants, insects, and meteorological and astronomical indicators (Mugabe in Alvera 2013). This knowledge is a form of intangible cultural heritage (ICH) for the community. The United Nations Educational, Scientific and Cultural Organization (UNESCO) *Convention for the Safeguarding of the Intangible Cultural Heritage* defines intangible cultural heritage as,

the practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artefacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognize as part of their cultural heritage. This intangible cultural heritage, transmitted from generation to generation, is constantly recreated by communities and groups in response to their environment, their interaction with nature and their history, and provides them with a sense of identity and continuity, thus promoting respect for cultural diversity and human creativity (UNESCO, 2003).

Indigenous based weather forecasting fits into this definition. The first sentence in the above definition is voluminous in terms of what it is that constitute the intangible cultural heritage of a people. It starts by referring to the practices. These practices are very important since they are the activities that the concerned people do every day in their life for a living. It is these practices that shape the civilization and industrialization of these people. Ziervogel and Opere (2010) indicate that indigenous knowledge weather forecasting indicators are produced locally by people who live in the area for which the production has been made. They are usually based on both the biophysical and mystical indicators peculiar to a given area. This makes IKS based forecast to be specific and relevant to a given area unlike scientific forecast which tends to be general and covers a wide area.

One of the many reasons why indigenous knowledge plays a big role in farmers' decisions is because traditional societies' livelihoods are closely intertwined with nature (Ziervogel and Opere 2010). Their survival has depended on the ability to study and analyse closely the conditions obtaining in their locality. Indigenous weather forecasts indicators are a result of the people's ability to analyse their surrounding and use the knowledge to ensure their survival. Such knowledge has helped the rural folks to plan for the planting seasons and ensure food security. The ability to identify potential natural hazards, monitor environmental conditions, including weather and climate, and make relevant predictions has helped rural communities to plan effectively for their farming activities.

It is unfortunate that such knowledge has not been properly documented but depends on oral education by adults (Ziervogel and Opere 2010). Accumulated indigenous knowledge on weather indicators has been passed from one generation to the next orally through traditional socialization processes. It is essential, to record such precious knowledge before it 'dies' with the elders.

Data Presentation and Analysis

Indigenous Weather Indicators

Bird Indicators

Table 1: Bird indicators observed in Chapo Village

Bird Indicator	Observed Behaviour	Interpretation
Amangabuzane (stork)	Appearance in the area Large flock which forms a circle in flight Movement resembling dancing people	Rainy season has arrived A good rainy season is expected Imminent rains
Inkonjane (swallows)	Appearance in the area Flying at high altitude Flying at low altitude	Beginning of the rainy season No rains Rain within hours
Inkanku (Jacobin cukoo)	Singing for a short period Singing continuously	No rains Heavy rains coming
Insingizi (Southern ground hornbill)	Crying in different locations Flying and settling on large trees Gathering together and crying continuously	Rains might fall Temperature expected to drop Rains most likely to fall with the advent of the new moon A drizzle which might later turn to incessant rains is expected
Intaka (weaver birds)	Nests built on top branches Nests built on branches that are at the bottom	A good rainy season is expected Poor rainy season expected
Umzwazwa (Sparrow hawk)	Disappears soon after the planting season and then reappears	Rainy season has come and a good season is expected

From the interviews and focus group discussions, the study established that there are several bird species commonly used by the villagers to predict the weather Chapo Village. Most of the predictions were related to the rain. Table 1 above shows the bird indicators used in Chapo Village. The villagers narrated that the arrival of migratory birds such as *amangabuzane* (storks) and *inkonjane* (swallows), indicated the onset of the rainy season. True to the adage, one swallow does not make a summer, the appearance of these birds in large numbers is viewed as an indicator that the rainy season is about to begin. One swallow or one stork seen in the area is believed to have been 'carried by the wind'. When they, however, appear in large numbers they are a welcome sight to the villagers.

The swallows are not just seen as an indicator of the arrival of the rainy season but can indicate whether or not the rains will fall. The altitude at which they fly is of a great significance to the population of Chapo Village. If the swallows fly at great altitude, the villagers view that as an indication there is no rain in the sky. If they, however, fly at low altitude, that is interpreted as an indication that the rains would fall very soon. The same observation was noted by the residents of Ward 12 and 13 (Shoko 2012). It is also

interesting to note that swallows and stocks are observed as weather indicators in many societies across the globe. These include villagers in Tanzania (Elia et al 2014) and India (Chinlamiaga 2011). This could be attributed to the fact that these birds migrate from either hemisphere to warmer and wet regions where food will be available.

The other bird that is regarded as important in the weather forecast systems is the southern ground hornbill, locally known as *insingizi*. The villagers expressed that the bird is only seen in the area when the villagers would have planted their crops. Their presence is an indication that a good rainy season is to be expected. Their behaviour is interpreted as an indication of when the rains will fall and if the temperature would drop. If the birds sing from various geographical locations, the villagers interpret that as an indication that temperatures could drop in the near future and no rainfall would be expected. If they, however, perch on the same trees and sing from there, the villagers interpret that as the coming of a good rainfall. If they sing continuously the villagers expect a light drizzle which would later develop to heavy rainfall. Such a rainfall would be expected to last for several days.

Werner (1933:345) makes the same observation and states that; "If a number of birds [ground hornbills] are seen gathered together in one place, uttering their cries, it is supposed that they are calling for rain, and that it would soon fall". Although the ground hornbill is also used as an indicator in Mberengwa, the behaviour noted is different from the one observed by the population at Chapo Village. Shoko (2012) outlines that if the ground hornbill is heard hooting in the morning, *guti* (drizzle) is expected within 12 to 48 hours. If it, however, hoots any time of the day, imminent cold weather is expected. This variation in the observed behaviour is not alarming but a confirmation that indigenous knowledge is unique knowledge specific to an area. Each society attaches different meaning to the phenomenon in their environs. This is true of African identity. It is not universal and each society has unique ways of dealing with day to day challenges.

The villagers of Chapo noted that the jackobin cuckoo (inkanku) is the most significant indicator in the birds' species in as far as predicting the rainfall is concerned. This corresponds with observations made by Shoko (2012) who noted that in Mberengwa the bird is ranked as number one in predicting rainfall. The bird is rarely seen flying around and when it is seen the locals associate its presence with the rains. The locals believe that it has the power to bring the rains. The manner in which the bird 'sings' is of great importance in as far as weather prediction is concerned. If it sing like "kwe, kwe, kwe, kwe" then the villagers would be expecting low rainfalls. If, however, the singing changes to "kwe, kwe, kwe, tshopo, tshopo, tshopo" that is interpreted as a sign of a good rainy season. An incessant singing of the birds could be implying a very heavy and violent rainfall. Alvera (2013:30) notes the same sentiments in Mbire District as she holds that; "If the sings like kowe, kowe, tsvo, tsvo, above normal rains will fall but if it just sings kowe, kowe the rains will just be normal".

The positions of the weaver birds' nests are also used as indicator of how much rainfall to expect. The villagers take a keen interest at the level in which the birds build their nest. Weaver birds prefer to build their nests on trees along the river banks. If the nests are built on high branches, away from the river bank, villagers would interpret that as a sign that a good rainy season is to be expected. By choosing high branches the birds would be minimising chances of their nests being caught up in floods. If they, however choose to build the nests on low branches, that is interpreted as a sign of an impending drought. The birds would be

indicating that water was not going to be a threat to their nests. The concept of using the position of the weaver bird's nests to predict the rainfall pattern is also noted in Swaziland. Manyatsi (2011) reports that when ploceidae [weaver birds] are nested high on trees next to rivers, this is seen as an indicator of imminent floods. Though floods are not a common phenomenon in Chapo village, the same principle applies. If above normal rainfall is to be received, the weaver birds would build their nests on high branches.

Though these six specific bird species were indicated, the villagers acknowledged that there were other species whose names were unknown to them that also indicated the type of the rainy season to be expected. They intimated that, generally birds heralded the coming of the rainy season and whether to expect a good or poor season but were not good indicators of the exact time that the rains would fall

Mammals, Amphibians and Reptiles Indicators

The study findings also indicated that the villagers observed the behaviour of both the domestic and wild animals as weather forecast indicators. The behaviour observed included that of mammals, amphibians and reptiles. The table below, (Table 2), shows the animal behaviours observed and the implications of the behaviour in weather forecasting.

Table 2: Amphibians, reptiles and mammal indicators used at Chapo Village

Animal	**Behaviour Observed**	**Forecast**
obabhemi/amadonki (donkeys)	Braying continuously	Rain is coming
Inkabi (bulls)	Bellowing continuously Bulls fighting	Expecting rain soon, Imminent rains
Amathole (calves)	Calves agitated	Rain will be coming soon
Inyoka (snakes)	Heavy presence of snakes of all kind	A good rainy season
Indwangu (baboons)	Barking as if they are barking at something Moving in large troops	Rain will fall the following day
Imbila ezimnyama lezimhlophe (black and white rock rabbits)	Chattering	Temperature will drop Might experience a light drizzle
Amaxoxo/amadlamedlo (frogs/toads)	First appearance in the area Croaking continuously	Rainy season is near A good rainy season

From the interviews and focus group discussions, it was established that domestic animals were not largely used as weather forecast indicators. A few of these, like donkeys, bulls and calves had their behaviours observed as weather indicators. The respondents agreed that the behaviour of bulls, donkeys and calves served as indicators showing that the rain was about to fall. The bellowing and fighting of bulls is interpreted to mean that rain would fall immediately. Agitated calves and the braying of donkeys continuously are also viewed as indicating the same. The behaviour of cows is also used as a weather forecast indicator by the people of Mberengwa. The people of Mberengwa expect the rains to fall soon when cows bellow on dry river beds (Shoko 2012). These divergent views on the same indicator confirm that indigenous knowledge is local. African societies have unique identities and they each rely on these to ensure their survival.

The study revealed that the presence of snakes in large numbers is seen as a good sign. Though snakes are dangerous reptiles and the locals would kill them if they are spotted within human habitats, their presence in large numbers is interpreted to mean that the rains will fall soon. Snakes hibernate in winter and when they come out in large numbers, villagers view this as a sign of good rains. Not all the responds shared the same sentiments on this regard. Some of the respondents said they had not observed this behaviour. Not many societies view snakes as weather forecast indicators as there is very little literature in this regard. Shoko's findings from his research in Mberengwa also confirms that these reptiles are not common weather indicators. Snakes were ranked last as weather forecast indicators in both wards that he studied (Shoko 2012). This is an indication the use of snakes in the indigenous weather forecast indicators is limited to few people. Further observations by the locals of this phenomenon needs to be done if society is to benefit from this knowledge.

All the respondents agreed that frogs were also an important indicator in forecasting the coming of the rainy season. The appearance of any species of frogs is a sign that the rainy season has arrived. The presence of bull frogs and their behaviour is viewed as a more significant indicator. When bullfrogs are seen in the area, the villagers believe that izulu liyabe lihleli (the rain will be set) and a good rainy season is expected. When they croak continuously, the villagers expect rainfall within a day or two. For other communities, it is the sound produced by the frogs that is taken with a keen interest. For example, Elia et al (2014) note that frogs produce a certain sound continuously when rain is imminent in a particular season. This further illustrates the peculiar nature of indigenous knowledge. One cannot assume that what is true in one community will necessarily be true in the next.

Chapo village is close to Matobo Natural Park where wildlife is abundant and observing the behaviour of such animals would not be impossible for the locals. The villagers observe the behaviour of wild animals that prefer rocky and mountainous animals to predict the weather. They assert that rock rabbits and baboons are also useful weather forecast indicators. Rock rabbits are said to have umkhosi wamakhaza (a cry for a cold spell). When they are heard chattering from the mountains, the villagers expect temperatures to drop significantly. A light drizzle might also be experienced. Baboons on the other hand are said to bark as if 'zibona olunye ulutho' (as if they are seeing something) when the rains are about to fall. The strange bark is interpreted to mean that the rains would probably fall within the short run. These observations differ from those observed by the Mberengwa community which holds that when baboons move in troops of large numbers, a good rainfall season is expected (Shoko 2012) making each interpretation relevant to a specific society.

The mating and giving birth to young ones by both the wild and domestic animals is said to be an indicator of how the rainy season would flare. If a good rainy season is expected, both wild and domestic animals would mate frequently and produce a lot of young ones. To the locals, this would be an indication that there would be enough food to feed their young ones. The locals believe that the animals would have sensed that nature would be able to nurture their young ones that would have been born in that season. In this regard, the community of Chapo draws on its heritage to deal with weather forecast problems.

Insect Indicators

Insects also form part of the indigenous weather forecast system in Chapo Village. Table 3 (below) shows the insects used in the weather forecast system in Chapo Village.

Table 3: Insects indicators used at Chapo Village

Insect	Behaviour Observed	Forecast
Amatheza (termites)	Cutting grass and collecting food Very industrious	Imminent rain
Amavevane amhlophe (white butterflies)	Flying from the west to the east and then back to the west	Their return from the east is an indicator that rain is imminent
Isidlonono/inyeza (cicadas)	If it screams continuously Stop screaming during a hot spell	High temperature and no rainfall are expected Rain is imminent
Amatshongololo (millipedes)	Initial appearance Presence in large numbers	Rainy season is approaching Good rainy season
Inyosi (bees)	A lot of bees Bees building their nests in anthills	Little rainfall/drought Good rainy season is expected

Termites (amatheza) are observed to actively cut grass and collect food just before the coming of the rain. This behaviour is viewed as a warning that the villagers should also collect and store their provisions indoors as they would be stopped by the rains from going outside. Inyeza/isidlonono (cicada) is said to be heard screaming during periods of high temperatures indicating a dry season. If they stop screaming during the hot season, the villagers interpret that as a sign that temperatures are about to drop and some rainfall could be received. Cicadas are viewed as the most reliable indicator in predicting high temperatures.

Termites and cicadas seem to be a popular indicator in the dry savannah areas. The same behaviour is observed in Mberengwa (Shoko 2012), Mbiri Village and (Alvera 2013). This contrasts with the observation made of termites in Tanzania. Elias et al (2014) point out that though termites are not used as weather indicators their appearance in large numbers after the rainfall season is taken to signify a famine as they are said to destroy the already cultivated crops. This highlights that unique African societies have unique knowledge about a given phenomenon, making local knowledge peculiar to a given society.

Bees and butterflies are also observed as weather forecast indicators at Chapo Village. The sign of white butterflies flying from the west to the east brings hope to the villagers. When they fly from the east to the west, the villagers would interpret that as a sign that rain is imminent. A presence of many bees on the other hand is viewed as an indicator that drought is imminent in the coming season. The villagers believe that this is a sign that food shortages would be experienced, and people would feed on the honey produced by the bees. If the bees are, however, seen building their nest in anthills, villagers would view this behaviour with joy. When bees build their nests in the anthill it is believed to be a sign that the rainy season would be good. Villagers believe that by building in the anthills, the bees would be seeking a safe place so that they

would not be disturbed by the heavy rains. Bees do not seem to be used as a weather forecast indicator by any other community in Zimbabwe making the knowledge unique to Chapo Village.

Millipedes are viewed as both an indicator of the beginning of the New Year and an indicator of whether the rainy season would be good or bad. An early appearance of the millipedes is viewed as an indication that winter and the year has come to an end. When they appear in large numbers, villagers would interpret this as a sign that a good rainy season is to be expected. Millipedes seem to be a popular indicator amongst many communities. Villagers stated that millipedes were a very popular indicator and they quickly multiply if the rainy season is going to be a good one. For example, studies carried out in Uganda by Okonya and Kroshel (2013) also indicate that the communities in Uganda interpret the presence and behaviour of millipedes in the same light as those in Chapo Village. Shoko (2012) highlights that the community of Mberengwa also expects the rain spell to persist for some days if millipedes are seen moving around in large numbers. This demonstrates how African people rely on their environment to solve problems and ensure their survival.

Mountains, Astronomic and Meterological Indicators

The table below shows the mountains, astronomic and meteorological indicators used at Chapo Village. It was noted that these were not very well known by most of the respondents. It was known by a few very elderly people.

Table 4: Mountains, astronomic and meteorological indicators used at Chapo Village

Indicator	**Observation**	**Forecast**
Intaba ezizilayo –iBulale leNjelele (sacred mountains- Bulale and Njelele)	Fog on the mountain early in the morning Roaring mountains Burning mountains (intaba ezitshayo)	Very good rainfalls are expected
Ukuqanda kwebusika (severity of winter)	Severe winter	Good rainy season
Ukuvunguza komoya (winds)	Winds blowing from the west	Good rainy season
Inyanga lelanga (the sun and the moon)	Hallowing of the sun/moon	Good rainy season expected
Inkanyezi eziwayo (shooting stars)	Many shooting stars observed at night	Good rainy season expected
Amayezi (clouds)	White high dispersed clouds Dark clouds	Dry weather Rain expected

The two mountains in the vicinity of Chapo Village are used as weather forecast indicators. The respondents indicated that from ancient times the locals viewed Bulale and Njelele mountains as good indicators of what to expect in the coming rainy seasons. If fog is seen on top of the mountains early in the morning, the

villagers would expect a good rainy season. They also anticipate the same if wild fires developed on top of the mountains and the mountains produced a roaring sound. They believe that the rains would come and put out the fires. In a study carried out on integrating indigenous knowledge systems into climate change interpretation, Munyanhaire and Chitura (2015) comment that spontaneous fires on mountains in September and October are regarded as a sign of a good season in Zimbabwe. None of the literature related to this, however, made any mention of roaring mountains, making this knowledge local to the community of Chapo Village. This shows that the people of Zimbabwe depend on their environment to plan their day-to-day activities as demonstrated by the people from Chapo Village.

Winter temperatures are also used as local weather forecast indicators. The respondents indicated that if the winter is severe, they expect a good rainy season. Severe winters are believed to bring to birth above normal rainfall. If the winter is severe, the low temperatures *'ayabe ephehla izulu'* (will be stirring up the rain). Elia et al (2014) make the same observation in Tanzania. They go on to add that if the cold spells continue further into spring that is viewed as an indication of a poor rainy season.

Wind direction is used to predict the nature of the coming rainy season. When the wind blows from the east to the west, no rainfall is expected. The respondents indicated that when the wind changes its direction and then blows from the west, heavy rains are expected in the area. The Mbire people know that easterly winds from Mozambique bring abundant rains while winds blowing from the south/southwest (Guruve) direction, would bring light rains and would be a bad sign. Patience is greatly valued in the African context. It is a virtue. African societies patiently observe any behaviour before drawing a conclusion. Through patiently observing their ecosystem over a long period of time, the people of Chapo Village have been able to make conclusions about how wind patterns influence their weather system.

Though clouds are not specifically used as weather indicators, respondents expressed that certain clouds were associated with rainfall. They described the clouds in terms of colour. White clouds were associated with a dry weather while dark clouds were associated with rainfall. This agrees with modern meteorology as no rainfall is expected from fair weather clouds but from dark cumulonimbus and nimbus clouds.

The stars, sun and the moon are also part of the local weather forecast systems at Chapo Village. Stars are not specific indicators in this village. When, however, many shooting stars are witnessed in the area, the villagers expect a good rainy season. The respondents noted that they associated shooting stars with good luck. If a number of them are witnessed, they are seen as bearers of good news. Both the sun and the moon are also weather forecast indicators. The villagers believe that when a dense and dark halo is experienced, an above average rainy season is expected. The villagers made reference to a halo that was seen in the country in the early morning hours on the 28th of September 2015. This was one indicator that the villagers said had given a true prediction. In Mbire District, the same knowledge is applied, and the villagers view the halo as an indication that the rainy season was about to start (Alvera 2013).

Tree Indicators

The research established that trees are the most common weather forecast indicators used in the area. The shooting of new leaves, the colour of the leaves of some of the tree species, flowering of some trees, the amount of fruits produced and the trees ability to sustain the trees until they mature are all regarded as indicators of how good or bad the rainy season would be. The table below (Table 4) shows the trees used in the weather forecast system at Chapo Village.

Generally, the shooting of new leaves after winter is interpreted as an indicator that the rainy season is approaching. For example, the leaves of the mahogany tree are observed with a keen interest in predicting the rainy season. When the tree has reddish leaves which are 'closed', the respondents believe that would be a sign to indicate that the rainy season is coming. Dark green leaves are viewed as an indication that a good rainy season is expected. Yellow mahogany leaves are an indication that winter is approaching. The villagers interpret that as a sign that late maturing plants like groundnuts can now be harvested. The people of Chapo use the knowledge of their immediate environment to plan their farming activities throughout the year. They put their heritage at the core and refer to them for survival.

Findings from this research also showed that when the commiphora Africana *(iminyela)* tree produces dark green leaves and has a lot of fruits, the villagers anticipate a good season. The commiphora Africana tree is also said to indicate a wet season when there are water droplets falling from its leaves. The tree is one of the few tree species where rain-making ceremonies are conducted. Rain-making ceremonies are conducted under trees that have water and *iminyela* tree is one of them.

The development of three other trees, "*uthwasa kanye ngomnyaka"* (English name not found), *uxakuxakwana* velvet sweet berry (bridella mollis hutch) are also watched with keen interest in relation to predicting the anticipated rain fall. When *uthwasa kanye ngomnyaka* and *ubuhlungu benyoka* (dune poison-bush) develop lash leaves and flowers, the respondents indicated that they expected an above normal rainy season. The *uthwasa kanye ngomnyaka* tree is said to bloom once a year and only does so at the onset of a good rainy season. *Uxakuxakwana* (velvet sweet berry) has also been observed to flower before any other tree species in the area. Its flowering does not only indicate the beginning of the rains but also a good rainy season. Africans rely on their environment to make decisions pertaining to agricultural sustainability.

Table 5: Tree indicators used in Chapo Village

Name	Description	Meaning
Isigangatsha(live long tree/lannea discolour)	Flowering Fruits dropping before reaching maturing Fruits retained until they reach maturity	Coming of the rainy season Good rainy season above average rainfall expected
Umhagawuwe (snowberry tree/ flueveggea virosa)	Flowering Fruits dropping before reaching maturity	Rainy season beginning Poor rains expected

Umwawa (Strynchnos innocua/monkey orange)	Abundance of fruits Fruits falling completely Fruits not falling from trees	Poor rainfall expected Rainy season has arrived Drought is expected
umbumbulu(red milkwood/mimusopos zeyheri)	Abundance of fruits	Drought expected
umtshekisane (diamond leaved eudea/eudea divinorum hiern)	Abundance of fruits	Good rainy season expected
Umkamba (mahogany/afzelia quanzensis)	Reddish closed leaves Dark green leaves and flowering Sugary flowers – dropping Yellow leaves	Rainy season is coming A good rainy season is expected Good rainy season expected Winter is approaching
(Iminyela)poison grab commiphora/ commiphora Africana	Leaves shooting; dark green Water droplets dripping from tree	A good rainy season expected Good rainy season expected
Intakubomvu (wild berries/lannea edulis)	Abundance of fruits	Good rainy season expected
ubumese (wild castara apple/annona senegalensi)	Abundance of fruits	Good rainy season expected
Amakhukhuzela (English name not found)	Abundance of fruits	Good rainy season expected
Uxakuxakwana (velvet sweet berry/ bridelia mollis hutch)	Starts to flower	Rainy season is near
Crops	All germinating even those planted in poor soil	Poor rainy season
uthwasa kanye ngomnyaka/magwe (acanthera spectabilis/acokanthera venrata)	Appearance of lash leaves and blooming	Above average rainy season expected
umvimila (white syringe/kirkia acuminate)	Releasing water droplets	Above average rainy season expected
umkhiwa (fig tree/ficus carica)	When it starts to have fruits and has a lot of leaves Abundance of fruits	Coming of the rainy season Above average rainy season expected

The amount of fruits produced by some of the tree species in the area is also used as a good indicator of the amount of rainfall to be expected. When certain trees produce abundant fruits the respondents indicated that they would expect a wet summer. When trees like the fig tree, *intakubomvu* (lannea edulis), *umtshekisane (*euclea divinorum), *ubumese* (annona senegalexis) and *isigangatsha* (lannea discolour) bear a lot of fruits the respondents indicated that this was a sign of good rains. When the latter's fruits are ripe they become purple black in colour which is viewed as symbolising the dark rain clouds. Lannea edulis, lannea discolour and the fig tree have been recorded to be used as weather forecast indicators in other dry areas found in the country like Lupane and Mberengwa (Changonda et al 2013 and Shoko 2012).The interpretations derived from these trees help the villagers make decisions pertaining to the planting seasons. For instance, they

expressed that those who believed in dry planting did so when the ripe lannea discolour fruit was in abundance. This demonstrates that African communities rely on their environment to make strategic plans.

Observations made over long periods of time have made the villagers note that there are some fruits that prosper during the dry spells in the area. An abundance of mimusops zeyheri (*umbumbulu),* for instance, is viewed as a bad sign. If the *umbumbulu* fruit is in abundance the villagers anticipate a drought. Women go out and gather the fruit in large quantities and preserve it for the coming dry season. The abundance of strynchnos innocua (*umwawa)* fruit was viewed with mixed reactions by the respondents. While some of the respondents indicated that the abundance of this fruit implied a good rainy season, a few noted that the opposite was actually true. Some people stated that an abundance of strynchnos innocua fruits was an indication that drought was imminent. Those who held the latter view noted that the abundance of this fruit meant that the villagers had to collect as much of the fruit as possible and dry it, conserving it for the coming drought.

The research also established that there were some trees that were part of the weather forecast system in Chapo Village that are now becoming extinct. Trees like *intakubomvu* (wild grapes) and *amakhukhuzela* (English name not found but also known locally as *amathofi)* were no longer easily found in the area. One respondent commented that *"abantwana basawazi yini amathofi labontakubomvu? Sebekuzwa ngelika bathi* (do today's children know *amathofi* and wild grapes? There only know of them from hearsay). The abundance of these fruits used to be also viewed as an indication that the rainy season was going to be good. The respondents expressed that that could be an indication of climate change.

Forecast Based on People and Spiritual Realm

The research established that people with scars and fractures could foretell the weather. These scars included even those obtained through caesarean sections. Those people reported that their fractures and scars usually became painful a day before the temperatures dropped. There are also some *zangomas* (diviners) who have the ability to foretell the weather. The respondents emphasised that it is not every healer who has the ability to foretell the weather but only a few *zangoma zezulu* (rain diviners) could do that. The rain diviners can foretell the weather conditions, and this is held as divine knowledge. The African environment consists not only of the physical but also the spiritual realm. The people's religion also plays an important role in the indigenous weather forecast system.

The response from Mwali after a ceremony to request for rain had been performed. The villagers believe that after the ritual by *amawosana* (people with rain making spirits) asking for rain at Njelele Mountain, Mwali responds in different ways so as to indicate if their prayers had been heard or not. They noted that if a lion was heard roaring and a cockerel crying, the wosanas would know that an above average rainfall was to be expected. When they came back from Njelele, the wosanas eagerly anticipated the falling of the rains. If this happened, it was interpreted as meaning that the rain *'licitsha inyawo zabo'* (was erasing their feet); a sign that Mwali had accepted their prayer and a good rainfall was to be expected. This spiritual indicator was not found in any of the literature accessed. Njelele is the major shrine associated with the rituals for praying for rain. The African religion is interwoven into every aspect of life. Africans draw on their religion for their survival.

Villagers' Perception of Ik Weather Forecasting

This research established that the locals at Chapo Village hold indigenous traditional weather forecast indicators in high esteem. The weather indicators used are as a result of observations made over a long period of time and passed from generation to generation. They are also part of the people`s world view. True to the Afrocentric nature of this community, the people rely on their environment and their culture to deal with weather forecast issues.

The research established that the villagers use and rely on traditional weather forecast indicators because they have limited access to the scientific forecast. The locals acknowledged that they could access weather forecasts from the press and electronic media. The radio was said to be the media that was most accessible to them. Despite the availability of such platforms, the villagers indicated that they still relied on the traditional forecast indicators as the weather forecasts on the radio were too technical and difficult for them to understand. They also noted that radio forecast tended to be general and were never specific to their area. A few others feared that the scientific weather forecast *"ingabe iphekiwe ukwenzela ukuthi senze abakufunayo"* (it could be doctored so that we do what they want us to do) and were not a true reflection of the conditions that they were going to be experienced.

The research established that the indigenous weather forecast systems are richly embedded in the worldview of villagers and they are a form of their intangible cultural heritage. The people of Chapo Village understand their environment and relate to it closely in planning their agricultural activities. They intimated that, *"okuqakathekileyo ayisilo lwazi kuphela ucine khonapho. Sokumele wazi ukuthi yiphi inhlanyelo okumele inhlanyelwe"* (merely having the knowledge is not enough. One has to know which crops to plant in the coming season). They mentioned that a wise man would listen to nature and plan his activities in line with what nature would have predicted. The villagers tap into their indigenous knowledge to make decisions on issues that affect their lives. This stance indicates the society's Afrocentric approach in coming up with strategies that ensure their survival.

The people of Chapo Village believe that contemporary society is failing to read the signs that nature gives them. One of the respondents noted that; *"Imvelo iyakhuluma. Iyazitshengisa yona thina singabe sisalwazi ulimi lwayo"* (Nature speaks. It reveals itself to us. Unfortunately, we fail to understand its language. The people who still understand nature`s language are the elderly and studies like this one would help translate nature`s language even to the contemporary society. To them, indigenous weather forecasting systems are more relevant to them as they are observed in their environment using indicators they are familiar with.

The research also established that villagers value the traditional weather indicators as they help them mark the different seasons as well. The villagers also mark the 'beginning' and 'end' of the year using the identified indicators. The African concept of the year differs from the fixed Gregorian calendar. Nyathi (2013) explains that in traditional African societies there were no standards of measures of time. He further explains that in the African thinking time is a composition and succession of events and has to be experienced to be real. To the people of Chapo Village the New Year is experienced by observing the weather indicators which also serve as time markers.

Trees are regarded as the best markers of the beginning of a New Year. When the leaves begin to shoot, the villagers know that the New Year has begun. In the African worldview the year begins after winter when new leaves shoot indicating *"intwasa hlobo"* (spring). The locals regard that as "*ukuqamuka komnyaka"* (the beginning of a new year). There must be an observable difference between the New Year and the trees mark that difference. One of the respondents clarified; *"izihlahla zibika ukuthi zulu wena uzanini- lokuthi zulu wena uza unganani"* (trees indicate when the rain will come and how much rainfall to expect). When they indicate when the rain will be coming, they will be indicating when the new season will begin. Plant indicators are therefore perceived as important weather forecast indicators and time markers.

Bird indicators are also perceived as important markers of time. Migratory birds like the stork, swallows and sparrow hawks are only seen in the area in the "new year". The arrival of these birds is held as an indicator that the New Year has begun. The villagers have, over time established that the arrival of these birds coincides with the changes that take place in plant life. For example, the arrival of sparrow hawks *"ukuzodobha inhlanyelo"* (to pick up the planted seeds) is seen to concur with trees like *uthwasa kanye ngomnyaka* in indicating the beginning of the New Year.

The people of Chapo view the rain making ceremonies held at Njelele as sacred. The outcomes of these rites indicate whether the villagers should expect a good season or not. To the villagers of Chapo Village, this is an important aspect of the weather forecast system which is viewed as part of their spirituality. The villagers believe that *"piyanedombo dumbo linetshilenga"* (the rock has sustenance). It is at the rock (Njelele) that they perform rain rituals, and the outcomes of such prayers are believed to be good weather forecast indicators. The 'rock' is perceived to be an important source of life and weather forecasts associated with it are greatly honoured. Religion plays a significant role in helping the villagers predict the weather.

The importance of birds as weather indicators is also reflected in the people's dances. Through the rain dance, *iwosana*, the locals imitate the stork birds which are believed to 'draw' the rain clouds. The dancers imitate the storks through both their attire and the actual dance. They wear two feathers on their heads, symbolising the stork. Whistles are blown, representing the croaking frogs. The sound of *amahlwayi* represents the sound of the raindrops and the sound of the big drum *'tshoma bhika'* represents the roaring thunder. This dance which, has been passed on from one generation of dancers to the next, is regarded as an important part of the weather forecast system. The dance, it is believed, creates *"umumo wezulu"* (conditions conducive to rain formation) and it is done in September. The locals believe that after the dance *Mwali* will answer them and reveal the nature of the rainy season. This is an African approach towards the weather systems. Western knowledge will never be able to explain such knowledge.

The respondents acknowledged that some of the signs the elders used to get from Njelele *"asethule"* (they are now silent). They attributed this to the commercialisation of the rain dances and rain making rites. The locals believe that for the rain dance to yield the desired results, the correct people have to perform it at the correct time. The villagers lamented that, this was a dance meant for old people and should only be performed at the beginning of the rainy season. They gave an example of the national primary schools dance competitions where pupils were expected to perform the *wosanna* dance. This, amongst other practices, is believed to have contributed to Mwali being silent. In the eyes of the villagers, western knowledge and practices are now interfering with their worldview hence, disturbing the indigenous weather systems.

Some of the songs sung by the community also reveal the positive attitude they hold towards the indigenous weather forecast systems. During the focus groups discussions and interviews, the locals would occasionally break into songs that reflect that they regard these birds in high esteem. For example, songs like *"sakhal'isidlonono"* (the cicada is crying) and *"nsingizi emnyama yakhala ngaze ngesaba"* (the southern ground hornbill has cried until it has scared me) reflect the philosophy that the society holds about the traditional weather forecasts indicators. The crying of the cicada indicates high temperature while the ground hornbill indicates a heavy storm hence the singers become scared. IKS is spread orally, and songs are one of the ways through which the society transmits the knowledge on the indigenous weather forecast indicators from one generation to the other.

Throughout the research, it became apparent that some of the indicators were no longer in tune with the knowledge held by the locals. They now seem to be inaccurate. In an interview one of the respondents intimated that *"lonyaka amasigns onke akhona but asephikisana lomumo womkhathi. Lamuhla imvelo ingani isikhuluma amanga*" (this year all the signs are there but they seem to be opposing the situation that is obtaining in the area. It seems as if nature is now lying). This could be viewed as an acknowledgement that climate change is now affecting the indigenous weather forecast systems in the area.

Conclusion

This research set to document and explain the meaning of the indigenous weather forecast indicators found at Chapo Village. The research also sought to establish the villagers' perception of the indigenous weather forecasts. This study established that the community of Chapo Village has developed, over a long period of time, intricate indigenous based knowledge pertaining to weather forecasting. This knowledge has become their intangible cultural heritage. Despite the availability of scientific based weather forecast, the villagers rely on their immediate environment to predict weather patterns. It was established that the villagers used vegetation, birds, amphibians, reptiles and insects available in their ecosystem to predict the weather. The indigenous weather forecasting indicators play an important role in the decision making of the people. The decisions made range from deciding which crops to grow in a given season and deciding whether or not to mend a roof.

Such knowledge would be even better documented if nomination files were to be compiled and presented to UNESCO as elements of intangible cultural heritage of humanity.

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