



## Case Study

# Indigenous methods used in rainfall forecasting, the case study of communities in ward 18 of Fort Rixon, Zimbabwe

Noel Dube

Department of Geography and Environmental Studies, Zimbabwe Open University, Box 346, Gwanda, Zimbabwe  
noel.e.l.dube@gmail.com

Available online at: [www.isca.in](http://www.isca.in), [www.isca.me](http://www.isca.me)

Received 14<sup>th</sup> February 2019, revised 17<sup>th</sup> August 2019, accepted 10<sup>th</sup> September 2019

## Abstract

*The aim of the study was to determine the different indigenous methods used to forecast rainfall and then rank the different forecasting methods. The acceptability of the forecasting methods by the different age groups in the community was also assessed. A random sample of 42 households out of a population of 410 households in Ward 18 of Fort Rixon was done and family members were interviewed using an interview guide. Youths and elders were also engaged in focus group discussions. Observation of fruit trees used to predict rainfall amounts was also done. The major indicators for the onset of rains are the direction of the winds, flowering of certain plants, movement of migratory birds, and behavior of insects. The prediction of the amount of rainfall is based on the amount of fruits produced by different fruit trees, the amount of butterflies and their direction of flight, and the amount and intensity of whirlwinds. The majority of the community 70% rely on the traditional methods of forecasting rainfall, 25% rely on both and 5% rely more on the meteorological department forecasts. There was no relationship between age and the method of forecasting used. The majority of Fort Rixon community members rely on traditional methods of forecasting to plan for their agricultural activities.*

**Keywords:** Indigenous methods, forecasting rainfall, ranking forecasting methods.

## Introduction

The term indigenous knowledge refers to the knowledge systems developed by local communities from their experiences and differs from scientific knowledge that is generated by academics<sup>1</sup>. Most rural communities depend on Indigenous knowledge for local-level decision-making. The indigenous knowledge can benefit the local communities and the scientists and planners to improve living conditions in rural localities<sup>2</sup>. Indigenous knowledge systems can be described as the knowledge that is developed by local communities naturally and these communities have survived on it for a long time<sup>2</sup>.

Local communities and farmers in Africa have developed intricate systems of gathering, predicting, interpreting and decision-making in relation to weather. A study in Nigeria revealed that farmers are able to use knowledge of weather systems such as rainfall, thunderstorms, windstorms and sunshine to prepare for future weather. Farmers have been known to plan their farming activities based on weather forecasts using indigenous methods of weather forecasting<sup>3</sup>. Studies in Burkina Faso showed that farmers have different approaches to weather forecasting with some elderly male farmers formulating hypotheses about seasonal rainfall by observing natural phenomena, while cultural and ritual specialists base their forecasts on visions and dreams<sup>4</sup>. The most widely used indicators are the timing, intensity and duration of cold temperatures during the early part of the dry season with

indicators like the timing of fruiting by certain local trees, the water level in streams and ponds, the nesting behaviour of small quail-like birds, and insect behaviour in rubbish heaps outside compound walls being used to a lesser extent<sup>4</sup>.

**Statement of the Problem:** Local communities can live sustainably using their Indigenous knowledge and experiences. However most communities are increasingly being influenced by formal education systems which have replaced indigenous ways of learning. There is a grave risk that most indigenous knowledge is being lost and, along with it, valuable knowledge about ways of living sustainably. Meteorological forecasts are highly technical in nature, such that most people cannot understand them and cannot therefore plan their farming activities based on such forecasts. Besides, these forecasts are available through radio, television and newspapers which can not be easily accessed by poor rural communities. This leaves them vulnerable to weather changes that may lead to poor yields and food insecurity. So the aim of this research was to find indigenous forecasting methods which can be used to plan agricultural activities, which are less technical in nature and inexpensive to the user.

**Purpose of the study:** The purpose of the study was to identify the different indigenous methods of forecasting rainfall and rank them.

**Objectives of the Study:** i. To determine the different methods used to forecast rainfall used in ward 18, ii. To rank the different

rainfall forecasting methods used in ward 18, iii. To assess the acceptability of the forecasting methods by the different age groups in the community.

**Research Questions/Sub problems:** i. What are the different methods used by ward 18 communities to forecast rainfall? ii. What are the ranks of the different forecasting methods?, iii. How acceptable are the different forecasting methods to different age groups?

**Assumptions of the Study:** It is assumed that the residents of Fort Rixon will respond positively to the study and provide all the necessary information required to complete the study. It is also assumed that other stakeholders will cooperate in giving out information relevant for the study.

**Significance (or Importance) of the Study:** Indigenous methods of rainfall forecasting can greatly improve the accuracy and reliability of rainfall forecasting if it properly researched documented and intergrated into the conventional forecasting system. The results of the research could be useful in conjunction with weather forecasting information from the meteorological office to improve the timing of agricultural operations and disaster management activities. Knowledge of traditional rainfall forecasting, can improve decision-making on agricultural activities especially for those farmers who mainly depend on rain fed agriculture<sup>5</sup>. The information can assist ordinary people, NGOs and government departments to better understand the environments and plan effectively their agricultural activities so as to improve human livelihoods. It can be argued that rainfall is one of the most important factors affecting harvests of communal farmer<sup>6</sup>.

**Scope (Delimitation) of the Study:** The study will identify the indigenous methods used to forecast rainfall in the 6 villages of ward 18 in Fort Rixon. The study will also assess the reliability and acceptability of the indigenous knowledge systems by the different age groups in the community. The study will also rank the different indigenous knowledge systems used to forecast rainfall.

**Limitations of the Study:** This will be case study and as such findings from the study may not necessarily apply to all situations in the country. The case study design like most qualitative research methods lack experimental and statistical controls which makes it hard to establish internal validity<sup>8</sup>. It is also difficult to generalize findings of case studies to other cases. However such findings can be generalized to similar situations<sup>8,9</sup>. The conditions in ward 18 of Fort Rixon are similar to conditions in other communal areas in Zimbabwe therefore the findings can be generalised to those settings. The respondents were informed of their right not to respond to questions and the study was therefore based on voluntary cooperation which meant that lack of cooperation could weaken the study. The researcher created good rapport with respondents and provided user friendly questionnaires, which were easy to understand and were unambiguous.

**Ethical and Legal Considerations:** The participants were informed of their right to withdraw from study if they felt uncomfortable. The aims and objectives of the research were made explicit to the participants. They were also advised that their responses would be confidential. The study was conducted in a way that made sure that the individual study participants did not experience any harm as a result of their participation in the research. The participants were also assured that the research findings and publications would be made available to them and that the report would be compiled in way that would not provide any harm to them. The ethical considerations which guided this research were honesty, informed consent, privacy, knowledge of results and confidentiality.

**Organisation of the Study:** Chapter one gives the background of the problem, highlights the statement of the problem, gives the aims and objectives of the study, the research questions, the assumptions and the limitations of the study. The chapter goes on to give the significance of the study, the scope of the study and ends with a discussion of ethical and legal considerations. Chapter two is literature review and will help identify gaps in existing knowledge in indigenous methods used to predict rainfall. The chapter basically looks at the indigenous methods used by other communities. Chapter three discusses research design/plan, then goes on to look at the population and sample of the study, followed by the research instruments used and ends with a discussion of the data presentation and analysis procedures. Chapter four presents the results and provides a discussion of the results. Chapter five is the last chapter which looks at the summary of findings and the conclusions.

## Methodology

This chapter will look at the research design/plan, population and sample of the study, research instruments, data presentation and analysis procedures. The chapter mainly focuses on the research design employed to analyze the different indigenous knowledge systems used by the Fort Rixon community to predict rainfall. The chapter begins by explaining the understanding of research design and methodology. This is followed by a description of the population and sample of the study. The chapter ends with a discussion of the data presentation and analysis procedures.

**Research Design/plan:** For this study the author opted for the descriptive survey research. This method is appropriate where a study of a specific situation can be done with a view to generalizing findings to similar situations. The strength of a descriptive survey method is that it is useful in describing the characteristics of large populations and is also flexible because quite a variety of questions can be asked about an issue which gives considerable flexibility in the analysis of the issue<sup>11</sup>. The descriptive survey method allows for the use of a variety of data gathering instruments such as questionnaires and interviews<sup>9</sup>. These instruments make it possible to acquire data, organize and present it in a manner that will lead to the drawing of valid and accurate conclusions.

However the descriptive survey method has its short comings which include the fact that the researcher has very little if any control of some variables which might affect the study<sup>12</sup>. However the interference by extraneous variables could adversely affect the findings of a study<sup>13</sup>. Another disadvantage of the survey method is its susceptibility to distortion and bias<sup>14</sup>. The possibility of bias in this study will be minimized by emphasis on anonymity and confidentiality in the handling of research data. The study will use descriptive survey design looking at the case of a given area. A case study approach is useful for qualitative research and not for quantitative studies. Case studies can assist the researcher to come up with generalizations even from cases which might seem to be exceptions<sup>15</sup>.

**Population for the study:** The population of the study were the local community of ward 18 in Fort Rixon. The ward comprises of 6 villages which are namely village 1 to 6.

Village	No. of Households
1	70
2	84
3	67
4	70
5	62
6	67
Total	420

**Sample of the study:** The subjects of the study were the randomly selected households and the youths and elders in the focus group discussions. Focus group discussions involved youths (age 16-25 years) and elders (over 50 years) from each village.

Village	No. of Households	Sample Size
1	70	7
2	84	8
3	67	7
4	70	7
5	62	6
6	67	7
Total	420	42

Village	No. of Youths	No. of Elders
1	7	7
2	8	8
3	6	7
4	7	7
5	6	6
6	7	7
Total	41	42

**Research Instruments:** Face to face interviews will be done and one of the advantages of this instrument is that a relationship is developed between researcher and respondent. It is also possible to be flexible with the respondent. Face to face interviews also give the interviewer a chance to explain the

purpose of the interview and to encourage the respondents to cooperate.

The interviewer can also clarify questions, correct misunderstandings and follow up on new ideas. Questions and answers can be clarified by both the interviewer and interviewee. One of the key features of face to face interviews is that the interviewees do not need to be literate to participate as the researcher can explain the questions. One of the advantages of face to face interviews is that responses are enriched by observing non-verbal cues and paralinguistic's, which is not possible with other research instruments where contact is not part of the data collection system<sup>15</sup>.

The advantages of face to face interviews are: i. The questions can be rephrased in a way that could be best understood by the respondent, ii. Gives the interviewer an opportunity to probe further when interesting issues come up during the interview, iii. Interviewer can observe non verbal responses during the interview<sup>16</sup>.

The inherent sources of error include: i. Questions phrased differently for different respondents, ii. Deviation from the written questions, iii. Interpretation errors in coding of answers, iv. Recording errors by the interviewer.

Face to face interviewing takes time to arrange, in addition the process of collecting data is time consuming and travelling can be costly where participants are located away from the researcher, which is common<sup>15</sup>.

**Data presentation and analysis procedures:** Data obtained from the study will be presented in tables and graphs in order to give an overview of findings to identify trends and to establish relationships between parts of the findings. Tables conserve space and present data in such a way that the narrative may be reduced, and can also be self explanatory<sup>16</sup>. Relationship among data in a table may be visualized and this process facilitates the process of data comparison.

Tables make it easy to summarize data by putting it into individual cells. Comprehension of tabulated data is enhanced as it is easier to understand and remember such data. Graphs will also be used to offer good visual presentation of the results.

## Results and discussion

This chapter will present the results of the study mainly looking at the different indigenous methods used to predict rainfall and then also present and discuss the ranking of these different methods. The acceptability of different rainfall forecasting methods will also be presented and discussed.

**The Different IKS used to Predict Rainfall in Fort Rixon:** Village 1 consists of 70 households and 7 households were interviewed and they identified the indigenous methods listed in Table-1.

**Table-1:** Different methods used to predict rainfall in Village-1.

Indicator	Interpretation
Croaking of the white frog	Rains within a week
Appearance of black kyte (inkonjane)	Rains imminent
Singing of the rain bird (inkanku <i>Jacobin cuckoo</i> )	Rains imminent
Lots of fruit for isigangatsha ( <i>Lannea discolor</i> )	Plenty rains and vice versa
Lots of fruit for idololenkonyane ( <i>Barleria obtusa</i> )	Plenty of rains and vice versa
Lots of fruits for intakubomvu ( <i>Lannea edulis</i> ), umlugulu ( <i>Carissa edulis</i> ) and umthunduluka ( <i>Ximenia caffra</i> )	Plenty of rains and vice versa
Singing of the ground hornbill (insingizi <i>Bucorus leadbeateri</i> )	Good rainfall season
Singing of cicadas (izidlonono)	Poor rainfall season
Wind blowing from North to South and Then change direction and blow from South to North	Rains within next two days
A lot of watery substance dripping from the apple leaf tree (ichithamuzi <i>Philenoptera violacea</i> )	A good rainy season
Halo around the moon and sun	Good rainy season

Focus group discussions with the youths and elders verified the above indicators and their interpretation. However there was some disagreement on the interpretation of lots of fruits especially for isigangastha (*Lannea discolor*) and intakubomvu (*Lannea edulis*) with some saying it indicated a poor season. The majority were of the opinion that it signaled good rains.

Village two consisted of 84 homesteads according to the village headman and 8 households were interviewed and identified the methods shown in Table-2.

Village 3 consisted of 67 households and 7 households were interviewed and identified the methods shown in Table-3.

Focus group discussion from both elders and youths generally agreed with observations from interviews. However youths added two indicators which were the baying of male donkeys and the mating of impala signaling the start of the rainy season. One of the interviewees mentioned the wind blowing from east to west signaling rains within 3 days. The elders added the indicators shown in Table-4 which had not been mentioned during interviews.

Village 4 had 70 households and 7 households were interviewed and gave the indicators shown in Table-5.

**Table-2:** Different methods used to predict rainfall in Village-2.

Indicator	Interpretation
Croaking of the white frog	Rains within 2 days
Appearance of black kyte (inkonjane)	Rains imminent
Singing of the rain bird (inkanku <i>Jacobin cuckoo</i> )	Rains within 2 days
Amangabuzane (Pelicans) flying over the sky (egiya)	Rains within a week
Ants cutting grass and putting in their holes	Rains in 2 to 3 days
Fish very active in water	Rains within 2 to 3 days
Heavy flowering of umsehla (N)/muzeze(S) ( <i>Peltophorum africanum</i> )	Poor rainfall season
Heavy flowering of acacia trees	Imminent rains and good rainy season
Lots of fruit for isigangatsha ( <i>Lannea discolor</i> )	Plenty rains and vice versa
Lots of fruit for idololenkonyane ( <i>Barleria obtusa</i> )	Plenty of rains and vice versa
Lots of fruits for intakubomvu ( <i>Lannea edulis</i> ), umlugulu ( <i>Carissa edulis</i> ) and umthunduluka ( <i>Ximenia caffra</i> )	Plenty of rains and vice versa
Singing of the ground hornbill (insingizi)	Good rainfall season
Singing of cicadas (izidlonono)	Rains within a month
Wind blowing from North to South and Then change direction and blow from South to North	Rains within next two days
Wind blowing from west to east	Rains imminent
Halo around the moon	Good rainy season
White Clouds moving a lot	No rains
Black clouds not moving a lot	Heavy rains imminent

**Table-3:** Different methods used to predict rainfall in Village 3

Indicator	Interpretation
Croaking of the white frog	Rains imminent
Appearance of bull frogs	Rains imminent
Appearance of black kyte (inkonjane)	Rains imminent
Singing of the rain bird (inkanku ( <i>Jacobin cuckoo</i> ))	Rains imminent within 2 days
Large number of rainbirds (inkanku <i>Jacobin cuckoo</i> ) singing	Good rain season expected
Ostriches beginning to lay their eggs	Onset of the rainy season
Amangabuzane (Pelicans) flying over the sky(egiya)	Rains within a week
Ants cutting grass and putting in their holes	Rains in 2 to 3 days
Sprouting of Mopane ( <i>Colophospermum mopane</i> )	Rains imminent
Heavy flowering of umsehla ( <i>Peltophorum africanum</i> )	Poor rainfall season
Heavy flowering of acacia trees	Imminent rains and good rainy season
Lots of fruit for isigangatsha ( <i>Lannear discolor</i> )	Plenty rains and vice versa
Lots of fruits for inhlokotshiyane ( <i>Ximenia armericana</i> ), intakubomvu, ( <i>Lannear edulis</i> ), umlugulu ( <i>Carissa edulis</i> ) and umthunduluka ( <i>Ximenia caffra</i> )	Plenty of rains and vice versa
Singing of the ground hornbill (insingizi)	Good rainfall season
Singing of cicadas (izidlonono)	Rains within a month
A lot of butterflies seen flying north	The more the butterflies the more the rain
Amanqina giving birth to many offspring	Good rainy season
Cattle having too many calves	Good rainy season
Wind blowing from North to South and Then change direction and blow from South to North	Rains within next two days
Wind blowing from west to east	Rains imminent
Halo around the moon	Good rainy season
Clouds moving a lot	No rains
Black clouds not moving a lot	Heavy rains imminent
A lot of whirlwinds	Good rainy season
Tilted moon	Poor rainy season
Upright half moon	Good rainy season

**Table-4:** Indicators added by elders.

Indicator	Interpretation
Sprouting of mopane ( <i>Colophospermum mopane</i> )	Rains imminent
See uxakuxaku (Azanza garckeana) producing fruits which later fall down	Very poor rainy season
See intakubomvu ( <i>Lannear edulis</i> ) with lots of fruit which does not drop especially around December/January	Plenty rainfall
Umhagawuwe ( <i>Securinga virosa</i> ) with lots of fruit	Good rain season expected
Isigangastha ( <i>Lannear discolor</i> ) with lots of fruit not dropping	Good rain season expected
Isigangastha ( <i>Lannear discolor</i> ) with fruit but dropping	Bad rainy season
Mangoes flowering but flowers dropping	Bad rainy season
Inhlokotshiyane/ichane( <i>Ximenia americana</i> ) with plenty fruits	Good rain season expected

**Table-5:** Different methods used to predict rainfall in Village 4.

Indicator	Interpretation
Croaking of the white frog	Rains within a week
Croaking of frogs in ponds	Rains in a less than a week
Appearance of black kyte (inkonjane)	Rains imminent
Singing of the rain bird (inkanku)	Rains within 2 weeks
Lots of fruits for intakubomvu ( <i>Lannear edulis</i> ), umlugulu ( <i>Carissa spinarum</i> )	Plenty of rains and vice versa
Singing of the ground hornbill(insingizi)	Good rainfall season
Ants actively collecting grass and dissappear	Rain imminent
Singing of cicadas (izidlonono)	Poor rainfall season
Wind blowing from North to South and Then change direction and blow from South to North	Rains within next two days
Sprouting and flowering of acacia	Rains imminent
Lot of whirlwinds	Rains are imminent and Good rains
Halo around the moon and sun	Good rainy season
Very hot weather	Chances of rainfall very high
Plenty of amangabuzane (Pelicans)	Plenty rainfall

One of the respondents said that the seeds of inhlokotshiyane and if they are dirty it signals poor rains. Focus group discussions mainly verified what was discussed during the interviews and none of the focus group discussions mentioned the dirty fruits of inhlokotshiyane as an indicator of poor rains.

Village 5 had 62 households and 6 households were interviewed and gave the indicators shown in Table-6.

**Table-6:** Different methods used to predict rainfall in Village 5.

Indicator	Interpretation
Croaking of the white frog	Rains within a week
Croaking of frogs in ponds	Rains in a week
Appearance of black kyte (inkonjane)	Rains imminent
Singing of the rain bird (inkanku)	Rains within 2 weeks
Flowering of umlugulu (Carissa spinarum) and isigangatsha (Lannear discolor) fruits and flowers not dropping	Plenty of rains and vice versa
Acacia flowers dropping	Poor rains and vice versa
Sprouting of intakubomvu (Lannear edulis)	Rains imminent
Umkhuna having a lot of flowers and fruits	Poor rains
Singing of the ground hornbill (insingizi)	Good rainfall season
Singing of cicadas (izidlonono)	Poor rainfall season
Wind blowing from North to South and Then change direction and blow from South to North	Rains within next two days
Sprouting and flowering of acacia	Rains imminent
Lot of whirlwinds before onset of rainy season	Good rains
Halo around the moon and sun	Good rainy season
Very hot weather	Chances of rainfall very high
Plenty of amangabuzane (Pelicans)	Plenty rainfall

From focus group discussions added sprouting of intakubomvu indicating imminent rains and a lot of baby tortoises also indicating imminent rains.

Village 6 had 67 households and 7 households were interviewed and gave the indicators shown in Table-7.

**Table-7:** Different methods used to predict rainfall in Village 6.

Indicator	Interpretation
Appearance of bull frog	Rains imminent
Croaking of the white frog	Rains within 2 days
Appearance of black kyte (inkonjane)	Rains imminent
Singing of the rain bird (inkanku)	Rains imminent within 2 weeks
Amangabuzane(storks) flying over the sky(egiya)	Rains within a week
Ants cutting grass and putting in their holes	Rains in 2 to 3 days
Heavy flowering of acacia trees	Imminent rains and good rainy season
Lots of fruits for intakubomvu (Lannea edulis), umhagawuwe (Flueggea virosa), and umthunduluka (Ximenia caffra)	Plenty of rains and vice versa
Lots of fruits on Isigangatsha(Lannear discolor)	Poor rains
Sprouting of Mopane trees	Indicate onset of rains
Flowering of uxakuxaku (Azanza garckeana), mango and isigangatsha (Lannea discolor) and then flowers dropping	Poor rains
Singing of the ground hornbill (insingizi)	Good rainfall season
Singing of cicadas (izidlonono)	Rains within a month
Cows having lot of calves	Good rains
Ostrich starting to lay eggs	Rains imminent
Mating of donkeys	Indicate onset of rains
Wind blowing from North to South and Then change direction and blow from South to North	Rains within next two days
Halo around the moon	Good rainy season
White Clouds moving a lot	No rains
Black clouds not moving a lot	Heavy rains imminent
A lot of whirlwinds	Good rainy season

The focus group discussions mainly verified the indicators and interpretations from the interviews. However there was an addition of appearance of army worm (umhogoyi) which indicates a good rainfall season and the prevalence and increased number of anthills signifying a good rainy season from the focus group discussion with the elders. There was also reference to fire outbreaks on the local Ntabazamalungwana mountains signifying the onset of rains.

Most of the indicators and interpretations are in agreement with findings from other studies conducted in Zimbabwe. Indicators like halo around the sun and moon, singing of cicadas, singing of ground hornbill, ants cutting grass, occurrence of whirlwinds, appearance of migratory birds and singing of rain bird have the same interpretation as those found by Maguti and Maphosa<sup>17</sup>, Shoko<sup>18</sup> and Makwara<sup>19</sup>. However interpretation from abundance of fruits contradicts studies by Maguti and Maposa<sup>17</sup>, Shoko<sup>18</sup> and Makwara<sup>19</sup>. The interpretation from the abundance of umkhuna tree is the only one which is similar to studies by Maguti and Maposa<sup>17</sup>, Shoko<sup>18</sup> and Makwara<sup>19</sup>. It was also noted that none of the communities mentioned the feeding of chickens and birds when it is raining which was noted by Maguti and Maposa<sup>17</sup>. It was also interesting to note that the behaviour of fish which was mentioned by just one village in the six villages was also noted by Maguti and Maposa<sup>17</sup>. The wind direction associated with imminence of rain is site specific as also noted by Maguti and Maposa<sup>17</sup>.

### Ranking of the Different IKS used to Predict Rainfall in Fort Rixon

Village-1: Indicators of imminence of rains: i. Singing of the rainbird (inkanku), ii. Appearance and croaking of the white frog, iii. Wind blowing from north to south and then change direction and blow from south to north, iv. Appearance of the black kyte (inkonjane).

Indicators of the amount of rainfall: i. Halo around the sun and moon, ii. A lot of watery substance dripping from ichithamuzi, iii. Singing of the ground hornbill (insingizi), iv. Plenty of fruits on fruit trees, v. Singing of the cicadas (izidlonono).

Village-2: Indicators of the imminence of rains: i. White frog, ii. Singing of the rain bird(inkanku), iii. Wind blowing from north to south and then south to north, iv. Appearance of amagabuzane(Storks), v. Activity of ants, vi. Hyper activity of fish.

Indicators of rainfall amount: i. Fruition of isigangatsha(Lannea discolor) , ii. Flowering of Acacia, iii. Halo around the moon, iv. Singing of the ground hornbill, v. Flowering of umsehla (Peltophorum africanum).

Village-3: Indicators of the imminence of rainfall: i. White frog, ii. Appearance of the bull frog, iii. Wind blowing from the south, iv. Singing of the rainbird (inkanku), v. Activity of ants,

vi. Ostrich beginning to lay their eggs, vii. Amagabuzane (Storks) flying over the sky.

Indicators of the amount of rainfall: i. Halo around the moon and sun, ii. Singing of the ground hornbill (Insingizi), iii. Dropping and non-dropping of intakubomvu (Lannea edulis), isigangatsha (Lannea discolor) and mango fruits, iv. Fruition of isigangatsha (Lannea discolor) and umhagawuwe (Flueggea virosa), v. A lot of whirlwinds, vi. Position of the half moon, vii. Cattle and amanqina (Red Duikers) bearing lot of calves.

Village-4: Indicators of imminence of rain: i. Croaking of frogs in ponds, ii. Singing of the rain bird(Inkanku), iii. Wind direction north to south and then south to north, iv. Activity of ants, v. Acacia trees sprouting and blooming, vi. Appearance of black kyte (inkonjane), vii. A lot of whirlwinds, viii. High temperatures.

Indicators of the amount of rainfall: i. Lot of fruits on intakubomvu (Lannea edulis), umlugulu (Carissa spinarum) and umhagawuwe (Flueggea virosa), ii. Halo around the moon and sun, iii. Singing of the ground hornbill (insingizi), iv. Position of the half moon, v. A lot of amangabuzane (Storks), vi. Singing of cicadas(izidlonono).

Village-5: Indicators of the imminence of rains: i. Croaking of frogs, ii. Singing of the rain bird(inkanku), iii. Wind blowing from north to south then change direction south to north, iv. Sprouting of intakubomvu (Lannea edulis), v. Appearance of black kyte (inkonjane), vi. Sprouting and flowering of acacia.

Indicators of the amount of rain: i. Flowering and fruition of umlugulu(Carissa spinarum) and isigangatsha (Lannea discolor), ii. Flowering of umkhuna (Parinari curatellifolia), iii. Acacia flowers dropping, iv. Halo around the moon and sun, v. Singing of the ground hornbill, vi. Plenty of amangabuzane(Storks), vii. A lot of whirlwinds, viii. Singing of cicadas.

Village-6: Indicators of the imminence of rains: i. Croaking of frogs, ii. Singing of the rain bird (inkanku), iii. Wind blowing from N to S and then from S to N, iv. Ants cutting grass and putting it in their holes, v. Amangabuzane (Storks) flying over the sky, vi. Appearance of black kyte (inkonjane), vii. Sprouting of mopane trees, viii. Ostriches starting to lay eggs, ix. Mating of donkeys, x. Singing of cicadas.

Indicators of the amounts of rainfall: i. Lots of fruits for intakubomvu (Lannea edulis), umhagawuwe (Flueggea virosa), and umthunduluka (Ximenia caffra), ii. Flowering of uxakuxaku (Azanza garckeana), mango and isigangatsha (Lannea discolor), iii. Singing of the ground hornbill (insingizi), iv. Halo around the moon and sun, v. Flowering of acacia trees, vi. A lot of whirlwinds, vii. Cows/Amanqina(Red Duikers) having lot of calves.

Ward-18: Indicators of the imminence of rainfall: i. croaking of frogs, ii. singing of the rain bird (inkanku), iii. change of wind direction, iv. activity of ants, v. appearance of black kyte

(inkonjane), vi. appearance of amangabuzane (Storks), vii. sprouting of acacia trees, viii. sprouting of intakubomvu (*Lannea edulis*), ix. sprouting of mopane, x. mating of donkeys, xi. hyperactivity of fish.

Indicators of the amount of rainfall: i. lots of fruits on fruit trees (isigangatsha, intakubomvu (*Lannea edulis*), umthunduluka (*Ximenia caffra*), umhagawuwe (*Flueggea virosa*), umlugulu (*Carissa spinarum*), ii. halo around the moon and sun, iii. singing of the ground hornbill, iv. dropping of flowers and fruits before maturity (intakubomvu (*Lannea edulis*), mango, isigangatsha (*Lannea discolor*) and uxakuxaku (*Azanza garckeana*), v. position of half moon, vi. singing of the Cicadas, vii. frequency of whirlwinds, viii. cows and amanqina (Red Duikers) having a lot of calves, ix. flowering of umsehla (*Peltophorum africanum*), x. flowering of Acacia.

**Acceptability of the different weather forecasting methods:**

This was basically a comparison of the indigenous rainfall forecasting systems as compared to the meteorological department forecasts. Table-8 shows the preferences for the different forecasting methods by local communities in the different villages.

**Table-8:** Preferences for the different forecasting methods by local communities in the different villages.

Village	Traditional	Both	Meteorological Services	Total
1	5	2	0	7
2	4	4	0	8
3	4	2	1	7
4	6	0	1	7
5	5	1	0	6
6	5	2	0	7
Total	29	11	2	42

**Table-9:** Preferences for the different forecasting methods by local communities according to age group.

	Traditional	Both	Met	Total
Youth	7	3	0	10
Middle Aged	12	5	1	18
Elders	10	3	1	14
Total	29	11	2	42

**Table-10:** Expected Preferences for the different forecasting methods by local communities according to age group.

	Traditional	Both	Met	Total
Youth	7(6.9)	3(2.6)	0(0.5)	10
Middle Aged	12(12.4)	5(4.7)	1(0.5)	18
Elders	10(9.7)	3(3.7)	1(0.7)	14
Total	29	11	2	42

$$X^2_{2(0.05)} = 6$$

$$X^2_{calc} = \sum \frac{(O-E)^2}{E} = 0.01 + 0.16 + 0.25 + 0.16 + 0.09 + 0.25 + 0.09 + 0.09 + 0.09 = 1.19$$

At 5% significance level age has no effect on the preference of method of rainfall forecasting used for planning agricultural practices.

**Conclusion**

The prediction of the amount of rainfall is based on the amount of fruits produced by different fruit trees, the amount of butterflies and their direction of flight, and the amount and intensity of whirlwinds. The majority of the community 70% rely on the traditional methods of forecasting rainfall, 25% rely on both and 5% rely more on the meteorological department forecasts. There was no relationship between age and the method of forecasting used. The majority of Fort Rixon community members rely on traditional methods of forecasting to plan for their agricultural activities.

**Acknowledgements**

I am very grateful to the community of Ward 18 in Fort Rixon for their cooperation during the study especially the traditional leadership and the councilor of the ward. Special thanks to Mr. Mtambo who assisted me in doing the interviews.

**References**

1. Ajibade L.T. (2003). A Methodology for the Collection and Evaluation of Farmer's Indigenous Knowledge in Developing Countries. *Indilinga African Journal of Indigenous Knowledge Systems*, 2, 99-113.
2. Altieri M.A. (2000). *Agroecology: principles and strategies for designing sustainable farming systems*. Agroecology in action.
3. Ajibade L.T. and Shokeni O.O. (2003). Indigenous Approach to Weather Forecasting in ASA LGA, Kwara State, Nigeria. *Indilinga African Journal of Indigenous Knowledge Systems*, 2, 37-44.



4. Roncoli C., Jost C., Kirshen P., Sanon M., Ingram K.T., Woodin M., Some T., Quattara F., Santo B. J., Sia C., Yaka P. and Hoogenboom G. (2009). From Assessing to Assessing an end-to-end Study of Participatory Climate Forecasting Dissemination in Burkina Faso West Africa. *Climate Change*, 92, 433-460.
5. Chenje Munyaradzi, Sola Lovemore and Paleeczny Dan (1998). *The State of Zimbabwe's Environment*. Harare: Government.
6. FAO (1988). *Indigenous Knowledge for Watershed Management in the Upper North-West*. Retrieved from <http://www.fao.org/docrep/X5672e09.htm> Accessed on 10/12/2016
7. George Alexander and Bennett Andrew (2005). *Case Studies and Theory Development in the Social Sciences*. Cambridge, MA: The MIT Press
8. Flick Uwe (2009). *An Introduction to Qualitative Research*. 4<sup>th</sup> Edition. Thousand Oaks CA, SAGE Publications Ltd.
9. Cohen Louis and Manion Lawrence (1994). *Research Methods in Education*. 4<sup>th</sup> Edition, London: Routledge.
10. Keyton Joann (2006). *Communication Research: Asking Questions. Finding Answers*. 1<sup>st</sup> Edition
11. Barbie Earl (1989). *The Practice of Social Research*. 5<sup>th</sup> Edition, Belmont, CA: Wadsworth.
12. Tuchman Gaye (1994). *Historical Social Science: Methodologies Methods and Meanings*. In Denzin N. K. and Lincoln (Eds). *Handbook of Qualitative Research* pp 306 – 323, Thousand Oaks, CA, US: SAGE Publications, Inc.
13. Best John and Kahn James (1993). *Research in Education*. 7<sup>th</sup> Edition, New Delhi, Prentice Hall
14. Borg walter and Gall Meredith (1989). *Educational Research. An Introduction*. 5<sup>th</sup> Edition. White Plains, NY longman.
15. Hancock B., Ockleford E. and Windridge K. (1998). *An Introduction to Qualitative Research: Trent Focus Group Nottingham*. Trent Focus: Nottingham, UK.
16. Gwimbi P. and Dirwai C. (2003). *Research Methods in Geography and Environmental Studies*. Harare, Zimbabwe Open University.
17. Muguti T. and Maposa R.S. (2012). Indigenous weather forecasting: A phenomenological study engaging the Shona of Zimbabwe. *The Journal of Pan African Studies*, 4(9), 102-112.
18. Shoko K. and Shoko N. (2012). Indigenous weather forecasting systems: a case study of the biotic weather forecasting indicators for wards 12 and 13 in Mberengwa district Zimbabwe. *Journal of Sustainable Development in Africa*, 14(2), 92-114.
19. Makwara C.E. (2013). Indigenous Knowledge Systems and Modern Weather Forecasting: Exploring Linkages. *Journal of Agriculture and Sustainability*, 2(1), 98-141. ISSN 2201-4357.