

Weather Forecasting and Indigenous Knowledge Systems in Chimanimani District of Manicaland, Zimbabwe

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Abstract

The study focused on how traditional knowledge is used to forecast weather in the Chimanimani District in Manicaland Province of Zimbabwe. It is the purpose of this study to show how Indigenous Knowledge Systems [IKS] have been used by rural communities to predict weather and seasonal changes in their environment. A descriptive survey was adopted using open ended questionnaires and interviews to collect information in order to assess peoples' understanding, attitudes and beliefs on the value of indigenous knowledge on weather prediction. Purposive sampling was applied to collect data from people purported to be rich in indigenous knowledge. It was found that biological, atmospheric conditions, astronomic and relief features are used to predict weather over short and long periods of time. Temperature and wind patterns were regarded as pointers to weather changes. The behaviour of animals and insects were less mentioned as useful in determining weather conditions. Human ailments such as operations were pointed out as accurate indicators of impending weather changes. Astronomic features were used to predict weather especially coming of rains within a period of about two weeks. The study notes that there is rapid disappearance of plants and animals due to climate variability and human activities. There are few elders aware of traditional methods of weather forecasting. This makes traditional weather forecast less reliable. The study concludes that both modern and traditional methods have got some positives and weaknesses and therefore can be used together to produce more comprehensive reports of weather forecasts for end users. The information on IKS is useful for end users including farmers, planners, educators, weather forecasters and Non Governmental Organisations [NGO's]. Traditional leaders need to be empowered to assist in the conservation of resources in their communities. Traditional methods of weather forecasting should be part and parcel of the school curriculum at all levels of education.

Keywords: indigenous knowledge systems; weather forecasting; climate variability; traditional leaders; conservation; climate change; rain making ceremonies.

INTRODUCTION

Indigenous Knowledge Systems (IKS) is a body of knowledge or bodies of knowledge of the indigenous people of a particular geographical area that have survived on for a very long period of time [Mapara, 2009:140]. Indigenous knowledge determines decision making in areas such as agriculture and resource management [Warren, 1991]. Indigenous/Traditional methods of weather predictions have been used since time immemorial but with the coming of modern methods of weather forecasting these traditional methods have tended to be ignored. Mhita [2006] noted that before modern methods of weather forecasting the rural communities of Tanzania observed plants, animals and birds for weather forecasting. In Burkina Faso apart from observing the behaviour of animals and plants cultural and ritual specialists use visions, dreams and divination to predict weather [Rocoli et al, 2001 cited in IPCC Fourth Assessment Report, 2007]. There is therefore a need to promote these methods taking cognizance of climate change which makes modern methods less reliable especially in rural areas where

there is inadequate weather forecasting instruments. There is need for research in traditional methods to compliment modern weather forecasting so as to produce more reliable and valid information for end users. In addition those people with valuable information (elders) are passing away and living organisms such as plants and animals are quickly disappearing or extinct due to climate change and overpopulation. Grace [2008] observed that global warming and recurrent droughts has resulted in extinction of both plants and animals. It has also resulted in the replacement of original plants by drought resistant ones and changes in the flowering of plants and shedding of leaves. Chang'a et al [2010:67] pointed out that, weather and climate prediction is under threat due to lack of documentation and death of old people who have got the knowledge. The information on traditional methods is not being fully harnessed to help the greater population in Zimbabwe hence the need to tape this knowledge. Southern Africa including Zimbabwe is very vulnerable to the negative effects of climate change such as changes in seasons. Most

communal areas in Zimbabwe rely much on natural rains such that accuracy in weather prediction results would improve farmers yield and productivity. The community would also be able to plan for natural hazards such as frost, drought and floods. In the Philippines Farmers and Fishermen rely on observing the behaviour of animals and insects to predict the coming of rains and bad weather [Galasgac and Balisacan, 2003]. Indigenous Knowledge of weather forecasting can be combined with the modern methods to produce more reliable and accurate forecasts. In Western Kenya Rainmakers from the Nganyi family has got sacred shrines with indigenous trees they use to predict weather. Their weather forecast in combined with that from the Kenyan Meteorological Department to produce more accurate weather reports [Thomson Reuters Foundation, 2012]. Rural communities in many parts of Tanzania use Indigenous knowledge to cope up with hazards related to climatic variability [Changa, Yanda and Ngana, 2010]. In Australia the Government make use of Indigenous knowledge in order to cater for the varied microclimates in the region [Australian Government Bureau of Meteorology, 2010]. Recent information on weather forecasts in Southern Africa has shown a difference between what is needed by farmers and what is provided by modern meteorological services [Blench, 1999]. These suggest a growing need to complement modern methods of forecasting with traditional ones.

Modern Methods of Weather Forecasting

Weather forecasting is a scientific estimate of the weather conditions at some future time which are expressed in terms of variables such as temperature, precipitation and wind [Lutgens and Tarbuck, 2010]. It is a statement of weather expected to occur in a particular area during a stated time period [Buckle, 1996:218]. Weather forecasting can either be subjective or numerical. Subjective forecasting is based on describing the current daily observation of the atmosphere and what has been happening in the past. The observations are then inferred to the future [Buckle, 1996]. The method is cheap, simple and therefore can be easily used in poor countries where finances and technology are poor. Numerical forecasting is an objective method that uses mathematical equations and physical laws to simulate atmospheric conditions and then predict weather conditions. The technique use high technology such as satellites and radar (radio detection and ranging) [Buckle, 1996]. In Zimbabwe this is done by the Meteorological Services Department in Belvedere, Harare. It is expensive since it requires high technology and expertise. It is therefore a challenge to Least Developing Countries such as Zimbabwe. Modern weather forecasting can be done over short or long period. Very short range forecast can cover up to 12 hours and can be used to predict the movement of cyclones. Short range forecast caters for

periods from 12 hours up to few days [Lutgens and Tarbuck, 2010:353]. Medium range forecasts ranges from few days up to two weeks. Weather predictions in excess of one month are grouped under long term forecasts [Barry and Chorley, 1968]. This type of weather forecast is more general as it predicts averages and variability of weather elements over long periods. The accuracy of such predictions are still poor [Lutgen and Tarbuck, 2010].

Problems in Modern Weather Forecasting

In Least Economically Developed Countries (LDC's), modern weather forecasting is a problem due to shortage of weather data. There are few weather stations at the ground and upper air stations. This is worsened by poor telecommunications [Buckle, 1996]. In addition there is insufficient understanding of atmospheric processes such as pressure and wind that are important to predict weather. Aguado and Burt [2010] noted that modern weather forecast may be imperfect due to factors such as lack of information about the composition of the atmosphere, unstable atmospheric composition and air motions in the atmosphere. The cost to acquire weather forecast equipment is a great hindrance in poor countries in their quest to produce reliable and accurate forecasts [Buckle, 1996]. Modern weather forecasts make use of Global Climate Models (GCM) which are developed from global air circulations. These models are based on the patterns of greenhouse gases in the atmosphere. These greenhouse gases are dependent on the global social, political and economic development. These parameters are difficult to predict making weather forecasting models less reliable [Grace, 2008].

This paper focused on Indigenous knowledge Systems used by the community of Chimanimani District, Zimbabwe to predict weather using biological, atmospheric conditions, astronomic features and traditional ceremonies. It is the argument of this paper that the current modern methods of weather forecasting is a positive development but for Least Economically Developed Countries burdened by numerous problems ranging from inadequate weather stations, financial problems and rapid degradation of the environment there is need to fuse both modern and traditional methods in order to produce more accurate weather forecast for the local communities. The problem in which vegetation and animals are fast disappearing due to human activities and the effects of climatic change makes it mandatory to fuse modern and traditional weather forecasts to improve on weather predictions. A record of methods used to forecast weather in local communities is important since it addresses the needs for a particular community. Modern methods tend to generalise the findings more particularly with the scarcity of forecasting equipment in developing countries.

IMPORTANCE OF THE STUDY

The study is of value to scholars and readers as it stimulate them to undertake further research in weather issues. The research has illuminated researchers in traditional methods of weather forecasting and how they fit into current developments in climate variability. Readers shall be acquainted with indigenous knowledge systems utilized within a given region. The findings can be used or compared with other research done in other regions. Modern scientific weather researchers can find ways of blending their findings with IKS in order to produce more reliable forecasts. Similarities and variability in the perceptions on weather predictions are revealed through this research. A wide range of end users such as farmers and planners can plan for the effects of climate variability such as extreme heat and cold spells.

THE STUDY AREA

Chimanimani District is situated to the East of Zimbabwe. The council offices for the district are 150 kilometres from the Provincial capital, Mutare. It shares its boundary with Mozambique in the East with Chimanimani mountain ranges forming the boundary. The Save river mark the western boundary. It shares the southern boundary with Chipinge District and northern boundary with Mutare rural. River covering places like Nyanyadzi and Gudyanga. As a result of varied relief the district is classified into five regions with region one which is wetter and cool to the East and semi arid region to the west. The varied relief and climate produces variations in vegetation and soils as we move from the highlands in the East to the lowlands in the west. The highlands are characterised by trees such as *musasa* [*Brachystegia spiciformis*], *mutondo* [*Julbernardia globiflora*], *mupfuti* [*Brachystegia boehmii*] and *muunze* [*Brachystegia glaucescens*]. Towards the western lowlands dry resistant trees including acacia, Mopani and baobab are dominant. There is a wide range of animal species in the Chimanimani Park and domesticated animals by the rural communities. The population is largely Ndaui tribe and practice mainly Christianity and African traditional religion. Chiefs namely Ngorima and Chikukwa, Muusha and Mutambara play a major role in the conservation of resources and tradition.

METHOD OF STUDY

The study was carried out in Chimanimani District in Manicaland Province, Zimbabwe. A descriptive survey was used. Purposive sampling was used in administering questionnaires and interviews. Fifty three (53) adult participants spread over all villages were issued with questionnaires. The participants were chosen from people with varying educational and social backgrounds. Adults were chosen as they were believed to be informed on Indigenous knowledge of weather forecasting. A broad stratum

of participants was intended to access peoples' understanding, attitudes, views and beliefs on traditional methods of weather forecasting. A time frame of one week was given in which the researcher would collect the questionnaires. Ten elders (10) in the community were purposively sampled for interviews. These were selected on the basis that they were old and assumed to be rich on information regarding traditional methods of weather forecasting. These elders have the knowhow of what was done in the past on predicting weather that determined their activities particularly preparation of land, planting and harvesting.

Biological Weather Forecasting Indicators

Table 1: Biological weather forecasting Indicators

| Predictors | Description | Weather forecast Interpretation |
|------------------|---|---|
| Plants | blooming of plants | onset of summer season |
| | plants shedding off leaves | dry season |
| | abundance of fruits eg <i>mazhanje</i> [<i>Uapaca kirkiana</i>] and <i>hacha</i> [<i>Parinari curatellifolia</i>] | Drought |
| Animal behaviour | Presence of millipedes, frogs, | Onset of rain season |
| | Rock rabbit crying in the morning and evening | Beginning of hot season |
| | Presence of reptiles in large numbers | Hot season beginning |
| | Breeding of goats | Onset of rain season |
| Birds | Presence of stock birds | Onset of rain season |
| | Singing of <i>riti</i> | Rain just about to come |
| | Singing and flying of <i>haya</i> | Rains in the near future |
| | Guinea fowls laying eggs | Onset of summer season |
| | Large numbers of qualla birds | Onset of winter season |
| | Swallows flying at low altitude | Rains to fall immediately |
| | Birds singing and flying high | Clear dry conditions (stable weather) |
| | Birds seeking shelter during the day | Cloudy and humid conditions |
| Insects | Singing of insects such as <i>nyenze</i> | High temperature and onset of summer season |
| | Ants searching food | Rain season approaching |
| | Ants sealing off holes into ant mound | Rain to fall very soon |
| | Spiders running around | Rains about to start |
| Human ailments | Asthmatic attack, back aches, painful operations | Imminent cold weather and humid conditions |

Plants

Plant species were mentioned to be handy in weather predictions in a variety of ways. Some plants change their morphology with season. In the eastern part of the District plants such as *msasa* [*Brachystegia spiciformis*], *mnondo* [*Julbernardia globiflora*], bloom into green and release tender leaves marking the onset of the rain season. These trees start to bloom as from September. These trees also shed off their leaves during the dry season. Abundance of fruits from trees such as *mazhanje* [*Uapaca kirkiana*] and *hacha* [*Parinari curatellifolia*] signalled drought in the coming season. In the western part which is

arid the people use signs of trees such as shooting of baobab and Mopani tree leaves.

Animal Behaviour

Some small creatures such as *mazongoro* [millipedes] and *matatya* [frogs] are mostly seen at the beginning of the rain season. When *mbira* [rock rabbit] squeaks for a long time in the morning and early evening this could indicate that the hot season has began. Reptiles such as snakes mate as winter approaches. Their numbers increase during the time of harvests (summer). They hibernate in winter. Goats breed mostly during the summer.

Birds

Unique behaviour of birds could indicate seasons. The arrival of migratory birds indicates the approach of the summer season. Other birds such as *riti* or *hwiriti* [storks] produce sounds as the rains are about to start. The squeaking of the *haya* or *hwaya* bird was given as an indicator of imminent rains. Birds like *chivangatura* or *chigogodza* sing in the morning, when temperatures are high which indicates hot season has approached. When the weather conditions are overcast and a crow, crows the following day will be clear. Laying of eggs by birds such as guinea fowls signifies the onset of the rain season. The migration of *ngozha* [qualla birds] in large numbers indicates that the end of the summer season and onset of the winter season. The birds migrate in search of food during the harvesting period.

Insects

The emergence and singing of insects like *nyenze* mark the start of the rain season. Ants and termites collect grass and store food in preparation for the next rain season. This indicates that the summer season is just around. Creatures that include lucky insects, crickets and spiders are more active and move around as a sign of an impending rain season.

Human Ailments

Human ailments such as asthma, back ache, pain on operations were regarded as good weather predictors. When the patients suffer these ailments most, it indicates that cold conditions, windy, humid and rain is likely to be experienced within a short period of time. A closer assessment of these responses shows that diseases related to the heart and lungs could be used to predict weather over a short period of time.

Atmospheric Weather Forecasting Indicators

Changes in weather elements such as temperature, rainfall, wind and light intensity were cited as good indicators to determine future weather patterns. Winds blowing from the east often brought some rains concentrated on higher grounds such as Chimanimani Mountains. On the other hand westerly winds brought heavy rains that cover a wider area.

The rains are generally of high intensity. The prevalence of *chamupupuri* [whirlwind] is associated with hot weather conditions and gusty winds. *Mauma* [haze] indicates hot and dry conditions. This usually takes place in September and November. People start to prepare land for the summer season. *Makore ehanga* [wispy feathery clouds] indicate the coming of a storm. *Dziva reveve* [sun/moon halo] appearance was regarded as a good indicator of coming rains within two weeks. Haze indicates that during the day temperatures would be very high. When there is a prolonged cold season crippling into months of August to October a drier summer season is expected. On the contrary a warmer winter is expected to yield high rainfall during the summer season. In general respondents were of the view that cold temperatures produce less rainfall where as warm temperatures result in high rainfall. The presence of *mhute* [mist] and *beto/zando* [dew] in the morning was a signal for fine weather conditions during the day. The appearance of *utahwadande* [rainbow] when it has been raining indicates that the rains have come to an end.

Table 2: Atmospheric weather forecasting indicators

| Predictors | Description | Weather forecast Interpretation |
|--------------|------------------------------|---|
| Temperature | Hot conditions | Abundance of rain in the coming season |
| | Cold conditions | Low rainfall in the coming season |
| Rainfall | High summer rains | Cold winter in the next season |
| | Less summer rains | Warmer winter in the next season |
| Air movement | Whirl wind | Hot weather conditions |
| | Northerly winds | High rains that covers a wider area |
| | Easterly winds | Less rainfall concentrated on high ground |
| Visibility | Presence of haze | Hot and dry conditions |
| | Mist and dew in the morning | Fine weather during the day |
| Clouds | Wispy feathery cirrus clouds | Coming of a storm |
| | Sun /moon halo | Continuous rains within two weeks |

Astronomic Features

The appearance of the stars in the sky could be used to predict seasons. The respondents cited that *gwara rakurumbi* [milk way] changes its position in accordance with seasons. The milk way will be almost at the centre in summer and slightly shifts to the north in winter. In winter also a group of six stars observed in the western part of the sky is linked to the onset of the winter season. The moon undergoes various changes in terms of shape, size and brightness. When the moon is very bright it indicates that we have approached the winter season and no rain is expected. The quarter moon or its absence during the summer indicates that some rains can fall within a short space of time.

Table 3: Astronomic Weather Forecasting Indicators

| Weather forecast Indicator | Description | Weather forecast interpretation |
|----------------------------|---|--|
| Stars | Central position of <i>gwara rakurumbi</i> [milk way] | <i>Zhizha</i> [summer season] is approaching |
| | Northerly position of milk way | <i>Chirimo</i> [Winter] |
| | Group of six(6) stars observed in the western side | Onset of winter season |
| The moon | <i>Dziva remvura</i> [moon/sun halo] | On coming rains within a short period of time. |
| | <i>Jenaguru</i> [very bright moon] | Winter season has approached |
| | Full moon | No rain is expected |
| | <i>Mwedziwafa</i> [Quarter moon or its absence] | Rain is expected during this period |

Relief Features

The natural burning of mountains such as *Murwangemhanga* which is found in Chimanimani area was given as sign of impending rains. The presence of frequent occurrence of mist or fog at mountain tops was regarded as a warning of coming rains.

Mukwerere [Rain making ceremony]

Most participants agreed that rainmaking ceremonies can bring some rain if properly done. These are organised by the Kraal head or Headman for the village. The rain making ceremonies are done at sacred forests or under special trees such as *muonde* [fig tree] that is believed to be associated with water. It involves brewing of beer, roasting meat, singing and dancing. Soon after the function if the Ancestral spirits are pleased they will respond by providing some rains [Muguti and Maphosa,2012]. However it was noted that for the Ancestors to respond positively certain taboos have to be desisted from. These include incest, abortion, homosexuality and working on a *chisi day* [resting day]. Other taboos that may anger the Ancestors and therefore cause drought and even drying of rivers are killing sacred animals such as *haya* [cuckoo], killing frogs, and baby dumping and washing dirty in sacred pools

CONCLUSIONS AND RECOMMENDATIONS

The study found that traditional methods of weather forecasting can be utilised for the purposes of short term and long term seasonal weather predictions by local communities. It was noted that these methods ranged from biological, atmospheric, relief and astronomic features. Although a variety of methods were at peoples' disposal, it was noted with concern that a low percentage of people are at the moment using it or aware of the methods. This was due to ignorance and shunning away traditional methods in favour of modern methods. Some did not want to be involved in traditional methods such as brewing beer for '*mukwerere*' due to Christianity. In this regard

this study recommends that it is critical to implement a fusion of strategies that builds on such traditional and modern methods of weather prediction. This view is also supported by The Head of Meteorological Services Department in Zimbabwe, Mr Tichaona Zinyemba who observed that Zimbabwe is facing a challenge in projecting accurate temperatures for the whole season as a result of outdated technology(The Sunday Mail, June 3 – 9, 2012:D16).

It has also been noted that the traditional knowledge of weather forecasting has been rendered less useful and reliable as a result of current climate change attributed to both human and natural factors. The study has shown that traditional methods have become less reliable due to destruction of vegetation or extinction of plants and animals, desertification processes in semi arid regions, rapid industrialisation and increased population growth resulting in rampant destruction of vegetation. The weather and seasonal indicators largely used by traditional forecasters particularly biological ones are quickly disappearing. The study also noted that the aged population knowledgeable on traditional methods of weather prediction are dying with their oral knowledge. The effect of climate change on traditional weather forecasting was noted among all participants. A case in point was cited where winters are now characterised by warm periods punctuated by extreme cold spells. Mr Tichaona Zinyemba has noted that, traditional weather forecast based on astrology, phenology of plant flowering and wildlife movements are no longer as reliable as they used to be in the past due to a number of reasons(The Sunday Mail, June 3 – 9, 2012:D16).

The study further recommends that local communities and their traditional leadership need to tap and utilise indigenous knowledge on weather prediction for planning their activities such as farming. The modern and traditional weather forecasters can work together to produce a comprehensive weather forecast that is more reliable and meet the needs of local communities. The local leadership can have the responsibility of advising its communities on expected weather conditions for that season. It was also noted that the younger generation need to be acquainted with ideas that are important in weather prediction from a traditional point of view. Thus indigenous knowledge on weather forecasting needs to be encouraged across all age groups. The Ministry of Education could work with all stake holders to develop curricula on traditional weather forecast for all levels. At the moment Zimbabwe education system concentrates on teaching modern methods of forecasting especially at primary and secondary education. Apart from making the young generation aware of the indigenous methods of weather forecasting, natural resources such as forests,

wildlife and water resources would be conserved as these are important in weather predictions.

The study has been limited to a small geographical area of study. The area is in ecological region one of Zimbabwe. The research did not have the capacity to compare results of traditional methods of weather forecasting with the scientific ones over a certain period. The results may not be accurately generalised to all regions with varying geographical aspects such as climate and vegetation. The research did not have the capacity to compare results of traditional methods of weather forecasting with the scientific ones over a certain period. There is therefore a need to carry out research in other areas of Zimbabwe and produce a comprehensive report on traditional methods of weather forecasting.

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