The Role of Indigenous Knowledge in Climate Adaptation: Experiences with Farmer Perceptions from Climate Change Project in Sedumbwe Agricultural Camp of Southern Zambia

Kafula Chisanga[*], Andrew Bosco Mvula[**], Taban Habibu[***]

[*]Department of Zambia Agriculture Research Institute, Mochipapa Research Station, Choma, Zambia
[**]Department of Zambia Agriculture Research Institute, Misamfu Research Station, Kasama, Zambia
[***]Department of Computer and Information Science, Muni University, Arua, Uganda

Abstract- *Climate change is a world wide phenomenon that has huge implications on economic, social and ecological challenges to the global community and to smallholder farmers especially in low income countries. In this paper we seek to provide information on the role of Indigenous Knowledge (IK) to climate adaptation based on the experiences with farmer communities from the climate change research project which was implemented in Sedumbwe Agricultural Camp of Southern Zambia. Data were collected mainly through focus group discussions. The paper points out the common indicators used to predict drought/rainfall and how reliable they are. Possible recommendations are also provided on how the IK weather forecasting could be integrated and operationalized in agriculture policies of many countries in the sub Saharan African region to climate adaptation*.

Index Terms- Climate Adaptation*;* Forecasting; Harnessing; Indigenous Knowledge

I. INTRODUCTION

Indigenous Knowledge (IK) which is fondly known as traditional knowledge denotes knowledge which is generated by the community over a long period of time and enables them to understand and live within their environments. IK is the foundation for any decision making by the communities as regards food production and natural resources management. IK has also been referred to as the unique, traditional, local knowledge existing in a particular social setting and developed by women and men indigenous to a certain geographic location (Grenier, 1998). It is fundamental to local decision-making regarding daily activities like hunting and gathering, fishing, agriculture, animal husbandry, water conservation, health, etc. Moreover, unlike formal scientific knowledge, IK is generally transferred as oral wisdom from one generation to the other, and is seldom, if ever, documented. Combining all forms of knowledge other than the formal ones as IK would lead to its generalization and oversimplification, and down grade the role of local knowledge to sustainable development.

In general it is widely accepted that IK represents an alternative way of thinking, which has evolved through time, keeping in mind the requirement for communities to safeguard themselves and their families from variations in the local climate. In today's society, where science is playing a pivot role, many people believe that orally transmitted knowledge is non-scientific, which is totally false. IK is also as scientific as any other form of present knowledge as it evolved on the same principles of experiments and trial and error methods which are widely followed in sciences (Particularly in physical sciences). Historically, indigenous people are conspicuously amongst identified as particularly vulnerable to climate changes. Many indigenous territories are located in areas where impacts from global warming are anticipated to be both early and severe (Nayong et al., 2007). But, indigenous people have learnt the art of adapting to any changes in their climate and this knowledge or skill can help present generation to fight present form of climatic change and variability.

Climate change is a major threat to sustainable development in developing countries. According to IPCC (2007), poor communities particularly in sub-Saharan Africa will be most vulnerable because of their low adaptive capacity and great dependency on high climate sensitive resources such as water and ecosystems. Environmental and social consequences of climate variability have already jeopardized the livelihood of many populations in developing countries. However, even though it is acknowledged that poor communities will be most affected by climate change, the magnitude of this vulnerability depends heavily on ecological and socioeconomic characteristics of each community. So, given the urgency to cope with climate changes the present study is an attempt to discover the traditional skills prevalent among communities of southern Zambia that can help to build future course of action forpresent generation. The aim of this paper is to present and draw some IK experiences on climate adaptation by the communities for the project "***Lack of resilience in African smallholder farming: Exploring measures to enhance the adaptive capacity of local communities to pressures of climate change"*** which was implemented in Choma district, southern province of Zambia. The community experiences regarding how they use IK in their decision making

for agricultural production and natural resources management are discussed.

II. MATERIALS AND METHODS

A. Focus Group Discussions

In order to obtain the required information for the study, focus group discussions were held with elderly men (63) and women (42) regarding their IK and climate change prediction. The discussions provided a basis for the information collected to compile this paper

B. Description of the Study Area

This study was conducted in southern province of Zambia in 2008/09 agriculture season. The province lies approximately between latitudes 16 and 18°S, and longitudes 26 and 29°E, with a total area of about 85,283km^2 representing 11% of the country's total land area. Southern province is among the key agricultural based provinces in Zambia and accounts for 11.0% of the total agricultural households in the country of which 83.3% and 16.7% are male and female headed respectively. At provincial level, Southern province has the highest mean agricultural household size of 6.5 compared to the national average of 5.5 persons per household (CSO, 2000).

The people of Sedumbwe Area where the project on climate change and adaptation wasimplemented are mainly Tonga speaking and live in extended families with an average size of 9. About 95% of the people in the area are actively involved in agriculture which is their major source of livelihood. Cultivation of land is done using draught power. About 85% of the local farmers are small-scale farmers who only grow crops for family consumption with a little surplus for sale.The farming systems in this area of southern province are characteristic of agro-pastoral farming, with maize being the dominant staple food crop. Other food crops include sorghum, groundnuts, millet and cowpeas. Cotton and tobacco are the main cash crops grown. The most important livestock types reared include cattle, goats, pigs and chickens. At smallholder farming level, crop production is typically rainfed and livestock management practices
are characterized by less supplementary feeding practices and communal grazing arrangements.

C. Choma District

Choma district covers an area of 4, 860 km$^{2.}$ The estimated total population is 203 305 people (48.7 percent of whom are male and 51.3 percent female) live in 33, 453 households (CSO, 2001). Choma district lie in agro ecological region II, with average annual rainfall between 800mm and growing seasons of 90 to 95 days. More than 97 percent of the total number of households are full time farmers although most of them are small scale. The major cropping systems in the district is semi commercial maize, groundnuts, sunflower, cotton and sorghum. The vast majority of farmers also keep livestock, mainly cattle and poultry, but also goats, sheep and pigs.

Figure 1: Map of southern province showing study area

III. EFFECTIVENESS OF THE USE OF IK IN TERMS OF COMMUNICATION AND DOCUMENTATION

Households and focus group discussions revealed that communities have traditional methods ofpredicting weather patterns. The findings show that 83.2% of sampled households acknowledged that they know some form of indicators that are used to predict weather patterns. A drought season is characterized by a high prevalence of some kind of special insects especially those in the family of caterpillars, winters preceding the on-set of the rain season are very cold, wind flow is also characterized by unusual direction and this is also coupled with high fruiting levels by the fruit trees.

A normal season in terms of rainfall pattern will display a combination of the following weather patterns; there will be plenty of fruits, normal wind (usual) direction, hot summers and appearance/prevalence of blank ants just before and during rain season. Flood seasons were not clearly defined due to very low incidences of such weather patterns in the study area which are more drought prone (see Table 1)

IV. COMMON INDICATORS TO PREDICT DROUGHT/RAINFALL AND THEIR RELIABILITY

In terms of degree of accuracy regarding predicting a drought/rainfall year, the households indicated that more than 80% of what they see in terms of traditional indicators turn out to be true and this makes them to start preparing for the expected weather pattern. Communities noted that on knowing that the rainfall pattern will not be favourable, they tend to prepare land early, buy early maturing maize varieties and also think of alternative livelihood strategies such as involving in piece works, sale of assets (e.g livestock) and others ask for remittances from relatives among other strategies

V. COMPARISON OF INDIGENOUS WEATHER FORECASTING AND METEOROLOGY/MODERN FORECASTS

In terms of comparison of indigenous and modern weather forecasting the table below provides a summary of categorized traditional indicators fordrought and floods and degree of accuracy as reported by the community in the study area.

Table 1: Traditional Indicators of rain seasons

Normal Rain Season	Drought Season
• Swallows (type of bird) appear around October	• Low temperatures during the months of September/October
• Mist of the hills	• Migration of "Black Ants" from one point to another
• Appearance of dark clouds during "Lwiindi Traditional Ceremony" – Harvest thanks Giving Ceremony	• High fruiting of wild fruits
• Appearance of the "Morning Star" just before the on-set of the rain season	
• Appearance of "Danga Balya" star at dusk (18:00 – 20:00hrs)	
• High prevalence of "Whirl Winds" just before on-set of rains in September/October	

Source: Author, 2008

Table 2: Drought Early Warning Indicators

Emergency	Traditional indicator in Tonga	English translation of Tonga indicator	Time when the indicator happens	Category of indicator	Degree of accuracy
Drought	Bamoomba kutalila kuseeni.	Specific birds not making noise at dawn	July-Sept	P.S.E.W.I	90%
Drought	Muyuni Siapilyo kuti mapepe kasumbula	Specific birds are not seen flying around during an eminent drought	Aug	P.S.E.W.I	85%
Drought	Matongola kuti katako	Specific birds not seen flying around	Oct-Nov	S.H.M.I	90%
Drought	Inswi zya kuwe kuti zyavula	Small fish population in rivers/streams decreases	Jan	P.S.E.I	50%
Drought	Nyenze kuti tizyalila	Mole cricket do not make noise	Sept-Oct	P.S.E.I	90%
Drought	Kutazwa kwa nseele zinji	White termites not in abundance	Nov-Dec	S.H.M.I	80%
Drought	Kutaboneka kwa nkonkoolekwa	Specific butterflies are not seen flying around	Oct-Dec	S.H.M.I	95%
Drought	Cikumbi lusele ca mupeyo	Cloud cover lasting for less than seven days	July	P.S.E.W.I	95%
Drought	Kuhula kwa micheelo minji	Abundant wild fruits	Aug-Sept	P.S.E.W.I	80%
Drought	Kumuka kumana kwa mpeyo	Long winter season	Sept	P.S.E.W.I	90%
Drought	Kutavula kwa zinkubala	Caterpillars not in abundance	Oct-Jan	S.H.M.I	70%
Drought	Mukololo kuti kutalosyi meenda ku mwaka	A particular tree does not drop water	Aug-Sept	P.S.E.W.I	98%
Drought	Kutaba kwa bunkululu	Shrubs/Plants not flowering during drought period	Sept-Oct	P.S.E.W.I	90%

Source: (MET, 2008) Note: *P.S.E.W.I means pre-season early warning indicators, S.H.M.I means season hazard monitoring indicators*

Table 3: Flood Early Warning Indicators

Emergency	Traditional indicator	English translation	Time when the indicator appears	Type of indicator	Degree of accuracy
Flood	Mukololo kuti kaulosya meenda ku mwaka	A particular tree drops water in excess	Sept	P.S.E.W.I	90%
Flood	Kuboneka kwa matongola	A lot of birds are seen flying all over	Nov	S.H.M.I	85%
Flood	Kuzyala kwa musamba	A lot of fruit from a *Pericopsis angolensis* tree	Oct	S.H.M.I	95%
Flood	Kuvula kwa majongola mapati asiya	Abundance of millipedes	Nov-Dec	S.H.M.I	75%
Flood	Maholopyo kuti kali manji		Oct	P.S.E.W.I	60%
Flood	Bamoomba kuti kabalila maningi kuseeni	Specific birds making a particular noise at dawn consistently	Nov-Dec	S.H.M.I	85%
Flood	Nkonkolekwa zinji kuti ka zizwa kujwe kuya kumbo	Butterflies moving from east to west	Nov-Dec	S.H.M.I	95%

Source: (MET, 2008) Note: *P.S.E.W.I means pre-season early warning indicators, S.H.M.I means season hazard monitoring indicators*

VI. HARNESSING OF IK POTENTIAL FOR ADAPTATION TO CLIMATE CHANGE AND VARIABILITY IN ZAMBIA AND BEYOND

From experiences in Sedumbwe regarding the IK and how it is useful in knowing the weather pattern of a particular year, it is felt that indeed there is need to harness this potential by integrating it in the work programmes of the meteorological departments of countries in the region as they also show a degree of accuracy in determining the weather pattern. For example in Zambia, most of the areas do not have weather stations and hence communities could rely on IK for weather predictions and make informed decisions on their adaptation to climate change and variability. It is also believed that the EL NINO prediction was developed from IK of fishermen in the Far East who could predict a drought/flood season using indigenous knowledge (Ngwenya, 2009 per comm.) Such kind of efforts should be developed further in other areas of the world. The realization of IK's contribution to these sectors has led to an increasing interest in it by academicians, and policymakers alike. Many government and non-governmental organizations, as well as international organizations such as the World Bank, International Labor Office, UNESCO and FAO are now appreciating the role IK can play in achieving sustainable development in a country. This interest is also apparent in the policies and programmes of various countries.

VII. EMERGING POLICY MESSAGES FROM CASE STUDY

This paper recommends that the agricultural policies in Zambia should take into account the role of IK in weather prediction. In addition issues of documentation and translation should also be emphasized so that the generations to come will learn the traditional way of predicting weather patterns for possible action to climate change adaptation.

It is very clear that southern Province in Zambia especially Choma district has a rich collection of traditional knowledge and if this knowledge is purposefully and logically applied with modern skills and technology can save the life of millions on the earth. The study has also demonstrated that southern province and other societies of sub Saharan Africa could play pivot role of Climate Adaptation and prediction of climate changes using Indigenous.Knowledge if well harnesed. It is very pathetic that under the pressure of modern science and technology, traditional knowledge is dying without due recognition from community and government. And at the same time absence of literary sources about traditional skills ishindering the dissemination of traditional knowledge.

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REFERENCES

[1] A, Nayong, F, Adesina, B.O, Elasha (2007) The Value of Indigenous Knowledge in climate change mitigation and adaptation strategies in African Sahel. Mitigationand Adaptation Strategies for Global Change 12: 787-797

[2] A, Ngwenya (2009) Personal Communication, Met Department, Choma, Zambia

[3] Central Statistical Office (2000) Zambia Living Conditions Monitoring Survey, Lusaka, Zambia

[4] Central Statistical Office (2001) Zambia Living Conditions Monitoring Survey, Lusaka, Zambia

[5] Inter Governmental Panel on Climate Change (2007). Climate change 2007: Synthesis report, Contribution of Working Groups I, II and III to the fourth assessment report of the Intergovernmental Panel on Climate Change

[6] L, Grenier. (1998) Working with indigenous knowledge: A guide for researchers. IDRC.

[7] Met Department (2008) Monthly report, Choma, Zambia, unpublished

[8] Minisry of Agriculture (2016) Department of Landhusbandry, Choma, Southern Province, Zambia, unpublished

[9] UNFCCC (1992) The United Nations Framework Convention on Climate Change.

AUTHORS

First Author – Kafula Chisanga, MSc. Agroforestry, Zambia Agriculture Research Institute, P.O. Box 630090, Choma, email address: kafulac@yahoo.co.uk

Second Author – Andrew Mvula Bosco, MSc. Soil Microbiology, Zambia Agriculture Research Institute, P.O. Box 410055, Kasama,email address: andrewmvulabosco@gmail.com

Third Author – Taban Habibu, MSc ComputerScience and Engineering, Muni University, PO. Box 725, Arua, Uganda, email: sultannubi@gmail.com

Correspondence Author – Kafula Chisanga, email address: kafulac@yahoo.co.uk,alternate email address: chisangak@nm-aist.ac.tz, contact number: +260 972 056 043