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THE EFECTIVENESS OF ETHNO-SCIENCE BASED STRATEGIES IN DROUGHT MITIGATION IN MBERENGWA DISTRICT OF SOUTHERN ZIMBABWE

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ABSTRACT

The imbalance between ethno-science and techno-science mechanisms in coping with drought, accompanied by overdependence on external relief and food aid was a motivating factor for this research. The sought to identify and assess the indigenous knowledge based drought coping strategies being practised in Mberengwa District in Southern Zimbabwe. This was a case study in which both quantitative and qualitative data collection techniques were used. Data collection was done through questionnaires administered to a sample of one hundred and seven household heads constituting both male and female respondents. Focus group discussions were administered to communal farmers from all parts of the study area and three AREX officers operating in the ward were interviewed. Field observations were also carried out to complement other data collection instruments. A variety of ethno-science based drought coping strategies were being implemented in Chingechuru ward and the major ones were multiple cropping, early planting, planting drought tolerant crops, basin tillage, transhumance movement, supplementary feeding, destocking, deep welling, barter trade, selling/hired labour and begging. Barter trade was the most widely implemented strategy at a rate of 66%, followed by multiple cropping (62.8%). The least implemented were basin tillage (15.8%) and abiding to traditional leaders' advice (16.1%). Most of the ethno-science based drought coping strategies were effective, but this was hindered by low levels of implementation. Early planting, basin tillage, multiple cropping of drought tolerant crops and maintenance of controlled granaries were recommended in order to deal with the adverse impact of drought. Further research should focus on devising methods that can be used to increase the levels of implementation of ethno-science based drought coping strategies in conjunction with techno-science based drought coping strategies.

Key words: Ethno-science, techno-science, drought mitigation, indigenous knowledge systems

INTRODUCTION

Drought can be defined in meteorological, or hydrological, or agricultural terms though in general, the term was derived from the Anglo- Saxon word '*drugoth*' which means dry ground (Chenje and Johnson, 1996). The common aspect in all the definitions of drought is that it is concerned with the shortage of water. It is thus a condition of abnormal dry weather, resulting in a serious hydrological imbalance with consequences such as losses of standing crops and shortage of water needed by people, livestock and wildlife (A.D.B, 1993; Chenje and Johnson, 1996). When drought occurs, various responses are put in place and they fall into two broad categories which may be techno-science based and/or ethno-science based. According to Mohamad (1992), techno-science entails those responses linked to modern conventional

technologies while ethno-science relates to techniques based on local people's knowledge of their physical environment. The most common phrase often used to refer to ethno- science is 'indigenous knowledge systems' (IKS).

Droughts have occurred in most parts of the world since time immemorial. In the United States a severe drought lasting for seven years occurred between 1930 and 1936 (Abbott, 2006). The most obvious response by farmers was to seek food aid from the Red Cross, but the Red Cross could not provide enough food. This led to the abandonment of farms and migration to better places and other western cities (Abbott, 2006). In some parts of Asia and Africa, drought has been the way of life for several years (Kemp, 1990). A notable drought occurred in Southern Africa between 1968 and 1975 and the major response was to seek international relief and food aid (WRI, 2007). In Ethiopia a succession of drought years lasted more than a decade from the early 1970's to the mid 1980's (Sarre and Blunden, 1996). Many people, particularly in the rural areas were forced to sell their land in order to buy food. Pastoralists were evicted to make way for commercial agriculture. In 1984, the Ethiopian government sought and acquired relief from western nations (Kemp, 1990; Sarre and Blunden, 1996). Recently, migration from areas of water scarcity to areas of abundance was seen as the best alternative by nomadic pastoralists in Uganda and Kenya (Derman et al, 2007). In the year 2000 drought in Kenya worsened the scarcity of water and forestry resources throughout the nation. Once again, international relief was the first resort, however in addition, traditional knowledge systems and resources were incorporated in order to alleviate some of the adverse impacts of the drought (Kemp, 1990; Derman et al, 2007).

Zimbabwe is no exception as far as drought is concerned. Some of the most notable drought years in living memory are: 1982-83; 1986-87; 1992-93; 2002-03; 2004- 05; 2007- 08 (Springer, 2004). In almost all these drought situations, the major response was to seek international relief and food aid. Mberengwa is among Zimbabwe's severely affected districts and the trend is that drought usually occurs once in every two years. Chingechuru ward in Mberengwa (ward 33) is representative of areas where the majority of people rely heavily on food aid for the greatest part of their lifetime during dry conditions. Besides food aid some conventional drought coping strategies have been incorporated and these include dam construction, borehole drilling and introduction of irrigation schemes.

It should be noted that since drought is one of the many environmental problems which are localised and specific, it requires local, ecologically particular responses. Local inhabitants of an area have an intimate understanding of their agro-ecological conditions, thus their knowledge is superior to that of outsiders (Piearce and Gumbo, 1993). At the same time it cannot be disputed that traditional management strategies for indigenous resources exist and these are firmly anchored in a given community's compendium of knowledge and experience. It is against this background that ethno-science based drought coping strategies need to be encouraged so as to increase a community's resilience to drought. According to the WRI (2007), Indigenous Knowledge Systems should be the basis upon which other conventional methods can build on to help the community adjust to the increasingly changing environment. The general objective of this study is thus to assess the role of indigenous knowledge systems as measures of reducing the adverse impacts of drought in Southern Zimbabwe. The specific objectives are meant to identify the drought coping strategies that are based on indigenous knowledge systems in Mberengwa to assess the effectiveness of the ethno-science based drought coping strategies and hence to identify the challenges being faced by the community in implementing ethno- science based drought coping strategies so that relevant recommendations can be made for effective drought mitigation strategies.

STATEMENT OF THE PROBLEM

Drought is among the most serious natural disasters affecting many people in several parts of the world. This implies that there is need for everybody to plan for the risk, given the uncertainties brought about by climate change and global warming. In many countries, drought management strategies are largely based on modern technology at the expense of indigenous knowledge systems. In Zimbabwe much attention tends to be given to these techno-sciences as well. These are manifested through borehole drilling, dam construction and the introduction of irrigation schemes. However, this needs not be construed to mean that such interventions are worthless, but rather the endless cries from the majority of our rural subsistence farmers each time a drought occurs is an indicator of the need of local strategies to be incorporated parallel to the conventional techno-science based methods of coping with drought. In terms of food acquisition during drought induced famines, overdependence on international food aid still characterise the majority of affected areas way of life. In Mberengwa district of Southern Zimbabwe, Ward 33 fits well into this category, hence the need for a paradigm shift towards self reliance. This can be achieved through maximising ethno-science based drought coping strategies in the area.

JUSTIFICATION OF STUDY

The study was meant to come up with useful information about coping with drought in a rural background characterised by semi arid to arid conditions. It is intended that the information obtained through this research will be useful and can be relied upon by other sections in Zimbabwe and abroad in coping with drought in their own situations. Expectations are that the results of the study will be of much importance to the government as the information will be the basis for decision making on the nature of intervention that is required towards coping with drought. It is further expected that the findings of this study will be made available to relevant ministries, development agencies, the international community and agencies, research, learning and teaching institutions as well as the private sector investment.

Drought management itself will benefit from understanding how the societies respond to the extensions of eco- climatic variations and cope with phenomena such as drought. Improvement of food security is more likely to result from strengthening the indigenous coping strategies than reliance on only techno-based strategies.

The selection of the study area was based on many factors including the fact that Mberengwa is very much susceptible to drought: even when several parts of the country experience minor dry episodes. Mberengwa District is in the Midlands Province of Zimbabwe at an altitude of one thousand six hundred and thirty-seven (1637) metres above sea level, latitude $20^0\ 29^1$ S and Longitude $029^0\ 55^1$ E. The setting is about one hundred and twenty kilometres southwest of Zvishavane town.

Mberengwa lies in natural region four (4) of Zimbabwe's agro-ecological zones where annual rainfall is usually between four hundred to six hundred millimetres (400- 600 mm). Maximum temperatures rarely exceed thirty-two degrees Celsius and minimum temperatures are experienced during the winter season. The soils in the area are not uniform throughout, but vary from area to area though loamy sands are the most dominant. For purposes of this research only, the study area was temporarily divided into four sections which are: Zibanga, Ruvabvu-Jeka, Chirungubwe-Gobera and Hamandishe-Ndawana. The variations in soils and vegetation across these sections are shown in Table 1.

Table 1. Vegetation and Soils in Ward 33

Section	Vegetation	Soils
Zibanga	Trees along the mountain range Patches of grass across inhabited land	Silty loam and occasional red clays along the east-west mountain range
Ruvabvu- Jeka	Shrubs and grass	Dark loamy clays
Chirungubwe- Gobera	Shrubs and grass	Sandy loam and occasional dark clays
Hamandishe- Ndawana	Shrubs and patches of grass across the uninhabited land	Sandy loam and occasional dark clays

The main economic activities in Mberengwa are rain-fed subsistence agriculture and domestic livestock rearing. A few individuals in the Chirungubwe- Gobera, Hamandishe – Ndawana and Zibanga sections are employed by Sandawana Mines. Illegal emerald mining on the Mweza range constitutes a considerable proportion of the community's livelihood. In the Ruvabvu – Jeka and Chirungubwe – Gobera sections, illegal gold panning along Mwanezi River also accounts for a considerable proportion of the people's livelihood. However these are seasonal activities due to changes in the market trends and rainfall season that may flood the banks of the river.

In all the sections, the residents are engaged in small scale seasonal gardens due to erratic and variable precipitation mostly between October and March which sometimes terminates prematurely. Tomatoes, onions and vegetables are the most preferred crops in the household gardens. Subsistence rain -fed agriculture and domestic livestock rearing thus remain the pre dominant economic activities in the ward.

Given the current climatic conditions that are ever-changing, the area is exposed to a high risk of frequent droughts. The need to address the problem remains inevitable. Communities' traditional drought coping strategies need to be encouraged as the basis to integrate any other relevant technologies.

LITERATURE REVIEW

The term ethno-science is defined as an organised examination of thought across cultures (W.R.I, 2007). In relation to drought, this definition is strongly based on the views that ''how farmers perceive, name and classify nature is a first step towards improving decisions', and "ethno-science can uncover clues to help in designing better decision support systems". According to Mohammad (1992), ethno-science is the term often used for vernacular ''local knowledge of the physical environment'' and to this end, some have used the terms ''people's science'', ''folk science'', ''folk ecology'', ''ecologic populaire'', ''people's knowledge'' and ''indigenous knowledge'' (A.D.B, 1993). Currently, the most popular term is Indigenous Knowledge and in many countries the suffix ''systems'' is added and the resultant phrase ''Indigenous Knowledge Systems'', IKS, has become so popular in a number of settings. Some have also identified ethno-science as African traditional mechanisms for coping with their surrounding environment (ALM, 2009). Indigenous knowledge is believed to be the knowledge that is unique to a given culture or society, which creates the basis for local level decision making in agriculture, health care, food preparation and preservation, education and natural resource management. The general consensus is that ethno-science relates to indigenous knowledge systems (IKS) which

are accessible by recall and practices, and passed from one generation to the next. It generally provides a holistic view of how to handle certain issues based on traditional ethical perspectives (Meinderstma, 1997). The terms 'ethno-science' and IKS will be used interchangeably in this paper.

Drought has been studied in Southern Africa for over a hundred years (Chenje and Johnson, 1996) and is recorded in text and in oral history dating back many generations. As noted by Springer (2004), drought is a recurrent phenomenon in dry land Africa. It has been observed that droughts are not always the same. Oba (2001) acknowledges that droughts are not always the same: some are localised while others are widespread; some affect grass production while others affect crops. The World Disaster Report of 2004 ascertained that drought and famine have proven to be the deadliest disasters of the decade worldwide, accounting for at least two hundred and seventy- five thousand (275 000) deaths since 1994. According to FAO (2008), extensive droughts have afflicted Africa with serious episodes since independence in 1965-66; 1972-74; 1981-84; 1986-87; 1991-92 and 1994-95. The 1991-92 episodes in Southern Africa are largely remembered as the worst drought in living memory. The consequence was that the number of food insecure households among communal farmers in Zimbabwe more than doubled, especially in semi-arid zones (FAO, 2009). Major concern arises from the fact that drought produces a web of impacts that spans many sectors of the economy and reaches well beyond the area experiencing physical drought.

It is inevitable to cite that drought results in the dislocation of the poor, despite the massive handouts of famine relief by governments and donors (Oba, 2001;CIDI, 2002; IISD, 1999). Indeed drought survival involves survival of the fabrics of the social security systems that depend on survival of livestock, the ability to grow crops, and marketing of the produce as well as sharing the resources.

The obvious direct impacts of drought are:-

- reduced crop, rangeland and forest productivity
- reduced water levels
- increased livestock and wildlife mortality rates and damage to wildlife and fish habitat.
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These further lead to low income for farmers and agribusiness, increased prices of food and timber, unemployment, reduced tax revenues because of reduced expenditures, increased crime, foreclosures on bank loans to farmers and agribusiness, and migration and disaster relief programs (ALM, 2007; IISD, 2002; Springer, 2004).

The aggregate impact of drought on the economies of Africa can be large: 8-9% of the Gross Domestic Product (GDP) in Zimbabwe and Zambia in 1992, 4.6% of GDP in Nigeria and Niger in 1984(ALM, 2007). During the 1991-92 drought in Southern Africa, regional grain production fell 60% short of expected levels and food stocks had been depleted (Chenje and Johnson, 1996). This meant that more food had to be imported into Southern Africa. The level of the reservoir at Kariba Dam fell below the level required to generate hydro- electric power to Zambia and Zimbabwe (ALM, 2009). Water shortages, electricity shortages and rationing, input supply difficulties, reduction in demand and macro-economic constraints led to a 9% reduction in manufacturing output in Zimbabwe with a 6% loss in foreign currency earnings (Wolmer, 2007).

Zimbabwe has been affected by a number of droughts in the recent past in the years 1982-83; 1986-87; 1991-92; 1994-95; 2002-03 and 2007-08 (Moyo, 2008) with the 1991-92 episodes being the worst of them all. Mberengwa district lying in the Southern region of Zimbabwe, in natural region four of Zimbabwe's agro-ecological zones, has witnessed all the above-mentioned drought conditions or even many more during that particular period. The district is thus significantly exposed to the risk of frequent droughts and the most serious consequences are felt in reduced crop production as well as forest productivity, which consequently culminate into food insecurity by both human beings and livestock. As the community's economy is strongly rooted in rain-fed subsistence agriculture and livestock rearing, a downward spiral of debt and poverty results as families end up selling their entire herd which is their source of wealth. In Ward 33, the situation is made even worse by the limited number of water points, that is, only two rivers- Mwenezi and Mutsime rivers being the physical boundaries for the ward, and Chingechuru dam that is not centrally situated for access by almost all the households in the ward. It therefore becomes essential to explore the measures that may assist the local communities in coping with frequent unfavourable conditions such as drought.

Droughts resulting in complete crop failure are common in Eastern and Southern Africa and crop failure related to drought are threatening millions of people in the region. Several governments including Zambia, Tanzania, Uganda and Kenya have always sought for strategies for dealing with drought and these evolve around ensuring food security for the affected communities. This is usually in the form of food –for –work programs (WRI, 2007). In southern Africa the most notable responses during the 1968-75 episodes were:-

- Continuous drought monitoring .
- Rainwater harvesting and desalinisation of sea water ,
- Construction of more dams and drilling of boreholes such that each community particularly in the rural areas at least had a source for domestic purposes, irrigation and for livestock, and
- Food aid from the international community.
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It has been observed that mismanagement of one drought leads to reduced productivity and greater susceptibility to the next drought (Chenje and Johnson, 1996). In most cases the responses by governments in Africa to drought resulting in famine are centred towards alleviating food shortages. FAO (2009) postulated that food crises as a result of crop failure resulting from drought expose nations to reliance on food aid as shown in Table 2.

Table 2. Regional summary of countries on food aid

African region	Expenditure on food (% of consumption)	Food aid (crops, Kg per capita)
Northern	42	18
Sudano - Sahelian	42	13
Gulf of Guinea	39	6
Central	39	3
Eastern	37	4
Southern	57	15
Indian Ocean	57	12
Total	57	10

Source: ALM (2009).

According to Table 2, it can be noted that southern Africa occupies the upper most seat in receiving food aid. During the 1984-85 droughts in the region, food aid was the major resort (ALM, 2009). The total emergency food and non-food requirements sourced through the DHA/SADC appeal process exceeded nine hundred and fifty million US dollars ($US 950 000 000) for ten southern African countries. The trend continued even to the 1991-92 episode which saw five times more food being imported into the region than had been imported in the previous one (Springer, 2004). This does not mean that no action was being taken as drought mitigation measures, but that the measures were, and continue to be insufficient.

In all these situations, Zimbabwe was no exception in the impacts or the adaptation strategies, an obvious indication that the ward under study was also affected. Country wide, the 1991-92 episodes remains a good example of the most disastrous droughts in living Zimbabwean memory. The resulting regional and international responses have been acclaimed as unprecedented success with eleven thousand metric tonnes (11 000 MT) of food being imported into the country to avert nationwide famine. in addition to the large volumes of food imports, the regional operation was also positively reviewed for giving priority to the non-food needs generated by the drought. In this case, the response was generally an externally supported food driven operation (Springer, 2004; Derman et al 2007). Of late there is growing awareness that recurrent drought is inextricably linked to the more careful management and conservation of groundwater as well as surface water resources (ALM, 2009; WRI, 2007). To add more to the strategies that have been mentioned earlier, concerns are expressed now about aquifer recharge and the depths that boreholes should be drilled. But still, a participatory approach is a necessity and it involves the incorporation of IKS (Derman et al 2007; IISD, 1999; Springer, 2004).

In Chingechuru ward, almost all these features of coping with drought exist- that is, a dam, three boreholes and one irrigated garden close to the dam. However, these cannot provide total efficiency as the boreholes experience long downtime periods and the garden is even too small to accommodate a large number of the inhabitants. In this regard, it remains problematic to satisfy human needs, livestock requirements and agricultural concerns even during dry episodes

that may be regarded as minor in other communities within the district and beyond. Dependence on food aid is therefore inevitable given such circumstances. Yet also according to Oba (2001), local communities need to be helped enforce their indigenous coping strategies to deal with problems such as drought and by so doing, total reliance on relief and food aid can be reduced.

METHODS OF DATA COLLECTION

Questionnaire surveys were the major data collection instrument for the research. Other instruments were also used to compliment the major instrument and these are interviews, focus group discussions and field observations in an effort to ensure validity of the data obtained through the use of questionnaires. Interviews were particularly chosen because of the need to have some views from officials who work with the local people in agricultural concerns, Agritex officers. The kind of data involved and the number of the officers in the area pre- determined interviews the best instruments as there would be need for clarification of some issues. However, interviews have loopholes of researcher's influence on the results due to direct interaction with the respondents. Focus group discussions were particularly important to gain an overview of the respondents concerning ethno-science based drought mitigation strategies in the area. Field observations were carried out in a bid to gain an appreciation of the spatial distribution of water resources, grazing veld as well as the cultivated land units. This technique was essentially useful in validating data that had been collected through questionnaires, interviews and focus group discussions for instance concerning crop varieties and livestock diversity in the area.

Secondary data sources were used essentially for the collection of informaton on the size of the ward, that is, the number of households and total population constituting the ward. The ward councillor's reports were the major secondary data sources consulted during the research. Ward 33 is made up of eight hundred and twenty one households with an average household size of seven people and a total population of five thousand and thirty-three by late 2008. The four sections that make up the study area, Zibanga, Chirungubwe- Gobera,Ruvabvu- Jeka, and Hamandishe- Ndawana (as mentioned earlier in section 1.5) have one hundred and eighteen (118), one hundred and seventy-three (173), two hundred and twenty-seven (227) and three hundred and three (303) households respectively.

The temporary division of the ward into sections facilitated an organised working environment which provided distinct units from which both time and resources could be allocated easily and systematically (Table 3).

Table 3. Distribution of villages and households in ward 33 of Mberengwa

Section	Number of villages	Number of households
Zibanga	5	118
Chirungubwe- Gobera	7	173
Ruvabvu- Jeka	9	227
Hamandishe- Ndawana	12	303
Total	33	821

RESULTS AND DISCUSSION

The survey showed that 88% of the households grew maize, 57 %grew groundnuts, 29% grew roundnuts, 33% grew rapoko, 34% grew sorghum, 10% grew millet, 12% grew sugar beans and 3% grew cow peas. Eighty -two percent grew at least two types of crops and this was mainly done to produce a variety of basic food crops required at household level, 7 % indicated that they grew maize only during the season and 7 % did not grow any crops during the season probably due to problems such as unavailability of seeds, lack of draught power and poor rains.

The most commonly grown crops are maize and groundnuts. In many cases two or more crops are grown by each individual. There is a strong link between the type and variety of crops grown in an area and awareness levels on the local agro ecological conditions among community members. This also measures their ability to make accurate forecasts of the quality of the season. Since most of the crops grown during the season are drought tolerant, it indicates that the people are aware of the frequent drought conditions that usually affect their area. Although maize is not so highly tolerant to drought, taking the highest position of cropping is mainly because it is the staple cereal which everybody needs to have even under less conducive conditions.

The most common drought tolerant crops are rapoko, sorghum, millet and groundnuts. However, the hectrage under which these crops are planted is quite low, an indication that knowledge of crops relevant is available but the levels of application of the knowledge are low probably due to their nature of demand on time and labour. Multiple cropping seems effective in providing a considerable degree of security when some of the crops fail completely, at least one other crop may succeed. This was especially noted in those 62% of the households who planted maize and rapoko or sorghum or millet, 43% indicated that maize completely failed while rapoko, sorghum and millet had high quantities of expected yield and only 19 % indicated that of all the crops they grew, 11% had very low expected yields while the other 8%reported that the crops completely wilted due to drought. Hence planting a wide variety of crops is quite effective in coping with drought.

Abiding to advice from traditional leaders and Agritex officers

In the decision making concerning which types of crops to grow, 16.1% have their basis as advice from traditional leaders, 32.9% just plant the types of crops they have always preferred, 25.2% utilise the seeds that will be available during the beginning of the season while 27.8% follow the advice from Agritex officers. Another important source of advice is a combination of tradition and Agritex officers as they provide details on the appropriate crops based on their forecasts of the quality of that particular season. The percentage of those who use tradition as their basis for decision making is low and this could be probably due to modernisation and religion which tend to wipe out some cultural norms and values as primitive and outdated ideologies. Hence, some drought coping strategies based on such beliefs are neglected.

Adoption of various farming techniques

Early planting seems to be moderately effective since only 57% of the households indicated that they expected high yields especially of maize while 19% indicated that the crops could produce very low yields (less than or equal to 50Kg) and 25% stated that the crops had completely wilted and no yield was expected. It is therefore evident that early planting is an effective measure for reducing the adverse impact of drought on crops. Out of the 15.8% households that practised

basin tillage, 11.3% expected moderate to high yields for the crops they grew while 4.5% expected very low or no yields at all. This shows that basin tillage can be a powerful technique in coping with drought.

Coping strategies for shortages of livestock water and pasture

Thirty-seven percent of the households indicated that they tracked water resources together with their livestock (transhumant movement) while 16% dug wells along the river to the maximum possible depths to get household water and filled large dishes or containers so that their livestock would drink from these containers or dishes. In most cases different sites were selected, one for household water and the other for livestock. Fourteen percent also stated that they relied on borehole water for both household uses and their livestock. However, this strategy could be less appropriate in some cases when the boreholes were out of order or dry up due to drought. The next possible option would be tracking water resources no matter how long the distances could be. Seven percent noted that they reduce the numbers of their livestock as soon as they notice any indicators of serious drought. This form of destocking could be by selling some or by slaughtering some of the livestock and thus reducing some form of loss that would be incurred if the livestock were left to die of starvation. In many cases, people lose a considerable number of their livestock during drought conditions. Three percent of the households indicated that they loaned some of their livestock to their relatives or friends who reside in better places. Such low levels of application of this sort of response may be due to the selfishness of the members of the community in that they consider being identified with the large sizes of livestock they own than allowing others to assume ownership of the livestock.

Pastures depend on the availability of water and in places where water is scarce, it is less likely to find grazing pastures and vice versa. All these strategies sound logic but the most effective is destocking in the form of loaning to relatives residing in better areas (*miraga*). Other strategies including transhumant movement are only practicable during the early period of the drought but when the conditions get worse, distances involved continue to increase beyond many people's reach.

Coping strategies for shortages of household food during drought

There are various ways of acquiring food for the households during drought induced famines and these range from barter trade, begging, selling/slaughtering livestock, selling labour, and adding wild fruits to the usual diet. While some people indicated that they used at least two of the above strategies, barter trade and additions of wild fruits to usual diet were the most widely practised strategies among several households. The most common wild fruits that provide supplementary food for human beings in the area are *uapaca kirkiana* and *parinari curatelli-folia*. Some of the respondents claimed they would cook fruits like *uapaca* during drought periods. Thirty-five percent of the households did not abide by traditional drought coping strategies as 24 % indicated that they could buy food and 11% stated that they relied on remittances. Begging tends to be the least practised resort and in most cases it will be from chieftaincy grain reserve or from relatives.

Challenges faced in implementing ethno-science based drought coping strategies

A number of problems hinder the successful implementation of ethno-science based drought coping strategies. Abiding by advice from traditional leaders is hindered by religion, modernisation and lack of trust in the mediators. Most Christians view traditional leaders as ungodly people and thus do not believe in their advice. Modernisation drives many

people to think that certain ways of planting and certain types of crops are old fashioned and outdated or primitive. For example crops like rapoko and millet are usually planted by old household heads.

Unavailability of seed was identified as strongly detracting people's efforts to implement ethno-science based drought coping strategies like early planting and planting drought tolerant crops. Lack of co-operation by other members of the community is also one of the problems affecting the successful implementation of ethno-science based drought coping strategies. This may be accompanied by laziness that leads some people not to like to plant earlier even when they have the seeds, avoiding extra associated duties, for example herding livestock outside the cultivated areas. These are also the same people who leave their livestock invading the cultivated fields and devouring the crops for other members of the community who would have planted earlier.

The problems associated with barter trade include lack of standard valuations of livestock and other assets. In some cases livestock may be exchanged for very small quantities of grains that cannot sustain the household. Selling livestock particularly cattle and goats is problematic because the market is not always available. Selling labour is also sometimes less practical when the drought becomes so severe. Access to wild fruits such as *uapaca kirkiana* and *parinari curatelli-folia* is a problem to people from other areas as compared to those residing nearby. An example is that of the two households in Ruvabvu fenced in the *uapaca* trees close to their homesteads so as to restrict free access to these fruits by other non family members. The fruits are also seasonal and hence not available during certain times of the year. Although several respondents indicated that they had various means of coping with drought, the measures could not be applied fully due to the challenges discussed in the preceding sections.

Drought management in Zimbabwe

Seventy percent of Zimbabwe's population derives its livelihood from rain-fed subsistence agriculture and other rural activities. However, the major threats are natural hazards such as the frequent droughts and floods. Drought has particularly become more frequent over the past two decades with devastating effects on food security (WRI, 2007; Wolmer, 2007). Different ethnic groups in the rural areas have different ways of coping with the changes in climatic conditions around them, but these ethno-based strategies are being neglected and substituted by modern technological innovations which on their own continue to fail to eradicate the problems caused by drought (WRI, 2007). This is evidenced by the fact that the majority of recipients of food aid outnumber self-reliant groups during times of natural disasters such as flooding and drought. During the 1991-92 droughts, five million six hundred and two thousand five hundred and sixty-eight (5 602 568) people were on drought relief program and this is about 74% of the countrywide rural population according to the 1992 census. People in the low-veld communal areas are also among the most frequent recipients of drought relief in the form of food-for-work schemes and loans. An example is Chiredzi district when during the droughts in 1983/84 and 1992/93, the number of people receiving food aid was thirty-four thousand four hundred and thirty-seven (34 437), which was about 55% of the total population of the district. This stands as evidence that the communities are highly susceptible to drought despite the efforts that have since been made by government and non-governmental organisations over the past years. The Action by Churches Together (ACT) is one of the dominating organisations providing relief during several drought emergencies and includes organisations such as the Lutheran Development Service (LDS). The LDS has assisted several desperate families in districts such as Mberengwa,

Zvishavane, Chivi, Mwenezi, Gwanda and Beitbrigde in the 1991/92, 1995/96, and 1998/99 droughts. The forms of aid provided were food-for-work schemes, supply of seed packs and school feeding schemes (CIDI, 2002).

While the WRI (2007) attributed this scenario to insufficient inception of necessary coping strategies particularly limited consideration of indigenous coping strategies and mechanisms into the decision making process. Efforts by government, non-governmental organisations and local communities including traditional drought coping strategies, are set back by the unprecedented shifts that are currently occurring to the World's climate. The ever changing climatic conditions are believed to be responsible for the high frequency of drought in most parts of the world including Zimbabwe. Given these circumstances, certain traditional weather forecasting techniques and other drought coping strategies that have proved to be useful in the past are disrupted and this renders various efforts to cope with drought less successful, hence leaving communities with very limited options which consequently justify reliance on external relief and food aid (Chenje and Johnson, 1996).

Ethno-science as the basis for drought mitigation

Ethno-science is a precious national resource that can facilitate the process of disaster prevention, preparedness and response in cost effective, participatory and sustainable ways. It cannot be disputed that a blend of approaches and methods not only from science and technology, but also from traditional knowledge as well, opens avenues towards better decisions on disaster prevention, preparedness, response and mitigation (Oba, 2001).

Ethno-science was first given prominence when the following issues were recognised:-

- development took no notice of the indigenous coping strategies of the local communities, their goals and aspirations, yet coping strategies are a component in their survival and thus drought management plans which ignore them would probably not be suitable.
- While it was widely accepted that development programs might alleviate problems of food insecurity during drought induced famines, this could happen on a sustained basis only if the local people are helped to revive their indigenous means of coping.
- Programs designed to help communal farmers failed to integrate the local people's drought coping strategies into management plans.
- Improved knowledge of indigenous coping strategies, which is essential for developing self reliance, is decaying.

Local adaptive strategies, when reinforced appropriately by appropriate policy and technology, can lead to sustainable livelihoods and reduce community vulnerability to harsh environmental changes like drought, the situation that is currently prevailing in Ward 33. Incorporating indigenous knowledge can add value to the development of sustainable climate change mitigation and adaptation strategies that are rich in local content, and planned in conjunction with the local people. For instance, in the Malian Sahel, it has been proven beyond doubt that communities have developed coping strategies that have improved their ability to cope with uncertainties resulting from climate change (ALM, 2009). This should also be encouraged in Zimbabwe's rural communal areas especially the southern and south- eastern districts that are usually affected by drought.

Globally, there is increasing acknowledgement of the relevance of indigenous knowledge as an invaluable and underutilised knowledge reservoir, which presents developing countries particularly in Africa with a powerful asset in environmental conservation and natural disaster management. IISD (1999) ascertains that from time immemorial, natural disaster management in Africa has been deeply rooted in local communities which apply and use indigenous knowledge to master and establish early warning indicators of their own benefit and future generations. In Zimbabwe, this knowledge and strategies differ from location to location and from each ethnic group to the other (Moyo, 2008).

Ethno-science based drought coping strategies have also been upheld in African countries such as Kenya, Uganda, and Tanzania (ALM, 2009). While it cannot be disputed that each drought results in the dislocation of the poor despite the massive handouts of famine relief by governments and donors, in the Makueni, Marsabit and Turkana districts in Kenya, the greatest form of dislocation has been eradicated by developing and implementing extensive mitigation and adaptation strategies that have enabled them to reduce their risk or vulnerability to the impacts of drought through their indigenous knowledge systems. Agro-pastoralists in these districts hold indigenous knowledge on indicators of rainfall variability. This knowledge is the equivalent of weather prediction models and forecasts in techno-science mechanisms. To several pastoralists, indigenous knowledge forms the basic knowledge frame with which agro-pastoralists adapt their practices in anticipation of indigenous knowledge based forecasts partly due to the conditioning actors to the high rainfall variability characteristic of the area and partly due to lack of resources (Springer, 2007). Hence, it has been possible to ensure food security at the household level which is also aided by ensuring survival of the livestock herds on which they depend and their economy is largely rooted. Such is the scenario in Zimbabwe's rural communities and thus the success of such strategies in Kenya may point to the potential success of IKS based drought coping strategies in Ward 33.

CONCLUSION

Management of drought in Mberengwa District of Southern Zimbabwe is largely based on relief and famine handouts by government, non-governmental organisations and other donors. Although some of the local inhabitants are endowed with traditional forecasting skills, adoption of the concepts tends to be continually declining. At the same time droughts are increasing in frequency from one in three to five years in the 1980's to one in two to three years since 2005 and hence drought relief and food aid continue to characterise the communities' way of life. This should not be misconstrued to mean that the local people do not have their own drought coping strategies, but rather, the adoption of the IKS based drought coping techniques is declining and this may be rendered responsible for the community's overdependence on relief and food aid during drought induced famine. The traditional drought coping strategies identified in Ward 33 were multiple cropping, planting drought tolerant crops, basin tillage, transhumant movement, supplementary feeding, destocking, deep welling, barter trade, selling/hired labour, additions to the usual diet and begging. The effectiveness of strategies such as early planting, basin tillage and planting drought tolerant crops was mainly limited by the low levels of application of the strategies in most cases due to unavailability of seeds and draught power as well as lack of co-operation among the community members. Major findings were that ethno-science based drought coping strategies were being neglected by an average of 66. 4% of the community and out of these, 61.1% claimed satisfactory effectiveness indicating that ethno-science based drought coping strategies can be an effective tool for combating the adverse impact of drought.

RECOMMENDATIONS

There is need to increase the area under which the most drought tolerant crops like rapoko, millet and sorghum are planted in order to increase the yield for small grains and improve the levels of security when less drought tolerant crops fail completely due to drought in southern districts of Zimbabwe such as Mberengwa. Early planting should be encouraged among all the community members so as to increase their levels of co-operation particularly in livestock herding as soon as the rainy season commences. In order to counteract the problems of shortage of draught power, local people need to be mobilised to maximise basin tillage farming techniques accompanied by close monitoring by the Agritex officers. Controlled granaries need to be always maintained so as to provide food during times of scarcity and these can also be used as seeds for the next season when the supply runs out. Traditional leadership should maintain some acceptable degree of honesty so that they are respected by the people they lead and their advice is taken seriously particularly on the types of crops to plant and the timing of planting for each season.

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