

Application of Indigenous Knowledge Systems in Hydrological Disaster Management in Swaziland

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Abstract: The hydrological disasters facing Swaziland include persistent drought, erratic rains, occasional floods and devastating lightning during rainy seasons. The purpose of the study was to document indigenous knowledge systems that were applicable in hydrological disaster management in Swaziland. Information on indigenous methods that were used to manage hydrological disasters was collected from review of literature and focus group discussions that were conducted at Ntandozi area in Swaziland. A variety of methods were employed to predict weather, based mainly on environmental cues and behavior of animals. The nesting position of the *Ploceus* spp bird was used for prediction of floods. The cry of *Cuculus solitarius* bird signaled the start of the wet season between the period of August and November, and farmers started assembling their farming inputs upon hearing its cry. The abundance of butterflies, locusts and grasshoppers during farming season was taken as a sign of imminent drought. Indigenous methods used to prevent natural disasters included taking refuge under the *Kigelia africana* tree during lightning. It was believed that the tree is immune from lightning strikes. One was to avoid sitting under certain trees during lightning as they were known to be prone to lightning. They include *Sclerocarya birrea*, *Ficus africana* and *Vangueria esculenta*. The mitigation and coping mechanisms for hydrological disasters included traditional methods of storing food during periods of good harvests, selection of crops that were tolerant to drought and the use of indigenous fruits and vegetables.

Key words: Drought, floods, hydrological disasters, indigenous knowledge systems, lightning

INTRODUCTION

Swaziland is prone to a number of hydrological disasters with drought being the most common hydrological disaster in the country. The most severe ones occurred in 1983, 1992, 2001, 2007 and 2008. It was reported that over 500 people lost their lives due to the drought of 1983. In 2007, close to 50% of the population needed food aid, as they did not have sufficient food due to failure of their crops (Manyatsi *et al.*, 2010). The other hydrological disasters in recent years include incessant lightning during rainy seasons, cyclone Domonia in 1984, and torrential rains and floods in 2000 (IRIN, 2007). Cyclone Domonia affected over 400,000 people (about 40% of the population) and caused damage worth US\$ 54 million (Government of Swaziland and United Nations, 2008). The winds of 1984 affected over 630,000 people, and the fires of 2007 affected over 270,000 people. Hailstorms are also common in the country. They tend to occur during the months of September to April, destroying crops and property such as houses, electricity and telephone poles (Manyatsi *et al.*, 2010). Dlamini (2009) reported that lightning killed 123 people between 2000 and 2007. The average lightning fatalities for the eight year period was 15.5 per million people, a rate higher than

the estimated 6 per million for southern Africa (Dlamini, 2009).

Indigenous knowledge (IK) is the local knowledge that is unique to a given culture or society. It is the basis for local-level decision making in agriculture, health care, food preparation, education, natural-resource management, and a host of other activities in rural communities. (Warren, 1991; Tekwa and Belel, 2009). IK research originally emphasized indigenous technical knowledge of the environment, but it is now accepted that the concept of IK goes beyond this narrow interpretation. IK is now considered to be cultural knowledge in its broadest sense, including all of the social, political, economic and spiritual aspects of a local way of life. IK is embedded in a dynamic system in which spirituality, kinship, local politics and other factors are tied together and influence one another. Spiritual beliefs about nature may influence how resources are managed and how willing people are to adopt new resource management strategies (Morris, 2005). Most of this knowledge and these skills have been passed from earlier generations but individual men and women in each new generation adapt and add to this body of knowledge in a constant adjustment to changing circumstances and environmental conditions. They in turn pass on the body of knowledge

intact to the next generation, in an effort to provide them with survival strategies (CTA, 2011). IK, like all human culture is dynamic, and it changes with time. IK may represent, in one sense, traces from the past (e.g., memories, traditional knowledge) and it may also constitute a version of history in the present (Morris, 2005).

The intergration of traditional knowledge systems with agricultural and disaster management was reported in a research conducted in communal lands of Zimbabwe (Svotwa *et al.*, 2007). The research showed behavior of wild animals and observations of trees, vegetation and environment that were used to predict disasters, and actions were taken to mitigate the predicted disasters. Large swarms of swallows were taken as a sign of wet conditions approaching and farmers would prepare land in the fields in anticipation of the start of the rainy season. The breeding of water fowls on the ground under cover of grasses and reeds were taken as a sign that low rainfall to drought conditions were expected. Drought tolerant crops such as sorghum and pearl millet were considered for planting (Svotwa *et al.*, 2007). In Burkina Faso, it was reported that farmers formulated hypotheses about seasonal rainfall by observing natural phenomena, while cultural and ritual specialists drew predictions from divination, visions and dreams (Roncoli *et al.*, 2001). The environmental indicators used by the farmers to predict seasonal rainfall included timing, intensity and duration of cold temperatures during the early part of the dry season. Farmers believed that intense cold during this time corresponded to abundant rainfall during the rainy season, and that if this cold period began early or ended late, the rains would do otherwise (Roncoli *et al.*, 2001). According to farmers, good yields from trees such as *Butyrospermum parkii* and *Anogeissus leiocarpus* predicted a favourable season. On the other hand, farmers linked abundant fruit production by *Sclerocarya birea* and *Lannea acida* trees to drought (Roncoli *et al.*, 2001).

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METHODOLOGY

Description of study area: The study was conducted at Ntandozi area which is situated at the centre of the country, in the Manzini administrative region. It is situated in the middleveld ecological zone, with long term average annual rainfall of about 1,000 mm. The area is prone to a number of hydrological disasters including lightning strikes, drought, hailstorms and strong winds.

Data collection and presentation: Data were collected using literature review and focus group discussions that

were conducted at Ntandozi constituency centre during the period of February 2006. Three groups were formed for the discussions (one group for the youth, one group for male adults and one group for female adults). Each focus group comprised of between five and ten persons. Question guides were used to moderate and direct group discussions. Responses were recorded and summarized.

RESULTS AND DISCUSSION

Indigenous methods used to predict weather patterns: Several methods were used to predict weather patterns. They were mainly based on behavior of animals and yield of plants (Table 1). It was believed that some animals have premonition of hydrological conditions. The cry of the *Cuculus solitarius* bird during the period of August to November was taken as a sign of beginning of the wet season and rainfall was expected within a period of one week from such a cry. After hearing the cry, farmers would prepare their farming implements in readiness to the start of the cropping season. The chirping of *Centropus burchellii* bird during the periods of October to April was taken as a sign of imminent thunderstorm, within a few hours. Related results were reported in Zimbabwe where the singing in large numbers of *Annual cicada* was taken to signify the beginning of a normal to above normal season, and that wet conditions were approaching (Svotwa *et al.*, 2007). When *Ploceus spp* birds nested high on trees next to the river it was taken as an indicator of imminent floods. The concept of using the position of nesting of birds to predict weather patterns was also reported in Zimbabwe (Svotwa *et al.*, 2007). The abundance of fruit production by *Sclerocarya birea* was used to predict drought in Swaziland, as it was used in Burkina Faso (Roncoli *et al.*, 2001). Some of the methods used to predict weather patterns were linked to superstitions and their effectiveness were not proven. For example, the *Scopus umbretta* bird is believed to have magical powers. It is believed in Swazi (and Zulu) culture that if someone destroys its nest, it will take revenge by sitting on the roof of that person's hut and call for lightning (Anderson, 2008). This superstition has protected the bird because most people leave it alone, and they do not destroy their nests.

Indigenous methods used to protect from hydrological disasters: Lightning is the most feared hydrological disaster in Swaziland, and some Swazi traditional homesteads are "protected" from lightning by making the homesteads immune to lightning strike. This ritual is performed by a traditional doctor annually at the beginning of the rainy season (August to October). The traditional doctor often charges a cow for such service (a cow cost about US\$ 300). The practice is superstitious

Table 1: Indigenous methods used to predict weather patterns

Predictor/ signal	Description	Implications
Nesting position of <i>Ploceus</i> spp birds	When floods are likely to happen, the <i>Ploceus</i> spp birds nest very high on the trees next to rivers between November and February. When floods are not likely to occur, they nest low on the trees.	Planting of crop along flood plains is avoided.
Cry of <i>Cuculus solitarius</i> bird	The cry of <i>Cuculus solitarius</i> bird between August and November is a sign of the beginning of the wet season.	Farmers prepare farming inputs upon the cry of the bird.
Chirping of <i>Centropus burchellii</i> bird	The chirping <i>Centropus burchellii</i> bird during October to April is a sign that a thunderstorm is approaching.	Herd boys will bring livestock home for the safety of the livestock and their safety.
The visit of <i>Scopus umbretta</i> bird in a homestead	The visit of <i>Scopus umbretta</i> bird in a homestead is associated with imminent strike by lightning in that homestead.	Some means of protecting the homesteads against the lightning is done.
Abundance of some wild fruits	The abundance of some wild fruits that include <i>Vangueria infausta</i> , <i>Englerophytum natalense</i> and <i>Sclerocarya birrea</i> during the period of December to February is taken as a sign of imminent famine.	Harvest from previous season is preserved. Wild fruits and vegetables are also collected and preserved.
Cry of frogs	The cry of frogs during the summer season (September to March) is taken as a sign of approaching rainfall.	Farmers prepare their farming inputs in readiness to plough and plant.
The position of the moon	When the moon is slightly tilted to the west and the crescent is facing down during the periods of August to December, it is taken as imminent sign of rainfall within a week.	Farmers prepare their farming inputs in readiness to plough and plant.
Dark clouds on the west of the country	The appearance of towering scary darkened clouds on the west, of immediate fierce hailstorm accompanied by thunder and lightning.	Herd boys bring livestock at home and every member of homestead leave fields and rush home for safety.
Abundance of certain insects	The abundance of butterflies, locusts and grasshoppers during the farming season is taken as a sign of imminent drought and famine	Harvest from previous season is preserved. and preserved.

Table 2: Indigenous methods used to protect from hydrological disasters

Method	Description
Planting of trees immune to lightning strike.	<i>Kigelia africana</i> tree is believed to be immune from lightning strike, and it is often planted within homesteads to “repel” lightning.
Burning of fruits of <i>Kigelia africana</i> tree	The dry fruit of <i>Kigelia africana</i> tree is burned inside the house to “repel” lightning.
Taking refuge under the <i>Kigelia africana</i> tree	Herd boys are encouraged to take refuge under the <i>Kigelia africana</i> tree when they are caught in lightning storm while herding cattle in the rangelands.
Using of parts of trees to divert lightning	Pegs of trees known to be prone to lightning are placed at strategic places around the homesteads to divert lightning from the huts and houses. The pegs are often treated with some traditional medicines. They are taken out of the house (hut) to strategic places within the homestead whenever there were signs of approaching thunderstorm. The trees used for pegs include <i>Gardenia cornuta</i> , <i>Monanthonax affra</i> and <i>Vangueria cyanescens</i> .
Avoid sitting under or near trees that are prone to lightning strike	Certain trees are believed to be prone to lightning strikes and herd boys are warned not to take refuge under them in the event of lightning storms. The trees include <i>Scleroarya birrea</i> , <i>Vangueria esculenta</i> and <i>Gardenia cornuta</i> .
Avoiding walking along footpaths during rainfall and lightning storms	Herd boys are told to avoid walking along footpaths during lightning storms to avoid being struck by lightning, as it is believed that lightning will travel along foot paths with flowing water.
Avoid being next to cattle in the rangelands during lightning storms	Cattle are known to be prone to being truck by lighting as they are often the tallest objects in the grasslands (except when there are trees). Herd boys are warned to avoid being close to cattle in the event of lightning storms to avoid being struck by the lightning.
Use of traditional medicine	Indigenous plants are used to treat a number of ailments that are associated with hydrological disasters. <i>Lannea discolor</i> , <i>Aloe marlothii</i> and <i>Ozoroa engeri</i> are used for treatment of running stomach which may be due to consumption of water contaminated due to floods. In all cases the bark or leaves of the plants are boiled in water and taken orally to contain the ailment.

and its effectiveness on protecting against lightning has not been proven. The other means of protecting against disasters include the planting of trees believed to be immune to lightning strikes, taking refuge under certain trees, and avoiding sitting under certain trees in the event of lightningstorms (Table 2).

The *Kigelia africana* tree is believed to be immune from lightning strikes and it is often planted within homesteads with the belief that the tree will repel lightning from the homesteads. Its dried fruits are burned inside huts to repel the lightning, and herd boys are encouraged to take refuge under the tree in the event of

Table 3: Indigenous methods used to mitigate effects of hydrological disasters

Method	Description
Use of underground pit to store produce	Pits of depth ranging from one meter to two meters and width of about 75 cm are dug inside the cattle kraal in a homestead. Maize and other crops (such as sweet potatoes) harvested during good seasons are stored in the pit with a stone covering the opening of the pit.
Hanging of cobs above fire place	Maize is stored by hanging the cobs above a fire place inside a cooking hut. The smoke from the fire protect the maize from attack by insects.
Preservation of milk	During prolonged rains, milking cattle may not be collected from the rangelands. Milk is thus preserved for consumption during period when it is scarce by storing it in calabash. The milk stored in calabash form sour milk to be consumed when there was need.
Harvesting and consumption of indigenous fruits	The fruits that are harvested and stored for consumption during periods of food shortage include <i>Vangueria esculenta</i> , <i>Ficus capensis</i> , <i>Ximenia Americana</i> , <i>Strychnos madagascariensis</i> , <i>Englerophytum natalense</i> and <i>Syngium cordatum</i> .
Harvesting of indigenous vegetables	Indigenous vegetables form an important component of the diet under situations of drought and famine. They include <i>Amarantus esculentus</i> , <i>Corchorua olitorius</i> and <i>Bidens pilosa</i> .
Crop selection	When there are signs of imminent drought, farmers will grow drought tolerant and quick maturing varieties. These include some varieties of Bambara groundnuts that are known to be tolerant to drought. Jugo beans matures within three months, and is grown under conditions where rainfall started late during the growing season (after December).

lightning strike while they were in the open rangelands. No tangible proof has been presented on the immunity of the *Kigelia africana* tree from lightning strikes. Some trees are known to be prone to lightning strike, and they are not supposed to be planted within homesteads. They include *Scleroarya birrea* and *Vungueria esculanta* (Table 2).

Casual observations have shown that the *Scleroarya birrea* trees are more often struck by lightning than other trees within the same area, and this could be due to the fact that they tend to be taller than the surrounding trees, thereby being more of a target to the lightning strike. The use of parts of certain trees to divert lightning strikes is associated with the ritual of making homestead immune to lightning strike, and the pegs are often treated with some traditional medicines.

Indigenous methods used to mitigate and cope with hydrological disasters: The mitigation and coping mechanisms against hydrological disasters include traditional methods of storing food during periods of goods harvests, harvesting and consumption of indigenous fruits and vegetables, selection of crops to plant during disasters and use of traditional medicines to treat ailments associated with hydrological disasters (Table 3). The traditional method of storing maize and other crops harvested during good seasons include use of underground pits. Normally the harvest will be kept in the pit and only be retrieved under conditions of poor harvest. The fact that the location of the pit is obscured by kraal manure makes it difficult for other people to know that a certain homestead has some food reserves. Milk is preserved in calabash as sour milk, and consumed when there is need. Some wide fruits are harvested and stored for future consumption.

The *Vangueria esculanta* fruits can be harvested and consumed fresh. Fruits can be harvested during the months of December to February and sun dried for consumption when they are out of season. *Ficus capensis*

fruits are made into paste and consumed for breakfast in times of famine. Indigenous vegetables are often harvested and sun dried and consumed in times of famine. The indigenous vegetables include *Amarantus esculentus*, *Corchorua olitorius* and *Bidens pilosa*. Drought tolerant and quick maturing crop varieties are planted when there are signs of imminent drought and poor rainfall. Meat from cattle killed in large numbers during drought or struck by lightning is often preserved by sun drying and adding salt, for consumption at later periods.

CONCLUSION

Swaziland suffers from a range of hydrological disasters, including drought, occasional floods, hailstorms and lightning strikes. The indigenous knowledge methods that are used to predict the weather patterns are based on animal behavior, while others are based on environmental cues. The methods used to protect against hydrological disasters include taking refuge under plants that are perceived to be immune from lightning strike, and avoiding being next to plants that are prone to lightning strike. The mitigation and coping measures against disasters include use of indigenous methods to preserve excess harvest for use during periods of drought and famine, collecting of wild fruits and vegetables and growing of crop varieties that are tolerant to drought.

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