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African Indigenous Knowledge Systems and Natural Disaster Management in North West Province, South Africa

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ABSTRACT Contrary to the western view the Batswana were not mere victims of natural disasters. The case study of their indigenous knowledge systems on natural disaster management, demonstrates the wide knowledge they had on environmental management. Using participatory and interactive methods the study found that the Batswana utilised the behaviour of natural phenomena of biotic and abiotic factors, as early warning indicators of natural disasters. However, much of this knowledge is not documented and hence vulnerable to loss when the older knowledge holders die. The study recommends the following: further research should be done on these knowledge systems so that they contribute to policy development and the search for sustainable solutions to natural disaster management and climate change; the knowledge should be integrated into the educational curriculum for sustainability; and appropriate legal and policy frameworks should be enacted to protect the intellectual property rights of the indigenous knowledge holders and practitioners.

INTRODUCTION

The effects of natural disasters such as floods, droughts and earthquakes to cyclones, landslides and tsunamis affect both developing and developed countries. The loss of life and property is becoming more destructive in most countries, both developed and developing. In the context of this discussion natural disaster refers to extreme and sudden events resulting from environmental causes that lead to loss of property and life. These include floods, drought, diseases and landslides (Salim 2002). Kamara (2008) indicates that a large number of people in Africa, in both rural and urban communities live in hazard-prone areas and have over the years developed various indigenous or community-based knowledge systems (IK) of adapting and mitigating against these natural disasters. These knowledge systems developed over years and traditionally transmitted orally across and within generations, include skills, technologies, practices and beliefs on the natural environment (World Bank 2004). This was elaborated by Forno (1996) who states that in the African indigenous worldview, natural resources such as land, water, animals and plants are not just production factors with economic significance, but have also natural and cultural significance in the lives of communities (UNEP 2005). It is this symbiotic relationship between human culture including social practices and nature that enabled African traditional communities to develop a wide knowledge of early warning systems against natural disasters (Brokensha and Riley 1991). This paper demonstrates that the Batswana had also a rich knowledge of natural disaster management. The Batswana in North-West Province, South Africa are composed of various ethnic communities. These include the Barolong (Mafikeng), Bafokeng (Phokeng), Bakgatla (Moruleng), Batlhaping (Taung), Bahurutshe/Batshweneng (Lehurutse), Batlokwa (Tlokweng) and Baphiri (Mabalstaad).

METHODOLOGY

The study used a participatory research approach involving interactive research methods such as depth interviews, focus group discussions and participant observations. Macaulay (2007) explains that in the past, researchers never involved the community knowledge holders in the research process. This led to the stigmatisation of local communities and publishing negative findings. The participatory research process involves a partnership between the researcher and those being researched.

In this study Batswana community knowledge holders and practitioners were actively involved in the research process in problem identification, selection of study cases and interpretation of the data collected. The study was conducted among the following Batswana tribal grouping in the North-West province, that is, Barolong, Baphalane, Baphiri, Bakgatla, Batlhap-

ing, Bakubung, Batlokwa, Bahurutshe, and Batlhako. The researchers live in the study area and know the culture of the people.

In consultation with community leaders, elders and other key persons in the district municipalities, a purposive sample of 180 respondents (100 women and 80 men) participated in the study. In the context of this study, a purposive sample is a subset of large group selected based on competence to serve a particular research purpose (Berelson 2000). In this study the issue of gender, especially the role of women in the Batswana natural disaster management was taken very seriously. According to the community leaders, women had a very wide indigenous knowledge of environmental conditions including climatic changes because they were the ones most actively involved in household and community activities such as agriculture, food processing and security, and natural resource management.

Taking into consideration the community-based nature of IKS, the study was predominantly qualitative. It involved direct interaction between the researchers and the knowledge holders and practitioners in the research process. Qualitative research aims to gather an in-depth understanding of human behaviour and the reasons that govern such behavior. The qualitative method investigates the why and how of decision making, not just what, where, when. In this case smaller but focused samples were more often used (Borneman and Hammoudi 2009). Qualitative research methods such as key informant interviews, focus group discussions and participant observations formed the core of the data collection methods. These research methods were used to gather in-depth information on the study population's cultural attitudes and opinions related to the various aspects of the research problem (Adèr 2008). Key informants including traditional healers, heads of households (male and female) and community elders (male and female) were interviewed at all stages of the research process as a means to gain in-depth qualitative information (Faubion et al. 2009).

Focus group discussions were also conducted with randomly selected groups of 6-10 community members in the study areas. In the focus group discussion, people from similar backgrounds or experiences (for example, IKS practitioners such local farmers, traditional healers and community leaders) were brought together to discuss a specific topic of interest to the research process. Homogeneous samples were preferred because mixing age/ gender groups could inhibit some people, especially women, from expressing their views (MacKay et al. 2005). The objectives of these focus group discussions were to: explore the range of opinions/views on a topic of interest; and explore meanings of research data that cannot be explained statistically (Berelson 2000).

Focus groups discussions are different from other types of group interviews in that they focus on a particular topic and they rely on group dynamics in order to generate data. The interaction is mainly between group members themselves and not between the members of the group and the interviewer. Group interaction was used in this type of research to generate data and as a source of data analysis (Dick 1990). The assumption was that there is an interaction that is productive in widening the range of responses, in activating forgotten details of cultural experience/knowledge and in releasing inhibitions that are part and parcel of interviews with individuals (Stewart and Shamdasani 1990; Morgan 1998).

The qualitative data in the form of audio taped interviews were transcribed and translated from Setswana into English. Interview and participant observation notes were typed and a content analysis conducted. This is a systematic analysis of the content rather than the structure of a communication, such as a written work, speech, or film, including the study of thematic and symbolic elements to determine the objective or meaning of the communication (MacKay et al. 2005; Ader 2008).

RESULTS AND DISCUSSION

This section presents and discusses the following aspects as findings of the study: indigenous early warning indicators of natural disasters such as drought, floods and famine were discussed. What did the community do traditionally to prepare for these natural disasters? What did they do specifically to prepare for food security? The responses are discussed below.

Batswana Indigenous Knowledge on Early Warning Systems

The study found that the study local communities had a variety of indigenous knowledge systems on community social structures and

associated early warning indicators related to natural disaster management. Social structures such as a council of elders, traditional healers and the speed and strength of numerous young people were used to investigate a particular natural phenomenon or to pass on urgent messages upon. Traditionally, they used the behaviours of plants, domestic and wild animals, birds, insects, atmospheric, astronomic and wind as indicators of various forms of natural disaster in their arid and semi-arid environment.

Interviews with key persons including community knowledge holders revealed that there were certain tree behaviours which indicated when famine was imminent. For instance, when the Moretlwa (wild berry tree or *Grewia flava*) and Motlhatswa (*Transvaal milkplum*) have a lot of fruit, it signifies that there will be less rain because these trees require heat, sunshine and less moisture to bear fruits. The following are additional examples of indigenous early warning systems:

(i) Certain plant behaviours were generally observed as indicators of rainfall. For example, a good amount of well distributed rainfall was signalled by the presence of higher than normal flowering intensity of certain trees; the immature dropping of fruits by certain tree species, the shedding of leaves of the sycamore fig (*Ficus sycomorus*) during August to October and the exuding of water from the leaves of the *Albizia schimperiana* before the onset of rains in September/October.

Interviews with Batswana community knowledge holders in the various areas of the province indicated that certain indigenous shrubs and trees signalled the approach or advent of certain annual seasons like winter, spring and summer including the imminent onset of rains or drought. For instance, interview with Rre Lephunyake Wa Mogokgo (a head man of the Batlokwa in Madikwe area) showed that when the cactus plant buds around November to January, rain can be expected within a week.

(ii) Rre Monyatsi (a community knowledge holder around Mafikeng) demonstrated to the researchers a wide knowledge and experience on the behaviour of insects as indicators of forthcoming changes in the weather conditions. He stated that insects are sensitive to more extreme weather conditions, especially temperatures, than larger animals and human beings. He informed the researchers that experience with insects in the area showed that changes in temperatures affect insect numbers and activity more than any other weather condition. For instance, numbers usually decline significantly during extended dry periods and increase greatly when good rains break the drought.

Rre Monyatsi revealed that some species of ants will, apparently, raise the level of the soil around the entrance hole to their nest when rain is on the way, possibly to prevent surface runoff from entering the nest. He pointed out that the height of the soil around the hole was indicative of the amount of rain expected.

(iii) The behaviours of animals, both domestic and wild were used by community knowledge holders to predict changing weather conditions. Batswana are traditionally cattle herders, therefore, if cattle were seen to be flocking on their way back from grazing in the evening and were reluctant to go for grazing the next morning; it was an indication of the abundance of rains in the following season. Again, if in October or November donkeys were seen shaking their bodies vigorously while standing, it was a sign that the rains were about to start. Wild animals' behaviours were also used to predict weather conditions: if lions and hippopotamuses made frequent roaring sounds in October or November, this was a sign that there would be a lot of rain in the coming season.

(iv) The behaviours of certain bird species were also used to predict natural disasters. For instance, the heights of the nests of certain birds on trees growing by river banks were used to predict floods. When floods were likely to occur, the nests were very high up on the trees and when floods were unlikely, the nests were low. Weavers nesting high up in trees, especially along the river banks and lakes, were a sign of heavy rains and forthcoming floods. Finches building nests higher than usual indicated that heavy rain is coming. The Batswana knowledge holders also used the cry of certain birds to predict rain; certain birds were seen for only two weeks before the rains started and not at any other time; and other birds sang once a week before the rains commenced; when partridge birds (*kgaka*) stopped moving after a signal from the leader and made a special sound, the rainy season was about to start; and when ostriches made roaring sounds, the start of the rainy season was known to be around the corner.

(v) Insects were frequently used by indigenous knowledge holders to foretell weather conditions. The phenomena associated with insects include the appearance of red ants in large swarms in October or November, bees flying from hills to lowlands and the appearance of a large number of moist anthills in August or September were indicative of a wet season.

(vi) The atmospheric indicators used to determine weather changes were: hot weather conditions, especially at night, during the months of September to November. This signalled the prospects of good rains. On the other hand, low night temperatures during the same months were indicative of a late onset of the rainy season and the possibility of drought. Similarly, the rising of air temperatures to above normal levels at night during August to October was an indicator of high rainfall in the coming season.

(vii) Wind directions were as well indicators of changing weather conditions: if prevailing winds blew from west to east in September or October, it indicated that the rainy season was about to start. If prevailing winds in August changed from a westerly to southerly direction, the season was likely to be wet, but if the winds changed from north to east, below normal rainfall and possible drought conditions were to be expected. Strong winds associated with hot sunny conditions and frequent incidences of dust devils during the months of August and October were indications of excessive rains.

The study was also interested in investigating the issue of IKS in disaster preparedness, especially with regard to food security. This is discussed below.

Batswana Indigenous Natural Disaster Mechanisms

According to the community knowledge holders, the Batswana had over the years devised mechanisms of natural disaster preparedness against heavy rains/ floods, hail, cyclones and thunderstorms. For heavy rains and flood control, the Batswana believed that during the floods the mud could be poured in a container and be boiled to dry up. As soon as the water from the mud dried, the floods would also stop. They also believed that when rough salt was thrown into the fire; the rain would stop. For hail control, it was believed that the sucking of the hail by a first born child, would stop the hail storm. Some Setswana cultures believed that it has to be the last child as this would symbolised the last hail the village would experience. Furthermore, it was also believed that if one of the elders took two pieces of iron and while standing at the middle of the gate, hit them against each other to make a sound, the hail would also stop.

The Batswana also believed that they could control cyclones and storms so that during a thunder storm, they would only experience, a heavy wind with dark clouds. They believed that when the wind became strong and the clouds became dark, one of the village elders could stand outside in the middle of the court yard and reprimand the storm and the thunder – saying *'Sefefo didimala kapo Maru didimala'* that is, wind stop or thunder stop. Moreover, the chief, as the leader of the tribe, used to call an appointed traditional healer to ascertain the source of the thunder storm. Both the chief and the healer would instruct the whole village to go to the veld outside the village and shout in unison to chase the thunderstorm away.

Signs of Thunder and Storms

According to the Batswana belief system, the sign of thunder and storms were as follows: clouds resembled mountains in the sky. When this happened, the Batswana knew that they had to prepare to control and stop the severity of the pending storm. When a cyclone raised *"setsokotsane"* and was in the shape of a cow's tail, the community predicted danger and the destruction of houses and the environment. They also believed that when the big river snake relocated from one river to another, it left a trail of disaster. Houses were destroyed and trees uprooted. Sometimes when its young ones were killed or captured the same disaster could occur. Traditional healers were then called to cleanse the area in order to prevent this from recurring. It was believed that when pythons are killed during harvest, there would be thunderstorms and the crops would be destroyed.

Use of Batswana Indigenous Knowledge in Natural Disaster Preparedness for Food Security

According to the Batswana community knowledge holders, when indicators of weather

and climate signified the occurrence of a drought it was also a signal for crop failure and shortage of fodder for livestock which could lead to possible occurrence of famine. Famine did not necessarily result from drought only. Red locusts and desert locusts and other pests and diseases sometimes precipitate famine. However most incidences of famine among the Batswana were associated with drought. Therefore, after a good harvest, granaries were filled with grain as a coping strategic reserve against famine. The granaries were made of different materials depending on the area.

Some ethnic groups used honey; ashes and cow dung as a preservative for cereals and other seeds to be used during famine. For instance different types of cakes were prepared by using honey such as honey-sorghum and honey baobab fruit cakes. These cakes were preserved so that they could be eaten during famine. Another food security strategy against famine was the use of early maturing crops. When a drought was predicted, the growing of early maturing or drought tolerant crops such as sweet potatoes and sorghum was encouraged.

According to the community knowledge holders, mixed cropping or intercropping was used as a strategy to stabilise yields, preserve the soil and this made it possible to harvest different crops at the same time. Other advantages of these indigenous farming strategies were a reduction in susceptibility of the crops to pests and diseases and a better use of the environment where the combination of species grown had different light requirements or explored different depths of soil. The system also tended to provide a complete vegetation canopy at different heights and thus broke up heavy rainfall and protected the soil. After harvesting the corn, millet or sorghum the crop was covered with ashes or with cow dung to protect it from insects. It was put into bags and transported to the family house.

Focus group discussions also revealed that to mitigate drought conditions the Fig tree (*Ficus* spp) was used by the local people as a water catchment plant species for divining water when locating village well sites. It was believed to maintain a perennial supply of water in the well if it was left to grow near it. The fig trees were left to grow in water catchments to maintain a constant source of water for springs and wells. These trees have taproots and widespread lateral roots that hold wet soil and maintain wetness of the soil after rainfall. Local communities also planted drought tolerant crops such as pigeon peas, finger millet, sorghum, bulrush millet, cow peas and sweet potatoes.

The Batswana also practised valley farming system in which use was made of small water catchments. This implies that rainwater stored in the soil on hills during the previous rain season was used in the dry season to grow crops. Crops, such as maize, beans and pumpkins were grown on the banks of the stream, using this water management system to mitigate drought conditions for food security. During famine edible wild food resources were collected, mostly by women, as used as food. Communications among and between neighbouring local communities and farmers on natural disaster indicators was very common. For instance, during flood times, whenever upstream communities or farmers along rivers and streams noticed signs of floods, they notified their downstream neighbours about the danger by drumming, blowing of horns or shouting out aloud. Sometimes thunderstorms occurred when people were farming in the fields. Therefore, special shelters were constructed in the fields to protect people in time of storms or heavy rain. In case a thunderstorm is imminent, people sought refuge in nearby caves. In order to avoid landslides and mudslides people were discouraged from building shelters on steep slopes.

CONCLUSION

Using data from participatory research methods, the paper discussed the different indigenous natural disaster management systems used by the Batswana in North-West Province, South Africa. The aspects examined included indigenous early warning indicators of natural disasters such as drought, floods and famine; the traditional ways of community preparedness against natural disasters including food security.

It was revealed the Batswana local communities had a variety of indigenous knowledge systems and community social structures related to natural disaster management. Traditionally, they used the behaviours of flora and fauna (domestic and wild), atmospheric, astronomic and wind as indicators. On the basis of these indigenous knowledge systems, they generated strategies for food security. There were also

indigenous communication systems to inform neighbours on impending natural disasters. However, most of this indigenous knowledge is not documented hence vulnerable to loss.

RECOMMENDATIONS

The paper recommends further research and sharing of this valuable knowledge to inform policy and educational curriculum development for sustainability. Indigenous knowledge data banks and networks should be established for sharing this knowledge at local, provincial and national levels. The role of Information and Communication Technologies (ICT) will play a great role in this effort. This knowledge should be incorporated by policy makers, development agencies and other stakeholders in the search for sustainable community-based solutions to natural disaster management and climate change mitigation. In order to improve its efficacy to meet global challenges, it should be interfaced with other knowledge systems and appropriate laws should be enacted to protect intellectual property rights of indigenous knowledge holders in local communities.

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