Public Perceptions of Climate Variability Risks on Wetland Management: A Case of Ward 15 of Matobo North District, Zimbabwe

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ABSTRACT

Wetlands are unique for storing water from storms; recharging ground water and serving as the habitat for a variety of aquatic organisms, wildlife and plants, including rare, threatened, endangered and endemic species. However, climate variability has led to the shrinking and drying up of most wetlands in Zimbabwe. This study looked at the public perceptions of climatic experiences in their environment, level of knowledge about wetland management and attitudes towards implementing these strategies. Data collection and analysis was based on field surveys in two villages around Intunjambili wetland, including five focus groups, questionnaires (five point Likert-scaled) given to 27 households, structured interviews and observations. The results indicate that a significant proportion of the locals are aware of the dynamics of the local climate; the majority of the participants have heard of climate variability but very few know the causes. The majorities of the participants use indigenous knowledge systems to conserve their wetlands and are reluctant to implement scientific methods as they are perceived as expensive. The study points to the need to encourage residents to merge scientific methods and indigenous knowledge systems in wetland management and to increase outreach about the climate variability risk, for sustainable environmental management.

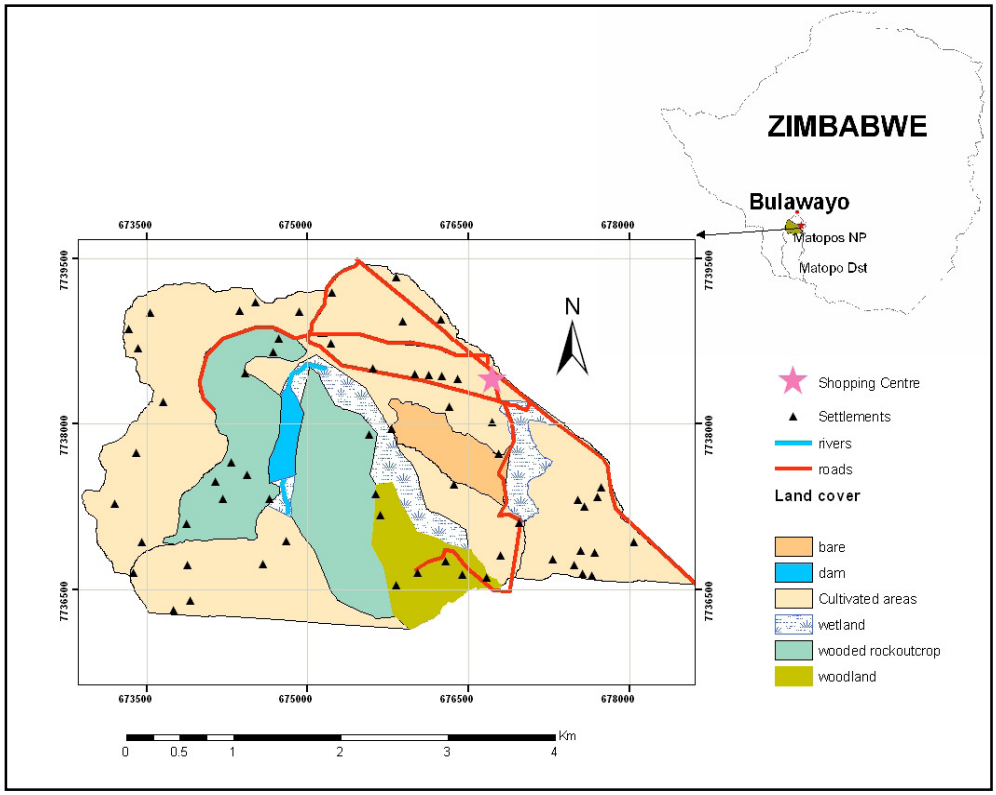
Keywords: Climate variability, Climate risk, Wetlands, Perception

INTRODUCTION

Wetlands are defined as areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres (Ramsar, 2007).Wetlands cover 6% of the world's land surface and contain about 12% of the global carbon pool, however, they are among the most biologically diverse and threatened ecosystems due to climate change, climate variability and human activities (Ferrati et al. 2005). Climate variability refers to variations in the mean state and other statistics (standard deviation, occurrence of extremes) of the climate on all temporal and spatial scales (Zambuko, 2007). Wetland ecosystems are adversely altered by climate variability (Poff and Hart, 2002). This implies that climate variability poses a danger to most of the wetlands globally and this risk is compounded by high population growth leading to the extension of agricultural activities and settlements into these fragile environments. In southern Africa many low-lying peatlands have been converted to agriculture and remaining natural peatlands are under severe threat of conversion and degradation (http://www.fao.org/docrep/x5872e/x5872e04.htm). Matobo north district in southern Zimbabwe is greatly endowed with wetlands and they are part of the economic base of the region. People's livelihoods anchor on wetlands in this area as it supports agricultural activities and tourism. However, little is known about the measures that have been implemented by indigenous people on sustainable conservation of these ecosystems. Moreover, there is a need to determine the most effective strategies to conscientise the local

people about the causes and risks of climate variability especially on the environment which is the source of their livelihood. While a small body of research has focused at public perceptions of climate variability risk on wetland management, the existing studies are far from conclusive and have looked on other regions of the country and the world (Ndhlovu, 2009). In order to expand this knowledge area and assist environmental managers and indigenous people, a survey was conducted of local residents living around Intunjambili wetland in Matobo district about their perceptions of climate variability risk on wetland management and their attitudes towards wetland management. An important management strategy to ensure wetland sustainability is the prevention or reduction of additional stress that can reduce the ability of wetlands to respond to climate variability. Maintaining hydrology, reducing pollution, controlling exotic vegetation, and protecting wetland biological diversity and integrity are important activities to maintain and improve the resilience of wetland ecosystems so that they continue to provide important services under changed climatic conditions (Kusler et al. 1999; Ferrati et al. 2005). It is therefore the aim of this paper to explore public perceptions of climate variability risk on wetland management and their attitudes towards wetland management.

STUDY AREA



Source: Ndhlovu, N (2009)

Figure 1. Map showing Intunjambili wetland area in Matobo, Zimbabwe

Ward 15 of Matobo North district has Intunjambili wetland which is a peatland. Peatlands are those wetland ecosystems characterized by the accumulation of organic matter (peat) derived from dead and decaying plant material under conditions of permanent water saturation (Parish et al. 2008). Intunjambili wetland is approximately 30 ha in size, and is mainly used for cultivation, water abstraction, vegetable gardening, grazing, settlements, eucalyptus plantations, dam, brick making and sand abstraction (Ndhlovu, 2009).The catchment lies in

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agro-ecological region IV which is a semi-intensive farming region characterized by total amounts of rainfall that range from 450 to 650 mm (ibid). It is subject to periodic seasonal droughts and severe dry spells during the rainy season (Meteorological Services Department, 2007). The Intunjambili wetland climate is characterised by a short wet season and a very long and hot dry season (Chuma, 2007 in Ndhlovu, 2009). According to the research which was done by Ndhlovu (2009) the results show that there was a 57.9% increase in cultivated areas, a 48.5% decline in woodland, and a 50% decline in permanently wet areas, which indicated that the wetland was drying up from 1990 to 2008. Alien invasive species like *Lantana camara*, dry land plants like *Euphorbia sp* commonly known as Cactus and ruderal species like *Eragrostisenamoena*were found to replace wetland vegetation in some areas of the wetland. Table 1 shows that Matobo district is experiencing rainfall reduction.

Table 1. Climate changes in Zimbabwe

Station	*Rainfall in old climate (annual)*	*Rainfall in new climate (annual)*	*Percentage Change*
Victoria Falls	684,7mm (1905/06 – 1934/35)	635,2mm (1975/76 – 2004/05)	-7,17%
Matopos	598,4mm (1903/04 – 1932/33)	548,8mm (1975/76 – 2004/05)	-8,36%
Nyanga	960,3mm (1905/06 – 1934/35)	1209mm (1977/78 – 2006/07)	25,94%

Source: Zambuko, C (2010)

Causes of Climate Variability

According to Marshall (2005) the natural variability of the climate system is the result of four factors:

1. Mathematically, the climate system exhibits “chaotic” (i.e., complex and non-linear) behaviour, which means that it has limited predictability; just as we can’t accurately forecast the weather two weeks from now, we will not be able to forecast the climate a century from now.
2. Important parts of the climate system exhibit oscillating behaviour, e.g., the El Niño-Southern Oscillation (ENSO) cycle that repeats every 2-8 years in the tropical Pacific and the North Atlantic Oscillation that has a cycle length of 60-80 years;
3. Variability in solar intensity, a key natural driver of climate, which occur in cycles which vary in length from familiar 11-year sunspot cycle to shifts in the Earth’s orbit that occur in cycles of 100,000 years; and
4. The random nature of volcanic eruptions, which are also a natural driver of climate. For example, the June, 1991 eruption of Mount Pinatubo resulted in a decrease of global average surface temperature of about 0.5°C in 1992 and 1993.

Human activities (the combustion of fossil fuels and changes in land use and land cover) have increased the atmospheric concentrations of greenhouse gases since the pre-industrial era (1700 – 2000). These together with natural forces, have contributed to changes in the earth’s climate (both mean and variability), land and ocean surface temperatures have warmed, the earth’s surface has warmed by 0.4 – 0.8^{o}C, and the frequency and intensity of el Nino events have increased (Finlayson et al, 2006). El Nino events have become more frequent, persistent and intense during the last 20 – 30 years compared to the previous 100 years (Marshall, 2005). These El Nino events have increased the severity of droughts especially in southern

Africa. Five warmest years on record for Zimbabwe have occurred since 1987 and that the frequencies of droughts since 1990 are as follows: 1990/91, 1991/92, 1992/93, 1994/95, 1997/98, 2001/02, 2002/03, 2004/05 and 2006/07 (Zambuko, 2010). In the last 25 years in particular, the earth has been warming at a rate that is faster than at any point in at least the last 2000 years (Grodrej, 2007). It is predicted that as the tropics gain more heat, there will be a greater transport of water vapour towards higher latitudes. Thus, it is likely that, in general, lower latitudes will experience a decrease in precipitation and higher latitudes will experience an increase in rainfall (Day et al, 2005).

The Role of Wetlands in the Environment

Wetlands are natural assets that are able to provide a range of products, functions and services: water supply, stream flow regulation, erosion and flood mitigation, water quality enhancement, maintenance of biodiversity, products (fish, grazing, building and crafts material), cultural attributes, recreation and tourism, maintenance of natural processes and climate change mitigation. Wetlands are the most efficient terrestrial ecosystems in storing carbon, especially peatlands. According to Grundling (1999), 50% of all wetlands are peatlands and their peat contains as much carbon as all global forest biomass and about the same as in the atmosphere. They sequester and store atmospheric carbon for thousands of years. Degradation of peatlands is a major and growing source of greenhouse gas emissions. Carbon dioxide emissions from peatland drainage, fires and exploitation are estimated to currently be equivalent to 10% of the global fossil fuel emissions (Grundling, 1999). This shows that these wetlands play a major role in regulating atmospheric processes and they are also a source of livelihood and food security especially in rural areas.

Climate Variability Risks On Wetland Management

Climate risksare defined as the likelihood that the interaction between climate hazards and vulnerability conditions will have a negative impact on the pond, its resources and the local population (UNISDR, 2004). Climate variability threatens the stability of mires (wet, swampy ground; bog; marsh) by increasing decomposition rates due to higher temperatures and lowering water tables due to increased evaporation. Godrej (2007) assets that as greenhouse gases build up in the atmosphere, temperatures rise, soils start to dry out and release carbon and forests begin to die back and burn. Wetlands in drier regions will receive less rain and will suffer desiccation and fire and unpredictable rainfall patterns with prolonged droughts will make wetlands more vulnerable to land use change (Grundling, 1999).

Wetlands are highly stressed from habitat loss to agriculture, reduced water flows caused by water abstraction for irrigation, pollution and increasing salinization (Kingsford and Norman, 2002). Shrinking of water levels in wetlands leads to a change in vegetation structure, altering the physical aspects of habitats and plant productivity (Smart and Gill, 2003). This shows that climate variability and anthropogenic activities can derail the environmental roles of wetlands.

METHODOLOGY

Two villages around the wetland were randomly selected for data collection. From each village two focus groups were interviewed and purposive sampling was done in the selection of participants who have gardens around the wetland. An average of 27 households from both villages were given questionnaires (five point Likert-scaled), at least 13 households from each village. Systematic random sampling method was used to select participants in the study areas. The observation method was used to assess changes taking place in the wetland in

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terms of hydrology and vegetation type. The data was analyzed using SPSS method and presented in tables, bar graphs and pie-charts. The results indicate that the wetland and its inhabitants are highly vulnerable to successive droughts, which have led to the reduction of the water table and, in turn, falling productivity from all agrosilvopastoral activities (the combination of growing of crops, trees, and pasture/animals in the same units of land) and recurring food crises. The participants' perceptions of the causes of climate variability are low and they are not proactive when they are supposed to implement environmentally sustainable agricultural methods.

RESULTS

Table 2. Gender of the participants

		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	Male	17	63.0	63.0	63.0
	Female	10	37.0	37.0	100.0
	Total	27	100.0	100.0	

The majority of the participants were males (63%). Most of the households were male owned and this is a patriarchal society since it is male dominated.

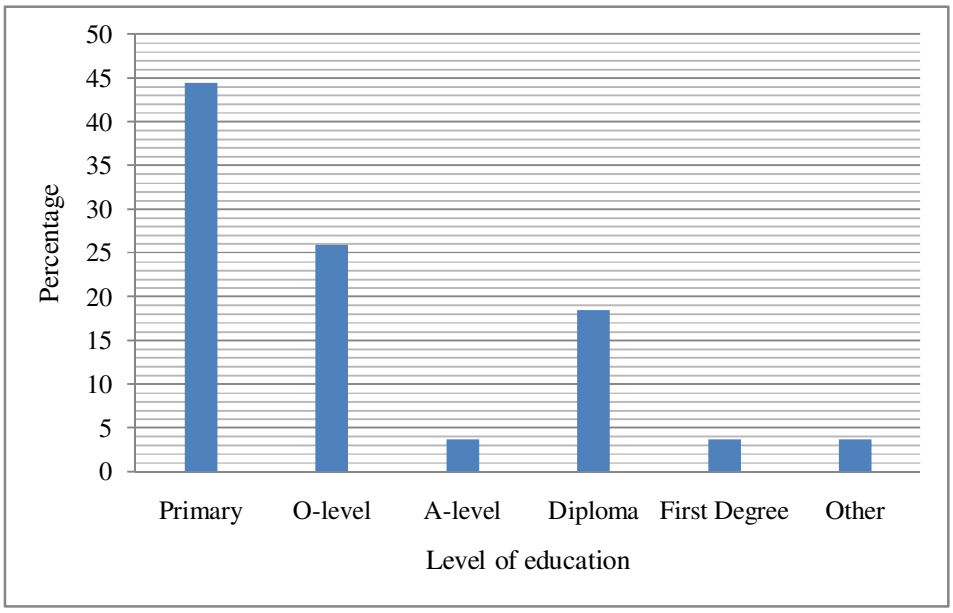

Figure 1. Level of education

Survey results also revealed ambivalence towards the causes, effects and sources of information on wetland management. Figure 1 shows that about 44% of the participants had primary education as their highest qualification. This affects their knowledge on the causes of climate variability and their perceptions and attitudes towards climate variability risks on wetland management and their attitudes towards internalization of external information on the management of wetlands. Only about 26% of the participants had tertiary education.

Table 3. Age and knowledge of climate variability

Age Group	*Heard about climate variability*			*Total*
	A lot	*Some what*	*A little*	
21-30	40%	40%	20%	100%
31-40	25%	0%	75%	100%
41-50	86%	14%	0	100%
51-60	40%	40%	20%	100%
61+	67%	33%	0	100%

Table 3 shows that the majority of the respondents in all cohorts have heard about climate variability. They know that the climate is not static but is always changing. The 31-40 age cohort had the lowest number of participants who had heard a lot about climate variability, the majority (75%) in this age group new a little.

Table 4. Gender and awareness of causes of climate variability

Gender	*Awareness of the causes of climate variability*				*Total*
	A lot	*Some what*	*A little*	*Not at all*	
Male	6%	29%	29%	35%	100%
Female	0	10%	50%	40%	100%

The majority of the participants are not aware of the causes of climate variability. Only 6% of the males said they have a lot of information on the causes of climate variability. They only know that the climate is variable but the minority is aware of the causes of this variability. The majority (35% males and 40% females) has not heard about the causes and the other 29% males and 50% females have heard a little on the causes. Further results were disaggregated per level of education and awareness of the causes of climate variability as shown in table 5. The knowledge of the causes of climate variability is directly proportional to the level of education. As the level of education increases the knowledge of the causes of climate variability also increases.

Table 5. Level of education and aware of the causes of climate variability

Level of Education	*Aware on the causes of climate variability*			
	A lot	*Some what*	*A little*	*Not at all*
Primary	0%	0%	58	42
O-level	0%	14%	14%	72%
A-level	0%	100%	0	0
Diploma	0%	60%	40%	0
First Degree	100%	0	0	0
Other	0%	100%	0	0

There is a need to extend community outreach through workshops to educate people on the causes and effects of climate variability. Study participants' familiarity with climate

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variability causing wetland degradation was above average, thus 67% as shown in table 6. They were somewhat more familiar with climate variability causing wetland degradation.

Table 6. Age group and knowledge of climate variability and wetland degradation

Age Group	*Climate variability and wetland degradation*				*Total*
	A lot	*Some what*	*A little*	*Not at all*	
21-30	40%	20%	20%	20%	100%
31-40	0	50%	0	50%	100%
41-50	43%	43%	0	14%	100%
51-60	0	40%	40%	20%	100%
61+	0	67%	33%	0	100%

Study participants' familiarity with human activities causing wetland degradation was very high. The majority said human activities lead to wetland degradation a lot. In terms of age groups, as revealed in table 7, those aged between 21-30 and 41-50 said human activities lead to wetland degradation a great deal. A very low percentage (20%) said a little i.e. those aged between 51-60.

Table 7. Age group and human activities and wetland degradation

Age Group	*Human activities and wetland degradation*				*Total*
	A great deal	*A lot*	*Some what*	*A little*	
21-30	60%	20%	20%	0%	100%
31-40	25%	50%	25%	0%	100%
41-50	57%	29%	14%	0%	100%
51-60	0	60%	20%	20%	100%
61+	0	100%	0%	0	100%

According to figure 2, the majority of the participants (66.7%) said they a have lot information on wetland management. The percentage for those who are not sure (somewhat) is also high (25.9%). This means that environment managers should also educate the public on wetland management.

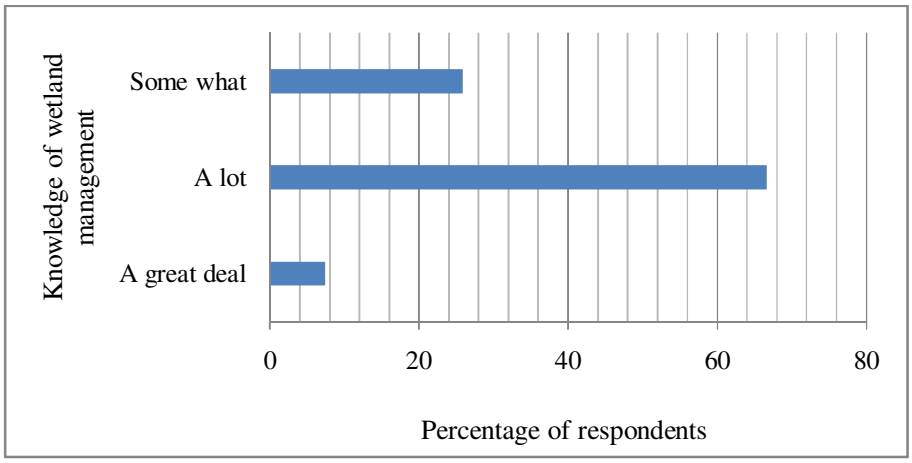

Figure 2. Knowledge on wetland management

In terms of sources of knowledge on wetland management (figure 3), most of the farmers (48%) educate each other on wetland management. A very low percentage (7%) got the knowledge from school. One can argue that Agritex officers are not really educating the public on wetland management as only 15% of the participants said they got information from them.

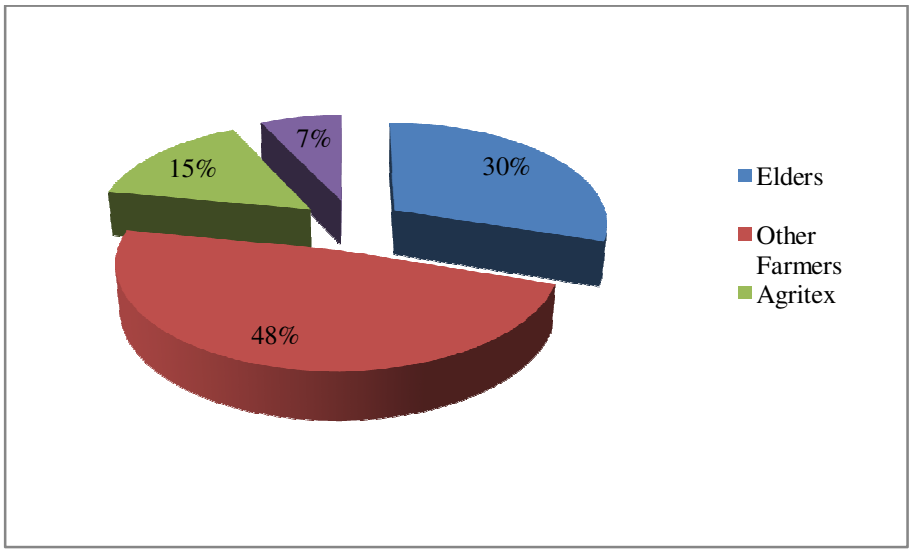

Figure 3. Sources of knowledge on wetland management

DISCUSSION

The results suggest that Matobo males still dominated agricultural activities since the majority of plot holders in the wetland were men. Therefore gender dynamics favour the males and hence Matobo north is a patriarchal society.

The findings also show the importance of both the level of knowledge on causes of climate variability and knowledge of factors that lead to wetland degradation as key variables that influence the public's perception on wetland management. In general, those participants who had knowledge on causes of climate variability were more willing to conscientise others to uphold environmentally friendly activities. In the words of one participant,

"*After the drought of 1992 (and later ones) I have tried to educate people about the dangers of draining wetlands and deforestation since it can lead to shortage of water and food in our area. This heightened awareness to wetland management,"* (T. Ncube, personal communication, October 18, 2012).

However, the majority of the people seem to be concerned about high productivity compared to environmental management. The elderly (51^{+}) were more concerned about wetland management than the economically active because most of the elderly people have stayed long in the area and they are now emotionally attached to it. They claimed that they were really disheartened when they see the vegetation type and density changing including water levels. M. Dube (personal communication, October 19, 2012) stated, *"we don't want people to extend agriculture into the heart of this wetland. As elders we have designated areas that are not supposed to be cultivated."*

The majority of the farmers had average knowledge on wetland management; they tend to get this from other farmers. They are not sure whether the knowledge they have can lead to sustainable wetland management. This causes them to have a laisser-faire attitude towards the

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implementation of these techniques. They tend to be concerned about high productivity. They believe that wetland management is independent of climate variability.

These prevailing attitudes present a challenge for environmental managers who wish to increase the public's awareness of climate variability risks and sustainable wetland management. Many locals indicated that they have heard about climate variability and they believe it is just a natural process which is independent of human activities. However, there was significantly more support for the programmes that can lead to the sustainable management of their environment. This means that one strategy for overcoming the public's reluctance about the climate variability risks on wetland management is to increase awareness and knowledge about the anthropogenic causes of climate change and variability.

The level of knowledge on wetland management is not uniform throughout the population. It is high amongst the males and even higher amongst those who have tertiary education. This has created groups of people who understand wetlands differently and they tend to administer contrasting strategies for wetland management, as one participant noted, *"The problem with elders is that they want to use strategies that were used buy our forefathers that no longer apply now. They just believe in taboos which tend to be against our religions,"* (B. Sibanda, personal communication, October 18, 2012).

This shows that some sections of the population are not willing to use indigenous knowledge systems in wetland management. The majority of the women also lack knowledge of wetland management because they tend to be sidelined from the programmes that equip people with skills on environmental management.

The issue of wetland management is extremely timely in rapidly changing climate and rapidly increasing population. Increasing local residents' knowledge about climate variability risks on wetland management to reduce wetland degradation is critical.

CONCLUSION AND RECOMMENDATIONS

The study concludes that it is a challenge to sustainably manage the environment since the population found in any given locality tends to be heterogeneous and this affects its perceptions and attitudes. The variation of the population in terms of gender, level of education, age and religious affiliation has a bearing on people's attitudes and perceptions towards their environment. When the differences are very diverse this leads to conflicts amongst the locals and this eventually leads to unfulfilled community agendas and this necessitates environmental degradation, for example, part of the population was concerned about the quantity of their produce regardless of the environmental effects. Some farmers wanted to extend their fields into the centre of the wetlands which is against the wishes of the majority especially the elders who were concerned about wetland management. The researchers recommend that an important management strategy to ensure wetland sustainability is the prevention or reduction of additional stress that can reduce the ability of wetlands to respond to climate variability. Environmental Management Agency needs to expand outreach efforts in general as a means of distributing specific information on climate variability risks on wetland management. Another recommendation is to engage local residents in volunteer stewardship programmes to help manage fragile ecosystems such as wetlands. Traditional leaders should also make use of public meetings to promote environmental awareness programmes. This means that the public should be directly involved in the programmes that concern their natural resources. Therefore, environment managers need to partner with local communities to engage them in reducing wetland degradation as a means to complement government action on public lands that surround their communities.

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