



Significance of Lake Bosomtwe as a freshwater resource in Ghana; communities' perception

Marian A. Amu-Mensah*, Frederick K. Amu-Mensah, Mark O. Akrong, Humphrey Darko, Gloria Addico

Council for Scientific and Industrial Research, Water Research Institute, Accra, Ghana

Abstract

The research seeks to find out the significance of freshwater and its sustainability in a given community, using Lake Bosomtwe as a case study. Most initial settlements were formed along water-bodies since freshwater helps to nourish and sustain life. Humans, however, have taken its abundance for granted. This is seen in the deterioration of water bodies near communities and the lack of access to clean water supply in these communities. This is a common feature in more than half of Africa's settlements especially Sub-Saharan Africa and specifically Ghana. Studies show that the measure one puts on the freshwater and the services the resource provides determines how it is used or protected. Simple random sampling technique was used to select 170 respondents (men and women) from the two districts in the Bosomtwe and Bosome-Freho Districts in the Ashanti Region of Ghana, bordering the Lake Bosomtwe. Primary data was generated through the administration of structured and semi-structured questionnaire. Descriptive statistics and ranking methods were used to achieve objectives. The major findings indicate that the lake is a major source of protein and livelihood. Economic activities are having a great impact on the lake in terms of pollution and sedimentation on the Lake. Spiritual importance of the Lake has dwindled over time and the materialisation of the lake has become an important measure which is causing its possible extinction. Findings indicated only 39.8 percent of respondents rated religious issues as very important, with 84.5 percent rating economic issues as very important and 80.7 percent rating social issues as very important thus giving more prominence to the economic value of the lake resources.

Keywords: Lake Bosomtwe; Resource Degradation; Spirituality; Sustainability; Knowledge; Economic Importance; Social Issues; Ghana

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* Corresponding author. E-mail address: fkamu.mensah@csir-wter.com

1. Introduction

Water plays a vital role in all aspects of life, its significance is visible in its sustenance to the environment; to economies; to food security; to productivity; health; politics and to spiritual matters. Throughout human history significance of freshwater resources is seen in its interrelationship with man (UNESCO, 2002). The significance or importance of a lake is seen in the measure one puts on it and the services the resource provides, considering the inability of humans to survive without it. This explains why most initial settlements were found along water bodies since the freshwater helped to nourish and sustain their lives.

However, more than half of Africa's villages lack access to clean water supply, especially Sub-Saharan Africa, because its abundance is taken for granted (WWAP, 2012). According to Martino (2003), water has a special significance for the great religions in the world, be it Christian, Traditional Religion, Hinduism or others. He explains that water is a source of beauty, wonder, health, food, wealth, recreation and relaxation, emphasising that it helps to renew and rejuvenate the individual on sight. Shackleton et al (2000), indicate that the importance of freshwater as a source of livelihood security for the rural poor is often underestimated. This is because its use and exchange has not been valued in a monetary sense and therefore is not valued. Freshwater's significance to users should, therefore be distinguished from the value of the resource. Martino (2003) also shows how water has always been recognised for its significant role in production and thus in economy, health and sanitation and so has its spiritual significance, for both health and economic gain. Yet in recent years the reverence and fear of the spirits have been taken away by Western religious beliefs, ideas as well as systems of water governance (Awuah-Nyamekye, 2009; Fairhead and Leach, 2004). This is irrespective of existing conventional water laws, therefore marginalising customary laws that were regulating the application of knowledge in water governance and alienating people from their traditional water management practices (Bonye and Miller, 2004; WHO et al., 1993; Flavier et al., 1995). This makes the participation of traditional and community leaders in water governance inconspicuous by their weak and insignificant representation at higher levels of water governance. This is also stressed by Nakashima and Roué (2002) who point out that increased emphasis has been given to the general demand for food, shelter and recreation which is primarily materialistic, as opposed to its spiritual and traditional knowledge, which support conservation. Yilma and Donkor (1997) explain that freshwater's materialistic uses increase as the population continues to grow and increase in prosperity through the unsustainable use of freshwater, which ends up destroying it.

A number of studies have examined the relationship between individuals' personal beliefs and values in their adoption of water conservation practices. Findings included individual's values and beliefs on water resource use which is non-renewable and were more likely to ensure conservation of such resources in their communities (Lynne et al., 1988; Awuah-Nyamekye, 2009). On the other hand Individuals with strong beliefs in technology and profit maximization display less efforts towards conservation. Likewise, other studies have found that people who believe that "one has a moral obligation to maintain the land for future generations" were more likely to adopt conservation based measures than those who believe that they have an unbroken, God-given right to use resources as they please (Nowak and Korsching, 1983). This goes to show the extent of importance or reverence an individual ascribes to a natural resource, and to what extent they would want to conserve or protect it.

The intention of this paper is to present the perception of the importance or significance of Lake Bosomtwe in the twenty-four communities living around it in the context of conservation and protection. The findings are expected to inform on the right approach to the sustainable management of the lake in the light of the reported deterioration of the resource (Amu-Mensah et al., 2014). In addition, it examines activities in the area and their impact on the lake.

2. Methodology

2.1. Study area

Lake Bosomtwe is located in the Ashanti Region of Ghana within latitudes $6^{\circ} 28' 15.11''$ N and $6^{\circ} 32' 28.53''$ N and longitudes $1^{\circ} 24' 24.06''$ W and $1^{\circ} 26' 46.30''$ W (Figure 1). It is the only Endorheic (closed) lake in Ghana and Africa, and the third largest closed lake in the world. Being the main inland water body in the Ashanti Region, the lake environment is rapidly gaining popularity as a tourist and recreational centre. This has led to increased inflow of revellers that has the tendency of putting more pressure with regard to sanitation, demand for fish and pollution of the lake. The lake is enclosed within two administrative districts, Bosomtwe District and the newly created Bosome-Freho District.

Population around the catchment area of Lake Bosomtwe has increased from 87,325 in 1984 to 146,028 during the 2000 population census to the current population of 154,307 in 2010. This indicates a growth rate of 3%, which will put extra pressure on the Lake Bosomtwe (Ghana Statistical Services GSS, 2012; Bosomtwe District Assembly, 2006). It is therefore not surprising that many people are confronted daily with an inadequate supply of safe water. The majority of women and children bear the consequences of inadequate water supply as they spend time and money in search of water for domestic and other uses (Amu-Mensah et al., 2014).

Several studies have been conducted in different study areas to help reduce the degradation of the freshwater resources yet none of the studies has considered studying the significance of the resources, based on the communities' perception of their necessity for conservation.

The consent of the Chiefs, sub-chiefs, elders, opinion leaders, committee chairpersons, some pastors and individuals were sought before embarking on the survey.

An in-depth interview, observation and interview questionnaire administration, was conducted to collect data from all the 24 communities around the Lake Bosomtwe, namely Ankaase, Apewu, Duasi, Detieso, Bansa, Domba, Esaase and Adeito all in the Bosome-Freho District of the Lake Bosomtwe. From the Bosomtwe District, the Lake Bosomtwe is surrounded by these communities; Abease, Amakom, Old Brodekwano, New Brodekwano, Agyamanmu, Abrodwom, Old Pipie (No. 1), Pipie No. 2, Adwafo, Abonu, Obo Nsebi, Nkwawi, Anyinatiase, Hantaase, Esisiriwa Dadeimu and Mmebemu. Konkomba and Bansa which were previously located on the lake shore, have moved uphill (due to flooding) thus having less impact on the Lake based on their immediate anthropogenic activities and so they were not added to the communities.

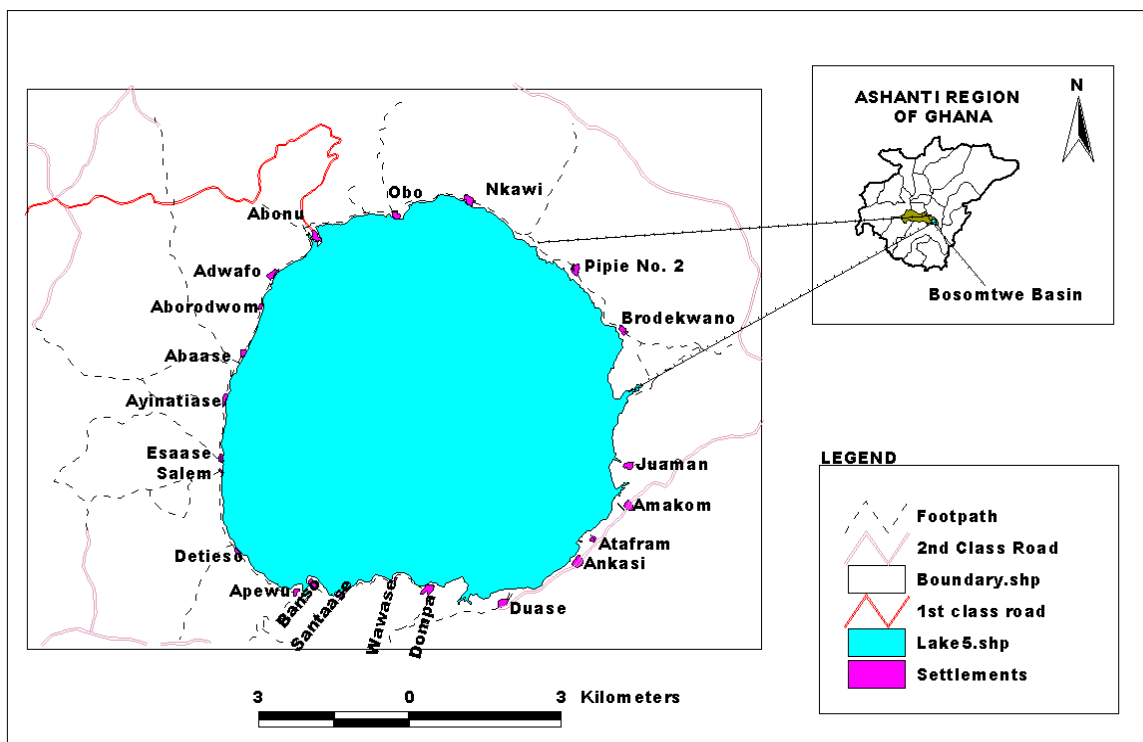


Figure 1. Map Showing the Lake Bosomtwe Basin, the Study Area. (Source: Authors' Construct)

A sampling size of 161 respondents was used for the survey and 48 participants for the in-depth interview. All the communities were purposively selected for their fishing, agricultural as well as their nearness to the streams and the Lake, in addition to communities who were tourism oriented. In all, eight communities engaged in fishing during the early hours of the day as well as in the evenings and also farmed during the remainder of the day.

2.2. Lake Bosomtwe and effects of human activities

Lake Bosomtwe is a meteoritic impact lake believed to have been created in the Pleistocene period. The name Bosomtwe (also spelt "Bosomtwi") is derived from two Akan names, "bosom" meaning god or deity and "ɔtwe" meaning antelope. Thus Bosomtwe is thus translated antelope god. It is a sacred environment for the communities because of the folk tales associated with the area. Sacrifices are performed occasionally for the lake god Kwasi Bosomtwe. Although Christianity thrives in the area, residents still resort to traditional methods of healing that have links to the lake.

The elevation of the lake surface is currently at 97 m above MSL (assumed to be 0.0 m). The surrounding crater rises to heights above 350 m with rather varying steep slopes. It lies in the deciduous forest agro-ecological zone of Ghana with average annual rainfall of 1,260 mm (Gyau-Boakye, 2012). Flows from the

streams are therefore very fast and have the potential to erode the soil if vegetation is removed from the catchment. Lake Bosomtwe is a hydrologically closed basin and according to Siddharth et al (2005), makes it very sensitive to these effects (increase in the pollution of the lake) from human activities.

Recent findings confirm that the slopes of the channels range from 4° to 20°. More than 75% of the catchment has slopes around 20° with the lowest slope being about 2°. Fortunately, the steep slopes and the small catchment size does not allow the flows to progress for significant durations. The relatively shallow stream channels have predominantly stony soil conditions as opposed to the silty clay conditions found at the locations with deeper channels. The Lake Bosomtwe environment is predominantly made up of sandy soil. The estimated pollution loads from human activities into the lake is more than 50,000 kg/year for nitrogen and 6,000 kg/year for phosphorus (Prakash et al., 2005). Fish stock is declining and meanwhile, the size of fish caught has reduced (Bosomtwe District Assembly, 2006).

The study provided the perception of the general or natural significance (source of beauty, wonder, health, food, wealth, recreation and relaxation). In addition, the economic and religious significance of the freshwater resource to determine its importance to the communities in ensuring its protection or conservation were also investigated.

3. Results

3.1. Demographic characteristics of respondents

Respondents representing 99 % were all native-born who still live in the community. Analysis of socio-economic characteristics of respondents was restricted to respondents aged 18 and 96 years old. For the survey, the age group, 49-58 were 30.4 percent out of 161 respondents sampled and the age group 29-38 comprised 22.4 percent. These are shown in Table 1. Educationally, respondents with Middle School Leaving Certificate (MSLC) were 31.9 percent and those with Junior High School (JHS) certificate (28.8 percent) formed the majority group. These groups are capable of understanding issues pertaining to water resource management. Respondents with no education were 15.3 percent and those with primary education only, were 13.0 percent.

Table 1. Age Range * Level of Education Cross-tabulation

Age Range	Count	Level of Education					Total
		No education	Primary	MSLC	JSS	SSS	
18-28	1	3	1	17	2	1	25
29-38	2	4	3	23	4	0	36
39-48	3	6	10	2	1	1	23
49-58	10	8	28	0	1	2	49
59-68	4	0	10	0	0	3	17
69-78	4	0	3	0	0	0	7
79-88	1	2	0	0	0	0	3
89-98	1	0	0	0	0	0	1
Total	26	23	55	42	8	7	161

The participants explained that Tuesdays are rest days for the communities and no farming or fishing is undertaken. It was observed that due to reduced fish catches, the locals have resorted to farming on the steep slopes of the impact crater lake. Waste disposal is a problem with its subsequent impact on the quality of the lake water during runoff.

Through observation, it was realised that the communities around the Lake Bosomtwe depend heavily on the Lake for their source of protein. Bosomtwe's physical existence in the district, in Ghana as well as its international interests, help with its importance in general. In all the communities, agricultural activities are a major source of livelihood and a crucial attribute of the local, social and environmental culture cohesion. This is because without a water source, agriculture, which represents a key sector in the economies of developing countries cannot be sustained. Fishing from the lake is the communities' major source of protein, in addition to some game hunting in the forest of the Lake's catchment.

3.2. Significance of Lake Bosomtwe

The study findings indicate that the economic and social significance of the lake has resulted in the intensification of agricultural and other activities in the Lake's Basin to provide other sources of income. As population and tourist-induced population increases, activities around the lake also increase with greater impact on the lake's resources. This is coupled with a rapid rise in the number of hotels, tourist lodges and other tourism facilities. Even though this helps to reduce pressure on fishing in the Lake (by moving labour from the direct exploitation of the lake and its resources), it more often than not poses a huge environmental threat (pollution and sedimentation) to the natural resource due to the waste produced and release of untreated effluents into the lake as well as the removal of vegetative cover to construct these facilities. Current sediment load into the lake is estimated at approximately 2,674 metric tonnes per annum (Amu-Mensah et al., 2014). Estimated rainfall in the year 2013 around the catchment was 340mm compared to previous rainfall of 1,260 mm, confirming Siddharth et al. (2005) on the possible reduction of water inflows leading to the pollution of the closed lake. From the study, respondents indicated that the lake provides water for their food security.

Table 2. Social and economic benefits of the Lake

Activity	Percentage %
Bathing	97
Washing of Clothes	98
Building	98
Cooling for local gin preparation	57
Cooking	95
Watering of animals (pigs)	75
Recreation (controlled)	24
Recreation (uncontrolled)	85

Source: Field survey, 2012

According to respondents, besides using the lake for fishing, 50% of the inhabitants sometimes drink from the lake. In addition, 88% also use it as a source of irrigation water for agricultural activities. Local breweries also use the water for cooling during the production processes of their local gin thus heating up some parts of the water. Other uses for the lake are indicated in Table 1, based on the respondent's use.

From Table 1, 97% of the respondents indicated that they took a bath in the Lake, although the very old respondents indicated that they only fetch the water for bathing outside the lake. For washing of clothes and building, respondents indicated that the lake water is all they use. The lake also provides the basis of other social and economic opportunities for tourism. However, the in-depth interviews revealed that developments related to tourism are mostly concentrated at Abono, Ankase Lakeside, Adwarfo Lakeside, Amakom Lakeside, Duasi, Apewu, Lake Point at Obu, and Pipie No. 2.

The physical significance of the lake to the communities was evaluated based on the perception of its aesthetics as a great national Crater Lake, a source of domestic water supply, food and the feeling of ownership. Values recorded in Table 2 show that out of a total of 161 respondents, 80.7% indicated that the lake was very important and 1.2% were of the opinion that it was not important at all. It was indicated from the focus group discussion and in-depth study that the water resources is of an immense significance to them, since it provides the source of protein, water for irrigation, watering of animals, recreation, especially to the youth and serves as a major water source for cooking and laundry. Without it, they would have to travel long distances in search of water as well as to buy fish at an exorbitant price from other communities. The importance is also characterised by the elevation of the crater and the steep slopes that need to be traversed to exit the crater.

On the issues of health benefits, crucial concerns were raised in relation to water and sanitation and its management, since the lake is held in trust by the central government for the communities. Currently, the lake is being managed by the District Assembly with representation of the locals as well as other water stakeholders, where policies and practices are at variance with cultural practices and beliefs of the traditional systems. Participants believe that the traditional laws protecting the lake and its catchment are eroding away very fast. An example is the current practice of planting of trees around the lake, which will in effect produce a lot of litter to be managed and yet will not support fish breeding as was in the case of the elephant or water grass, the original vegetative cover along the shoreline.

3.3. The economic significance of the lake

Water has always been recognised for its role in the economic production and thus, increased emphasis has been given to the economic value of water in recent years. There is no doubt that the economic value or importance of a natural resource would lead to its protection and sustainable management. It is therefore important to know the economic role a water resource plays and how it contributes to livelihood security.



Figure 2. Smoked fish from the Lake Bosomtwe ready to be sold

The use of water for agriculture, tourism businesses, water cooling for small breweries are of great importance or significance in terms of the amounts of water used, as well as the fish catch from the Lake for sale. Its value is seen in the cost of investments to provide the water and the economic significance of the resultant production. In determining the importance or significance of the lake, respondents were asked to decide on the economic importance by ranking within a range of whether it was very important or not at all important to the individual. From the responses, it can be inferred that the lake contributes highly to the economic sustenance of all the communities around the lake. Owing to the economic benefits from the lake, none of the respondents indicated that the resource was not at all important and only 1.9% said it was fairly important. Compared to its general or physical importance as shown from tables 1 and 2, the economic benefit was of more importance. Out of the 161 respondents, 84.5% indicated that the lake was very important.

3.4. Religious importance of the Lake

Water has a central place in the practices and beliefs of many religions of the world. This significance manifests itself differently in various religions and beliefs. According to the chiefs interviewed, the native Ashanti

religious beliefs are inextricably linked to both the natural environment and the everyday lives of the individual. Unlike the predominant religions of modern day Ghana, the traditional Akan or Ashanti native religion cannot be separated from day-to-day activities. It is a way of life in which their environment, language, and nature often play important roles.



Figure 3. Fisherman working with “Pedua” on Lake Bosomtwe

Lake Bosumtwi also represents a sacred site for the residents of the Ashanti Region. Respondents’ indicated that rainfall and an abundance of water in the lake is seen as a sign of God’s favour and goodness. The names of the streams depict their spiritual significance e.g. “Bo Twumwaa” and “Aberewa”. “Aberewa” means the old lady in Akan, or the mother of the lake, because it is one of the major streams that feeds the lake according to the respondents. This stream, “Aberewa” between Apewu and Banso in the Bosome-Freho District, scarcely dries up during the dry season. It is believed that these streams are spirits and therefore names are given to them. People with difficulties and problem from all over the country come to the stream “Aberewa” for spiritual solutions to their physical problems.

On the Lake's religious importance, respondents indicated that the Lake is a god which provides them with fish seasonally to ensure their well-being. Because of its sacredness, no one is to use boats fitted with outboard motors on the Lake since it disturbs the god who in turn refuses to supply their needs. The assemblyman of Duase, one of the opinion leaders, explained that the Lake is a god and he does not expect anyone to pollute it in any way. The only object or water-craft that can be used on the lake is the "Pedua" a wooden plank which the fishermen use. In the case of religious importance, twelve respondents indicated that the lake was not at all important to them. This is an increase in score compared to the other indicators. 21.1% also indicated that religiously, it was not important. Those who indicated that it was fairly important were 13.7%, with 18% indicating that it was important. Those who indicated that it was very important where 39.8%.

3.5. Correlation of significance

Correlation of the significance/importance of Lake Bosomtwe is shown in Table 3.

Variables

Scale of significance

0-1 = Not at all important

1.1-2 = Not important

2.1-3 = Fairly important

3.1-4 = Important

4.1-5 = Very Important

Table 3. Correlation of the Significance/Importance of Lake Bosomtwe

		Importance of Lake Bosomtwe	Importance of the Lake - religiously	Economic importance of the lake
Importance of Lake Bosomtwe	Pearson Correlation	1	.103	.583**
	Sig. (2-tailed)		.195	.000
	Sum of Squares and Cross-products	62.559	14.211	24.870
	Covariance	.391	.089	.155
	N	161	161	161
Importance of the Lake - religiously	Pearson Correlation	.103	1	.246**
	Sig. (2-tailed)	.195		.002
	Sum of Squares and Cross-products	14.211	306.124	23.217
	Covariance	.089	1.913	.145
	N	161	161	161
Economic importance of the lake	Pearson Correlation	.583**	.246**	1
	Sig. (2-tailed)	.000	.002	
	Sum of Squares and Cross-products	24.870	23.217	29.130
	Covariance	.155	.145	.182
	N	161	161	161

** Correlation is significant at the 0.01 level (2-tailed). With 0.1 coefficient value

4. Discussions

It may be deduced from the foregoing results that the major contributing factor to the social importance of the lake can be attributed to the economic value attached to the lake. There is a 60% correlation between the social importance of the lake and its economic importance. Conversely, there is only a 10% correlation between the lake's social importance and its religious importance. It can be seen that the correlation between the religious importance of the lake and its economic importance is only 25% suggesting that the economic importance of the lake may even be the reason for some importance being attributed to the religious significance of the lake.

Obviously, if the status quo is maintained, it is reasonable to expect that the economic importance of the lake will continue to be the overriding contribution to the importance of the lake. This can, however, be dangerous to the lake as beneficiaries of the economy of the lake, motivated only by their expected returns, may not be committed to investing in the management of the lake. This phenomenon is not new and is the main reason for the depletion of the timber reserves in Ghana. Sumit Chakravarty et. al. (2012) outline a number of factors that cause deforestation and an analyses of these show that like the lake resource, the perceived value of the economic returns from the resource is higher than the value of the resource itself. This leads to over exploitation and a lack of proper care of the resource, leading to its depletion or destruction.

Is it possible to channel the strengths of the economic importance to its religious importance with a view to boosting the religious and hence the conservation features of the water governance practices? A positive answer to this could help fuse traditional knowledge and contemporary governance methodology in the management of the lake. The participants explained that one idea worth exploring would be the promotion of eco-tourism and cultural tourism efforts that showcase the cultural diversity, traditions, festivals, and rites. These could become income generating events, whose proceeds could be channelled into conservation efforts in the catchment. From their perspective, the employment opportunities created, would reduce the pressure on the lake resources whilst channelling that labour force into taking care of the environment.

They explained that such an effort will require the combined efforts of the local government authorities, the traditional authorities and the locals in the communities, a win-win situation for the stakeholders including those who exploit the resources and an active buy-in relationship of stakeholders to maintain the resource.

Taking the respondents perceptions of Lake Bosomtwe, the results show that there is still a window of hope to save the Lake from deterioration, although it is clear that its religious significance compared with the economic benefits was low. The importance or significance of Lake Bosomtwe as a water resource is seen in the intensification of agricultural, tourism and other economic activities. These economic benefits not the spiritual significance that has supported its sustainability over the years, are the main driving force behind the exploitation of the lake and its resources. From the data, it can be seen that religiously the lake is not as important to respondents as it is in the case of the economic or its general importance. Reasons attributed to this situation of unimportance was western religion (Christianity) confirming Fairhead and Leach's (2004) study on the attribution of the irrelevance of natural resources as Christianity and Islam religion. Out of 161 respondents, 28.6% were sure that the lake was of no religious importance, although a greater percentage were of the view that it had some importance or that it was very significant. This goes to show that the

communities have the potential given the opportunity, of using their taboos and moral consciences to reduce the deterioration of the Lake through human activity.

Data collected from participants also show that increasing human activities are putting pressure on the Lake and its resources. Human activities ranging from agriculture, domestic, to services such as tourism and entertainment, continue to expand rapidly in the Lake Bosomtwe catchment. This expansion requires increased water services including both supply and sanitation, which can lead to more pressure on the closed natural Lake's resources. The culprit to this trend is the materialistic or economic benefits derived from the lake and its resources and not its spiritual benefits.

The question is if the lake is of such significance to the communities, why do the people put so much pressure on the Lake in view of the deteriorating effect. Why are the custodians of the lake not protecting or sustaining it for their benefit or that of the future generation? It is clear from the respondents that management or governance of the lake is not wholly in their hands. Their representation on the water resources governance does not have any significant impact on the Lake's administration, they explained. In addition, western religions have contributed to changing their perception of the Lake as a spirit that needs to be cared for. In addition, traditional governance has lost its hold on water governance and therefore cannot ensure that those who break the water resources management rules are punished, confirming Bonye and Miller's (2004) assertion on water governance. Group discussions revealed that in the past, the resilience of these beliefs and practices sustained the natural resources through enforced rules, beliefs, taboos and fear of water spirits, which forms part of their customary laws, and moral actions from the traditional authority (Awuah-Nyamekye, 2009). Women who play significant roles in the use and management of water resources are absent in the governance of the lake. In view of its economic and general importance, there is a significant indication of its importance, yet the way the water is used or treated does not signify that it is of any importance or significance to the people. The thinking currently is that the reverence and fear of the spirits have been taken away by religious beliefs and western ideas which is materialistic as opposed to traditional knowledge, which is spiritual, supporting Nakashima & Roué's (2002) view. Traditional views appear to have been done away with, irrespective of how it is going to affect the environment or water resources.

5. Conclusions

From the results and based on the perception of the respondents, the Lake has more economic significance to them than cultural, traditional or spiritual values. The participants' indications are that governance of the Bosomtwe should be an integrated partnership to ensure sustainable management by all stakeholders, especially the direct stakeholders who come from the communities. It is therefore recommended that documented cultures which support water resource governance should be refined and integrated into conventional water policies.

Since religious significance was low, religious bodies could help to improve the relationship between religion, significance of natural resources and the survival of mankind to protect the environment or water resources bequeathed to mankind by their ancestors. Consequently, water decision-makers and managers

currently need to prepare to fully realise the development potentials of new forms of water resources governance to be able to sustain the Lake.

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