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# An Assessment of Tourism's Environmental Impact on the Lake Bosomtwe Basin

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## ABSTRACT

Using information from interviews with key stakeholders and secondary sources, this article assessed whether Lake Bosomtwe tourism development has negatively impacted its ecology and, if so, what can be done to mitigate the impact. The evidence showed that despite the increase in awareness of the need to protect the lake environment, far greater abuses of the ecology are endemic for two reasons—the mismatch between knowledge and practice of ecologically sustainable tourism development, and the omission from the calculus of the influences that segments of the tourism supply chain have on one another to encourage more environmentally responsible tourism.

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## Introduction

Environmental degradation has dominated public discourse in recent years in many countries across the globe. Developmental activities have taken a toll on the environment and have resulted in loss of biodiversity. One of the major causes of the degeneration of the environment is unplanned and unchecked tourism development at many destinations. Tourism results in disorderly development especially of tourist facilities, which mushroom in unauthorized places and lead to aesthetic degradation of the landscape. Tourism activities also have negative impacts on natural resources as these contribute to soil erosion, increased pollution, and accelerated discharges into the sea (Akyeampong, 2008a; Mbaiwa, 2003). Tourism is also blamed for natural habitat loss and increased pressure on endangered species (Akyeampong, 2008a). Waste disposal systems are also a serious problem in most of the tourist destinations all over the world. For example, in the Okavango Delta in Botswana, waste from tourist accommodations and houseboats have boosted the growth of algae, which causes serious damage to the ecosystem (Mbaiwa, 2003). Similar discharges of untreated waste and consequent eutrophication have been reported in the Dal Lake in Srinagar, India (Shah, 2012). Wildlife viewing puts stress on animals and has changed

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their behavioral patterns. Noise and commotion created by tourists have adverse effects on their behavioral pattern (Akama & Keiti, 2007). Wanton disregard of the adverse environmental consequences of tourism development resulted in the Dal Lake in Srinagar in India shrinking from its original 22<sup>2</sup> km to 18<sup>2</sup> km and the deterioration of the lake's water quality (Shah, 2012). The shrinking was mainly caused by discharge of untreated sewage and solid waste into the lake, which resulted in an increased rate of sediment deposition (Shah, 2012). Global tourism is also one of the major reasons for climate change, as it involves 50% of traffic movements that result in the emission of green house gases (WTO, 2012). Tourism development has resulted in the loss of the spirit of place/ambience at many tourist destinations (Must, 2010; Page, Busby, & Connell, 2001). In recent years, it has tended to be a delivery vehicle for some of the darker effects of globalization—health pandemics. International travelers enabled the outbreak of severe acute respiratory syndrome and swine flu to spread rapidly across borders (U.S. Institute of Peace, 2009).

The aforementioned exposition on the negative environmental consequences of tourism development warns us that if we want to enjoy nature we must preserve it, otherwise all the exotic destinations will become extinct and the world will not be a beautiful place to live in. Eco-friendly tourism should be promoted all over the world. It is important to monitor and examine tourism impacts on the environment. Indeed, the environmental impacts of tourism have been extensively investigated in some developed countries (i.e., Australia, the United States, and the United Kingdom; Pickering & Hill, 2007) and some developing countries (for example, India and Nepal), and have also emerged recently as a hot research topic among Ghanaian tourism and other related fields of researchers. The emergence of research on the environmental impacts of tourism in Ghana is reflective of the increasing concerns over the negative tourism impacts on the environment. This concern is as a result of rapid tourism development since the late 1960s when Ghana began to adopt a proactive approach to tourism development. In 1996, tourist arrivals in Ghana reached 304,840—more than thrice the level attained in 1986. In 2008, tourist arrivals stood at 698,069 with a corresponding US\$1.4 billion in tourism receipts (Ghana Government, 1996). Within Ghana's external trade performance context, tourism's contribution during the 1990s and 2000s is remarkable. Tourist arrivals jumped to 1.08 million in 2011, resulting in US\$2.17 billion accrued tourism receipts (Ghana Tourism Authority [GTA], 2011). The estimated trade shares indicated that tourism's share increased to about 19% in 1993 and 1994 of total trade in terms of gross tourism receipts (Ghana Government, 1996). The contribution of tourism to gross domestic product has grown from 1.3% in 1990 to 3.5% in 1994 and then to 7.8% in 2012 (Bank of Ghana, 2007; GTA, 2012; Government of Ghana, 1996). Tourism provided about 19,000 direct jobs and 46,000 indirect jobs in 1996. These figures rose to

about 47,000 and 115,000, respectively, in 2004 and then summed up to 206,091 in 2007 and then jumped to 330,514 in 2011 (GTA, n.d). These indicators imply that tourism related jobs have more than doubled in less than 10 years (GTA, 2007).

Attendant on the rapid development of the tourism industry are increasing environmental problems such as increasing noise, declining air quality, increasing water pollution, and increasing biodiversity loss (Amuquandoh, 2009; Ishmael, 2013). For example, Ishmael (2013) reported on the wanton destruction and pollution along the coastline of Ghana especially at Bortianor, Tsokome, and Labadi. Some of the issues identified included littering, discharge of sewage directly into the sea and the Densu Estuary, defecation at certain portions of the coastline, and dumping of waste in close proximity to the sea (Ishmael, 2013). It was discovered that some of the hotels discharged their sewage either directly into the sea or the Densu Estuary. For instance, some resorts in Tsokome and Bortianor had their bathrooms located right at the bank of the estuary where tourists could wash down after bathing in the sea. These tourism-related environmental problems not only negatively affect the image of the tourist destinations in Ghana, but the sustainable development of the tourism industry in the country.

Given the negative environmental consequences that are already beginning to rear their ugly heads in the emerging tourism industry in Ghana, one wonders whether all tourist destinations are in the throes of ecological damage, and if so, to what extent? What can be done to remedy the situation? How effective are these mitigating measures? To answer these questions, the real environmental consequences attendant on tourism development in the Lake Bosomtwe basin in Ghana is investigated as a case study. Most tourism environmental impact studies particularly in Ghana concentrate almost exclusively on the perceived effects (see Amuquandoh, 2009; Akyeampong, 2008b). This study is different because it focuses on the real environmental impact of tourism in the Lake Bosomtwe Basin. The attention to the real environmental impacts is in order because there is dearth of information on stakeholders, particularly host communities' assessments of the actual impacts of tourism policy in developing countries. Furthermore, despite the fact that tourism is known to have far more visible impacts in rural peripheries in developing countries than in urban areas and in developed countries, and perhaps a greater effect on rural dwellers (Madrigal, 1993, p. 337), works on the impact of tourism development have overconcentrated on destinations, communities, and regions in the developed world to the neglect of those in Third World countries. Moreover, Scuter and Var (1988) observed in their investigation into residents' attitudes towards tourism in Argentina that there are some issues on the subject that are peculiar to developing countries but these have rarely been investigated. Moreover, in the developing world studies, particularly Ghana, omission occurs in the calculus of the upstream and downstream

influences on other parts of the supply chain to encourage more environmentally responsible tourism. Finally, a systematic analysis of the real environmental impacts of tourism could help local governments, planners, and tourism practitioners in the Lake Bosomtwe Basin identify real concerns in order to develop appropriate policies and actions.

## Methodology

The empirical basis of this study is primary and secondary data. The primary information was sourced from tourists, travel agents, local residents of the Lake Bosomtwe Basin, and local government officials as well as the GTA and tourism business operators. A multistage sampling technique was used; the first stage involved the use of the purposive sampling method to select five communities each from the Bosomtwe District Assembly (BDA; one of the local government areas where the lake is located) and the Amanse East District Assembly (AEDA; the other local government jurisdiction where part of the lake occupies) There are a total of the 22 communities in the lake basin. The five communities on the BDA's side are Abonu, Amokom, Adwarfo, Obo, and Pipie, while those on the AEDA's territory are Ankasi, Apewa, Banso, Deteisu, and Duase. The communities in the BDA's jurisdiction were selected because they are the most accessible, their tourism infrastructure and facilities are better developed and tourist visits are almost entirely to these communities and tourism activities are much more intense than in the other settlements. The communities on the AEDA's side were chosen because they are those that are relatively accessible in an area of general inaccessibility. This means they are areas tourists occasionally venture to, so tourist impacts may be slightly imprinted.

The second stage entailed the proportional allocation of 100 respondents (sample size of resident population) among the five selected communities in the BDA—Abonu (25), Amokon (22), Adwarfo (20), Obo (18), and Pipie (15). Similarly, another 100 respondents (sample size of local residents) were proportionally allocated among the five selected communities in the AEDA's jurisdiction—Ankasi (25), Apewu (22), Banso (20), Deteisu (18), and Duase (15). In the third step, the random sampling method was applied to choose the required stratified sample size for each settlement. A list of households generated by the Ghana Statistical Service was used as the sampling frame for the selection of households in the communities.

I conducted the interviews with the resident population with the assistance of trained research assistants who speak English and several Ghanaian languages including *Twi*, the dominant language in the lake basin. Questions were posed to adults, male and female; the interview method was preferred because respondents could not read the questionnaire and respond to the questions posed, as most of them are illiterate. The illiteracy rate in the Ashanti Region where the lake basin is located is

relatively high (40%; Ghana Government, 2002). The questions were posed to the respondents in a structured and uniform way. The questions worded in English were translated into the local language (Twi) and posed to the interviewees. In addition, 10 elite interviews were conducted with functionaries of local governments in whose jurisdictions the lake basin is located—BDA and AEDA. As well, structured dialogues with 10 tourism business managers were conducted. Responses from the different stakeholders enabled a well-informed and broad perspective on tourism development prospects and challenges in the lake basin to be formed.

The criteria adopted for evaluating tourism environmental impact in the Lake Bosomtwe Basin are reasonable. They are selected because they constitute either as instruments of environmental degradation or victims of ecological damage. Thus, how potent those tools are in environmental destruction and the extent to which tourism assets in particular, and the ecology as a whole suffer from their destructive capacity, should be an interesting area of analysis. This is because uncontrolled tourism development is likely to lead to not only environmental degradation, but also that the despoiled environment in turn poses a serious threat to tourism.

Environmentally destructive activities like farming, application of agrochemicals, indiscriminate disposal of waste, and the crowded consumption of tourism attractions have been noted. For example, high levels of nitrate—one of five water contaminants, causes *methemoglobinemia* in infants (Water Encyclopedia, 2016). Such contaminants infest fish with diseases and humans who eat diseased fish can themselves become ill, completing the circle wrought by pollution (Reddington, 2009). Thus, the application of agrochemicals on land is expected to have similar effects in the Lake Bosomtwe Basin.

Tourist attractions such as natural lakes, mountains, beaches, waterfalls, and wildlife habitats can easily be destroyed by tourist activities. For example, outdoor activities such as hiking and camping satisfy internal recreation needs that may be tangible or intangible like reduction in stress or having a sense of personal or community identity (Anderson, Nickerson, Stein, & Lee, 2000; Driver, 2008; Thapa, 2010). Nature-based outdoor recreation and tourism depends on natural environment to be ecologically, socioculturally, and economically sustainable (Newsome, Moore, & Dowling, 2002) for such benefits to be realized. If those resources are used irresponsibly by tourists and residents, they would be destroyed. Likewise, if visitors and natives use the natural attractions in the Lake Bosomtwe Basin in an environmentally unfriendly fashion they would be damaged and despoiled and thus lose their attractions as tourist attractions.

## **Tourism and The Environment**

Tourism development at any destination has both favorable and adverse environmental consequences (Burns & Holden, 1995; Puczko & Ratz, 2000).

In terms of the negative impacts, Puczko and Ratz (2000) noted that uncontrolled tourism development often results in increased stress on destinations and in negative changes in the destination's physical and socio-cultural characteristics. Wood and House (1991) argued that it is impossible to identify broad categories of impacts that may affect all destinations to a greater or lesser extent. Tourism is said to have led to inappropriate development around Lake Tahoe in the United States (Iverson, Sheppard, & Strain, 1993) and at Pattaya in Thailand (Mieczkoski, 1995); oil pollution of water bodies at King George Island (Harris, 1991); habitat loss, fragmentation, and erosion in Nepal (Croall, 1995); destruction of wildlife at Zakynthos in Greece (Prunier, Sweeney, & Green, 1993); disturbance of animals and loss of area of production in Kenya (Sindinga & Kanunah, 1999); and loss of the spirit of place/ambience at many destinations (Page et al., 2001).

Some scholars argue that tourism is a relatively environmentally benign activity and an economically viable alternative to extractive industries like mining and logging (Ceballos-Lascurain, 1996; Doswell, 1997). Doswell (1997) believed that tourism concentrates on critical environmental issues and stimulates initiatives to conserve and enhance the environment. Tourism draws attraction to issues relating to biodiversity, endangered species, and human impacts on the environment. Tourism is usually also used as a justification for the preservation of natural areas rather than to develop them for alternative uses such as agriculture, forestry, and mining (Master, 1998). In the case of Ghana, tourism provides the rationale for maintaining many native reserves established by the colonial administration (Amuquandoh and Dei, 2007).

A missing link in the analysis is the omission from the calculus of the influences that segments of the "supply chain" has on one another to encourage more environmentally responsible tourism. The supply chain in the tourism industry consists of those industries that supply accommodations, transportation, and make arrangements for travelers. *Upstream influence* refers to a sector's ability to influence an actor "above" them in the tourism services supply chain. A hotel's influence over a supplier's products is an example of upstream influence. *Downstream influence* refers to the influence an industry has over other sectors (including tourists) or industries "below" them in the tourism services supply chain (Davies & Cahill, 2000). An example of this type of influence is a travel agent's influence over a tourist's choice of vacation type and destination. This study addresses this gap by illuminating on the three primary types of influence: supplier relations, channeling of activity, and education. Each of the sectors of the tourism industry has potential for upstream and downstream influence on the environmental impacts of tourism.

In regard to the lodging industry, it can leverage its influence upstream on suppliers by insisting on products that impact the environment minimally. For

example, a hotel chain can exert its influence on a supplier by requiring paper towels made out of recycled materials for their bathrooms. The extent to which a hotel can leverage its suppliers depends upon several factors including type of hotel (for example, large chain or small independent) and type of supplies (Davies & Cahill, 2000). Mega hotel chains have negotiated national corporate purchasing agreements with different providers. Frequently these chains will purchase supplies based only on these corporate purchasing agreements for their convenience and lesser costs (Davies & Cahill, 2000). It might be most effective then to exert upstream leverage at this national level because franchises follow whatever contract is negotiated by their larger chains.

The Green Seal program is a classic case of an independent, nonprofit organization dedicated to protecting the environment by promoting the manufacture and sale of environmentally responsible products (Green Seal, 1999). The Green Seal program has also published an environmental purchasing guide for hotels, providing specific product and brand recommendations (Davies & Cahill, 2000).

Another program underway to encourage environmental responsibility through supplier relations (among other things) in the lodging industry is the International Hotels Environment Initiative. It was established in 1992, as a nonprofit organization developed by the international hotel industry that serves over 8,000 hotels (Davies & Cahill, 2000). It is manned by an international council of 12 multinational hotel company executives whose goal is to promote the benefits of environmental management as an integral component of hotel business (<http://caryon.oneworld.org/pwblf/ihei/index.thm>). The group influences supplier relations with hotels through its supplier program created in 1998. This program facilitates hotels' influence on suppliers in three ways: by creating a registry of industry suppliers who have an environmental policy and can also demonstrate that their products meet the best environmental standards; establishing and publishing environmental specifications for products or product groups; and creating and disbursing a comprehensive buyers guide with a list of all registered suppliers, guidelines for purchasing of products that minimize their environmental impact, and profiles of products (<http://caryon.oneworld.org/pwblf/ihei/index.htm>). The Ghanaian lodging industry can sign up to the aforementioned international watchdog organizations as a way to exert upstream influence.

In terms of channeling activity, sectors of the tourism industry have the opportunity to “channel” activities of both tourists and employees toward more environmentally responsible activities. This type of influence has been termed *downstream leverage* (Davies & Cahill, 2000). The lodging industry exerts downstream influence on tourists by encouraging environmentally sound practices. Ramada International Hotels and Resorts distributed 20,000 copies of “50 Simple Things You Can Do to Save the Earth” to guests as a method to encourage environmentally responsible behavior. In addition, the hotel chain established a children’s menu that encourages protection of

endangered species (Davies & Cahill, 2000). The Green Hotels Association provides member hotels with a towel rack hanger and a sheet-changing card to give guests the option of using their linens more than once. The association estimates that this practice alone can save 5% on the cost of hotel utilities (GHA, 1999). The lodging industry and hotels and guest houses in particular in the Lake Bosomtwe Basin can emulate this international best practice by also distributing copies of the “50 Simple Things You Can Do to Save the Earth.”

A sure strategy to mitigate tourism’s impact on the environment, says some experts, is to begin with hotel employees in areas such as laundry, house-keeping, and engineering (Shanklin, Petrillose, & Pettay, 1991, p. 65). These employees have first direct contact with some aspects of the hotel business that have an impact on the environment (such as washing linen and sheets). The Saunders’ Hotel Group solicits employee input and recognizes their input through its SHINE program, or Saunders Hotels Initiative to Nurture the Environment. This program began in 1989 as a recycling program and has since grown into a much more comprehensive environmental program, with investments in energy-efficient lighting and windows as well as an improved recycling program (Stipanuk & Ninemeier, 1996, p. 94).

According to Schultz (1994, p. 47) the highest percentage of tourists seek advice from travel agents about hotels. This number indicates that travel agents have the most opportunity to direct their clients towards hotels that have established good environmental practices and policies. A study conducted by a U.S. Travel Data Center revealed that 85% of travelers reported they would be very likely or somewhat likely to support or patronize travel companies perceived to be environmentally friendly (Johnson, 1994, p. 43). In this vein Ghanaian travel companies could establish a register of hotels with good environmental practices and policies to help them accordingly direct tourists.

The environmental impacts of the tourism industry can be partially mitigated through education of tourists and service providers. For example, efforts to educate about marine debris have targeted cruise line operators and owners. The Shipping Industry Marine Debris Education Plan, launched by the Marine Entanglement Research Program of the National Marine Fisheries Service, educates cruise line operators and owners by writing articles for cruise trade journals, presenting MARPOL information at cruise trade meetings, producing and distributing brochures about the problem, and presenting workshops about MARPOL compliance for members of the cruise industry (National Research Council, 1995, p. 180). Such programs seem rare or nonexistent in the Ghanaian tourism industry.

## **Background of Lake Bosomtwe Basin**

Lake Bosomtwe is an inland lake located about 32 km south of Kumasi, the capital of the Ashanti Region of Ghana. It lies in a deep circular crater



There are 11 known species of fish in the lake, including one endemic cichlid (*Tilapia discolors*). Two of the cichlid species are mouth brooders, meaning a parent holds the live-born fish in their mouth to protect them until they reach a certain stage of development. Lake Bosomtwe abounds in tourism resources such as natural environmental heritage, historical heritage, and cultural heritage. The lake itself can be used for swimming, cruising, racing, and other water sports. Its marine life can also be scientifically studied since some of the species are endemic to the lake. The origin of the lake presents an interesting area of research inquiry since conflicting accounts have been given. Some people argue that the lake came into being through a volcanic eruption while others believe that it resulted from subsidence, meteor impact, and volcanic gas explosion followed by subsidence (Amuquandoh, 2009; Mohammed, 1999).

The lake is endowed with many tourist attractions which include: the biggest natural lake in West Africa and a vital geological heritage site; the best-preserved young complex meteorite impact crater in the world as deemed by UNESCO; a unique and very attractive position in a virgin forest zone; rich geological and biodiversity information; the main lake for its recreational and aesthetic qualities; the crater rim formation and its relevance for geological research; natural and rural diverse landscapes; and the behavior and cultural history of its inhabitants (Anim, Yiping, Agadzi, & Nkrumah, 2013).

The lake basin also abound in flora and fauna—mammals, reptiles, amphibians, antelopes, cats, and birds—some of which are endemic to the Lake Bosomtwe Basin. The forest-clad hills are siren resorts; they are good for game, sightseeing, and climbing for exercising purposes or for sports. The local residents in the Lake Bosomtwe Basin are skillful craftsmen and craft women who craft a lot of traditional products and souvenirs. Other cultural heritage of the Lake Bosomtwe Basin are music and dance, architecture, traditional shrines, beliefs and practices, Ghanaian cuisine, and traditional village life. Given the wide-ranging tourism resources, the Lake Bosomtwe Basin is well positioned for an accelerated tourism development program. However, this will succeed only if the real negative environmental problems that are already emerging are addressed.

### **Effects of Tourism on the Lake Bosomtwe Basin**

Through secondary information, observation and interviews with key operatives, it was found out that the development of tourism in the Lake Bosomtwe Basin has created environmental awareness particularly among key industry players and also promoted initiatives at establishing or demarcating areas as protected zones. However, it was also found that far greater negative environmental consequences attended the development of tourism in the lake basin.

### ***Environmental Awareness***

The GTA together with the BDA and AEDA has educated and continue to educate tourism business operators and local communities in the lake basin on the need to protect the basin's fragile ecosystem. The education seems to be yielding results. When local residents were asked why there was the need to protect the natural environment, 41% said irresponsible and uncontrolled tourism development will sow the seeds for the industry's own destruction. For this reason there was the need to protect the natural environment. They added that tourism could kill tourism, destroying the very environmental attractions that visitors come to the lake basin to experience. A total of 48% indicated that nature protects itself and there was not much the human hand could do in that regard. The remaining 11% queried that it is the tourism businesses and the local governments (BDA and AEDA) who reap the benefits of the tourism trade in the lake basin and they should be answering the question and not the local residents. The respondents who indicated that tourism could be a source of its own destruction if its development is not controlled appreciated that environmental protection is urgent for tourism sustainability, and that the effort at protection should be a shared responsibility among all key stakeholders—tourism businesses, local population, municipal authorities, and visitors. The majority who said nature protects itself is indicative of the fact that environmental protection is not of concern to them and if it were, it should be the responsibility of other stakeholders and not local residents. This underscores the fact that the GTA and the municipal authorities need to intensify environmental education in resident communities in the lake basin. Without all stakeholders accepting responsibility for environmental protection, and without investment or expenditure on environmental protection and conservation the tourist attractions in the lake basin cannot be sustained.

### ***Protection and Maintenance of Environmental Assets***

Environmental assets of the Lake Bosomtwe Basin include the lake itself, vegetation, marine life, and other physical features such as mountains, caves, cemeteries, and shrines just to mention a few. The protection of these environmental assets enhances the attractiveness of the Lake Bosomtwe Basin as a tourist destination. On the other hand their destruction erodes the natural and aesthetic appeal of the basin and thereby debases it as an attraction. The assessment of tourism's impact on the environment of the Lake Bosomtwe Basin is done along the following areas for good reasons as explained in the methodology section.

### ***Impacts on Vegetation***

Although the number of tourist arrivals is not particularly high (about 60–100 overnight visitors per week averaged across the year, the basin is extremely over crowded during public holidays like Easter, Christmas, Independence Day, Republic Day, and May Day (Amuquandoh, 2009; Ghana Government, 1996). The overwhelming numbers of tourists during these festive occasions create problems of efficient monitoring of tourist activities by government officials, especially the BDA and the GTA. This has led to the creation of illegal roads by tourist vehicles in some environmentally sensitive areas such as shrines and cemeteries. The creation of illegal roads negatively affects vegetation and reduces the scenic beauty of the lake basin. A BDA employee said, “during the Christmas and Easter holidays in particular an average of 250 vehicles visit Abonu every day.” However, the figure might be higher if account is taken of supply trucks and official vehicles. The actual number might reach 270 vehicles per day. I personally counted 70 vehicles on December 26, 2014.

The concentration of camps and tents within a small radius points to the failure of municipal authorities and the GTA to establish a sound management plan for tourism development in which the radius between each facility is determined according to the ecological impacts of such facilities in the lake basin. The creation of many illegal roads and trails also indicates municipal authorities’ failure to implement the country’s rules and regulations in controlling traffic and numbers in environmentally sensitive and protected areas.

Mass visits to the Lake Bosomtwe Basin during holidays results in the trampling of vegetation. As one Abonu resident lamented, “during these occasions activities of visitors such as dancing, sitting, walking as well as camping and planting of heavy equipment have adverse consequences on the vegetation.” The impacts of the vegetation trampling could not be quantified. Only the visible signs like patchiness, dryness, and stunted growth could be picked as the damage to the vegetation. However, the damage could have been more than what met the eye. According to Hector (1996), recreational activities can have immediate, direct impact on the species composition of vegetation. This is especially true of ground layer vegetation and particularly as a result of trampling—almost invariably this involves a decrease in species variety (Hector, 1996).

The aforementioned adverse activities of tourist could have been significantly minimized if the upstream and downstream influences that leverage on other parts of the supply chain to encourage more environmentally responsible tourism were incorporated into the environmental impact calculus. For example, as in the case of the aforementioned destructive tourist activities, the travel agents, the GTA, and the lodging industry could have adopted the Ramada International Hotels and Resorts’ strategy of

distributing copies of “50 Simple Things You Can Do to Save the Earth” to guests as a method to encourage environmentally responsible behavior. When a respondent from GTA was asked whether his outfit had in place such environment protection tips in place he answered in the negative. Similar negative responses were tended by over 90% of the lodging industry operatives in the lake basin.

### **Noise Pollution**

Noise travel through air and is measured in ambient air quality level. Noise is measured in decibels. Experts argue that continuous noise levels in excess of 90 decibels can cause loss of hearing and irreversible changes in the nervous system. The World Health Organization (WHO) has fixed 45 decibels as safe noise level for a city (WHO, u.d., as cited by Institute for Environment and Sanitation, 2012).

In Ghana permissible ambient noise as set by the Environmental Protection Agency (EPA) for residential areas requires that during the day noise levels should not be above 55 decibels and 48 decibels at night (EPA, 2008). In the Lake Bosomtwe Basin noise pollution is caused by over 250 vehicles that travel to and from the gateway community of Abonu on holidays alone, with lesser numbers averaging 60 vehicles on other days. One hotelier said:

Noise pollution also arises from concert and music bands that are organized to grace such festive occasions in the lake basin. Noise also generates from the roaring of engine boats on the lake which are being used as commercial cruise boats which operate many trips a day. Together, these different sources of noise exceed probably six times the permissible noise level of 55 decibels during the day.

A respondent from the EPA said, “the cumulative noise produced from the different aforementioned sources on holidays exceeds more than three folds the ambient noise levels for residential areas of 55 decibels during the day.” The consequences of such excessive noise levels for the health of the people of the Lake Basin and wildlife should therefore be of concern. Local residents were therefore interviewed on what they thought the perceived or real impacts of noise on their health were. Respondents between the ages of 35 and 78 years (62%) reported that they probably have much reduced hearing abilities since they now have to turn on the volume on their radio or television sets to higher levels in order to hear and follow the program. A minority (13%) revealed that diseases such as hypertension, heart attack, and stroke as well as deafness, which were rare before the advent of tourism, are now beginning to emerge.

This means the excessive noise levels may be partly responsible for some health conditions in resident populations in the lake basin. Yet, a healthy destination community and the cultural heritage they embody constitute one of the core attractions for tourists. The resident population in conjunction

with other stakeholders also organizes, manages, and provides the tourist activities. So if they are in a poor state of health and their capabilities are reduced by disease, the sustainability of the tourism industry will be undermined.

A respondent from the EPA said that the “fast movement of engine boats creates waves which disturb nesting birds, mammals and reptiles in the lake.” He bemoaned this, saying, “I believe this is responsible for the dwindling crocodile population in the lake.” This evidence coincides with Roodt’s (1998) observation that crocodiles seek undisturbed areas, so it is likely that the dramatic reduction in the crocodile population in the Lake Bosomtwe Basin is due to excessive noise levels. According to Mathews (1982) and NRP (2001), noise pollution by motor boats and people can disturb waterfowl, leading to higher infantile death rates in sensitive populations. Another respondent confirmed that prior to the introduction of motorboats “water fowls built colonies in the shallow water close to the lake shoreline but that only few are now seen in the lake.” Respondent fishermen also believed that noise from engine boats disturbs fish at nesting sites.

Producing and distributing brochures about the problem of noise pollution and other menaces, and presenting workshops, durbars, and media programs about environmental stewardship will encourage environmentally responsible behavior in the lake basin. I personally perused the newsletters, brochures, and other tourist information of the GTA and hotels in the lake basin and there was little, if any, message to industry players about environmental protection and responsible behavior.

### ***Impacts on Water Resources***

Lake Bosomtwe is a completely enclosed meteorite impact crater which has no outflow for its water (Amuquandoh, 2009). Given the enclosed nature of the basin, it is susceptible to pollution by some of the tourism related activities, especially with the introduction of mechanical vessels on the lake. The advent of power-driven vessels has led to problems such as oil spillage and discharge of fuel, as well as littering by tourists throwing food packaging into the lake, which hitherto was not the case. (Amuquandoh, 2009, p. 224). The new generations of vessels that are presently plying the lake are significantly different from the traditional canoes used for fishing. Given that the water in the lake basin does not circulate and mix with other running water bodies, any pollutant entering it may not disperse or dilute, but will build up to the point of irreversibility (Amuquandoh, 2009).

The springing up of hotels, lodges, and camps in the lake basin each with its separate septic tanks and sewage collection receptacle respectively is likely to increase the potential for ground water pollution. Septic tanks for human waste have not been built in conformity to environmental design standards,

and in the adjoining local communities such tanks are unavailable except “pit latrines,” which have not been integrated with septic tanks in the tourist hotels. The lake basin is served by only two boreholes for use both by local communities and the tourist reception facilities like hotels, camps, and lodges. An overwhelming proportion of the interviewees (93.2%) lamented that one of the observed consequences of tourism development in the lake basin is the overload of waste water and sewage infrastructure especially during the peak holiday season. They said that this has led to the discharge of waste and raw sewage effluent into groundwater. This situation creates the potential for contamination of drinking water supply and the lake itself. A majority of the respondents (72%) agreed and intimated that there was discharge of effluent into groundwater with impunity.

According to an American tourist who was conducting research on the geology and soils of the lake basin, “the water table in the lake basin is high and the soils are sandy with high permeability” (Thane, 2015). Thus, “pollutants can seep down the soils to greater depths” (Thane, 2015). The water table in the lake basin is usually “about 1 to 3 meters below the surface during the raining season” (Thane, 2015). Consequently, discharge of effluent into groundwater is unavoidable. The tourist drew my attention to a colony of blue-green algae specifically in the shallow waters at the outer rim of the lake at Abonu, which he explained can be toxic under bloom conditions. This finding is consistent with research reports in the Okavango Delta in Botswana, which indicates that the potential for groundwater contamination with nitrate from septic tank drainage in areas where groundwater is close to the surface (10 m or less) is high (NRP, 2001). And that contamination by fecal bacteria and possibly pathogens could occur if septic tanks are situated in areas where groundwater is at 1 m or less beneath the surface (NRP, 2001).

In the Lake Bosomtwe Basin septic tanks of hotels and camps are located in areas where groundwater is closer to the surface, especially at the lower terrace closer to the sandy beaches on the rim of the crater. This implies groundwater contamination might be occurring at sites where the hotels and camps are built.

### ***Impacts on Sanitation***

The hitherto pristine environment of the Lake Bosomtwe Basin has been despoiled by the incessant littering, especially during the public holidays peak periods. Plastics bags, cans, and bottles as well as biodegradables such as leftover food, pieces of paper, and pet excreta are common sight along the roads, on the beaches, and on the outer rim of the lake. Garbage collection and sewage treatment and disposal are not carried out according to proper waste disposal protocols in tourist camps, hotels, and other visitor reception facilities as well as the adjoining local

communities. The rate at which the waste is generated especially during the holidays' peak outpaces the rate of collection and disposal. A Canadian tourist remarked, "the peak season is terrible with waste overload as authorities do not frequently remove the waste as they should." This has led to indiscriminate disposal of waste. Pollutants resulting from septic tanks of Paradise Hotel and Lake Point Hotel have been implicated by an EPA respondent for the growth of seaweeds (algae) in the shallow water close to the hotels. He said, "Sewage effluents are responsible for the growth of the algae." He added, "Since such growths spread out into the lake from the shoreline close to the hotels then they surely are the causal agents."

An Abonu resident lamented, "the waste generated from the hotels are improperly disposed by way of burying it underground (landfill) once collection delays or if the garbage is left unattended to for several weeks." He said "this practice results in foul smell hanging in the atmosphere which attracts flies." Ball and Taleb (2005) agreed when they argue that at landfill sites waste material breaks down and give off landfill gases, which often contribute to air pollution and adversely impacts on human health and the environment. The biodegrading process also causes the formation of leachate, which has the potential to pollute underground water (Ball & Taleb, 2005). It also causes problems to the surrounding communities in the form of odor, flies, litter, and noise (Shah & Wani, 2013).

### ***Impact of Agricultural Practices***

Agriculture has been identified as a great consumer of freshwater in the world and has been blamed for the diminution of surface and ground water resources and chemical leaching which greatly impact global water quality adversely (FAO, 2010). Aquaculture is implicated in eutrophication and ecosystem destruction.

### ***Impact of Farming Practices***

According to a majority of the respondents (84%), the Lake Bosomtwe Basin is home to 22 rural communities whose inhabitants are mainly employed in agriculture. They grow variety of crops including cassava, plantain, yam, and diverse vegetables, with cocoa as the main crop (Boamah & Koeberl, 2007). Areas close to the lake are used for farming purposes. The respondent farmers said there is now an intensive use of agrochemicals and fertilizers in the organic and inorganic categories. Some of these chemicals are supplied by the government agencies and NGOs to enhance the yield of cocoa and food crops. Likewise, the application of growth-enhancing chemicals and

pesticides (for example, Dichlorodiphenyltrichloroethane) on crops, particularly cocoa, has also been heightened (Gerken, Suglo, & Braun, 2000).

When asked why they use these chemical and fertilizers, the respondent farmers said the arable lands have become less and less fertile because of over cropping and the bringing of many virgin lands under the hoe and plough. When asked to suggest measures to tackle the identified problems one farmer from Adwafo said, "We are poor people and there is not much we can do but to venture further into the distant forest to open up new farms or get subsidized chemical fertilizers for our existing farmlands." Another farmer agreed, saying, "The emerging tourism industry has increased demand for agricultural produce particularly vegetables and fruits and we need to meet this demand by expanding our acreage and applying more fertilizers." Respondents were then asked to state the impact of the agrochemicals and the shifting cultivation practice on the land and the lake. In terms of the impact on the land, the majority (63%) of the respondents said they enabled them to get better farm yields, while 12% intimated they permitted the same piece of land to be cropped for several years without diminishing the yield. The remaining 25% could not identify any impacts on the land. Mostly, locals of the various communities surrounding the lake rely on farming than on fishing (Prakash et al., 2005). Over the years, land cover around the lake, which used to be mainly closed forest, has been converted into agricultural lands and open forest. This has permitted the extensive and seemingly irreversible exploitation of land resources through tilling, overgrazing, and tree felling. The consequent deforestation has contributed to the deterioration of the ecology around the lake.

This evidence corroborates Safe Drinking Water Foundation's (SDWF, 2011) point that, farming has resulted in significant modification of landscapes throughout the world. Practices like tilling of land alter the infiltration and runoff features of the land surface, which affect the way water and sediment move to surface-water bodies, and evapo-transpiration (SDWF, 2011). One consequence of this is increased soil erosion due to the bad farming techniques, which amounts to more nutrient runoff and leaching. Agriculture practices are the leading cause of sediment pollution because bare lands are susceptible to large amounts of erosion (SDWF, 2011).

In regard to the effects of the agrochemicals on the lake, a considerable number of them (59%) thought that the color, taste, and odor of the lake have changed. They said the color from a distance used to be blue but that this has changed to somewhat brown. In close proximity, they said, one discovers some oily rainbow coloration on the surface of the lake water. They also revealed that the odor of the lake has changed from mild sulfurous to strong sulfurous. They attributed these changes to the discharge of agrochemicals and other substances into the lake.

A majority of the respondents (65%) also believed that diseased and dead fishes that are sometimes washed ashore and also included in catches are to be blamed on the agrochemicals. Some interviewees (39%) also suspected that the leaching of the agrochemicals through runoff into the lake is responsible for the growth of lake weeds. The weeds, they lamented, have expanded over longer stretches and is becoming a nuisance to boating, cruising, fishing, and swimming in some parts of the lake.

These findings seem plausible because Reddington (2009) posited that when excess nutrients from fertilizer use runs off into waterways, they cause algae blooms sometimes big enough to make waterways impassible. He added that, when the algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic species cannot survive in these so-called dead zones and so they die or move to greener underwater pastures (Reddington, 2009).

In terms of the effects of shifting cultivation and other bad farming practices, a majority of the informants (61%) believed that these activities have led to loosened soils from the over cropped forest clad hills enclosing the lake to be eroded and transported as sediments into the lake. As a result, they added, the shoreline is expanding into the lake thereby subtly shrinking its size. This evidence seems to tie in with the observation of Shah (2012) that, sediments deposition in the Dal Lake in Srinager in India has shrunk it from its original 22<sup>2</sup> km to 18<sup>2</sup> km, while also deteriorating its water quality.

It has been estimated that the use of agrochemicals is expected to rise as more cocoa planting is becoming dominant in the area. According to a majority of respondents (79%), the farmers apply the chemicals by the use of Knapsack sprayers and the washing of the sprayers is done in the lake. The use of chemicals is harmful to both the farmers and nearby surface and ground water.

Minority of the respondents (18%) apply organic manure like cow dung. They intimated that they use organic fertilizer such as cow dung because it is cheaper and environmentally friendly than agrochemicals. Nevertheless, manure contains a high level of pathogens (disease-causing microorganisms). When the waste is applied to fields, those pathogens can be transferred to local water supplies like the lake during a run-off from either irrigation or rainfall. The impact of pathogens from manure is severe: according to the U.S. Centers for Disease Control, in every waterborne disease outbreak in the United States from 1986 to 1998 where the pathogen could be identified, it most likely originated in livestock (Grace Communications Foundation, 2015).

### ***Impact of Grazing Practices***

Also around the lake basin is a large population of livestock such as cows, goats, and sheep in the various communities. A significantly high

number of the keepers extensively graze their animals within the Bosomtwe Basin. These animals graze and drink from the lake defecating along its banks. It is therefore most probable that large portions of the dung (made up of phosphorus and nitrogen) gathers close to the shore and are finally drained into the lake when it rains. The impact of these livestock activities on the lake is substantial because of their numbers. As mentioned earlier, other farmers use the dung as organic manure. Livestock manure is high in ammonia concentrations, and dissolved ammonia in water is not only highly toxic to fish, but can also be converted to dangerous nitrates (Grace Communications Foundation, 2015). This may explain why dead fish are usually found on the shoreline along which cattle drink from Lake Bosomtwe. Elevated nitrate levels in drinking water are highly poisonous to humans, causing potentially fatal oxygen levels in babies (known as “blue-baby syndrome”), spontaneous abortions, and possibly cancer (Grace Communications Foundation, 2015).

### ***Fishing Practices***

The communities around the lake also engage in fishing to meet the growing demand of the tourism industry. Respondent fishermen were then asked to indicate the methods they use in fishing. Majority of the fishermen (68%) said they used to engage in canoe fishing (practice of navigating deep into distant waters with canoes and using casting out nets to catch the fishes). However, they lamented that canoe fishing currently has low yield prompting the recourse to heavy nets to sweep the lake floor. They also acknowledged that they engage in aquaculture by fencing off portions of the lake to introduce new varieties of fish and feeding them with artificially prepared fish feeds. The introduction of new fish species not only reconfigures the natural fishes composition of the lake, but it also results in the extinction of some of the original natural species that constitute the unique attractions of the lake. This situation is worsened by the effects of bad farming practices like wanton use of agrochemicals that wash into the lake and kill some fish species (Boamah & Koeberl, 2007). One fisherman affirmed this supposition when he said, “The fish species have been dwindling at an increasing rate over the years and that is why we have virtually only the small tilapia specie today in the lake.” Another respondent agreed, intimating that, “even these small fishes of the tilapia category do not taste as they used to and I am worried visitors may not continue to prime it over other species elsewhere in the country.” This evidence raises the fear that the varieties of fish population will continue to dwindle to extinction unless measures are taken to reverse the situation.

### ***Visitor and Resident Activities***

The dangers of human activities on the quantity and quality of water resources are experienced over a wide territorial expanse and over time (USGS, 2010). The population within the lake basin and its immediate environs has witnessed a temporal and permanent upsurge. The temporal rise is caused by the congregation of visitors, particularly on public holidays, in the lake basin. The permanent increases are caused by increased birth rates and immigration from other parts of the Ashanti Region (where the Lake Bosomtwe Basin is located). There has been increasing human (visitors and residents) activities along the lakeshore and in areas in close proximity to it over the years which in many diverse ways have impacted negatively on the lake environment. Activities such as clothes and car washing with detergents in the lake and also on the shores of the lake have been occurring over the years. The washing activities have resulted in the discharge of wastewater into the lake. Some inhabitants and fishermen also bathe and wash their fishing nets with soap in the lake. Research has shown that detergents can have poisonous effects on all types of aquatic life when they are present in sufficient quantities. Most fish will die when detergent concentrations increase (Anim et al., 2013). This claim is supported by 68% of the respondents who argued that human activities like washing and bathing with soap are a daily occurrence, and for this reason fish is scarcer to find from a certain radius from the shoreline into far reaches of the lake.

### ***Mining and Exploration***

According to some resident respondents (58%), the increasing exposure of the lake basin as a tourist attraction has brought tourists who later discovered the destination's mineral potential. They subsequently came back either alone or in association with others to prospect for minerals, especially gold. A Pipie respondent said the "illegal miners and prospectors have heavy equipments with which they scour out large areas of vegetative cover and dig out pits, tunnels and trenches." He added, "There is now growing concern about the illegal mining and prospecting activities around the lake basin." This was confirmed by Stolzenbach (2006), when he revealed that the Lake Bosomtwe Basin is located within the gold layer of the Ashanti region where several private enterprises are undergoing various explorations and mining activities. Mining activities normally require huge removal of soil and rock to access the valued ore. This generates huge quantities of waste that is often made up of heavy metals (such as metals arsenic, cobalt, copper, zinc, and lead) and acid-generating minerals that are highly toxic to humans and wildlife and also dangerous to aquatic life in the lake water (Anim et al., 2013).

## Effectiveness of Existing Mechanisms in Mitigating Environmental Impact

The overarching policy and regulatory framework for sustainable tourism development in Ghana is the National Tourism Policy of 2006. The policy is guided by the principles of Ghana Growth and Poverty Reduction Strategy (2000–2009), the New Partnership for Africa's Development and the Revised Treaty of the Economic Community of West African States. It is formulated around eleven themes, each with stated objectives and set of strategies (Ghana Government, 2012). One of the themes mandates the effective management and conservation of cultural, environmental and historical resources of Ghana, balancing economic utilization with sensitivity, preservation, and conservation (Government of Ghana, 2012). The policy also spells out the roles of different stakeholders in the sustainable development of tourism. One principal stakeholder identified in the document is the government. It is assigned the responsibility for facilitating, coordinating, planning, and policy-making, regulating and monitoring tourism development. The role of the private sector, traditional rulers, civil society organizations, especially environmental and community-based organizations, in developing and spreading responsible tourism practices and engendering sustainable development of tourism has been identified (Government of Ghana, 2012).

Nevertheless, there is a gap between policy and practice across the tourist destinations in Ghana. The 1996–2010 Tourism Development Plan Report warned that potential tourism areas, including Lake Bosomtwe Basin and the Volta Estuary, are particularly environmentally fragile and required careful integrated planning before development could take place (Government of Ghana, 2012). Despite this warning the development of tourism infrastructure like hotels is taking place haphazardly close to the lake waterfront, with poor siting and design of the facilities. The EPA is responsible for implementing environmental policy. It is also charged with applying the legal processes in a fair and equitable manner to ensure responsible environmental behavior (EPA, 2011). The Environmental Assessment Regulations, L.I. 1652 was enacted in 1999 and provides the legal cover for Environmental Impact Assessment (EIA). Yet tourism development in the Lake Bosomtwe Basin has proceeded without such EIAs and in most cases without recourse to an integrated development plan. The local governments—BDA and AEDA—under whose jurisdictions the lake lie have not developed such a plan due largely to the lack of the expertise to do so. For these reasons, tourism development is occurring with its attendant negative environmental impacts like poor sanitation, depletion of natural resources, and carrying capacity overload particularly in peak periods such as public holidays.

Since EIA in the Lake Bosomtwe Basin is low or virtually nonexistent, efforts should be made by the EPA to implement it with the support of the GTA, Town and Country Planning Department, and local governments. The GTA can support by either suspending or withdrawing or refusing to issue operating licenses to those hoteliers and other developers who fail to comply with EPA's environmental protocols. Local governments can assist by declining building permits to prospective developers until all development planning requirements have been satisfied and architectural and design specifications have been complied with. The Town and Country Planning Department should help local governments with the expertise to design the integrated tourism development plans since that arrangements is not yet in place.

Sanitation and waste management, as the evidence reveals, is a problem in the Lake Bosomtwe Basin. These require infrastructure such as landfills, treatment centers and sewage systems, which are lacking in the lake basin. Accordingly, illegal and indiscriminate dumping of waste is a regular practice. A major constrain in properly managing and discharging waste, as respondents from the local authorities revealed, is difficulty in the acquisition of land to construct landfills and treatment centers. Traditional rulers control land and they are often unwilling to allow landfills plants in their area. If local authorities are to effectively manage waste in the lake basin then traditional rulers there should willingly release land for landfill and treatment plants. Central government can assist, if need be, in compulsorily acquiring the land since it is for a greater good.

## Discussion

The study found that a reasonable proportion of respondents (48%) believed that nature has a mechanism for protecting itself and that with little conservation effort from human beings the ecology of the lake basin could be protected for posterity. Those who believed that the environmental destruction agents are humans and that all the preventive and conservative measures should be undertaken by them, made up 41%. This second category of respondents was mostly employees of government departments. They believed that environmental protection of the lake basin should be a shared responsibility between all stakeholders—local residents, hoteliers, municipal authorities, and GTB just to mention a few. The remaining 11% queried that the tourism stakeholders in the basin are divided into winners and losers with the gainers reaping the profits whilst the losers bear the costs of the tourism trade. They insisted that the gainers not the losers should bear the costs of environmental protection. This evidence indicates that different stakeholders of the tourism industry have different levels of environmental responsiveness—while some take responsibility for the ecological degradation and appreciate the need to do something about it, others shirk responsibility and are indifferent toward conservation

initiatives. The findings also point to the fact that there is a mismatch between knowledge and practice of ecologically sustainable tourism development. This undermines efforts at protecting the fragile lake basin environment.

The study found that tourism development in the Lake Bosomtwe basin has led to traffic congestion and its attendant fatal accidents. This finding is in line with the observation of Page (1999) that great concern has been expressed about traffic density on roads and its attendant adverse consequences on human health in tourism destinations. The police at Kuntanse (district capital of Bosomtwe District) put the mean fatal accidents on the Kuntanse-Abonu road (road connecting the district capital to the lake basin) during Christmas and Easter picnic at Abonu at two.

Primary and secondary information confirmed that tourism development has led to noise pollution of the lake basin. The noise level in the lake basin was found to be more than 3 times the EPA's permissible ambient noise level for residential areas of 55 decibels during the day. This had implications for the health and survival of residents and animal lives in the lake basin. Residents complained about the emergence of diseases like hypertension, stroke, hearing impairment, and restlessness, among others, which they attributed to the excessive noise levels. The linking of the health and survival problems with the excessive noise levels has basis because Stansfeld and Crombie (2011) and Kempen et al. (2006) claim that there is a possible association between environmental noise exposure and hypertension. Exposure to acute noise influences the body's compensatory mechanics to stress (Maschke, Rapp, & Hecht, 2000; Babisch, 2002), causes the arteries to constrict, increases blood pressure (Berglund, Lindvall, & Schwela, 2000), and may contribute to heart attack. Noise is also known to cause learning disabilities (Moszynski, 2011) as well as deafness. The evidence that noise from engine boats and other tourist activities have implications for the reproductive health and survival and development of marine life is supported by Roodt's (1998) observation that crocodiles seek undisturbed areas. So it is very likely that the dramatic reduction in the crocodile population in the Lake Bosomtwe Basin may be due to excessive noise levels. According to Mathews (1982) and NRP (2001), noise pollution by motor boats and people can disturb waterfowl, leading to higher infantile death rates in sensitive populations.

The finding that water fowl population has declined considerably and fish nesting sites have been disturbed is consistent with Gall's (1995) point that in the Okavango Panhandle in Botswana waterfowls are not only disturbed by the wakes and noise from motor boats but also the frequency of other more general boating and tourism related activities.

The study has revealed that tourism development in the lake basin has led to the pollution of the lake. This evidence ties in with the popular view that Lake Bosomtwe is one of the water bodies that are reservoirs of natural

pollutants (Amuquandoh, 2009). This is strengthened by the fact that the lake has been associated with intermittent dull detonations and sulfurous odors (Jones, Bacon, & Hastings, 1981).

The evidence suggests that the sanitation problem in the lake basin is of great concern and may lead to the degradation of that environment. The ecological damage caused by the discharge of effluents into the lake is disturbing because Henry (1988) states that in Jamaica sewage effluent has encouraged the growth of seaweeds that have damaged the attractiveness of beaches and have killed the coral reefs which protect the shoreline from erosion. Similarly, Becheri (1991) blames the accelerated eutrophication (nutrient enrichment) for the algae blooms on the Italian bathing resorts of Rimmi on the Adriatic coast. This means if the sanitation problems of the Lake Bosomtwe Basin is not addressed it will undermine the sustainability of the basin as a tourist destination through the destruction of its attractiveness.

The study has shown that human activities such as farming, fishing, grazing, and mining have brought about a negative relationship between resource utilization and environmental cost. For example, bad agricultural practices are the leading cause of sedimentation and pollution of the lake because bare lands are susceptible to large amounts of erosion (SDWF, 2011). Moreover, chemical agents such as cyanide used by the miners to process ore spill and leach from the mine sites into the lake and this can be harmful to human and marine life. Furthermore, phosphates in detergents used in washing cars and fishing equipment bring about freshwater algae blooms which introduce toxins and remove oxygen in waterways (Anim et al., 2013). The algae consume the oxygen available for aquatic life when they decompose.

The study also revealed that the omission from the calculus of the influences that segments of the tourism supply chain have on one another to encourage more environmentally responsible tourism development is partly to blame for the negative environmental consequences attendant in the lake basin.

## **Recommendations**

The study has revealed a range of negative environmental consequences along with minimum benefits attendant on tourism development in the Lake Bosomtwe Basin. The benefits are evident in the environmental awareness that has been created among stakeholders to relate to the basin's resources in an environmentally friendly manner. The negative effects include the destruction of the vegetation, water resources, insanitary conditions, noise pollution, and soil pollution as well as destruction of marine life.

To tackle the negative environmental consequences a range of options are offered here. First, the local authorities (BDA and AEDA) in whose jurisdictions the basin is found should develop policies for the conservation of the Lake Bosomtwe tourism resources. This can be done through outlawing water pollution

and sedimentation practices, which are the major problems. This should be followed by an aggressive effort to preserve the lake basin's environmental quality and promote it as an attractive tourist destination. This should be a shared responsibility between all the stakeholders: resident population, civil society organizations, green organizations, local governments, traditional authorities, hoteliers, and tourists just to mention a few. A proper waste management system should be established involving the provision of refuse receptacles at vantage points within the periphery of the lake and regular collection protocols should be instituted. This is important because if the garbage is not emptied at regular intervals it will be washed into the lake by the rains. Also, community facilities like showers and toilets that are connected to a good wastewater system needs to be supplied.

Whelan (1991) insisted that well-structured education of people about the environment is instrumental in the conservation of ecotourism resources. This is especially relevant for the local residents and some hoteliers and tourists because they downplay the negative environmental impact the basin is currently suffering. It would be appropriate to educate them to take the possible tourism related environmental challenges seriously and undertake preventive measures against the environmental problems. In particular, informing local inhabitants about the adverse consequences of the use of detergents and soaps in the lake, as well as providing less harmful alternative cleansers, is critical to achieving sustainable use of the lake. Also, farmers should be educated not to water their animals in the lake because they defecate into it or on the shoreline. This will minimize the amount of nutrients that is eventually carried into the lake as runoff. Nutrient-capturing plants can be grown along the lakeshore wherever possible to act as a natural obstacle preventing the influx of nutrients into the lake. All of these measures would ensure that tourism development would not cause irreversible changes to the basin's ecosystem. Edington and Edington (1986, p. 2) argued that a proper understanding of biological or, more specifically ecological factors can significantly reduce the scale of environmental damage associated with recreational and tourist development.

Integrating income generation into conservation activities promises to be one of the effective ways of ensuring environmental sustainable tourism development in the lake basin. Local inhabitants should be encouraged to integrate income generation and nature conservation through education. For example, in the case of farmers this can be done by educating them to move away from shifting cultivation to crop rotation where the same parcel of land is cropped over many years without losing its fertility. This will save the vast virgin forest of the basin which is increasingly being brought under the plough and whose vegetative cover is progressively being destroyed through the slash and burn practice in shifting cultivation. Strestha (1999) argued that integrating environmental conservation into income generating activities in a tourist destination is critical to effectively translating environmental plans into reality as economic development controls environmental conservation.

Eco-zoning of the lake shoreline is another sure way of protecting the lake basin from environmentally negative activities. Anim et al. (2013) claimed that nonpoint sources of pollution like agricultural land runoff is known to have greater effect than point sources of pollution such as washing areas, sewage disposal into Lake Bosomtwe. Viewed as a conservation method, eco-zoning involves the creation of a wide buffer zone around the lake, within which perimeter intensive commercial farming, mineral exploration, and mining activity would be prohibited and controlled. An afforestation technique can then be employed within this zone to green the already depleted land. This will be well embraced by the resident communities of the basin because they consider tourism as an appropriate strategy for addressing most of their needs including the planting of *Triplochiton soleroxylon* (*wawa*) which is 'needed for the construction of canoes for fishing on the lake as well as saving the lake from drying up' (Amuquandoh, 2009, p. 236). By Integrating planning with management practices to restructure the shoreline zone it will provide a well balanced means of lake restoration to accommodate various uses of the lake on a sustainable basis (Epler, 2002).

In order to mitigate the negative environmental impact on the Lake Bosomtwe Basin, several environmental policies and management practices related to air and water pollution should be introduced to control pollutant pathways into and within the lake basin. Controlling pollutant loads from sewage and other point sources, particularly in the communities located close to the lake should be a prime intervention by the local authorities for restoring the lake. A comprehensive land use plan including structural and nonstructural best management practices should be developed by the local authorities and stakeholders to reduce the pollutant loads from nonpoint sources. Making the local people share the gains and welfare engendered by tourism development is a realistic, fair, and durable way to exacting environmental sustainability in the lake basin. Residents will always be ready to protect their own economic interest when they see themselves as shareholders in the tourism industry. This will help to also change local attitudes towards living on consumption resources that adversely affect ecotourism development. Moreover, noise pollution can be significantly reduced if the EPA's permissible ambient noise level for residential areas of 55 decibels during the day is enforced effectively by both the local authorities and the EPA. Those who disobey should be severely sanctioned to serve as a deterrent to others.

Finally, encouraging tourism service providers such as hotels and travel agents to influence other parts of the supply chain to adopt more environmentally responsible tourism practices will be a step in the right direction. Also, addressing the mismatch between knowledge and practice of ecologically sustainable tourism development will facilitate efforts toward the conservation of tourism environmental assets in the lake basin. This article concludes that unless these minutiae are taken into consideration, achieving sustainable tourism development in the Lake Bosomtwe Basin will be quite formidable.

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