Journal of Environment and Earth Science
ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online)
Vol.5, No.4, 2015

Assessing the Impact of a Dam on the Livelihood of Surrounding Communities: A Case Study of Vea Dam in the Upper East Region of Ghana

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Abstract
River basins are well known as the origin of advanced human social development and cultural heritage which ancient and modern communities have depended on for livelihood, commerce and habitat. Dam is one of the many man-made alterations to river basins that have been built for centuries and without doubt have contributed to the development of many nations. However, their social, health and environmental impacts have in too many cases not been assessed most often in developing countries. This research sought to explore and understand the Vea Dam within the context of socio-economic and health impacts on the host communities. Secondary data were collected from Irrigation Company of Upper Region and Bongo District Assembly in Ghana whilst primary data were obtained through random and stratified sampling. The results revealed that 2.6% and 66% of the respondents are employed in the fishery sector and irrigation sector, respectively. The dam necessitated the relocation of about 34% of the communities and on the average two people are drown annually in the Dam. The prevalence of water borne diseases after the construction of the Dam was also perceived by the communities to have increased. The Dam has both positive and negative socio-economic and health impacts on the surrounding communities with the benefits outweighing the negative impacts. The availability of potable drinking water in the area has created development with inevitable rise in standard of living. The study also revealed that agricultural activities, freshwater fishery and availability of water for irrigation of farmlands have improved. However, an enhancement in the beneficial impacts and minimization of the adverse impacts would help better livelihood in the communities.
Keywords: Bongo District, Impacts of a dam, Livelihood, Socio-economic, Vea Dam

1. Introduction

River basins are well known as the provenances of civilization and cultural heritage, which ancient and modern communities have depended on for livelihood, commerce and habitat (Etiosa, 2005). The river continuum however is profoundly affected when subjected to alteration, which may be natural or human generated. One of the many man-made alterations is the construction of dams. Dams are barriers constructed across a stream or river to harness water for human purposes, and have one of the most important roles in utilising water resources. The economic benefits of dams have been assumed to outweigh the costs, thus providing rationale for construction of dams around the world (Lebel et al., 2005). Dams have been promoted as an important means of meeting perceived needs for water and energy and as long-term, strategic investments, which have many additional benefits. Some of these additional benefits are typical of all large public infrastructure projects, while others are unique to dams and specific to particular projects (ICOLD, 2000). Regional development, job creation, and fostering of an industry base with export capability are most often cited as additional considerations for building large dams (WCD, 2000). However, the development of these structures can be accompanied by negative biophysical, socio-economic, and geopolitical impacts; often through the loss of ecosystem services provided by fully functioning aquatic systems. Moreover, impacts of dams can be involuntarily imposed on marginalized people whose livelihoods are dependent on riverine resources; while dams can contribute to economic growth, the services they provide may come at a cost (Skinner et al., 2009). Globally, the last century witnessed a dramatic increase in the construction of large dams. By 1949, about 5,000 large dams had been built worldwide, three-quarters of them in industrialized countries (ICOLD, 1998). At the end of the 20th century over 45,000 large dams had been built in over 140 countries of the world (ICOLD, 1998). The belief that large dams, by increasing irrigation and hydroelectricity production, can cause development and reduce poverty has led developing countries and international agencies such as the World Bank to undertake major investments in dam construction. By the year 2000, dams generated 19 percent of the world's electricity supply and irrigated over 30 percent of the 271 million hectares irrigated worldwide, however these dams also displaced over 40 million people, altered cropping patterns, and significantly increased salination and water logging of arable land (WCD, 2000).

The construction of dams have often transformed surrounding communities positively and also led to

the complex and difficult displacement and relocation of populations, often affecting thousands of people: 80,000 people in the case of Ghana's Lake Volta created by the Akosombo dam; 75,000 people with the Kossou dam in Ivory Coast (Skinner et al., 2009).

In Ghana the largest and second largest dams (thus Akosombo and Bui dams, respectively) were constructed for the purpose of hydroelectricity, even though they have secondary and tertiary uses such as irrigation, fish production, recreation and water supply. Another hydroelectric power dam is the Kpong dam. Tono and Vea dams are the only major dams in the Upper East Region but built for agricultural purposes with the Tono dam being the largest which are managed by the Irrigation Company of Upper Region (ICOUR).

The construction of the Vea dam started in 1965 and completed in 1980. The dam covers a potential area of 1197 hectares and fed by the Yarigatanga River (ICOUR, 1995). The dam was originally constructed to serve 468 hectares of irrigated area (ICOUR, 1995) and it is particularly helpful in dry season farming of tomatoes, onions, pepper and rice among others. Fishing and fish rearing is also carried out in and around the dam but on a small scale. The dam is also a source of drinking water for the Bolgatanga Township and its environs as well as a source of drinking water for livestock of the surrounding communities (ICOUR, 1995).

The objective of this study was to assess the socio-economic and health impacts of the Vea dam on the livelihood of the surrounding host communities. Specifically the study sought to look at the contribution of the dam to improvement in agriculture, provision of employment and social amenities and outbreak of diseases among others.

2. Study Area

The Vea dam is located in the Bongo District (Figure 1) which has a land mass of 459.5 km^2 and lies between latitudes 10^o 48' and 10^o 56' North and 0^{o}44` and 0$^o$ 56` West. It shares boundaries to the North with Burkina Faso, Kassena-Nankana District to the West, Nabdam to the East and Bolgatanga Municipality to the South. The closest communities surrounding the dam are Balungu to the north, Zaare to the south and Vea and Gowrie to the west and east respectively. The dam project is multi-purpose such that it involves crop production, fish production, livestock production as well as domestic water supply. The catchment communities are Vea, Gowrie, Bongo Nyariga, Bolga Nyariga, Dindubisi, Zaare, Balungu, Yikine and Sumbrungu (Figure 2). However, people from outside these catchment communities have access to the irrigation facilities as well as harvesting of fish (ICOUR, 1995).

The vegetation of the study area is classified as a Guinea Savannah Woodland type. It consists of short deciduous trees often widely spaced and a ground flora composed of different species of shrubs of varying heights with two air masses: North-East Trade Winds and Tropical Maritime. The area experiences an average minimum and maximum rainfall ranging between 600mm and 1400mm, respectively and a Maximum and Minimum temperatures of 40ºC and 12ºC respectively (BONDA, 2014).

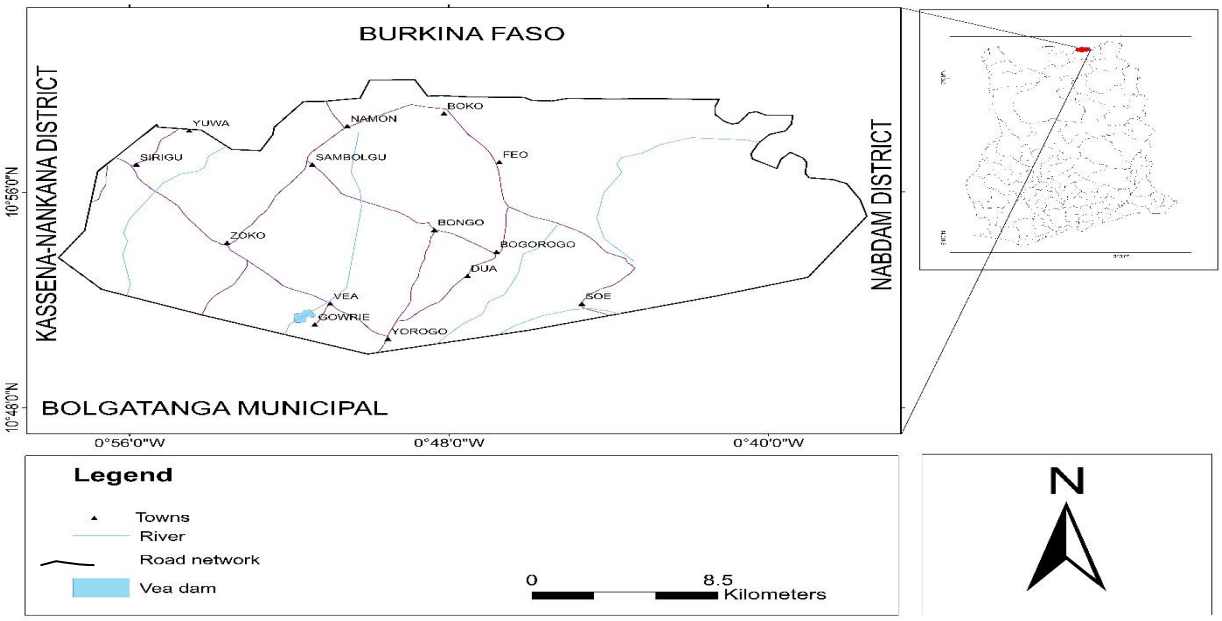

Figure 1. Map of Ghana and Bongo District showing the location of the study area.

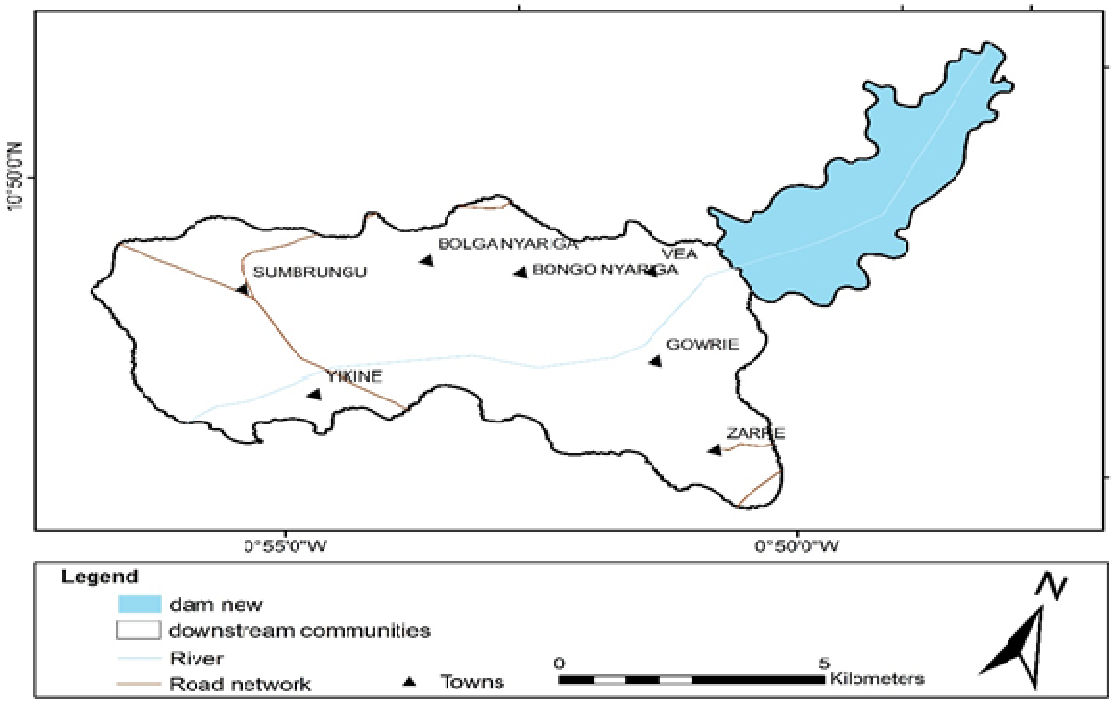

Figure 2. Map of Vea Irrigation site showing the location of the downstream communities.

3. Methodology

Questionnaire administration was mainly employed for this study to investigate how the construction of the Vea reservoir has contributed to employment, agriculture, income of fishermen, irrigation farmers and fishmongers, diseases, accidental deaths and displacement of indigenous people.

Using the statistical formula for sample size determination by Puopiel (2010), with a 92% confidence interval 150 respondents were selected for the study. A proportionate stratified sampling was then employed to select samples from three communities closest to the Dam; Vea, Gowrie and Nyarega (see Figure 2 for the location of the communities). Respondents were then selected randomly from each stratum. Using the proportionate stratified sampling (Freund and Wilson, 1993), the sample sizes obtained were 84, 38 and 28 for Vea, Gowrie and Nyarega, respectively.

The study employed both quantitative and qualitative methods for data collection. This approach was similar to the view of Flyvbjerg (2004) that, more often than not, a combination of qualitative and quantitative methods will do the task best. A distinctive characteristic of case study research is the use of multiple data sources, a strategy which also enhances data credibility (Yin, 2003). Interviews, observation, surveys and key informants were sources of data and tools used for data collection. The study utilized these tools in order to gain insights into impacts of the dam on the daily lives of the people. Secondary data on the impacts of the Vea dam were obtained from Irrigation Company of Upper Region (ICOUR), Ministry of Food and Agriculture (MOFA) and Bongo District Assembly (BONDA). The research employed both descriptive and inferential statistics in analyzing both the secondary and primary data using Statistical Package for Social Sciences (SPSS) software and Microsoft Excel.

4.0 Results and Discussions

4.1 Impacts of Vea Dam on Social and Economic status of surrounding communities

The construction of the Vea Dam has impacted on the host communities positively and negatively both on their social lives and economic status. It has provided employment in the form of fishing and fish farming and irrigation. Fishing is mainly an ancillary job in the communities especially in the dry season, usually from October to May when farmers have nothing productive to do besides irrigation farming but only wait for the rains to start. The study revealed that 2.6% and 66% of the people in the study area were employed in the fishery and irrigation sectors, respectively.

Most of the people around the dam (98.7%) asserted that the single rain-fed farming season did not yield adequate harvest to cater for the average household size of five individuals throughout the year. But unlike most communities in the Bongo district where dry season is characterised by intense drought and non-agricultural activities leading to migration of residents to southern Ghana in search for greener pastures and seasonal jobs while they await the rainy season, residents of Vea, Gowrie and Nyarega are different; farmers do not only

engage in irrigation for subsistence but for income earning as well. When the residents' opinions were gathered concerning agriculture, almost all of them (99.32%) thought the construction of the dam has improved agriculture. Since most of them are engaged in dry season farming as a result of irrigation. Some of the people (92%) also stated that ICOUR and MOFA personnel have improve their knowledge in irrigation farming techniques and agriculture in general. This agrees with the World Bank (1996) finding that, dams providing water for irrigation also produce, in general, substantial benefits stemming from linkages between irrigation and other sectors of production. Most of the residents in the communities think the dam has induced certain developments in the area. About 42.37% and 23.73% feel the dam has induced the construction of roads and electricity, respectively whilst the other 33.90% believe the dam has brought related infrastructural development such as shops, stores and markets as shown in Figure 3.

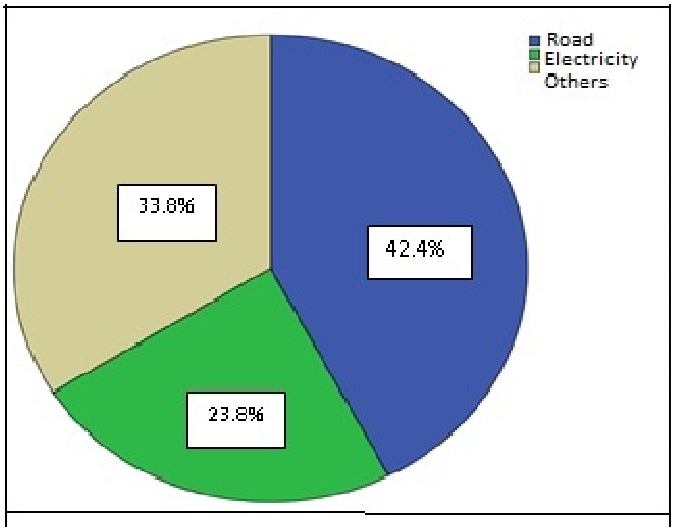

Figure 3 Dam induced Development

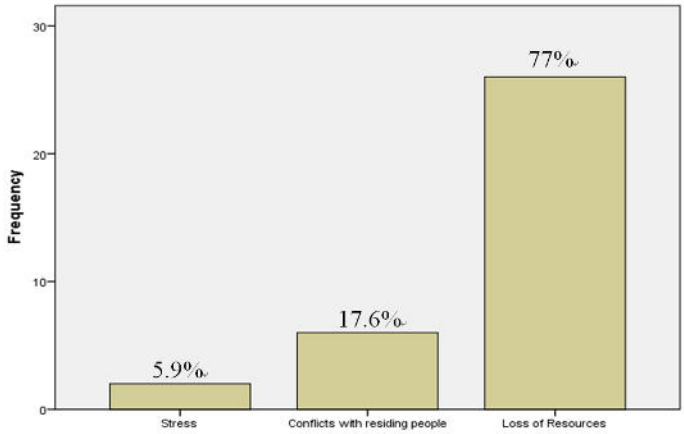

Figure 4. Problems encountered due to resettlement

On the other hand, 34% of the people in the study area asserted that they were displaced by the dam project, however, 80% of the displaced people were compensated: a compensation the people considered very small or insignificant. Of the problems associated with relocation, Figure 4 indicates that, 77% of the displaced people asserted that loss of resources such as farmlands, economic trees, homes, graves of deceased family members among others were their top-most problem, followed by conflicts with people at where they went to reside i.e. conflicts over farmland ownership (17.1%) and stress of being displaced (5.9%). From the members of the communities, drowning sometimes occur up to four cases per year, but on the average two people drown (totalling about 98 deaths since the construction of the dam in 1965). ICOUR and MOFA personnel attribute this incidence to high recreational use of the Dam as a swimming facility with no regulation or protection of any form.

4.2 Impacts of Vea Dam on Health and Water supply of surrounding communities

Table 1 indicates that only 6% of the people use KVIP/Pit latrine in their homes, 12.7% use public KVIP toilets, 2.6% use private water closet and an alarming 78.7% practice open defecation as compared to the national average of 19% (WHO/UNICEF JMP, 2014). The practice of open defecation contributes to incidence of

diseases since runoff from the surrounding may wash some of the faecal matter back into the dam, hence introducing pathogens into the water body, therefore any human contact or ingestion of the water might result in water-borne diseases such as: typhoid, diarrhoea, dysentery, cholera, hepatitis A, poliomyelitis, viral gastroenteritis, amoebic dysentery, giardia (lambliasis), balantidiasis, helminthiasis and trichinas.

Table 1. Usage of toilet facilities available in the communities

Options	Frequency	Percentage
Private KVIP/Pit Latrine	9	6.0%
Public KVIP	19	12.7%
Private Water Closet Toilet	4	2.6%
Open Defecation	118	78.7%
TOTAL	150	100%

Increases in the prevalence of schistosomiasis, malaria, encephalitis, hemorrhagic fevers, gastroenteritis, intestinal parasites, and filariasis (including onchocerciasis and bancroftosis) have been documented after dam and irrigation projects (Webbe, 1981; WHO, 1985; Ofoezie, 2002). Large dams also influence the health of animals through increases in diseases such as river fluke in cattle and changes in the distribution of trypanosomiasis (Stanley and Alpers, 1975). Most of the communities members (89.3%) asserted that they have contracted water related disease, which they attributed to the construction of the dam especially the Vector-borne diseases. Malaria (71.3%), dominate all the diseases which they claimed to have afflicted them after the construction of the dam, followed by Bilharziasis (16.7%), Cholera (10.0%) and River Blindness trailing at 2.0% as shown in Figure 5. The study also revealed that every household member has ever being infected with a dam related disease, with malaria being the prominent. Malaria used to affect them but they claimed it is on ascendancy after the construction of the dam.

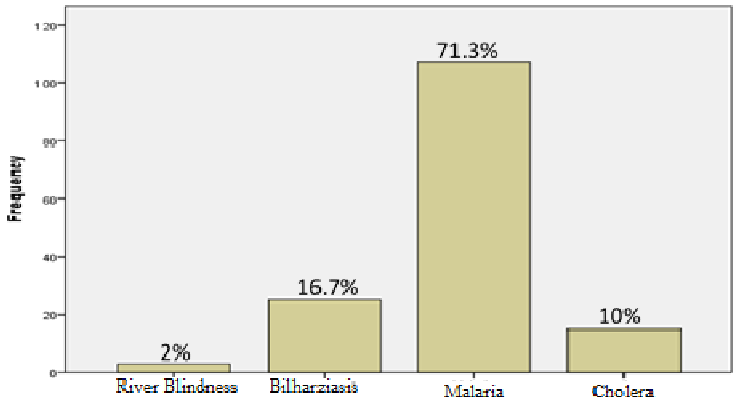

Figure 5. Dam related diseases affecting the communities

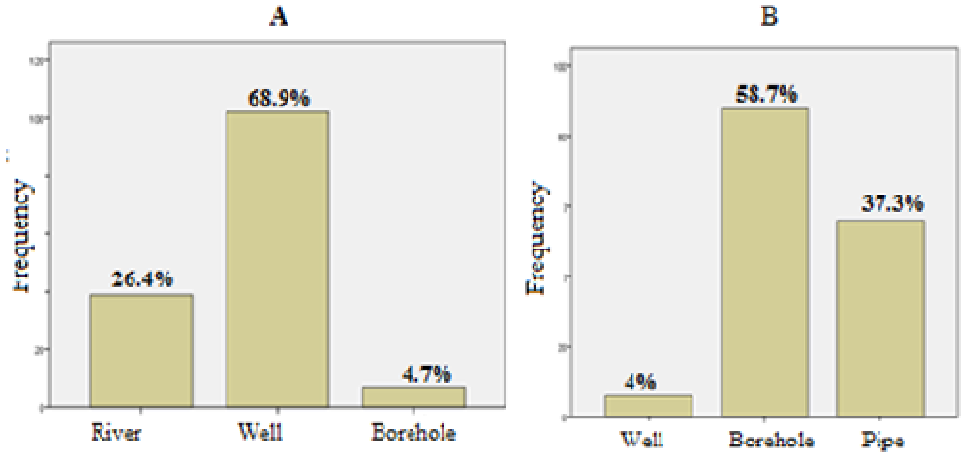

Figure 6 Comparison of sources of drinking water before (A) and after (B) the construction of the dam

Water is important natural resource because it is the source of livelihood. Before the construction of the dam the

river was the main source of drinking water to the communities, but the study revealed that 37.3% of the communities have their drinking water source being tap water against the previous 0%, with the consumption of well water reducing drastically from 68.9% to 4% and borehole water consumption also increased from 4.7% to 58.7% with no one depending on the dam or the river as a source of drinking water. Figure 6 indicates that only 4.7% had improved water sources (Borehole and Tap water) before the Dam was constructed against 96% after the construction of the Dam. However, pipe water sources are skewed to Gowrie and Vea communities due to the proximity of the water treatment plant to these communities.

5. Conclusion

The study brought to the fore that the construction of the dam has reduced poverty among the surrounding rural communities by providing employment: in the form of fishing, irrigation farming and sale of inputs, increased crop production, improved water supply both quality and quantity and enhanced dry season farming. These have been perceived to reduce rural-urban migration in the communities which is associated with unemployment and poverty. In addition to the direct impacts, the dam has induced the construction of roads, electricity and other infrastructure. On the other hand the construction of the dam is perceived by the communities to have also increased the prevalence of water related diseases such as malaria, schistosomiasis, bilharziasis among others and accidental deaths through drowning. The Vea Dam has positive impacts on the surrounding communities despite the adverse effects on the people such as displacement of indigents, loss of farmlands and accidental deaths through drowns among others, their economic status and standard of living of have drastically improved after the construction of the dam.

References

Bongo District Assembly (BONDA) (2014). District Medium Term Development Plan (2014-2017) Bongo, Ghana: Bongo District Assembly.

Etiosa, U. (2005). Dams and Livelihood: The Problems of Parasitic Diseases in Communities Hosting Dams in Nigeria

Flyvbjerg, B. (2004). Five Misunderstandings about Case-Study Research. In, Seale, C., Gobo, G., Gubrium, J.F. & Silverman, D. [Eds], Qualitative Research Practice. London and Thousand Oaks, CA: Sage p. 420-434.

Freund, R.J. and Wilson, W.J. (1993). Statistical Methods, Academic Press, Inc., Harcourt Brace Jovanovich, Publishers, Boston, 644 pp.

ICOLD (1998). ICOLD world register of dams, Computer Database, Paris, International Commission on Large Dams.

ICOLD (2000). Dams and the Environment: A Viewpoint from the International Commission on Large Dams.

Irrigation Company of Upper Region (ICOUR) (1995). ICOUR Information Handbook. ICOUR Ltd, Ghana.

Lebel, L., Garden, P. and Imamura, M (2005). The politics of scale, position, and place in the governance of water resources in the Mekong region. Ecology and Society, 10 (2), 18.

Ofoezie, I. E.(2002). Human health and sustainable water resources development in Nigeria: schistosimiasis in artificial lakes. Natural Resources Forum 26, pp.150-160

Puopiel, F (2010). Solid waste management in Ghana: The case study of Tamale metropolitan area (Unpublished MSc Thesis, Kwame Nkrumah University of Science and Technology), p.22.

Skinner, J., Niasse, M. and Haas, L. (eds.) 2009. Sharing the benefits of large dams in West Africa. Natural Resource Issues No. 19. International Institute for Environment a Development, London, UK.

Stanley, N.F., and Alpers, M.P. (1975). Man-Made Lakes and Human Health. London: Academic Press.

WCD (2000). Dams and development: a new framework for decision-making. The report of the World Commission on Dams, issued on November 16, 2000. Available at www.dams.org/ report.

Webbe, G. (1981). Schistosomiasis: some advances. British Medical Journal, 283: pp.18.

WHO (1985). The control of schistosomiasis. Technical Report Series 28, pp 113.

WHO/UNICEF JMP (2014). Joint Monitoring Programme for Water Supply and Sanitation. Country Report (Ghana)

Yin, R. K. (2003). Case Study Research: Design and Methods (3rd ed.). Sage Publication, Thousand Oaks.

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