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HEALTH IMPACT OF IRRIGATION SCHEMES: A CASE STUDY OF THE KAMPE IRRIGATION SCHEME IN NIGERIA

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Abstract: This study examines the health impact of the Kampe irrigation scheme on the immediate environment of Yagba West Local Government Area in Kogi State, Nigeria. The creation of water resources such as dams and irrigation systems have affected human health through the transmission of water-borne diseases. This paper explores the negative impacts of large river basin projects, including displacement of tribal people, salinization and waterlogging of soil, and the spread of diseases such as malaria, diarrhea, typhoid fever, ascariasis and bacterial dysentery. To mitigate these negative impacts, health impact assessments must be incorporated into water resources development policies and planning to implement measures for environmental management and vector control. This study aims to determine the health impact of Kampe irrigation scheme on its immediate environment. Data was collected using structured questionnaires distributed to farmers, villagers, and health officers of the Kampe irrigation immediate environment. The study highlights the need for a combination of integrated control measures and effective water management to reduce the burden of water-related diseases near irrigation or dam sites sustainably. This paper emphasizes the importance of considering the potential negative impacts on the environment and human health when developing water resources projects, in addition to the economic benefits. The study concludes that the provision of portable water, intensive health education, and physical hygiene are fundamental to achieving a healthy life in water borne diseases endemic areas.

Keywords: irrigation scheme, health impact, environment, water-borne diseases.

Introduction

According to Araoye (2002) [3], irrigation is the artificial application of water to the soil in order to make essential moisture available for the growth of plant. Irrigation provides a cooling effect on the soil environment and serves as insurance against drought for the development and growth of plants. Therefore, the aim of irrigation is to raise and improve the productivity of soil resources. The world agriculture contributes immensely to the food production over the next 30 years; irrigation is expected to contribute to the 80 percent of the additional food supplies to feed the world (Steele *et al*., 1997) [11]. Because there is only limited scope for development of new water resources, increasing the efficiency of irrigated agriculture is vital. To understand the way to improve the efficiency of a system, it is necessary to move beyond the narrow engineering view of a system and perceive the interactions with local communities served by the system and natural environment within which it is located. In the cause of damming water, arable lands are destroyed, wild life and forest resources are degraded, many animals and men are displaced, and countries concerned

incurred debts. Also, the prevention of livestock and man from the inherent spread of waterborne diseases has been ignored during the creation of dam. If man expose indiscriminately to the risk associated with waterborne diseases, the objectives behind the creation of such dam is threatened. Another major issue of concern is the uneconomic and poor management of the fish resources. Thus, it is important to take cognizance look at both positive and negative impacts of water conservation resources in order to promote water conservation and fully tap from the potential of reservoir projects.

Therefore, there is need for sincere collaboration with all experts from relevant fields besides the work of engineering especially the economists, sociologists and biologists for bio-socioeconomic reasons during the stages of planning and implementation of dam projects in Nigeria and other developing countries (Gbenga *et al*., 2015) [6]. Therefore, this study aimed to present the relationships between irrigated agriculture, the environment and the human health in accordance with the review of data available from Kampe (Omi) dam's immediate environment in Kogi State, Nigeria. The main objective of this study is to determine the health impact of Kampe irrigation scheme on its immediate environment, while the specific objectives are: to identify health centers used by the residents in the benefiting communities; to collect base line data of health status of people in benefiting environment as at 1999 to date; to collect data on current health status for the various diseases endemic in the area; and to assess the impacts on the environment.

2. Literature review

2.1 The environmental impact of irrigation development As the population grow and there is rise in the economic status, the demand for water and its related services increase. Dams are seen as effective way of meeting energy and water demands (Dogan, 2002) [5]. The major objective behind the construction of large dams is to provide continuous flow of water for domestic and irrigation purpose besides producing hydropower. Recently, many questions popped up regarding the existence of dams. Therefore, it is becoming challenging to build modern dam. After the mid-century, there has been excessive spread of projects on large scale river valley in developing countries going nearly 65 percent. These projects are always multipurpose in order to meet the various needs such as hydropower production, irrigation and flood control. Over the world, there are about 37,500 dams over 15m height. The improvement in standard of living and increase in population create extra pressure for economic growth, industrialization and food production. The argument against the creation of dam has always been the severe damages it causes to the environment. To reduce the negative economic, social and environmental effect and optimize the positive effects and sustainability of water resources projects are required (Sharma, *et al*., 2007) [10].

The potential impacts of irrigation scheme both positive and negative are interlinked, so therefore the conceptual problem is to define the direction of the impacts: while the natural environment affects the productivity of irrigated agriculture, irrigated agriculture affects the environment. These difficulties have been recognized and the irrigation/environment interface is separated into four types of linkages (Steele, *et al*., 1998).

- Environment impacts which occur within the domain of the irrigation system and affect its productivity (e. g salinization of soil, depletion of aquifer);
- Environmental changes outside the irrigation system that affect the productive capacity of the system (e.g. catchment degradation that increases siltation, irrigation water polluted by industry/domestic use); • Action within the irrigation system that cause environmental changes outside (e.g. agro-chemicals, salinization with downstream effects);
- Actions within the irrigation system which do not necessarily affect the productivity of agriculture but which may still have undesirable environment impacts (e.g. increase in vector–borne diseases).

2.2 The benefits of river basin development project

In the recent years, reports have shown that, the benefits from the river basin development project are quite many; however, such benefits are associated with risks. Thus, whether the benefits outweigh the risks or not is the point of the matter. The benefits comprise fisheries, erosion control purposes, navigation, and water storage for power generation, irrigation and flood. Reports also showed that about a quarter of the total supply of electricity of the world is supplied from the large lakes. However, majority of these highlighted benefits are not usually escape from the problems of finance and environment. The negative impacts can be minimized through efficient management and planning as the benefits are the lake projects are also maximize. Some third world countries have incurred heavy debts due to their engagement in large water projects; wild life and forest resources are degenerated, arable lands are destroyed and people are being displaced. These big projects also lead to harmful consequences as a result of collapse in coastal fisheries and the spread of water-borne diseases. Some of these problems were not considered critical though were foreseen until the harms were already done and could no longer be ignored (Owoyemi, 2011) [9]. In Nigeria and other developing countries, the concerns on environmental protection and conservation issue are of less interest when it comes to constructing lakes for irrigation and electricity. Probably, this is a result of necessity for agricultural production and industrialization in order to reduce problems of poverty.

Irrigation development, combined with the increase in the use of pesticide and fertilizers and introduction of high yielding varieties of rice has helped double rice production in Srilanka over the past 30 years. The increase in food production is one of the most obvious health benefits of irrigated agriculture. In general increase in food production not only has a beneficial effect on the farmers involved but also increases food security for the urban population. However some cases have shown that the nutritional status of the farming community is adversely affected if the system has a very low productivity or its main focus on cash crops (Steele, *et al 1997*) [11].

In arid and semi-arid part of the world, irrigation provides an important source of water for purposes other than agricultural production. An increased source of immediate available water for a large part of the year could have a positive effect on the hygienic population status involved and can considerably reduce the occurrences of enteric, skin and eye diseases. However, the provision of readily accessible water close to settlements will lead to this water being used for washing, bathing and sometimes even or drinking. This in turn may eventually increase the number of enteric diseases and increase such risks as cholera epidemics, since the canal water will inevitably be contaminated with infective micro-organisms. It is therefore always safe to assume that when developing an irrigation system the water delivered for irrigation purposes will be used for multipurpose, especially where proper water supply facilities have not been developed. In areas where the ground water is saline or the ground water table is too low, possibly as an effect of the introduction of tube walls, canal irrigation water may be the only water source for the community for part of the year (Steele, *et al*., 1997) [11]. The Figure 1 summarily presents other benefits of River Basin Development Projects.

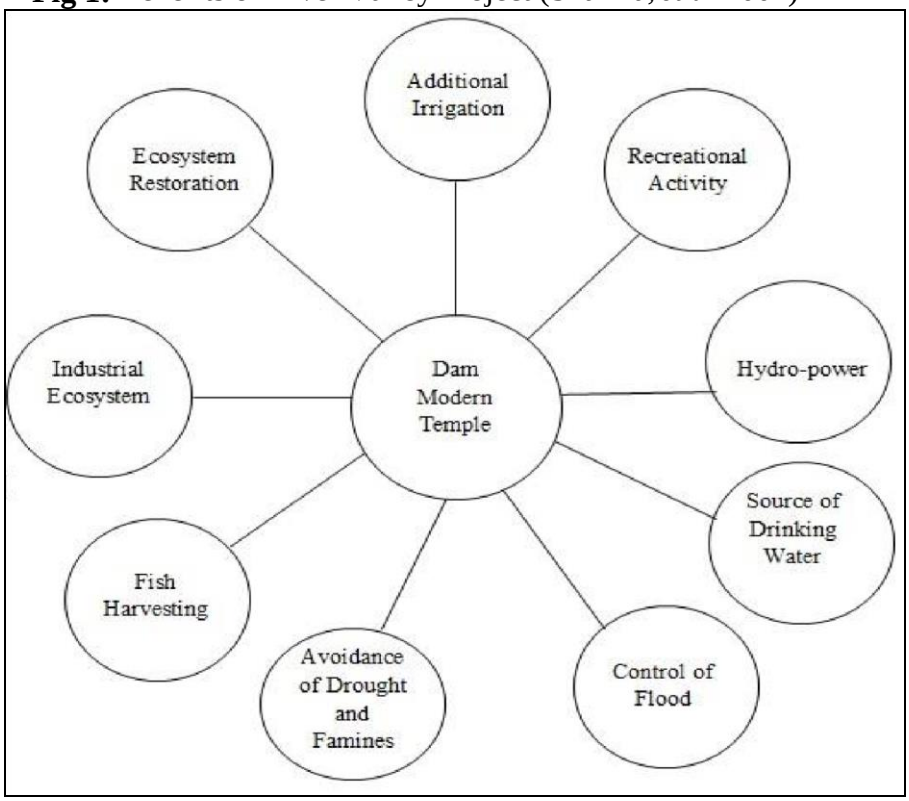
2.3 Negative impacts of river basin project

According to Sharma (2007) [10], the negative impacts of river basin project are:

2.3.1 Displacement of tribal people

The model of development of large-scale mega development projects like dams is adopted by the third world countries. Therefore, land was taken away and acquired from people who pre-occupied the proposed project

Fig 1: Benefits of River Valley Project (Sharma, *et al* 2007) [10]



areas. These people need relocation as they w ere displaced from their place of living. The displacement uprooted the livelihood of people and led to violation of people's rights to livelihood, housing and identity of rural people; with time, the problem of displacement grows. Presently, 2.5 million people in the world live on million hectares of land. The problem of displacement as time goes on will make the protest of the people to grow. The World Bank conducted a study between 1978 and 1988 on constructed 11 irrigation dams. Hectare of 143, 000 are reported to be submerged while 75,000 families are displayed. Similarly, the Central Water Commission conducted another study on 54 projects where the total population displaced was 144, 000, the impacts on the total submerged area is 1,326,000ha and the total forest submerged is 217,000ha.

2.3.2 Biodiversity

In 1974, 75 million hectare of land was under cover. There is continuous encroachment on the forest cover. Now, 40 million hectare of forest exists and divert at the average rate of about 1.5 million hectare per year. Forest diverted through compensatory afforestation due to submergence is made up. This includes plantation add to vegetation cover along the canal banks and periphery of reservoirs. The sites of these projects are always located at hilly areas; such areas are rich in biodiversity. The fauna is to be relocated or a great biodiversity can be lost if any national park or wild life sanctuary is located within the catchment area. While the protection of flora is a big problem, wildlife could be rehabilitated and shifted. Abandoning the project would be an extremely rare step for environmental protection.

2.3.3 Salinization and waterlogging

Waterlogging is as a result of indiscipline and lack of planning in water management. Construction of structures such as canal, dams and reservoir disrupts the natural land drainage leading to salinization and waterlogging. A total area of 6 million hectare subject to waterlogging was estimated by the national commission on agriculture in 1976 in India. Salinity and waterlogging have emerged as serious issue in

command area of these reservoirs and dams. Due to Salinity and waterlogging in India, an estimated loss of about 10,000 million per annum occurs.

2.3.4 Reservoir-induced seismicity

Seismic events can sometimes be triggered by construction of Dam. The impounding of water behind the huge structures results in an increase seismic activity near large reservoir. As at 1975, this has happened about 30 times. There is difference in the varying geology at the different locations. Thus, a seismic zone map is required so that other building located in different regions can be designed to absorb different level of ground shaking (Murty, 2004) [8].

2.3.5 Hazard microclimatic change and health The biotic and physical features of the river are changed by dam besides the natural system that is modified. Also, the microclimate of the region is changed the water evaporation. A corresponding change is created in the level of calcium, fluoride and trace metals in the subsurface and surface water, soil when there is change in the groundwater table; this subsequently enters the food cycle. There are five categories of diseases in which water is a significant factor:

1. Water-borne Disease: Hepatitis, Cholera, Typhoid
2. Water-washed Disease: Bacillary dysentery, Scalies, Trachoma
3. Water-based Disease: Guinea worm and Schistosomiasis
4. Water-related Disease: sleeping sickness, yellow fever, dengue and malaria
5. Diseases related to fecal disposal: hookworm

Due to water impoundment, there is rise in two kinds of public health problems. The first one is the group of vector borne disease which increases as a result of favorable condition to the vector growth. Similarly, due to development of water resources, many water-related diseases can be introduced or spread into areas. The classic case after the construction of dams is a spread of Schistosomiasis in Asia and Africa.

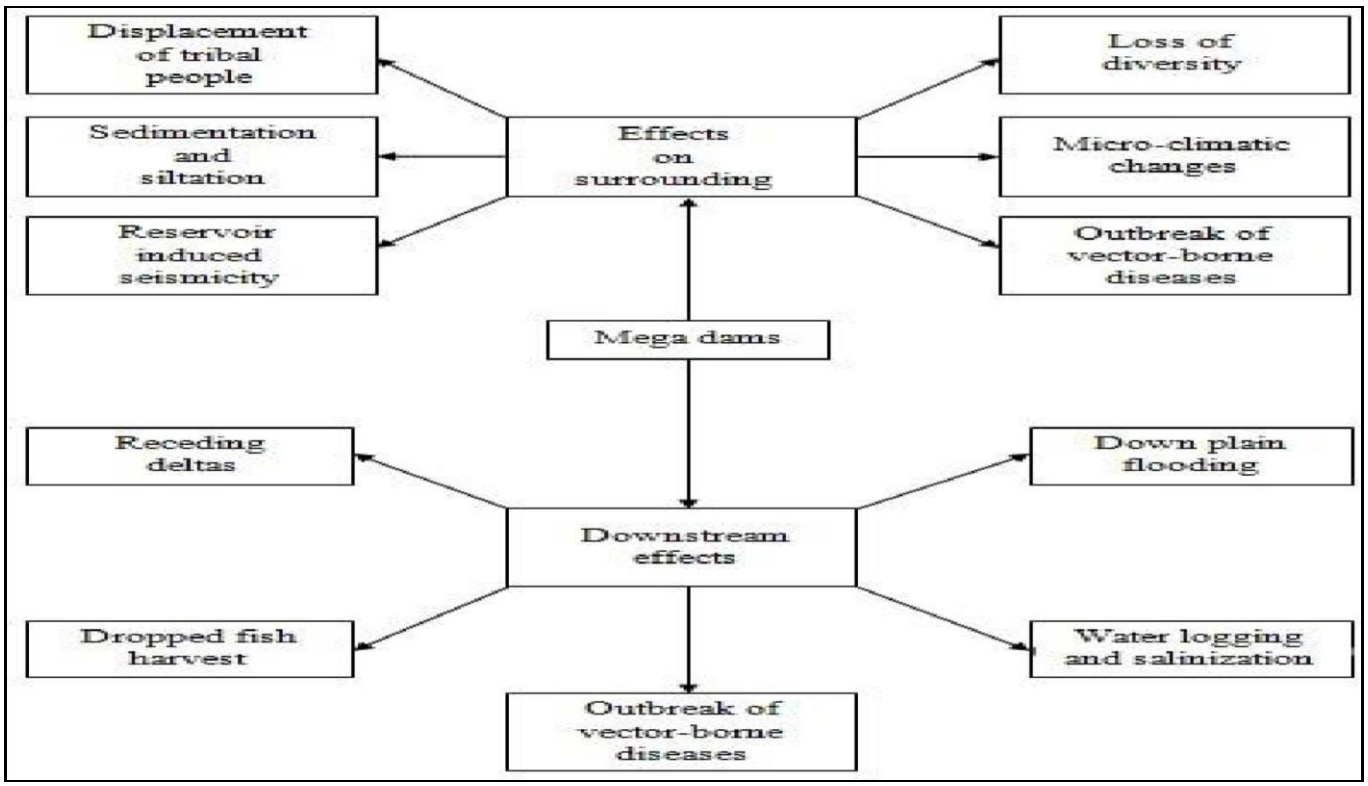
2.3.6 Pesticide poisoning (Acute and chronic impacts) Agro-chemicals are applied to reduce crop loss. Estimates are that plant pests, if left uncontrolled, would cause losses of between 10 and 15 percent of total yields, depending on the particular crop. Losses are generally highest in horticultural crops: flowers, vegetables and fruits. Therefore, it is essential that pests are controlled. A variety of methods including biological, selecting pest-resistant crops, mechanical, and chemical can be used to reduce crop losses. But agro-chemical measures have the advantages that they are convenient to use, give quick control and are able to reduce pests to extremely low levels. However, the intensive use of agro-chemicals within irrigation systems can have an impact on human health not only through the contamination of the water sources but also through the contamination of the water sources but also through acute and chronic pesticide poisoning (Steele *et al*., 1997) [11]. Therefore, the benefits derived from establishment of manmade lake are usually associated with great risks in Nigeria and other developing countries. When a dam is established, it seems the inherent consequences are also dammed to the detriment of man and the environment. The Figure 2 below summarily presents the adverse effects of River Valley Projects on the environment.

2.4 Adverse health effect of water development schemes Schistosomiasis, Malaria, Filariasis and Onchocerciasis are the major parasitic disease linked with social and ecological changes around and in water resources projects. The most significant report in disease prevalence and public health importance is attributable to schistosomiasis as a result of water development schemes. Although, this disease is not connected with mortality as it is in the case of malaria or with the dramatic morbidity of elephantiasis. The disease is always recognized as a major health problem to which people attribute much of their misery to due

to lymphatic filariasis in affected communities. Although, there may not be documentation in the health statistics as schistosomiasis is not a reportable disease, the schemes have its record on severity and frequency. In Fig 2: Negative impacts of river valley projects (Sharma, et al 2007) [10] different ways, aggravate health risks are created due to changes caused by water resources projects and dam constructions. The first impact is observed regarding parasitic diseases as a result of employment, settlement, migration and displacement. An infected person may be the first sign of risk as none of the parasitic diseases in question have major animal reservoir (Mughogho & Kosamu, 2012) [7].

2.5 Ecology of disease

The vector-borne diseases are covered in this section. Demographic and ecological changes due to building of irrigation systems create more favourable environment for disease vector. In different parts of the world, there are intricate transmission powers and there are subtle differences in the ecological necessities of a range of disease vectors. This information is at hand of the Local health authorities. The planners in the incorporation of environmental and engineering management measures are guided by an interdisciplinary dialogue in the planning, creation and renovation of irrigation schemes. Generally, two key factors can be affected: the vector density which is up to a saturation point, linearly connected to the transmission level; and vector longevity which means the greater the chance of a mosquito to transmit a disease to one or more people, the longer the



lifespan of an individual mosquito. People are exposed to danger these water-related diseases by indiscriminately drinking and washing from the artificial lakes (Figure 3).

Categorically, the vector-transmitted diseases are listed below (Amerasinghe, 2004)

- Faecal-oral: such as diarrhea, typhoid and cholera
- Water-washed: such as infectious skin and eye and louse-borne infections
- Water-based: living in water with an intermediate host such as schistosomiasis and guinea worms
- Water-related: incest-borne parasitic diseases such as filarisis, river blindness and malaria

Fig 3: Exposure to water-borne disease: drinking and washing from an artificial lake in Nigeria (Araoye, 2002) [3]

2.6 Vector-borne disease associated with water resources development (Boelee, Laamrani & Van Der Hoek, 2007)

2.7.1 Malaria

At a global level, Malaria remains one of the most important problems of health, causing sickness in over 300 million people each year. Over the past few years, its severity of the global burden has skyrocketed and now stands at 46.5 million DALYs (Disability Adjusted Life Years), which is 3.1 per cent of the world's total. In comparison with the year 1990, this is an increase of 23 percent. The mortality rate increased with 27 percent from 96,000 to 1,272,000 between 1990 and 2002. Most of the occurrences of Malaria concentrated in southern parts of the Sahara. The population faces intense year-round malaria transmission in many parts of Africa leading to a high disease burden, particularly among pregnant women, and children below the five years of age. In all malaria-endemic countries in Africa, an average 30 percent of all outpatients who visit clinic are for malaria. In these same countries, 20 to 50 per cent of all hospital admissions are as a result of malaria. The Roll-back Malaria Initiative led by WHO was a part of the international efforts to mitigate the malaria burden. The initiative was launched in 1998. The main objective of the initiative is to promote prompt diagnosis and treatment of Malaria and the use of insecticide-treated bed nets.

2.6.2 Japanese encephalitis

The Japanese Encephalitis (JE) is found in the Asian region; it is associated with irrigated rice ecosystems where pig rearing is practices as a source of income generation and food. In Asia, the disease is the leading cause of Viral Encephalitis with 30,000 to 50,000 clinical annual cases reported and in 2002, there was estimated global burden of 709,000 DALYs lost. Initiatives on vaccinations are the mainstay of outbreaks of JE but methods of water management have not been used to control the mosquito vector, particularly the alternate wet and dry method of cultivating rice.

2.6.3 Schistosomiasis

Schistosomiasis (Bilharzias) is transmitted by human through contacts with water infested with freeswimming larval stage of the worms (cercariae) that develop and penetrate into human body until maturity. Through faeces and urine, parasite eggs are released, hatch in fresh water, and infect the snail hosts within which they develop into cercariae. These in turn release the water to infect new human hosts. In almost every type of

habitat, transmission can take place from large lake or river to small seasonal ponds of stream. As the population density of the human is usually high, the man-made water bodies include the irrigation schemes are particularly important. In Africa, Asia and South America, the diseases occur in 74 countries with an approximated 200 million people infected while 85 percent of them are located in sub-Saharan Africa. Schistosomiasis is a debilitating and chronic parasitic disease which causes damage to the intestines and bladder, results to reduced cognitive and physical function and retarded growth in children. Recently, a study from subSaharan Africa estimated that 280, 000 deaths can be linked to Schistosomiasis.

2.6.4 Filariasis

Vectors transmit worm diseases from the group of the filarial nematodes such as black files in the case of river blindness (Onchoceciasis), mosquitoes, in the case of lymphatic filariasis and small crustaceans in the case of guinea worm disease. The uniqueness in the guinea worm diseases is that, it is the only communicable disease that is exclusively transmitted through water contamination. Thus, by protecting the sources of drinking water, it is the only disease that can be entirely prevented. Through improvement of water, guinea worm can be eliminated. The number of its occurrences reduced from 3.5 million to 35,000 from 1986 to 2003 in Africa. The majority of other cases are from Sudan as due to civil war, many are inaccessible to eradication efforts. The vectors of lymphatic filariasis live in polluted urban waters such as blocked sewers and drains. A population of 394 million urban dwellers is at risk of lymphatic filariasis due to absence of improved sanitation. Environmental management and good sanitation to reduce mosquito breeding places can play a major role in minimizing the risk of the disease.

2.6.5 Dengue

Annually, up to 50 million infections occur with 22,000 deaths of mainly children from 500,000 of dengue hemorrhagic fever (DHF) cases (Taylor, 2014). Only 9 countries have experienced cases of DHF prior to 1997. Since then, the number has continued to rise and it has increased more than 4-fold. In 2001 alone, United States reported about 652,212 cases of dengue where 15,500 cases were DHF, nearly twice the cases reported in 1995 for the same region. Dengue and DHF are found in the urban and sub-urban areas of the western pacific regions, South-East Asia, Americas and Eastern Mediterranean while dengue fever is mainly found in rural regions of Africa.

2.7 The challenges of water-related diseases Water-related diseases have continued to cause a large health burden especially in Asia and Africa whether it is expressed in number of deaths, DALYs or number of disease cases. In the global burden of causes of diseases, Malaria diseases are ranked 8th while Diarrhea diseases are ranked 4th. Significantly, overall burden of disease are contributed to by Malaria and Diarrhea diseases, accounting for 3 percent and 4 percent respectively of DALYs loss and 1.3 and 1.8 million deaths in the year 2002. This burden is virtually found among age group of five years old. Malaria is widely a burden for underfives in Africa while the burden of Diarrhea is concentrated in both South Asia and Africa. Half of the burdens of the world of onchocerciasis are accounted for in Africa, trachoma (52 per cent), schistosomiasis (78 per cent) and malaria (88 per cent). Also, more than half of the world's lymphatic filariasis (56 percent) and dengue (6 per cent) are accounted for by the World Health Organization (WHO) region of the South-east Asian. Data are reported annually by the WHO in the World Health Report for over 100 causes of diseases which includes the most important water-related diseases by sex, age and for 14 epidemiological sub-region that are based on the rate of adult and child mortality.

Diarrhea and many other related diseases can be eventually curtailed by universal access to sanitation and clean water, optimal practices of water management and improved hygiene. The extent of the healthcare

delivery system determines the control of many water-related diseases in the short term which is responsible for application of insecticides to treat bed nets in preventing individual from malaria, oral rehydration therapy to prevent deaths from Diarrhea and mass drug treatment for the various helminthic infections. There are some programs that successfully eliminated diseases against some water-related diseases such as trachoma, guinea worm disease, lymphatic filariasis and onchocerciasis. Mass treatments of at-risk populations are used as program to control schistosomiasis and intestinal helminthes. There is availability of effective, low-cost and safe drugs but there exist problems because of lack of capacity and insufficiency of health delivery system. This is also applicable to Malaria where immediate promorion of insecticide-treated bed nets and treatments of patients are the backbones of the current control strategies. Healthcare systems unfortunately in sub-Saharan Africa in particular are often fragmented, fragile and unable to effectively apply many of the evidence-based intervention strategies.

3. Materials and methodology

3.1 The study area

The Kampe (Omi) Dam Irrigation Project (KODIP) of the Lower Niger River Basin and rural development authority (LNRBDA) is located in Yagba West Local Government

Area of Kogi State about 146km from Ilorin i.e. IlorinKabba road. It lies between longitude 6°37'W and 6°42'E of Greenwich and latitude 8°38'N of the equator (check Figure 4). The project was first conceive in 1979 while the construction works started in 1983.It involves the construction of 42metre dam with a water reservoir capacity of about 250millioncubicmetres.The irrigation network consist of 39km length of main canal and about 300km length of feeder canal and complimentary drainage lines. The dam will be capable of irrigating about 4100 hectares when all the phases are completed. Phase one of the now completed comprises the main dam, spillway, head-walk and 16km out of the 39km length of the main canal commanding 2000hectares of irrigable land. This phase allows for agricultural production of maize, sorghum, vegetable and rice all the year round.

The salient features of the Omi earth dam outlet and spillway are stated below Table 1:

Table 1: Salient features of the omi earth dam outlet and spillway

Features	**Size/Length/Capacity/Level**
Dam length	1976m
Dam fills	4500000m^3
Crest elevation	247m.a.s.l
Minimum Flood Level	245m.a.s.l
Full Supply Level	241m.a.s.l
Reservoir Capacity	250mcm
Dead Storage	30mcm
Fetch	8.5km
Reservoir Area	2500ha
Spillway Length	250m

Spillway capacity	3550m^3/s
Outlet capacity	56 m/s

M. A. S. L - Meter above sea level, M.C.M- million cubic meter

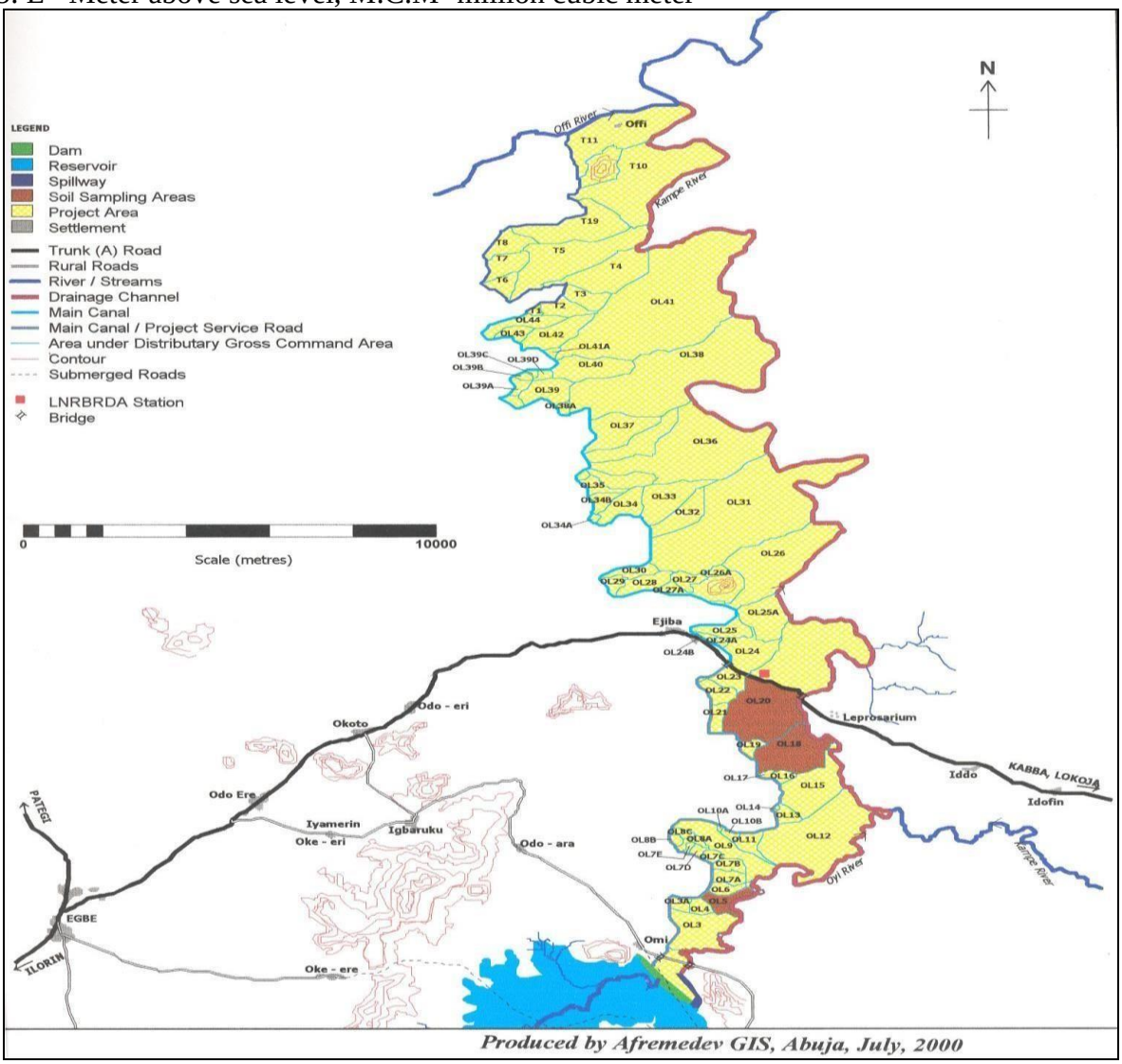


Fig 4: Location map of kampe (Omi) dam irrigation project

3.2 Methods

Questionnaires were distributed to the villagers, farmers and health officers of Kampe irrigation immediate environment. Both private and governmental hospitals were visited to collect past records on cases of waterrelated diseases in Kampe immediate environment. Therefore, data collected through structural questionnaires from farmers, villagers and health officers were analyzed using descriptive statistical analysis.

4. Results and Discussion

4.1 Field responses to questionnaires

Health and sanitation questionnaires were administered to Senior Medical Officers, Senior Health Officers, Community Health Officers and Nursing Officers as applicable in the project area. The data and information obtained were presented and analyzed. Pieces of information on water-related diseases were gathered from the following eight health centers:

- ECWA Mission Hospital, Egbe (Hospital)
- Family Support Programme clinic Omi (clinic)
- Ejiba Basic Health clinic (clinic) □ Cottage Hospital Egbe (hospital)
- Ogga basic health centre Ogga (clinic)
- Yagba West Local Government Health Department Odo-Ere (dispensary)
- Basic Health Centre Odo-Eri (clinic)
- Basic health centre Ejiba (clinic)

Figure 5 below shows the cases of existence of diseases among the villagers of Yagba West Local Government Area of Kogi State (Amaechi, 2016) [1]. From the villagers report we could conclude that there are some prevalent diseases in the area and we were made to realize that those diseases are malaria, onchoceriasis, filariasis, typhoid, diarrhea and bacterial dysentery while there is a limited range of existence of diseases such as schistosomiasis, cholera, bilharzias, river blindness, ascariasis and ancyclostomiasis among the community

by the villagers

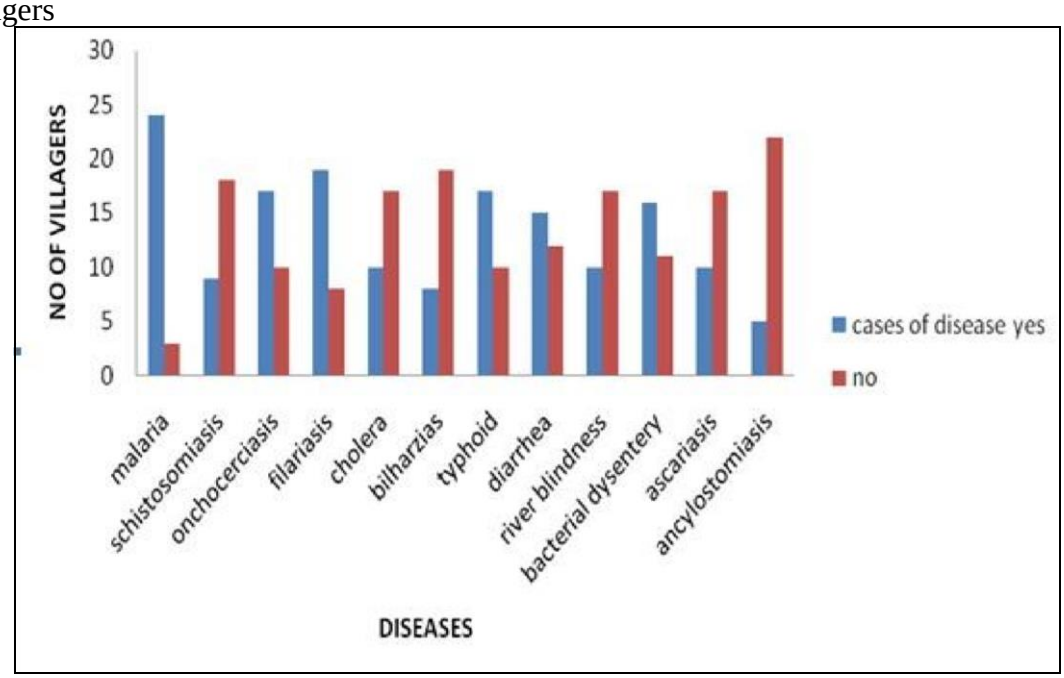


Fig 5: Cases of occurrence of diseases in Y. W. L. G. A. of Kogi State

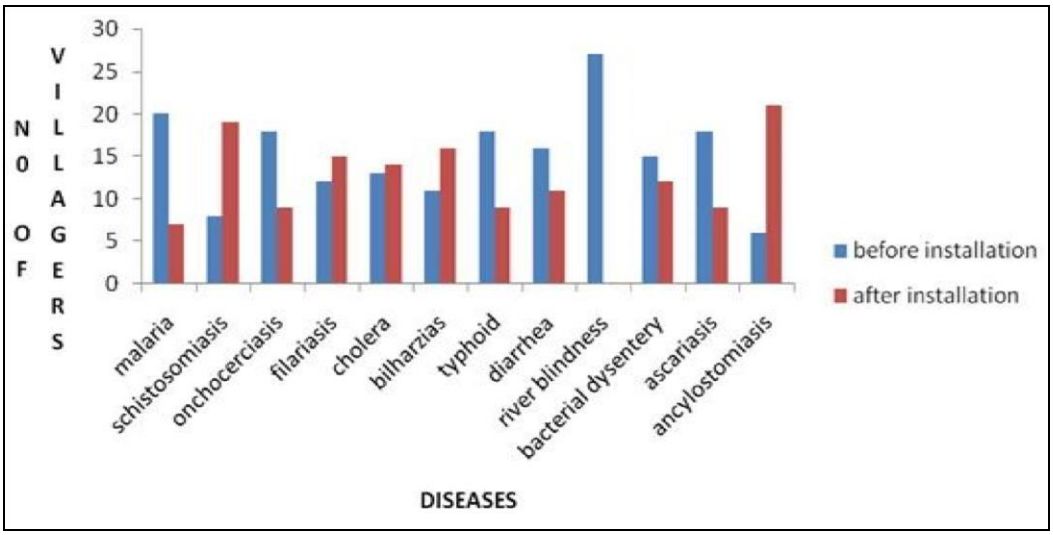


Fig 6: Frequency of disease occurrence of before and after installation in Yagba West of Kogi State

Figure 6 shows the statistical representation through bar chart of the occurrence of the diseases before and after the installation of Kampe irrigation scheme as reported by the villagers. It is reported that 20 villagers stated that malaria has existed before the installation of Kampe (Omi) dam while 7 villagers said that malaria started after the installation of the dam. Meanwhile, 19 villagers said that schistosomiasis started after the installation of Kampe (Omi) dam while 8 villagers argued that the disease started before the installation of the dam. Also, 18 villagers believe that Onchoceriasis has existed before the installation of Kampe (Omi) dam while 9 villagers said that Onchoceriasis started after the installation of the dam.

Furthermore, 15 villagers said that Filariasis started after the installation of Kampe (Omi) dam while 12 villagers argued that the disease started before the installation of the dam; 14 villagers said that cholera started after the installation of Kampe (Omi) dam while 13 villagers argued that the disease started before the

installation of the dam. In the same view, 16 villagers said that bilharzias started after the installation of Kampe (Omi) dam while 11 villagers argued that the disease started before the installation of the dam. Lastly, 18 villagers mentioned that typhoid has existed before the installation of Kampe (Omi) dam while 9 villagers said that typhoid started after the installation of the dam.

Similarly, 16 villagers believe that diarrhea has existed before the installation of Kampe (Omi) dam while 11 villagers said that diarrhea started after the installation of the dam. All the 27 villagers believe that river blindness has existed before the installation of Kampe (Omi) dam. Also, 15 villagers believe that bacterial dysentery has existed before the installation of Kampe (Omi) dam while 12 villagers said that bacterial dysentery started after the installation of the dam. In the case of ascariasis, 18 villagers believe that the diseases has existed before the installation of Kampe (Omi) dam while 9 villagers said that ascariasis started after the installation of the dam. Finally, 21 villagers said that ancyclostomiasis started after the installation of Kampe (Omi) dam while 6 villagers argued that the disease started before the installation of the dam.

The Table 4 shows list of diseases that have become more prevalent over the past few years in the project area with the various programmes that have being put in place by government to tackle the spread and occurrence of these diseases. The Table 3 shows that Malaria is the most occurring disease in the project area with 81,606 cases reported between 2008 and 2018. Unfortunately, because of

the short-comings in the diseases surveillance-system in the area, there were no adequate records over a long enough period time to compare the pre and post-project situations. The remaining diseases are also waterrelated, the incidence of which could have been aggravated by the presence of both the reservoir and the irrigation canals.

Table 2: Frequency of disease among infants, children and adults

Names of the Diseases	**Disease Frequency**		
	Infant	***Children***	***Adult***
Malaria	15	7	7
Schistosomiasis	NIL	8	NIL
Onchoceriasis	2	1	8
Filariasis	2	1	6
Cholera	1	1	NIL
Bilharzias	NIL	NIL	NIL
Typhoid	NIL	1	2
Diarrhea	1	NIL	3
River Blindness	NIL	NIL	1
Bacterial Dysentery	6	6	NIL
Ascariasis	NIL	2	NIL
Ancyclostomiasis	NIL	NIL	NIL

The Table 2 above shows the frequency range of diseases among the inhabitants of YWLG Kogi state from infants, children to adults. The data collected listed on the table shows the following constraints:

• Diseases such as malaria, bacterial dysentery and cholera majorly affect the infants in YWLG area of Kogi State.
• Diseases such as schistosomiasis, cholera, ascariasis and bacterial dysentery majorly affects the children of YWLG area of Kogi state.
• Diseases such as river blindness, onocheceriasis, filariasis, typhoid and diarrhea majorly affect adults in YWLG area of Kogi state.

Table 3: Cases of diseases recorded in yagba west local government area from 2001 – 2011

Diseases	**Years**										
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Cholera	-	-	-	-	-	-	1	-	2	3	1
Bacterial Dysentery	14	13	9	10	13	14	7	9	12	10	7
Typhoid	10	23	29	25	40	75	81	109	124	115	127
River Blindness	1	-	2	1	-	-	-	1	1	-	-
Malaria	3148	4117	4107	5504	8298	8144	10559	11825	10525	8000	7379
Filariasis	4	10	3	7	9	14	14	14	19	14	10
Diarrhea	152	461	606	503	416	671	980	1720	1592	634	745
Schistosomiasis	41	17	23	8	-	2	4	6	1	-	11
Ascariasis	10	27	9	22	12	26	13	9	27	9	8
Dracunculiasis	-	-	-	-	-	-	-	-	-	-	-
Yellow Fever	-	-	2	-	2	-	-	1	2	2	3
Onchoceriasis	10	5	10	10	4	5	5	4	2	3	-

The Table 3 above shows the frequency distribution of Kogi state with malaria being the most reoccurring disease diseases data collected for 11 years from various health and there were no report of Dracunculiasis in the area. facilities available in Yagba west local government area of

Table 4: Some existing or planned programmes to eradicate diseases in kodip area (a) YWLGA health department, Odo Ere

Disease	**Method of Control**	**Year Control Began**	**Who is Responsible**	**Remarks**

Typhoid fever	Health Education	-	State Government	Satisfactory
Schistosomiasis	Health Education	-	State Government	Satisfactory
Diarrhea	Health Education	-	State Government	Satisfactory
Malaria	Distribution of mosquito net and Coatem	2009	Federal Government	Effective
Bacterial dysentery	Good personal hygiene	-	Local Government	Effective

(b). Basic Health Centre, Odo-eri

Disease	**Method of Control**	**Year Control Began/planned**	**Who is Responsible**	**Remarks**
Malaria fever	Roll back malaria	2015 - 2020	Federal Government	Satisfactory
Onchoceriasis	Yearly distribution of Metizan	-	Federal Government	Satisfactory
Yellow fever	Routine Immunization	2005 - 2020	Federal Government	Satisfactory

(C). EJIBA Basic Health Clinic

Disease	**Method of Control**	**Year Control Began**	**Who is Responsible**	**Remarks**
Malaria	Roll back malaria	2010 till date	Federal government	Satisfactory

Table 5: Diseases considered most serious in the project area

Name of Disease	**Number of cases reported between (2008 – 2018)**	**Has the disease become more prevalent in recent years?**
Malaria	81,606	Yes
Diarrhea	8,480	Yes
Typhoid fever	758	Yes
Ascariasis	172	No
Bacterial dysentery	118	No

The health problem of villagers and farmers are numerous. eight diseases are prevalent within the project area. Infections and parasitic diseases can be contracted directly Although, the figures/numbers of cases appear to be few but or indirectly during the course of agricultural and fisheries they are very significant.
occupation. This study as presented in Table 5 revealed that

Table 6: Number of cases of water-related disease in communities of YWLGA in 2007

Diseases Reported at the Centers or Hospital	**Ejiba Health Centre**	**YWLGA Health Department**	**Family Support Programme (FSP) Clinic**	**Egbe ECWA Hopsital**
Water-Borne				
Cholera	Nil	Nil	Nil	-
Bacterial Dysentery	Nil	15	7	16
Typhoid	1	Nil	Nil	-
Ascariasis	Nil	Nil	Nil	39
Amoebiais	Nil	-	Nil	27
Others	-	250	-	45
Water-based				
Schistosomiasis	Nil	-	100	30
Dracunculiasis	Nil	Nil	Nil	-
Others	-	111	-	25
Insect-vector borne				
Yellow Fever	2	Nil	Nil	Nil
Dengue Fever	-	Nil	Nil	Nil
Rift Valley Fever	-	Nil	Nil	Nil
Lassa Fever	Nil	Nil	Nil	Nil
Encephalitis	Nil	Nil	Nil	Nil
Leishmemiasis	-	Nil	Nil	Nil
Loaiosis	Nil	Nil	Nil	Nil
Onchocerciasis	Nil	Pre-treatment	Nil	29
Malaria	80	2,366	Large	-
Others	-	130	-	18
Faecal Disposal				
Ancylostomiasis	-	-	-	20
Stomach Disease	-	-	-	-
Others	-	299	-	10

Nil = ZERO - = No figure provided

Comparing the Research Report in 2007 of the number of cases of water-related disease in communities of YWLGA in Table 6 with the Field Report in 2011 as shown in the Table 4 and 5, there has been a major increase in the number of diseases affecting the people in KODIP Area from eight in 2007 to nine in 2018. The health centers that facilitate people with medical care are being patronized and received complaints on

some certain number of diseases that are prevalent in the endemic areas. The report showed that due to illiteracy and lack of sensitization on predicament of self-medical care and traditional medicine, most people living in the study area do not normally attend the health centers whether it is hospital, clinic or dispensary. The diseases like malaria, diarrhea, typoid fever, ascariasis and bacterial dysentery are more prevalent in the recent years and that is how it has been since the initial point of installation and the final installation of Kampe Irrigation Scheme. Comparisons show that people living in Egbe and Odo-Ere communities have more access to health facilities since the relatively well equipped hospitals are located near the place, not like Omi and Oga that are located at the outskirt of the Local Government.

The findings agreed with early research report from YWLGA in 2007 as presented the Table 6 on Environmental Impact Assessment study of Kampe (Omi) dam irrigation project that malaria is the most occurring diseases and that some programmes are planned to provide mitigation measures for its alleviation.

5. Conclusion and Recommendation

5.1 Conclusion

In conclusion, a combination of integrated control measures and sound water management is essential to reduce the current burden of water related diseases in locations near irrigation or dam sites sustainably since Kampe (Omi) Dam Irrigation Project is intended to boost intensive agriculture for the community. However, the health hazards of the reservoir and canal water are not few. Every effort should be made to check the diseases that are associated with them. Disease surveillance and notification must be efficient. Health education on certain diseases, personal and environmental hygiene, if taught at the clinics, maternities and hospital can change a lot of behavioral habits that expose to infection. Early diagnosis and treatment of detected cases in the community is an essential component of health care services. It is also crucial to include comprehensive health impact assessment (HIA) procedures in the planning of all water resources development in water borne diseases endemic areas.

5.2 Recommendation

The following recommendations should alleviate the situation:

1. The provision of portable water to the communities within the project area should form an important component of the irrigation scheme.
2. Health education of the people should be intensified to create awareness of the danger of bathing, washing and drinking from the reservoir and canal water which usually harbor the disease vector organisms for schistosomiasis, typhoid, guinea worm etc.
3. The local government should address open dumping of the refuse and bush attack of defecation. Toilet facilities should be provided and the public should be educated on their proper use. Refuse should be collected and disposed-off at a particular site as chosen by the government or can be used for land reclamation.
4. Each health centre should put more emphasis on physical hygiene which is a fundamental stage to a health life and also wearing of protective foot-ware e.g. boot for fishermen, farmers and irrigation workers.
5. Government should make health facilities accessible and affordable to the public by preventing out of stock syndrome, lack of drugs, the high level of poverty ignorance and preference for traditional medicine is no doubt a reflection of the poor state of our national economy.
6. The River Basin Authority should have its own referral center, well equipped with trained personnel to man the place. Drugs should be both available to and affordable by the ordinary citizens. The health presence of Kogi State Government should be felt more in the project area.

6. References

Amaechi EC, Ohaeri CC, Ukpai OM, Nwachukwu PC, Ukoha U. Lymphatic filariasis: knowledge, attitude and practices among inhabitants of an irrigation project community, North Central Nigeria. Asian Pacific Journal of Tropical Disease. 2016; 6(9):709-713.

Amerasinghe F, Boelee E. Assessing the impact of irrigation development on the environment and human health. In Proceedings, Inception workshop on IWMIBOKU-Siebersdorf-EARO-Arbaminch, University collaborative study on the impact of irrigation development on poverty and the environment, 26-30 April 2004, Addis Ababa, Ethiopia, 2004.

Araoye PA. Man-made lakes, ecological studies and conservation needs in Nigeria. Revista de biología tropical, 2002, 857-864.

Boelee E, Laamrani H, Van der Hoek W. Multiple use of irrigation water for improved health in dry regions of Africa and South Asia. Irrigation and Drainage: The Journal of the International Commission on Irrigation and Drainage. 2007; 56(1):43-51.

Dogan Altinbilek. The Role of Dams in Development,International Journal of Water Resources Development, 2002; 18(1):9-24. DOI: 10.1080/07900620220121620

Gbenga O, Olanrewaju B, Henry A, Iyabo O. Irrigation and Income-Poverty Alleviation: An Assessment Study of Kampe Irrigation Dam in Kogi State, Nigeria.

Journal of Agricultural Sciences–Sri Lanka. 2015; 10(2). Mughogho BUG, Kosamu IBM. Water supply arrangements in developing countries: A case study of Blantyre City, Malawi. African Journal of Environmental Science and Technology. 2012; 6(2):94103.

Murty CVR. Learning Earthquake Design and Construction. How the Groll: and Shakes!. Resonance, 2004; 1:79

Owoyemi OT. Assessment of Socio-economic and Ecological Activities of Oyan and Opeji Lakes, Ogun state, Nigeria. University of Agriculture, Abeokuta, Ogun state, Nigeria, 2011.

Sharma SK, Kaushik A, Kaushik CP, Sharma A. Impacts of Water Resources Development Project with Special Reference to Dams and Reservoirs. In International Conference on Small Hydropower-Hydro Sri Lanka 2007; 22(24).

Steele P, Konradsen F, Imbulana KAUS. Irrigation, health and the environment: a literature review with examples from Sri Lanka. Colombo, Sri Lanka: International Irrigation Management Institute, 1997.

Taylor MW. Viruses and man: A history of interactions. Cham, Switzerland: Springer, 2014.