Sub-Sahara African Academic Research Publications
June, 2021, Editions

JECM
Journal of Environmental Design and Construction Mgt. Vol.20, No.4, ISSN 2292-7733

ADAPTING TO DAMS: SOCIO-ECONOMIC AND ENVIRONMENTAL CHANGE UP AND DOWNSTREAM OF JEBBA DAM, NORTH-CENTRAL NIGERIA

SULEIMAN YAHAYA MOHAMMED, Ph.D
Department of Geography, Federal University of Technology, Minna, Nigeria

ABSTRACT
In Africa, the economic, social and environmental impacts of large dams on communities inhabiting floodplains up and downstream have mostly been adverse. Large hydroelectric Dams wreck havoc on the ecosystems and communities where they are placed. The environmental damage can be so extensive and the direct and indirect costs to people and governments so high, that even the most grandiose of dam projects is difficult to justify. Upstream or down, the ecology and hydrology of a river are forever changed once a concrete wall chokes back its waters. Most studies of the impacts of dams have been short term, however, and confined to the years immediately following dam closure. This paper takes a longer term perspective, examining changes that occurred in the 25 years of the construction of Jebba Dam in North Central Nigeria. The results indicate occurrence of a wide range of social and economic dislocation, environmental degradation due to cessation of floods and flooding due to release of water from the dams, thus resulting in partial erosion of traditional pattern and collapse of rural economy. It is therefore recommended, that a programme to monitor the impacts of dam development (particularly in downstream communities) should be an integral element of the planning process, and should be matched by resources to mitigate impacts not addressed fully by the planning process.

Keywords: *Dams, Ecosystems, Downstream, Adaptation, Resettlement, Flood*

INTRODUCTION
Worldwide there are an estimated 45,000 large hydroelectric dams more than 15 meters high. The reservoirs cover an area as large as France. A recent study by World Wide Fund for Nature (WWF) (2001), suggests that the total number

of man-made reservoirs – whether used for electricity generation, irrigation, water supply or other purposes – is much higher, covering an area three times larger than France. Collectively, they hold back an estimated 5,000 cubic kilometers of water, enough to raise sea levels worldwide by 13 millimeters. Most have been built on the past half century – an era that has seen the tributaries and main stems of most of the world's largest rivers barricaded by dams.

In early heroic years of dam construction, many environmentalists as well as engineers hailed them as a new clean form of renewable electricity generation. Other dams improved river navigation, held back dangerous floods and supplied water to cities or new irrigation projects to boost food production. But this enthusiasm has faltered as evidence has grown of the downside of large dams. Many do more harm than good – in social, environmental and economic terms. The charge sheet against large dams is long. They typically flood rich fertile river valleys; forcing inhabitants – often tribal communities already marginalized in highland areas – unto unsatisfactory resettlement programmes. They disrupt the natural downstream flow of rivers and silt that sustain fisheries, fertilize soils and irrigated crops. They generate significant amount of greenhouse gases in some cases hydroelectric reservoirs may give off more gases than a fossil fuel power plant of similar capacity. And as they grow older and their reservoirs fill with silt, they do ever less good and run ever greater risks of catastrophic collapse.

Politically, they have become a weapon for the rich, urban and powerful to take control of water resources away from the poor and they have done considerable ecological harm to wetlands, rivers and estuaries. Dams are a major cause of the degradation of many of world's wetlands.

Some social, economic and environmental impacts of large dams have been extensively documented; especially those negative impacts associated with involuntary resettlement and population displacements. Dam impacts negatively on communities dependent on agriculture and fishing on channels, floodplains and inshore marine environment. In these areas, ecological, economic and social impacts are closely linked. This work address critical knowledge gaps on the impact of Jebba Dam on up and downstream environment with a view to analyse the extent to which the people have adapted to the environmental change.

THE STUDY AREA

The Jebba Power Station is located about 100 kilometers downstream of the Kainji Dam, and approximately 40 kilometers southwest of Mokwa, the nearest urban centre. This is approximately 256 kilometers by road, southwest of Minna, the capital of Niger State. The power station sits astride the Niger River at the border between Niger State and Kwara State, approximately 91.5 kilometers by road, northeast of Ilorin, the capital city of Kwara State. Jebba Dam sits at an elevation of 71.917 meters above mean sea level.

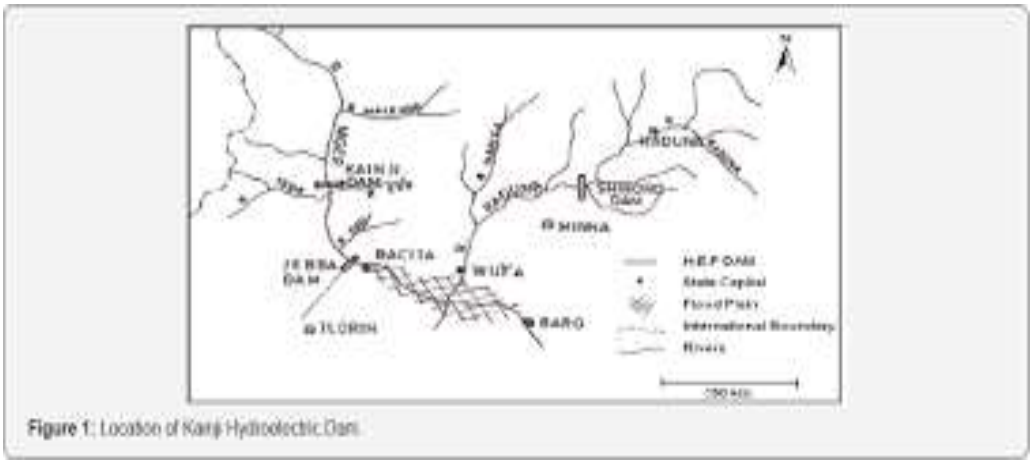

Figure 1: The Study Area (Up and Downstream of Jebba Dam, Nigeria)

MATERIALS AND METHODS

The data essentially utilized for the study are both primary and secondary data. Questionnaires were administered and oral interviews conducted, the results of which are depicted in Tables, Figures and Charts. Extensive literature review of documents on the project area and related analysis were carried out. This was done to enhance the quality of analysis, result presentation and discussion of findings.

RESULTS AND DISCUSSION

(a) Environmental and socio economic impacts.

The construction of large dams completely change the relationship of water and land, destroying the existing ecosystem balance which in many cases, has taken thousands of years to create. The Jebba Dam obstructs the Niger River, completely changing its circulation systems and flow regime and thus with dire environmental impacts. Through the past few years, the negative impact of the

dam have become well known that most countries have stopped building altogether and now forced to invest their money into fixing the problems created by dams.

The following are some of the socio economic and environmental problems caused by Jebba Dam to up and downstream communities.

(i) Flooding: Flooding is one of the most common environmental hazard in Nigeria (Etuonovbe, 2011).There is increasing vulnerability of populations and infrastructure to flooding and flood related hazards. Although flooding is one of many hazards occurring in human environment, its effects are significant both in terms of discomfort, destruction of lives, properties and pollution. The severity of flooding has been reckoned with, by the level of damage done (Williams, 1998).

A crucial part of the concept of flooding is the interface between flooding and people. Flooding not only damage property and endanger the lives of humans and animals, but have other effects as well. Flooding caused soil erosion as well as sediment deposition problem downstream. Spawning grounds for fish and other wildlife habitat are often destroyed by flooding. Prolonged high flooding delay traffic and interfere with economic uses of lands. Bridges may collapse; structures within floodways damaged, and navigation and hydroelectric power are often impaired.

Flooding and its impacts have been a major concern to farmers, engineers, economists, among others thus, forming headlines in the world and Nigerian dailies. Flooding has a wide range of influence on the interactions between man and his social, economic environment. Under normal circumstances, dams are built to control flood and the flood plains along the lower Niger. Where Jebba Dam is sited do experience an annual flooding of low magnitude. The annual white flood event usually sets in July and peaks in September. The return period is usually every four years. The story is however different from the 1990s.

Ataku (1999) documented that in an attempt to save the two dams along the River Niger – Kainji and Jebba from collapse which could result in greater catastrophe as a result of heavy downpour of rains and massive built up of water behind the dams, NEPA decided on September 14, 1999 with belated warnings to open dams letting out torrents of water which overran an estimated 2,200 communities, killing over 1000 people, submerged 1,500 houses while 52 primary schools were rendered inhabitable, rendering thousands jobless and

homeless in Niger, Kwara and Kogi States. This trend continued to date and has become an annual ritual.

(ii) Economic issues: Economic hardship due to temporary decline in tourism, food shortage leading to price increase, rebuilding costs, and so on, results during and after flooding. Moreso, at Bacita sugar cane fields downstream of Jebba dam in Nigeria, the cost of rehabilitation in 1994, 1998 and 1999 due to the effect of flooding at Bacita sugar irrigation field was about $10.8 million (Sule et al., 2009). Also, in Nigeria, the estimated amount to fix culverts and bridges damaged by flooding in 2011 totaled N2.1 billion (Oyo State Government, 2011).

Iroaganachi and Ufere (2012), in their study, "Flooding in Nigeria and Sustainable Land Development: Case of Delta State," concluded that aside loss of lives, properties, flooding affects crops, which generally unfit for agriculture leading to shortage of foodstuff and price increase. More so, some of the study areas form part of tourist attraction has experienced a remarkable decline in tourism.

In Nigeria, Yenagoa residents in Bayelsa State were cut off from all land routes by flooding in 2012, the situation caused food crisis and prices of essential food items skyrocketed followed reduced supply (Pere, 2013). His study revealed that N170 million were costs incurred by flood victims who moved from Bayelsa to other cities during flooding. The costs were attributed to packing and high transportation charges. Moreso, in Yenagoa 2012, flooding covered roads which paved way for high price of fuel sold at N150 and above per litre (Pere, 2013).

(iii) Land use and Downstream Communities: Diji (2018) revealed that the flood plain around the Kainji, Jebba and Shiroro hydropower reservoirs are very fertile and extensively farmed with soils being regularly replenished by flood waters. Flatter slope within their catchment has favoured ease of access and construction, and efficient supply of water and other services. Thus, despite being potential hazards for floods people have consistently settled around the plains of these hydro dams.

There are about one hundred and forty one (141) settlements within the Kainji dam plain comprising mostly of the initial 40,000 to 50,000 people that were originally living in 239 hamlets, villages and towns, while there are fourteen (14) settlements within the Jebba dam flood plains and comprise some 6,099

people in the original 42 villages. The Kainji and Jebba dam reservoirs catchment covers three states of the federation – Niger, Kwara and Kebbi states and comprise 438 settlements of a total population of 437, 212 people living in 44, 432 households. The Shiroro hydro dam reservoir catchment is made up of three local governments in Niger State – Shiroro, Munya and Gurara, with population of 235,665; 103,461 and 90,879 respectively (NPC, 2010).

he land use changes and the changes that have occurred in the same period in terms of changes in the size of the water body, forest and farmland/grasslands that have taken place in the downstream of Jebba dam between 1986 and 2018 as reported by Diji (2018) has Water Body; **1986** 23402.6; **2018** 23807.7, Forest; **1986** 120508; **2018** 78742.2 Farmlands/Grassland **1986** 62555.6; **2018** 103770. The percentage changes are +1.73 for Water Body, - 34.66 for Forest and +65.88 Farmlands/Grassland respectively.

(iv) Species Extinction: As fisheries become an increasingly important source of food supply, more attention is being paid to the harmful effects of dams on many fish and mammal populations. The Dam has interfered with the lifecycles of these animals and sometimes even forcing species extinction. There is a great change in the fish species composition following the impoundment both in the reservoir and downstream of the dam.

Fish families such as the Mormyridae and Citharinidae, which were in abundant before the dam, declined while the Characidae, Clupeidae and Cichlidae have risen in the lake. Downstream, around Ketso, Dzangu, Kanzhe, Sunlati, Muregi and Jiffun there is an increase in Nileperch (centropomidae) and Bagridae. As a result, the inhabitants resort to aquaculture of rare species and in extreme case became migrant fishermen into other people's territory. This situation is now the major source of conflict among various riverside communities over fish ponds ownership and control between migrants and natives.

(v) Erosion of Land: Dams hold back the sediment load normally found in a river flow, depriving the downstream of this vital agricultural resource base. In order to make up for the sediments, the downstream water erodes its channels and bank thus lowering the riverbed and thus threatens vegetation, river wildlife and riverside settlements.

(vi) Health and General Social Distress: There are also long term impacts which are generally not seen immediately after flooding. Studies such as Ahern et al., (2005) and Few and Matthies (2006) revealed that flooding have long-

term, "hidden" effects, in the form of stress and trauma during and after the flooding event. Increased flooding activities and challenges during disasters have aggravated the epidemiological effects and increased psychological and physical stress (Reacher, 2004). Also, mental health issues have been known to increase in populations that have experienced flooding, most commonly anxiety, depression and stress (Torti, 2012).

Similarly, during flooding waters are contaminated and clean drinking water becomes scarce. Unhygienic conditions and spread of water-borne diseases resulted (Adeloye and Rustum, 2011).

Olajuyigbe, Rotowa and Durojaye (2012) observed that flooding events are usually not limited to destruction of physical structures but are also accompanied with prevalence of diarrhea and other water-borne diseases as most sources of water are polluted. In addition, Odufuwa, Adedeji, Oladesu and Bongwa (2012) stated in their work, "Floods of Fury in Nigerian Cities" that flooding in cities contaminates water supplies and intensify the spread of epidemics diseases, such as diarrhea, typhoid, scabies, cholera, malaria, dysentery and other water-borne diseases.

Dam reservoirs in tropical areas, as the case with Jebba Dam, due to their slow-movement, are literally breeding grounds for mosquitoes, snails, and flies, the vectors that carry malaria, schistomiasis, and river blindness. This is evident in view of the prevalence of these diseases in the study area.

(b) Adapting to Dams

The downstream settlers are forced to adapt to the new ecological system and the change in their socio-economic life as the flow pattern of the Niger river on which their livelihood depend became regulated as result of the dam construction. The same view was reported by Olofin, (1988, 2000). Field evidence abound that about 85% of the inhabitants of those settlements around the dam up and downstream are far below the UN poverty line standard , (Suleiman, 2013, Abdulkadir et al, 2020).

Alternative mean of livelihood. Suleiman, 2013 in a study revealed that the building of Jebba dam and the subsequent resettlement of the affected communities resulted in the collapse of the rural economy. That they lost their farmlands, fishing ponds, economic trees to the dam reservoir. As adaptation strategy, not having sufficient land for farming, no fishing ponds and with few dozens of economic trees which were recently planted, the communities' able

bodied men and women migrated to neighbouring communities as tenants in search of farmlands. The fishermen without water to make catches now swing between farming and other occupations like trading and carpentry.

Old Gbajibo, Bukka, Yankede and Karogi for instance, use to be a major commercial fish centers, but has become an empty settlement due to relocation. 75% of the sampled population disclosed that no fishes are available for catch and that they turned to farming. As a survival occupation, the population has to adopt on not too fertile upland area where they were resettled. Some sizable fish ponds in those villages are owned by people from the urban centers that employ them to nurture fishes.

Resettlement Schemes: The desire of the Federal Government of Nigeria through the then National Electric Power Authority (NEPA) to harness the waters downstream of the Kainji dam completed in 1969 on River Niger, and to increase power generation in the Country, led to the building of the Jebba dam in 1978 and commissioned in 1984 about 70 kilometres downstream. In-between these two major dams are located twelve communities permanently settled for more than 200 years on the bank of the River Niger.

The building of the Jebba dam resulted in the creation of expanse of water reservoir behind the dam which was to flood and consumed these communities. A resettlement scheme was therefore planned but not properly delivered (Suleiman, 2013). The same was planned for downstream communities following the 1999 floods at New Muregi in Mokwa Local Government Area, Niger State. The communities have refused to move as there nothing on ground at New Muregi. Ever since then, they are ravaged with flood havoc year in year out, but forced to adapt to the dire consequences of flood and remained.

Human Dependence on Rivers: Societies need and value rivers for a host of reasons – from the spiritual and aesthetic to the cultural and very practical. Rivers provide water to drink, to irrigate crops, and to generate electric power that benefits, in one way or another, just about everyone on earth. But there is a segment of the human population that depends very directly on aspects of the river ecosystem that are sustained by particular patterns of river flow – the highs and lows, floods and droughts – that a river exhibits in its relatively natural state. Just as species evolve in response to variable environmental conditions, human cultures have evolved and adapted to the availability of resources and services provided by natural ecosystems. These are among foremost reasons the

inhabitants of floodplain downstream communities of Jebba dam have stay put to cope with the challenges.

For those populations that continue to be closely dependent on river ecosystems, disruptions in flow by a dam can mean a disruption in the freshwater goods and services that sustain them – especially fish, flood-recession crops, and flood-plain vegetation used for grazing. Large dams affect downstream river-dependent communities in myriad ways. The most common and most threatening impact is the loss of food security that stems from changes in the flow regime – especially the loss of seasonal flooding. Seasonal floods hydraulically connect a river with the surrounding landscape, promoting the exchange of water, nutrients and organisms among a rich mosaic of habitats.

This river-flood-plain connection increases both species-diversity and biological productivity. The moist, naturally fertilized flood-plain soils also allow for sustainable cropping systems that provide food during the drier months. Herders also look to flood-plains for water and grazing areas for their livestock during the dry season. Without the influx of water and nutrients in this annual cycle of flooding, these flood-plain production systems can disappear, taking with them human livelihoods.

Fisheries production: River and flood-plain fisheries are a critical source of food and income for hundreds of millions of people in the developing world, particularly the rural poor. Flood-plains are among the most productive ecosystems on earth (Millennium Ecosystem Assessment, 2005; Opperman et al., 2009). When a fish spawns on a flood-plain, its offspring will have many advantages over other fish born in the river itself. The water spilling into a flood-plain during floods becomes warmer, and is enriched with nutrients, which greatly benefits the growth of young fish. The drowned vegetation of the flood-plain harbours a bounty of insects to feed upon, and provides places where newborn fish can hide from bigger fish and other predators.

All of these advantages can play a big role in determining which fish grow fastest, live longest, and reproduce most often. Rivers supporting large numbers of flood-plain-spawning fish species typically produce far more fish tonnage than those without floods and flood-plains (Sommer et al., 2001; Koel and Sparks, 2002). Indeed, comparison studies show that while larger and deeper reservoirs yield fish, on average, at 10-50 kg/ha/y, flood-plains average 200-2000 kg/ha/y (Jackson and Marmulla, 2000). The three key factors supporting

this increased productivity in flood-plain rivers are the extent of the flooded area (Halls and Welcomme, 2004; Tockner and Stanford, 2002), flood duration (Koel and Sparks, 2002), and timing of the flood peak (Hoggarth et al., 1999).
When flood-plains are regularly connected to their rivers, they are not only more productive but house the majority of the river's species. Through the survival game of evolution, the advantages of flood-plain habitats have caused many fish species to become so specialised in their genetic make-up that they do not, and cannot, spawn anywhere but in the flood-plain. Ironically, those same genes that enable them to thrive and grow far more quickly by exploiting flood-plain habitats cause their populations to crash when an upstream dam eliminates a river's floods.

lood-based agriculture: Fish are not the only species that have learned to take advantage of the environmental benefits provided by floods. Human cultures around the world have developed sophisticated means for exploiting the natural subsidies of water, fresh soil, and nutrients supplied by floods. Some cultures will plant rice just before the flood arrives, and then harvest from canoes or wait until the flood has receded to gather their crops. More common is to plant when the flood peaks in order to take advantage of the increased moisture and nutrients left in the soil as floodwaters recede down the flood-plain slope.

Flood-recession farmers have become extremely adept at judging the likely duration of enhanced soil moisture in these areas, and they plant crops that will be most productive under varying circumstances from year to year. Because soil conditions such as the amount of clay in the soil will differ across the flood-plain and change from year to year depending on flooding, these farmers must continually adapt their planting strategies to a shifting mosaic of flood-plain conditions. Flood-recession agriculture is an age-old practice in Africa, extending back at least to 5000 years in the case of Egypt's Nile valley. The presence of early-maturing and drought-resistant varieties of millet and sorghum suggests that flood-recession cultivation was historically widespread on the continent (Scudder, 1991).
When the Bakolori dam was built on the Sokoto river in Nigeria in the late 1970s, it sent the flood-recession farming culture of the valley's 50,000 inhabitants into disarray (Adams, 1985, 2000). The dam affected the timing of the flooding downstream, and reduced both its extent and depth on the flood-plain. This meant that farmers no longer knew what to expect from the floods,

and their ability to match expected flooding and soil conditions with appropriate crop types broke down. Rice and sorghum cultivation during the flooding season became riskier and unpredictable. Other areas became too dry for rice yet too easily waterlogged by rainstorms to support dry land crops such as millet. Before the dam was built, more than 90% of the flood-plain was cultivated for crops. In some villages, that proportion dropped to 3% after damming (Adams, 1985). Because dams can provide a more regular and dependable supply of irrigation water to downstream areas, there is considerable potential to improve agricultural productivity. However, the beneficiaries of these new agricultural opportunities do not always include the original inhabitants of the downstream flood-plains.

Livestock management and other livelihood and cultural dependencies: The availability of flood-plain grazing is critical for the survival of livestock managed by both riverside communities and transhumant pastoralists, especially those in arid and semiarid regions, and especially toward the end of the dry season when water levels usually reach their lowest point. During the rainy season, inland grazing is temporarily available, but as the quality and quantity of these inland pastures deteriorates, the importance of flood-plain grazing increases. Though flood-plains are restricted in size in comparison to inland areas, livestock graze a variety of highly nutritional grasses that have varying tolerances for flooding. Dam-regularization of river flows for energy production, irrigation, and flood control has caused widespread loss of these vital flood-plain resources.

Naturally flowing rivers also provide river-dependent communities with timber, fuel, and a wide variety of edible, medicinal and other useful plants and wildlife. The availability of these resources typically decreases when river flows are altered by dams. Aquifer recharge also diminishes, so that groundwater wells are more apt to dry up. Also the loss of less tangible but important cultural and spiritual values stemming from naturally flowing rivers is a frequent complaint of those who are involuntarily resettled in inland areas from riverside communities after dams are built (Downing, 1996).

We readily acknowledge that dam development projects have played a very important role in advancing local and national economies, and have in many instances provided new livelihood opportunities, improved access to water and electricity, enhanced crop production through irrigation systems, and contributed to poverty alleviation. Many dam development projects have also provided ancillary benefits to local communities, such as health and educational

programmes and occupational training. The fact that dam development projects can provide important local to national benefits, including benefits that flow to downstream communities is not at issue here.

What is at issue is the degree to which dam projects degrade the natural food productivity of river ecosystems and disrupt livelihoods and cultures dependent on these ecosystems without an accurate accounting of these costs. Moreover, as described below, many of these negative consequences can be avoided by applying pragmatic 'best practice' approaches.

Monitoring and Adaptive Management: In the siting, design, operation, and re-operation of dams, many questions will arise about the likely short- and long-term ecosystem and social impacts, and the degree to which they can be avoided or mitigated. While the best-available expert knowledge and analysis should be employed in every step, dam developers, governments, and stakeholders need to understand that the environmental and social consequences of dam development and operations cannot be predicted with complete certainty.

Dam development projects need to be viewed as a continuum that begins with regional or national planning and continues throughout the life of the project. This process must be perpetually informed by monitoring, carefully targeted data collection and research, and further analysis to address new uncertainties or surprises. Therefore, a programme of monitoring, evaluation, and adjustment through valid Environmental impact assessment – commonly referred to as 'adaptive management' – should be fully and explicitly integrated into any dam development or re-operation plan so that management approaches can be continually modified in light of increased understanding or changes in human and ecosystem conditions.

CONCLUSION AND RECOMMENDATIONS

We readily acknowledge that dam development projects have played a very important role in advancing local and national economies, and have in many instances provided new livelihood opportunities, improved access to water and electricity, enhanced crop production through irrigation systems, and contributed to poverty alleviation. Many dam development projects have also provided ancillary benefits to local communities, such as health and educational programmes and occupational training. The fact that dam development projects can provide important local to national benefits, including benefits that flow to downstream communities is not at issue here.

What is at issue is the degree to which dam projects degrade the natural food productivity of river ecosystems and disrupt livelihoods and cultures dependent on these ecosystems without an accurate accounting of these costs. In fact, dams have been linked with overall biodiversity productivity reduction over time.

Although the dam host communities are calling for national attention over the burden they are bearing for the whole nation, many of these negative consequences can be avoided by applying pragmatic 'best practice' approaches. The recommendations include building an effective early warning system that can prepare the downstream communities against flooding activities, establish effective public participation in major projects that impact highly on the host communities as against the international donors-drive projects in most African countries The African experience demonstrates very clearly that relocation is not enough, but a development component is an essential ingredient, if people are not to be left socially and economically worse off. If reparation is to be achieved, we thus need resettlement as development opportunity.

REFERENCES

Abdulkadir, A., Yahaya, T. I., Suleiman, Y. M., Muhammed, M., Sule, I. and Godwin, N. N. (2020). Landuse Landcover Dynamics and Sustainability of Wetland Downstream of the Hydroelectric Dams, Niger State, Nigeria**.** *FUTY Journal of Environment. 14(2), 65-75*

Adams, A. 2000. *Social impacts of an African dam: Equity and distributional issues in the Senegal river Valley*. Contributing Paper, Thematic Review I.1: Social impacts of large dams equity and distributional issues. World Commission on Dams. Nairobi, Kenya: United Nations Environment Programme.

Adams, W.M. 1985. The downstream impacts of dam construction: A case study from Nigeria. *Transactions of the Institute of British Geographers, New Series* 10(3): 292-302.

Adeloye, A. and Rustum, R. (2011). Flooding and Influence of Urban Planning in Nigeria. Journal of Urban Design and Planning. 164 (3): 173-187.

Downing, T.E. 1996. Mitigating social impoverishment when people are involuntarily displaced. In McDowell, C. (Ed), *Understanding impoverishment: The consequences of development-induced displacement,* pp. 33-48. Oxford: Berghahn Books

Diji C.J (2018)Assessment of The Impact of Hydropower Generation System on Various Downstream Communities In Nigeria, *Niwe Water Journal* Http://Www.Niwe.Org.Ng

Etuonovbe, A.K. (2011). The Devastating Effect of Flooding in Nigeria. FIG Working Week, 2011.

Halls, A. and Welcomme, R. 2004. Dynamics of river fish populations in response to hydrological conditions: A simulation study. *River Research and Applications* 20(8): 985-1000.

Hoggarth, D.D.; Cowan, V.J.; Halls, A.; Aeron-Thomas, M; McGregor, J.A.; Garaway, C.A.; Payne, A.I. and Welcomme, R.L. 1999. *Management guidelines for Asian flood-plain river fisheries. Part 1: A spatial, hierarchical and integrated strategy for adaptive co-management.* FAO Fisheries Technical Paper (384)1. Rome, Italy: FAO

Iroaganchi, N. & Ufere, K. (2013). Flooding in Nigeria and Sustainable Land Development: Case of Delta State, Journal of Environment and Earth Science. 3 (5): 38-42

Jackson, D. and Marmulla, G. 2000. The influence of dams on river fisheries. In Berkamp, G.; McCartney, M.; Dugan, P.; McNeely, J. and Acreman, M. (Eds), *Thematic review II.1: Dams, ecosystem functions and environmental restoration.* Cape Town, South Africa: World Commission on Dams.

Koel, T.M. and Sparks, R.E. 2002. Historical patterns of river state and fish communities as criteria for operations of dams on the Illinois river. *River Research and Applications* 18(1): 3-19.

Millennium Ecosystem Assessment. 2005. *Ecosystems and human well-being: Biodiversity synthesis.* Washington, DC: World Resources Institute.

Oyo State Government (2011). Government of Oyo State Report on the Assessment of the 26th August 2011 Flood Disaster in Ibadan Metropolis. Ibadan: Oyo State Task Force on Flood Prevention and Management.

Odufuwa, B.O.; Adedeji, O.H.; Oladesu, J.O. and Bongwa, A. (2012). "Floods of Fury in Nigerian Cities". Canadian Center of Science and Education. 5 (7): 2.

Olajuyigbe, A.E.; Rotowa, O.O. and Durojaye, E. (2012). An Assessment of Flood Hazard in Nigeria. The Case of Mile 12, Lagos. Mediterranean Journal of Social Sciences. 3(2): 367-377.

Odufuwa, B.O.; Adedeji, O.H.; Oladesu, J.O. and Bongwa, A. (2012). "Floods of Fury in Nigerian Cities". Canadian Center of Science and Education. 5 (7): 2.

Opperman, J.J.; Galloway, G.E.; Fargione, J.; Mount, J.F.; Richter, B.D. and Secchi, S. 2009. Sustainable flood-plains through large-scale reconnection to rivers. *Science* 326(5959): 1487-1488.

Pere, A. (2013). Accounting Experience of Flood Disaster in Niger Delta Region, Nigeria. Retrieved April 8th, from http://ayaperescholar.blogspot.in/2013/03/accounting-experience-of-flood-diasater.html?m=1.

Richter, B.D.; Warner, A.T.; Meyer, J.L. and Lutz, K. 2006. A collaborative and adaptive process for developing environmental flow recommendations. *River Research and Applications* 22(3): 297-318.

Richter, B.D. and Thomas, G.A. 2007. Restoring environmental flows by modifying dam operations. *Ecology and Society* 12(1): 12, www.ecologyandsociety.org/vol12/iss1/art12/

Sommer, T.R.; Nobriga, M.L.; Harrell, W.C.; Batham, W. and Kimmerer, W.J. 2001. Flood-plain rearing of juvenile Chinook salmon: Evidence of enhanced growth and survival. *Canadian Journal of Fisheries and Aquatic Science* 58(2): 325-333.

Scudder, T. 1991. The need and justification for maintaining transboundary flood regimes: The Africa case. Special Issue of *Natural Resources Journal* on the International Law of the Hydrologic Cycle 31(1): 75-107

Suleiman, Y.M**.** (2013) "Assessment of Resettlement Problems of Communities in Gbajibo/Muwo Wards in Niger State, Nigeria*." CHSUD Journal of SettlementResearch and Development*, Vol.4 (1),pp 111 – 118

Tockner, K. and Stanford, J. 2002. Riverine flood plains: Present state and future trends. *Environmental Conservation* 29(3): 308-330.

Torti, J. (2012). Floods in Southeast Asia: A Health Priority. Journal of global health. 2 (2): 020304.

WCD. (2000). *Dams and Development - A New Framework for Decision-Making*. World Commission on Dams. Retrieved from http://www.internationalrivers.org/files/attachedfiles/ world_ commission_on_ dams_ final_ report.pdf.