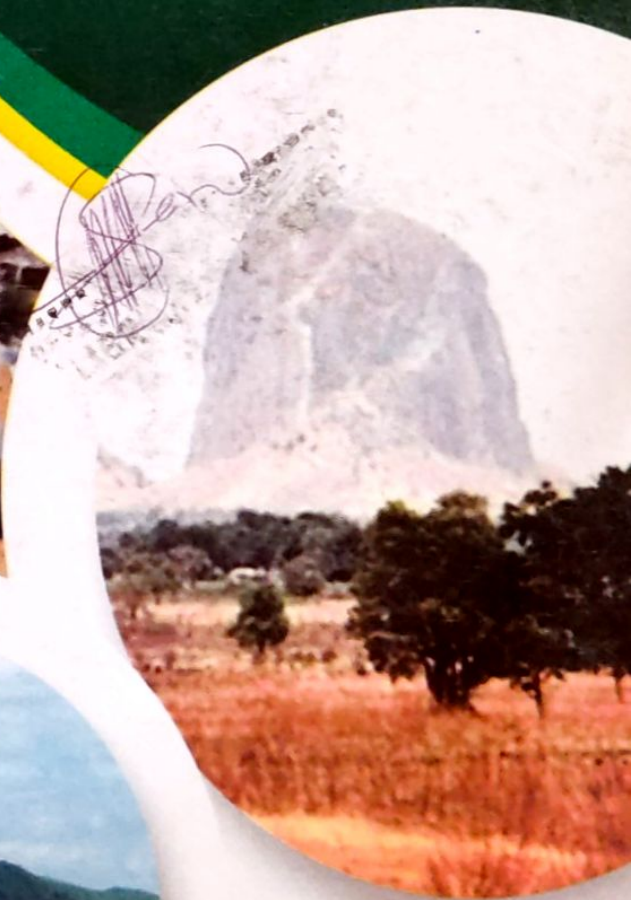


(ISSN: 0794-9154)

Volume 6, Number 1, 2015

Nigerian Journal of Tropical Geography

Promoting International Geographical and Environmental
Research for Sustainable Development and Solutions



Published by:

Department of Geography
Nasarawa State University
P.M.B. 1022, Keffi, Nigeria



ASSESSMENT OF THE ENVIRONMENTAL IMPACT OF SHIRORO DAM IN SELECTED COMMUNITIES DOWNSTREAM IN NIGER STATE

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Abstract The environmental impact of reservoirs comes under ever increasing scrutiny as the global demand for water and energy increases and the number and size of reservoirs increases. The aim of the study is to assess the negative environmental impact of Shiroro Dam in some communities of downstream location. The aim of the study is to assess the environmental impact of Shiroro Dam in some communities of downstream location. Primary data were collected through questionnaire and secondary data from hydrological unit of Shiroro dam. The descriptive statistical techniques were employed for data analysis. The finding of this study shows that the outflow is increasing despite the fluctuation and this process is affecting agricultural and social activities of the inhabitants' of downstream location of Shiroro dam. It reveals the negative effect of Shiroro dam on fishing in the study area. as 72% of the respondents' said the dam has reduced their fishing activities. There is also a considerable lost of Flora and Fauna in the study area, lost of forest rank the highest with 51%. The study also shows clearly the negative impact of flood on crops and farmlands. Based on the findings of this study, Proper channelizations of the downstream outflow as well as communities' participation in dam management were recommended among others.

Key words: *Biodiversity, Shiroro dams, downstream, communities.*

1. Introduction

The environmental impact of reservoirs has come under increasing scrutiny as the global demand for water and energy increases and the number and size of reservoirs increase. Dam and

reservoirs can be used to supply drinking water, generate hydroelectric power, increase the water supply for irrigation, provide recreational opportunities, and improve certain aspects of the

environment. However, adverse environmental and sociological impacts have been identified during and after many reservoir constructions. Whether reservoir projects are ultimately beneficial or detrimental to either the environment or surrounding human populations has been debated since the 1960s and likely before then, as well. In 1960 the construction of Lyn Celyn and the flooding of Capel Celyn provoked political uproar which continues to this day. More recently, the construction of Three Gorges Dam and other similar projects throughout Asia, Africa and Latin America have generated considerable environmental and political debate (Bruijnzeel, 2000).

The lives of many people and societies have been negatively affected by dams. An estimated 40-80 million people worldwide have been physically displaced by dam (WCD, 2010). In China alone, 10.2 million people were displaced between 1950 and 1990 (ADB, 2009). Among the projects involving displacement funded by the World Bank, large dams account for 63% of displacement (World Bank, 2006). Indigenous people and ethnic minority suffer disproportionately as they lack citizenship, tenancy or land tenure papers.

The failure of dams has also led to the displacement of many people, and even in many cases cause the death of some. In Nigeria, the Ojirami dam in southern Nigeria, failed in 1980 and affected two communities, Enwan and Akuku. Many people in Enwan and Akuku communities lost their houses and other property worth millions of naira to the huge flood plunging the communities into serious housing problems. Those who once lived in their houses were forced to relocate and now live in rented houses. It also led to the problem of overcrowding in many houses where up to 30 persons living in houses meant for 10 persons (Ogbeide *et al.*, 2003). Flooding of coastal areas is thus one of the most noted areas of concern in the country, especially flooding along the River Niger and Kaduna in Niger State.

2 Statement of problems

The World Commission on Dams (2010) reported that 60% of the World Rivers have been affected by dams and diversions. The impact of dams on the ecosystem includes the physical, chemical and geomorphological changes. Dam construction also causes changes in primary biological productivity including effect on riverine riparian plant life and downstream habitat. The

construction of storage dam and the subsequent inundation of the reservoir area effectively kill terrestrial plants and forest and displace animals (WCD, 2010). Dam construction results in decrease in water quality and variable changes in the seasonal timing of water yield (Bruijnzeel, 2000). Storage dam alter the natural distribution and timing of stream flow. Flood timing, duration and frequency are all critical for the survival of communities of plants and animals living downstream.

Impoundment may result in a variety of downstream modifications that may be important to its physico-chemical conditions and the stream biota.

These changes compromise the dynamic aspects of rivers that are fundamental to maintaining the character of aquatic ecosystem.

Dams have led to the loss of aquatic biodiversity, loss of forest and wildlife habitat and species population. Dams disrupt the movement of species leading to changes in upstream and downstream species composition.

Many river-dwelling species also have several migratory patterns.

Change in the physicochemical properties of water bodies due to dam may lead directly to the death of aquatic biota (WCD, 2010).

The questions that readily come to

mind are:

- a. What effect does Shiroro dam outflow have on the downstream communities
- b. What effect does Shiroro dam outflow have on the biodiversity downstream

3 Aim and Objectives

The aim of the study is to assess the negative environmental impact of Shiroro Dam in some communities of downstream location. The objectives are to:

- a. To examine the effect of outflow of Shiroro Dam in downstream location during rainy seasons
- b. To examine the social and economic impact of Shiroro dam in downstream location
- c. To assess peoples perception on the loss of biodiversity in downstream location

The study area

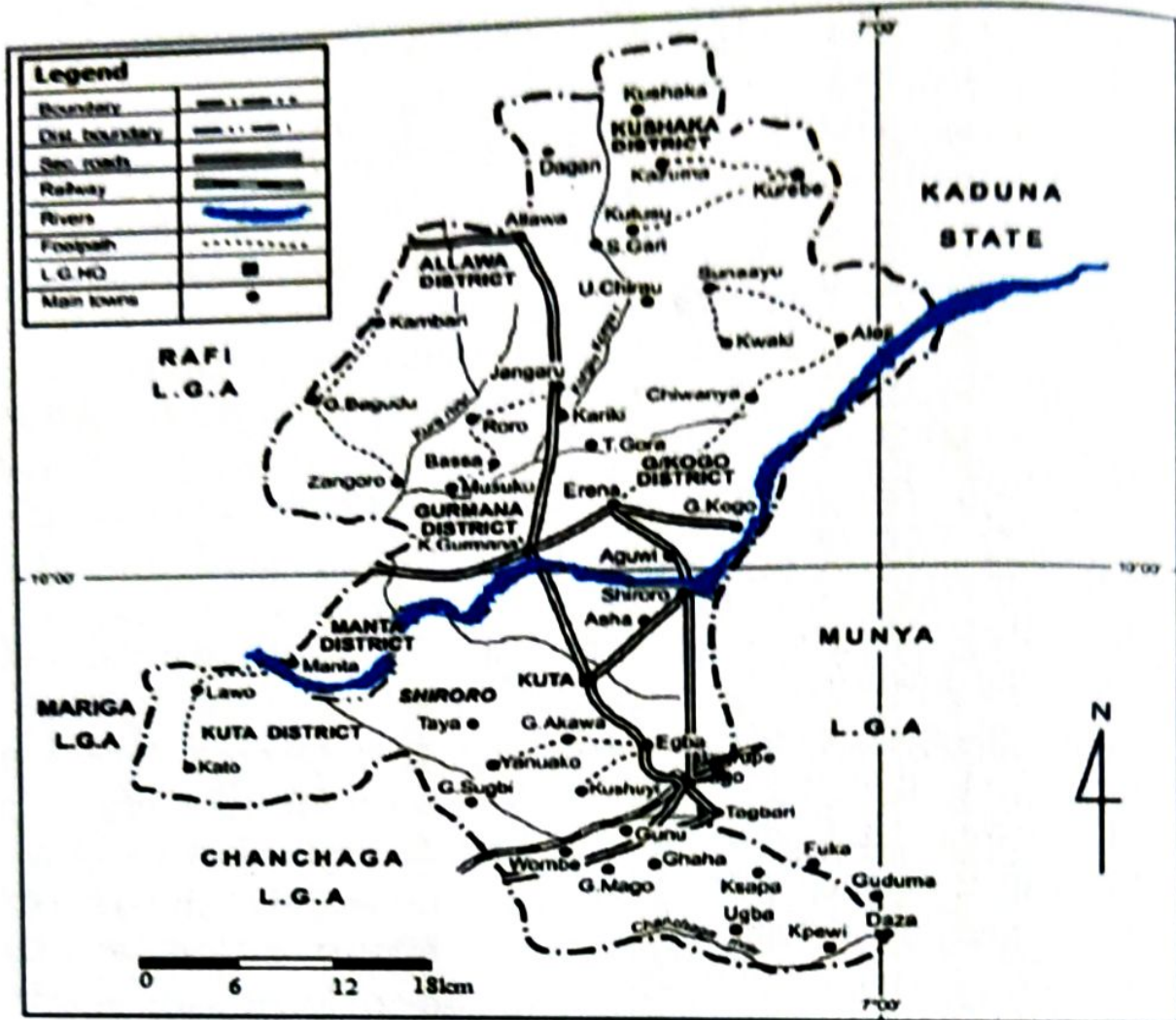


Figure 1: Location of Shiroro Dam in Niger State.

The study area is in Niger State which is located in Shiroro Local Government Area, and lie between longitude 6° 50E - longitude 7° 05E and latitude 9° 48N - latitude 10° 20N, on a geological base of undifferentiated base complex of mainly gneiss and magnetite situated at the base of prominent gorges in an undulating plain. The local government (Shiroro) is made up of six districts namely,

Kuta, Galadima-Kogo, Manta, Gurmana, Alawa and Kushaka districts. The climate of the study area is of tropical and belongs to the tropical wet and dry (AW) of the Koppen system of climatic classification, with rainfall varying between 1100mm in the north to 1600mm in the southern part of the area. Gwari language is the major language spoken while other indigenous tribes such as Bassa, and Gurmana language are also predominant. Other tribes representing the diverse socio-cultural groups are equally found

in this area, e.g. the Hausa, Fulani, and Igbo. Because of the rich fertile land of the area, the predominant occupation of the people is farming while other inhabitants earn their living through fishing due to the presence of the Kaduna River.

descriptive statistical technique. Outflow data was obtained on yearly basis for a period of twenty two years (22 years) [1991 – 2011] and was analyzed through graphical method. The mean annual outflow were computed using these methods below

$$X = \frac{\sum x}{n} \dots\dots\dots(1)$$

4 RESEARCH METHODOLOGY

Sources of Data

The data used in this research work were generated from both primary and secondary source. The primary data were collected directly from the field survey. The primary data were obtained through administering questionnaire and personal interviews from one hundred and twenty households randomly sampled from Galadima Kogo, Shiroro, Gurmana and Manta villages. The questionnaires were administered in the area of Household demographics, Livelihood Patterns and Flood Impact on: Agriculture, Health, Infrastructure, Biodiversity and Housing and Property. The secondary data represent the outflow data collected for a period of twenty two (22) years.

Where x = annual outflow for a giving period

N = number of years

The information derived from questionnaire administered was analyzed through simple percentage.

Method of Data Analysis

The method to employ for the data analysis in this research is the

5 RESULTS AND DISCUSSION

Table 1 Demographic characteristic of the respondents

	Category	frequency	percentage
Sample size	Gbaya	87	87
	Hausa	6	6
	Others	7	7
	Total	100	100
Gender	Male	76	82.6
	Female	16	17.4
	Total	100	100
Education	None	4	4
	Qur'anic	13	12
	Elementary	40	40
	Secondary	26	26
	Post Secondary/university	17	17
	Total	100	100
Occupation	fishing		40
	Farming		35
	Others		25

Source: **Field work, 2013**

From table 1, 87% of the respondents speak Gbaya, 6% of the respondents speak Hausa while 7% of the respondents speak other languages like English, Ibo, Yoruba, Nupe, etc.

The gender of the respondents shows that 76 (82.6%) of the respondents are males while (17.4%) of the respondents are females. It is further revealed that most of the respondents are literate because 40% had primary education, 26% had secondary education, 17% had tertiary education, 12% had non-formal (Qur'anic) education while 4% had no educational qualification. This showed that most of the respondents have attained some level of education which gave them better understanding of what

is happening within their environment including issues on negative effect of loss biodiversity in the study area.

In addition, majority of the respondents were fishermen and farmers. Fishing made up 43% of the sample, while farming respondents were 37%. Others represent 20% and these include traders, retired civil servants and self-employed.

Social Impact of Shiroro Dam in downstream location**Table 2: Perceived Impacts of Flooding on Housing in the study area**

Characteristics	No of respondents'	percentage (%)
Over flood the house	36	36
Weaken the foundation	51	51
Collapse of houses	13	13
Total	100	100

Source: Field Survey, 2013

From the Table 2, weaken the foundation of the houses rank highest with 51%, over flood the house rank second with 36% impact and collapse of building rank least with 13%.

Characteristics	No of respondents'	percentage (%)
Improved fishing	28	28
Reduced fishing	72	72
Total	100	100

Source: Field Survey, 2013

Table 3 shows the negative effect of Shiroro dam on fishing in the study area, 28% of the respondents' said the dam has improved their fishing activities; while 72% of the respondents' said the dam has reduced their fishing activities. This they say has impacted on their lives negatively by reducing their monthly income which in turn has lowered their standard of living. The reduction

in fishing at the downstream location may be attributed to blocking of migration of fish by the dam.

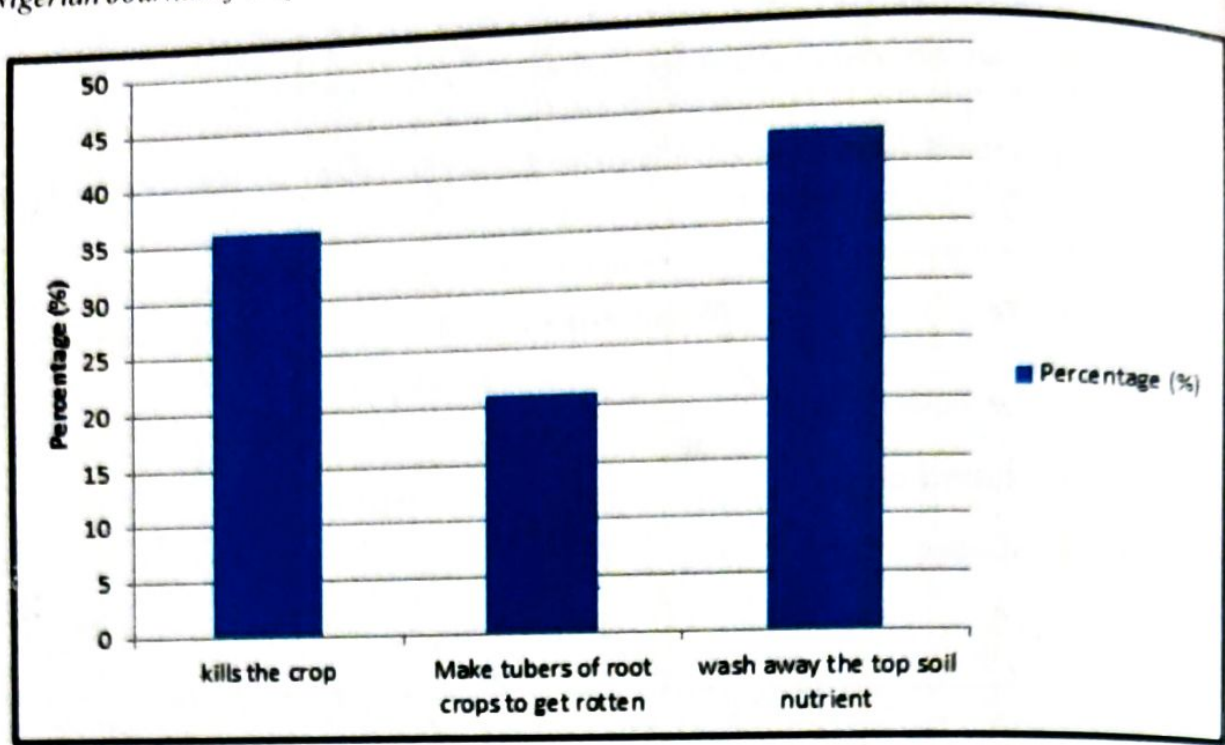


Figure 2. Negative impact of flood on crops and farmlands

Figure 2 shows clearly the negative impact of flood on crops and farmlands; wash away the top soil nutrients is the highest impact (43%) of flood on crops and farmlands because the degrade the land by allowing it to loss it fertility, destruction of crop rank second in term of flood impact on crops and farmlands with 36% and making tubers root crops to get rotten rank the least with 21% impact.

Examining negative effects of Loss of Biodiversity in Downstream Location

Biodiversity support human life and his livelihood, so depletion of biodiversity in the study can and has altered the ecosystem in which

human survival depend on. So in this study, amount of fish catches in the study area will be assess.

Impact of Shiroro Dam of Flora and Fauna

Reduction of flora and fauna in the study area is another loss of biodiversity in the study area and this includes lost of wetland, lost forested area to dam construction, lost of wildlife and loss of some seabirds all in the study area.

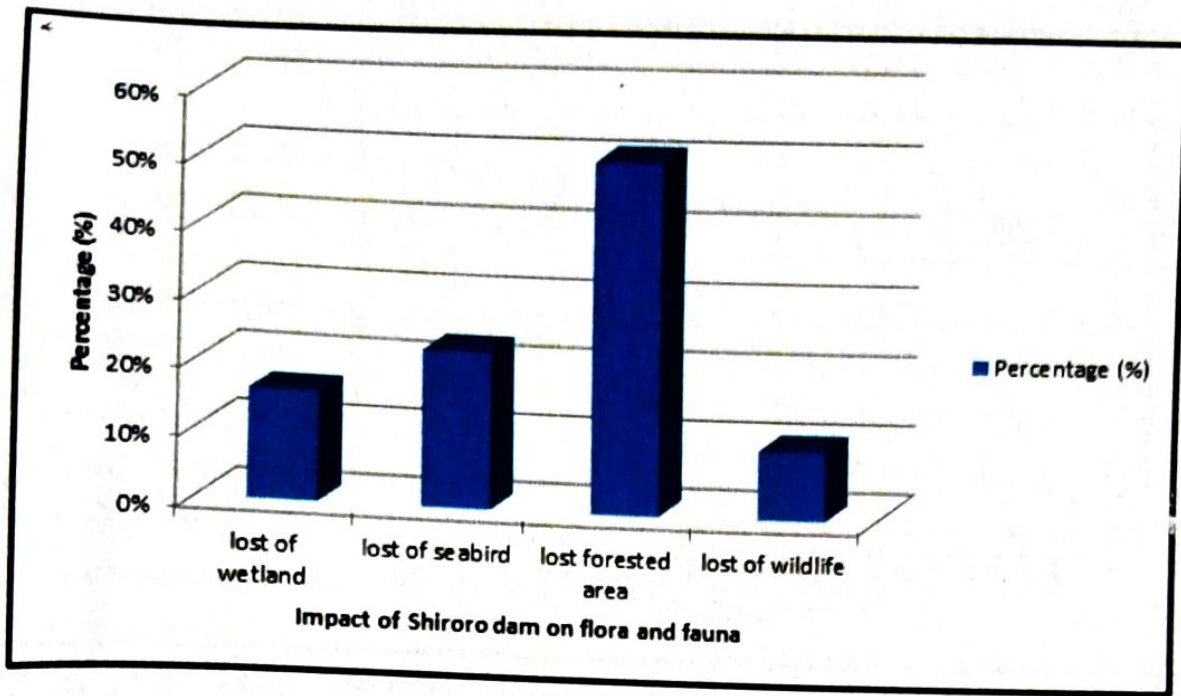


Figure 3: Impact of Shiroro Dam on Flora and Fauna

Based on the impact of Shiroro Dam of Flora and Fauna in the study area, lost of forested rank the highest with 51%, lost of seabirds rank second with 23%, lost of wetland rank third with 16% and finally lost of wildlife account the least with 10%.

Effects of shiroro Dam outflow on the downstream location

Examining the effect of outflow of Shiroro Dam in downstream location during rainy seasons we use outflow data of generated by hydrology department of Shiroro dam which was analyze using line graph. The operation of Shiroro dam often leads to environmental and ecological problems. When inflows are low, energy output

from Shiroro dam sources is limited. Water may not be released in adequate quantities from the reservoir, a situation that can affect ecological balance of the river below the Shiroro dam. On the other hand discharge from Shiroro dam has entail large water outflow which has caused flooding to adjoining lands downstream of the dam. The flood plains of the downstream location in the study area are affected economically, socially and agriculturally.

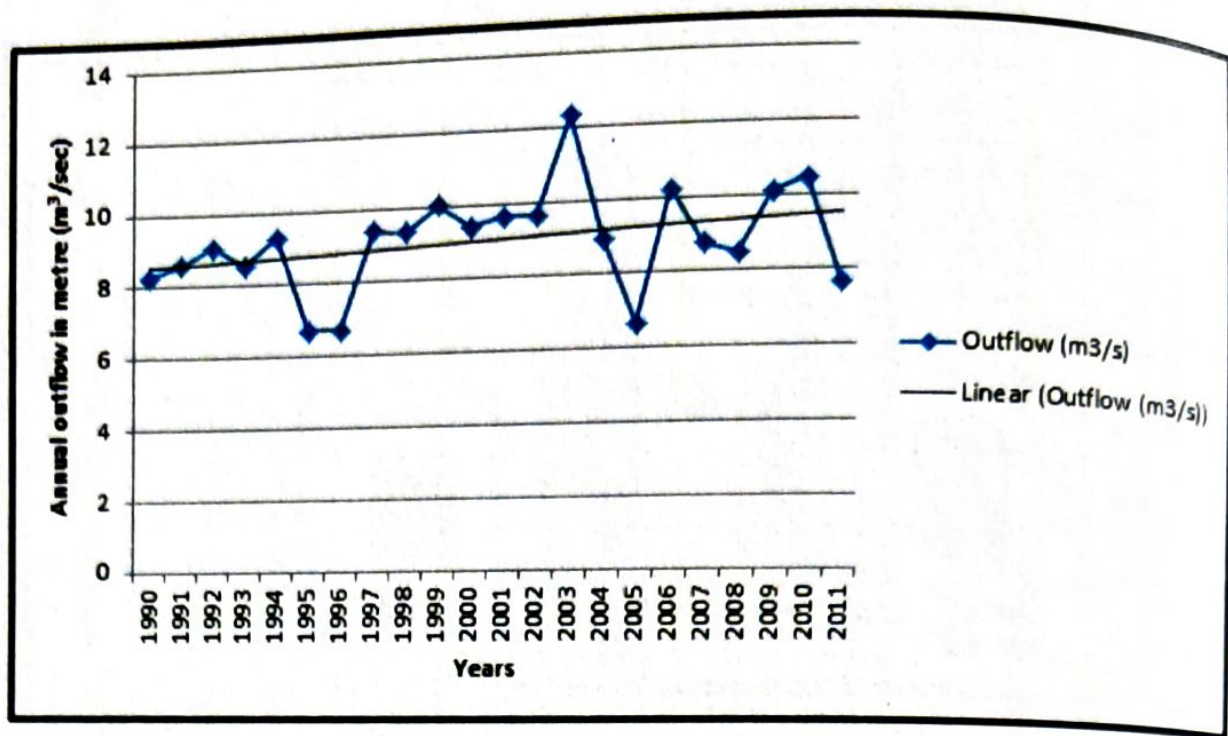


Figure 4: Outflow of Shiroro dam from 1991 to 2011

From the above Figure 4.1, the outflow is increasing despite the fluctuation and this process is affecting agricultural and social activities of the inhabitants' of downstream location of Shiroro dam. Years above the mean line like 1993, 1995, 1998 to 2004 has affected the downstream location with high volume of flooding which in turn damage farming and socio-economic activities in the study area. Years below mean line like 1991 and 1992 have lower tendency of flooding activities downstream which in turn leads moderate or lower flooding effect on farming and socio-economic activities in the study area.

6 CONCLUSION AND RECOMMENDATIONS

The operations of Shiroro dam appeared to have negative effect on communities around the dams, especially those that reside around the river bank. The effects are mostly felt in the area of income generating activities (Farmland and Crop destruction, Fishing Pounds) property ownership (destruction of houses), and loss of biodiversity (loss of wildlife, lost of forested area and lost of wetland). The finding of this study shows that the outflow is increasing despite the fluctuation and this process is seem to affect agricultural and social activities of the inhabitants' of downstream location of Shiroro dam. Years

above the mean line like 1993, 1995, 1998 to 2004 has affected the downstream location with high volume of flooding which in turn damage farming and socio-economic activities in the study area. Years below mean line like 1991 and 1992 has lower tendency of flooding activities downstream which in turn leads moderate or lower flooding effect on farming and socio-economic activities in the study area.

Based on the forgoing it recommended that

- Proper channelization of the downstream outflow as well as adequate numbers of flood detention basins, between the two dams and the flood liable areas, should be constructed to divert flow of rivers from the flood liable areas.
- Using water resistant cement like hydrophobic cement for plastering buildings up to the design flood level of Nigeria cities, which is 0.2m above sea level. This method is suitable for already existing buildings.
- Building on columns: Elevating structures above the design flood level of

Nigeria cities on reinforced concrete supporting columns to protect the buildings from under flow water.

- Collaborative management approach where early warning is disseminate to the communities

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Appendix

Table 3.2: Outflow data of Shiroro Dam from 1991 to 2011

Years	Outflow (m ³ /s)
1990	8.2584
1991	8.5785
1992	9.0667
1993	8.554
1994	9.2955
1995	6.7076
1996	6.7166
1997	9.4009
1998	9.3243
1999	10.0291
2000	9.4034
2001	9.6427
2002	9.6539
2003	12.3236
2004	8.9689
2005	6.657
2006	10.2332
2007	8.7486
2008	8.4817
2009	10.098
2010	10.4416
2011	7.7029

Source: Hydrological Department of Shiroro dam, 2013