

# JOURNAL OF ENVIRONMENTAL SCIENCE (JES)



**DEPARTMENT OF GEOGRAPHY**  
**FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA**  
**NIGER STATE, NIGERIA**

Maiden Edition

February, 2009



# THE DEGRADATION OF BOSSO DAM AND ITS IMPLICATION ON THE NEIGHBORING COMMUNITIES IN MINNA NIGER STATE

By

**Mohammed B. Yunusa**  
Department of Geography  
Federal University of Technology,  
Minna

## **Abstract**

*Degradation of dam can be caused by large number of activities either as natural or man induced. These factors need to be avoided at all cost because of their potential or immediate effect. These factors may include: processes of sedimentation, nutrient loading and eutrophication, toxic algae blooms, pollution from farming activities among others. Therefore, this research examines the factors responsible for the degradation of Bosso Dam and how this has affected the neighboring communities.*

## **INTRODUCTION**

### **Background of Water Problem**

More than 4,500 years ago, civilizations grew up along the river valley in Egypt, Mesopotamia, China and India. Man learned that flood and drought affect his well-being, he began to build earth work filled and stone dams to store water for later use. Water was also diverted for his growing plants and to protect the land people from disastrous flood.

The debate on whether dams are sustainable or not are becoming increasingly complex. While many large corporations, international finance organizations like the World Bank and many governments especially in developing countries still see dam construction and operation as developmental, many scientists, environmentalists, conservationists, and social activists see it otherwise. Scientists, NGOs and professional groups such as the International Commission on Large Dams (ICOLD), International Hydropower Association (IHA) and International Energy Agency (IEA) have written extensively on the impacts of large dams.

The history of dam can be traced back to Farmers in the foothills of the Zagros Mountains on the eastern edge of Mesopotamia may have been the first dam builders. The earliest dams for which remains have been found were built around 3,000 BC as part of an elaborate water supply system for the town of Jawa in modern-day Jordan. The system included a 200 meter wide weir which diverted water via a canal into ten small reservoirs impounded by rock and earth dams. The largest of the dams was more than four meters high and 80 meters long. Some 400 years later, around the time of the first pyramids, Egyptian masons constructed the Sadd el-Kafra, or 'Dam of the Pagans' across a seasonal stream near Cairo. This squat mass of sand, gravel and rock was 14 metres high and 113 metres long, and retained by some 17,000 cut stone blocks. After perhaps a decade of construction, but before it could be completed, the dam was partly washed away and was never repaired.

By the late first millennium BC, stone and earth dams had been built around the Mediterranean, in the Middle East, China, and Central America. The ingenuity of Roman engineers is perhaps most visible in their dams and aqueducts. The most

impressive surviving Roman dams are in Spain which continued to be preeminent in hydraulic engineering through the Moorish period and into modern times. A 46-metre-high stone dam near Alicante begun in 1580 and completed 14 years later was the highest in the world for the better part of three centuries.

Almost 200 dams higher than 15 metres were built in fast-industrializing 19th century Britain, mainly to store water for its expanding cities. In 1900, Britain had nearly as many large dams as the rest of the world put together. Nineteenth century dams were mainly earth embankments designed largely on the basis of trial and error – until the 1930s there was little scientific understanding of how soil and rock behaved under pressure. Dam builders in the 19th century (and even today in some parts of the world) also had little stream flow or rainfall data, and few statistical tools to analyze what hydrological data had been gathered.

By 20<sup>th</sup> century, the act of dam building advanced rapidly, spurred by advances in construction equipments with the use of science of soil mechanics and concrete. As a result dam increase rapidly.

Dams have two main functions. The first is to store water to compensate for fluctuations in river flow or in demand for water and energy. The second to raise the level of the water upstream to enable water to be diverted into a canal or to increase 'hydraulic head' – the difference in height between the surface of a reservoir and the river downstream. The creation of storage and head allow dams to generate electricity (hydropower provides nearly a fifth of the world's electricity); to supply water for agriculture, industries and households; to control flooding; and to assist river navigation by providing regular flows and drowning rapids. Other reasons for building large dams include reservoir fisheries and leisure activities such as boating.

### **Community and it Water Need**

In the society, some part where surface run off is low and underground water sources is inadequate, settlements are always sparse and even sometimes they are not possible. The traditional source of water supply is unevenly distributed among people and regions. Some community live in area where there is abundant supply of water where others have barely enough water for domestic needs due to drought in the wide belt of northern Nigeria. Leading to the inability of water to meet the demand of the teeming population. With the increase in population and industrialization in a community, the building of dams become necessary to provide water for the inhabitant of that community (Abramotiz 1996).

### **Background of the Study Area**

The study area is Bosso dam and Bosso community in Bosso local government area of Niger state. Niger state is located between 4°00' and latitude 7°00' with 9°30' to 10°00' and longitude 8°00' to 11.30.

The vegetation is predominantly shrubs- grassland and woodland. The aim of the dam was undertaken by PND in the year 1945, for the purpose of water supply to Minna and environs.

It was design by NCEXE and approved by H.E workers in the same year (1945). The construction of the dam started in 1945 and was completed in two years later. The deepest level trench in 299.2m with maximum depth of core trench (20.2ft) the minimum original ground level equal 304.47m (990.00ft) crest evolution of the dam is 324.0m (1063ft) maximum conservation and maximum width of base being 321.56m (1055ft) and 88.7m (291ft) respectively. The width of the crest was 4.27

(14ft) with maximum depth of water being 17.06 billion litres (150 million gallons). The daily supply to the township was 1.61 million litres (400,000 gallons). The dam was purposely constructed for domestic supply.

### **Vegetation and Soil**

The vegetation of the study area occupied about 10.65km<sup>2</sup>; fresh grasses occupied about 7.35km<sup>2</sup> and shrubs occupied 3.15km<sup>2</sup>. The area has mixed woodland; the central area has deciduous trees with considerable regional variation in woodland type. The grasses are usually about 80cm tall. Its real extent is diminishing at fast rate as a result of deforestation. The soil in the study area can be divided into three into five types or series. The classification is based on preliminary observation of soil as depth laboratory and analysis was not adopted.

Soils type one: The soils are developed from basement complex of profile six gneiss. Schist and amphiboles. They are shallow to moderately deep composed of fine coarse loamy sandy clay loam. They are usually well drained.

Soils type two: they are developed from basement complex rocks of granite essentially and some schist. It could be fine to coarse sandy clay, clay-loam sandy clay to clay. The shallow depth may be poorly drained.

Soils type three: they are formed from basement complex rocks of granite and gneiss. They are mainly loamy to sandy clay-loam and could be shallow to moderate deep.

Soil type four: the soil is loamy is loamy sands clay loam to gravelly sandy clay loam. They may be generally fair deep.

### **Aim and Objectives**

The aim of the study is to assess the impact of dam on a community taking into consideration the impact of Bosso dam on the community. The specific objective includes:

1. To identify the impact of dam on a community.
2. To identify the relevance of Bosso dam to Bosso development
3. To identify factors responsible for degradation of the dam to meet its desire objective

To suggest ways to improve the present state of Bosso dam to enhance water supply to Bosso community.

### **DATA AND METHODOLOGY**

#### **Data**

Data collection was based on both primary and secondary sources. Structured questionnaire was used for collecting available and relevant information from all stakeholders. The use of relevant journals, text books and other materials that have direct bearing with the research work were consulted, personal interview and reconnaissance survey were carried out to obtain enough information on the subject matter. In the course of data collection, previous papers that dwell that have direct relationship with the research topic were used. Primary data- this are data that was obtained by the student directly from the field. These include terrestrial photograph (aerial photography) at the study area. The second source of data is the secondary source which was obtained from text books, journals, previous research work in the study area, encyclopedia, libraries, magazines and publications.

### **Methodology**

In this study, two methods were adopted to obtain the require data: The first one is the field work survey and ground truthing exercise with objective of identifying the source of degradation of Bosso dam, how degradation has affected the water volume in Bosso dam.

### **Questionnaire**

The authenticity and validity of questionnaire as veritable tools for gathering of information was responsible for the choice of the method. A structured questionnaire containing implicate questions was design and distributed randomly to the selected areas in the study area. A fixed responsive technique was use in other to serve as a guide to the respondents. Options were provided for the respondent to choose from. The questionnaires prove pertinent and adequate data sourcing method because the technical response require were obtained. Because of the time limit of the research only 250 questionnaires were distributed

The questionnaire is structure in order to find out the impact of Bosso dam on Bosso community to identify way to improve the present state of the dam and the respondent opinion on how best the dam can be improve.

Each question is follow by option A to E. the options are graded 1to5 with A having the highest value of 5, B four, C, 3 D2 and E 1

### **Sampling Techniques**

A random sampling technique was use in the distribution of the questionnaire. All areas in the study area has an equal and independent chances of been given a questionnaire. These reduce problem of bias and make the task easier. The five randomly selected areas are:

- i. Tudun Fulani
- ii. Bosso estate/ low-cost
- iii. El-waziri
- iv. Anquwan Biri
- v. Maypa junction Bosso

### **Data Analysis**

The analysis of this result takes two forms, the first discusses the nature and causes of the degradation of the dam and the second discusses the impact of the degradation of Bosso dam on the Bosso community.

### **Nature of the Degradation of the Dam**

Certain effect on the dam vary according to the geographical location of the dam and to the location of such land use to the dam activities conducted in the river basin also affect the environmental impact of the dam. The dam is located on a hilly outcrop on each side- this feature made it almost impossible for agricultural practice to take place close to the dam. This protects the dam from effect of pollution resulting from agricultural land use and practice.

It has been observed during the reconnaissance survey that some portion around the dam as well as at the upstream were use for farming. The activities at the upstream of the dam were known to be the main factor responsible for the degradation of the dam. Bosso dam is fed by four river (some of which are show in the figure below) and streams this water bodies carry along suspended particles which subsequent enter into the dam.



Fig1. Major Tributaries supplying water to the Dam  
Source: field work 2008

### Causes of Degradation of the Bosso Dam

Although the rate of siltation and sedimentation of the dam depends among several factors on the rate of soil erosion, intensive land use around the dam may also open ways to erosion (Areola, 1982). In both cases the land are mostly bear. This makes erosion serious during the rainy season. During the raining season erosion can carry large amount of particles and deposit into the river which have the dam as there final destination. Thus land use by man around the dam together with other experiences in the increase in flood frequency and magnitude tending toward channel down eventually over compensate for the presumed increase in the sediment yield.

As the water flows down the slope, the overland slope washes the finest materials and as it flows, it pickup progressively silts and then sand. The soil of the area is made-up of about 35 percent of clay hence more susceptible to water erosion compared to soil that have higher clay content. The usually have a steep slope as it source, therefore it's usually of high speed leading to runoff rather than soaking the soil. The action of rain drop on the loose soils further break down the soil aggregates hence decrease surface structure and decrease rate of water percolation into the soil (Abubakar 1997).

Most of the farmland around 100m within the Bosso River is wrongly tilled along the path of the running water. These farming activities greatly increase the risk of erosion on the slope. ASCE (1997) state that any material which slows down water movement or increase the rate of percolation reduces the risk of erosion. The situation around Bosso dam aggravates the risk of erosion by providing already made channels for water to rundown.

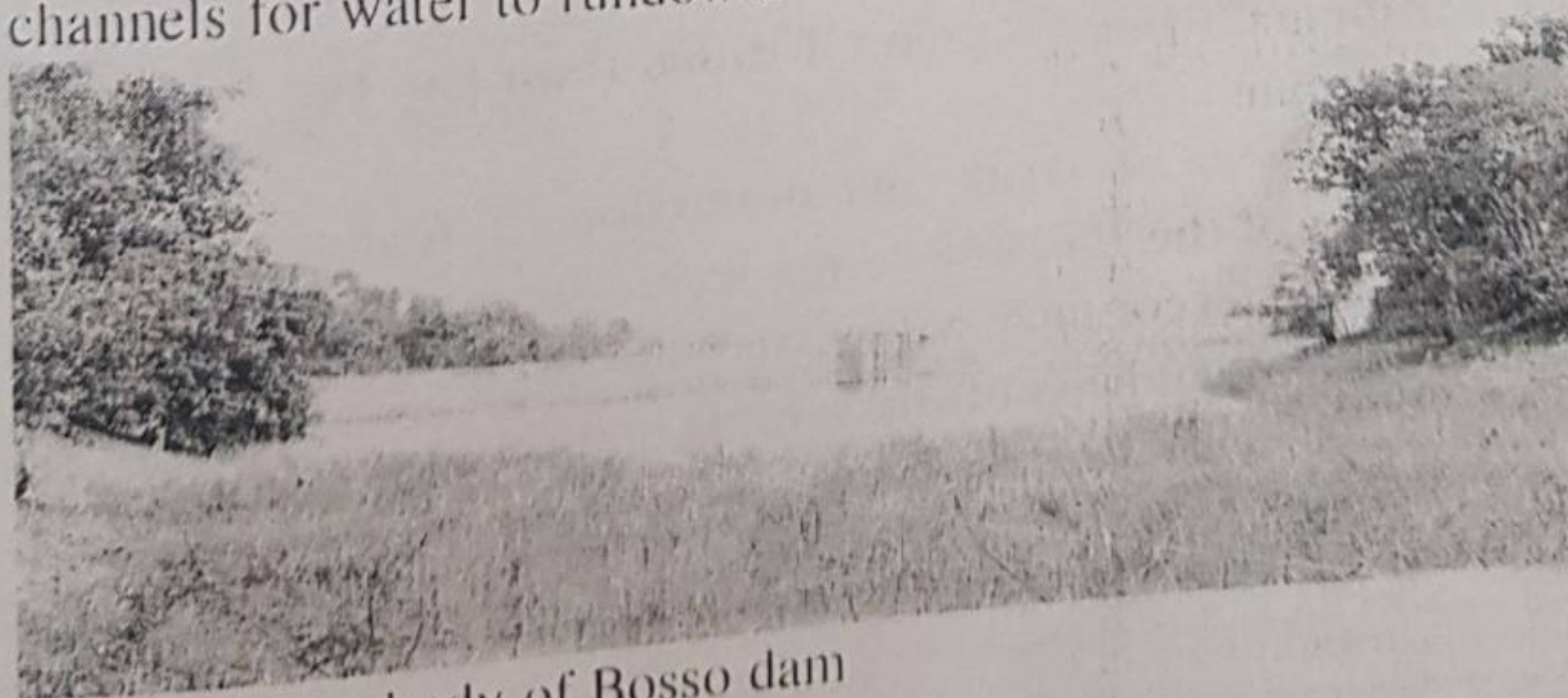


Fig 2. Water body of Bosso dam  
Source: field work 2008

Also during the reconnaissance survey, it was also observe that animals are also part of the causative agent of the degradation of the dam. As they use the water for animal consumption and grazed around the dam. The animal mostly involves are

the cow which are rear by the Fulani's Nomads living around the dam area.



Fig 3. Animals that contributes to degradation of the Dam.

Source: field work 2008



Fig 4. Degradation of the river bank

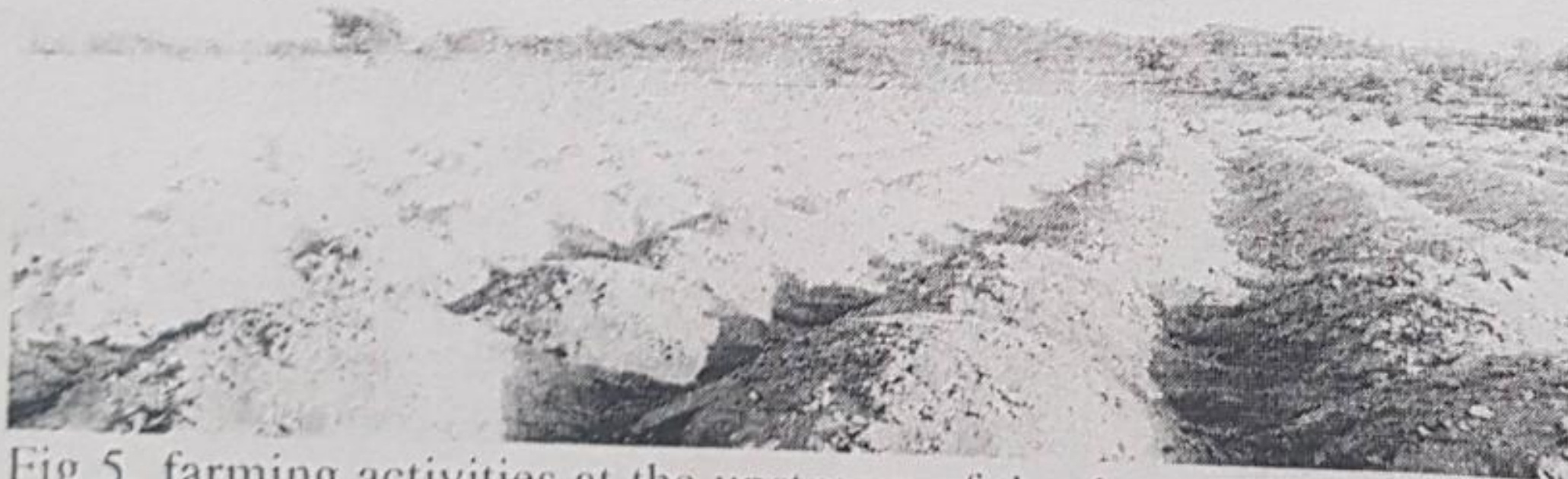


Fig 5. farming activities at the upstream of the dam

### Analysis And Result Of Impact Of Degredation Of Bosso Dam On The Neighboring Communities

This section deal with the analysis of result and discussion of findings from the questionnaires. Two hundred and fifty questionnaires were administered while only 234 were returned. This is shown on the table below.

**Table 4.1: number of respondents in each of the sample community**

community	Number of respondents	percentage
Tudun fulani	50	20
Bosso estate/low cost	50	20
Elwaziri	30	12
Anguwan biri	45	18
Mypa junction bosso	49	19.6

From the result obtained it shows that the degradation of Bosso dam has significantly affect the domestic water needs of the community. From the data generated, most of

the community rated the quality of water supply from Bosso water works as poor. (From figure 4 below)

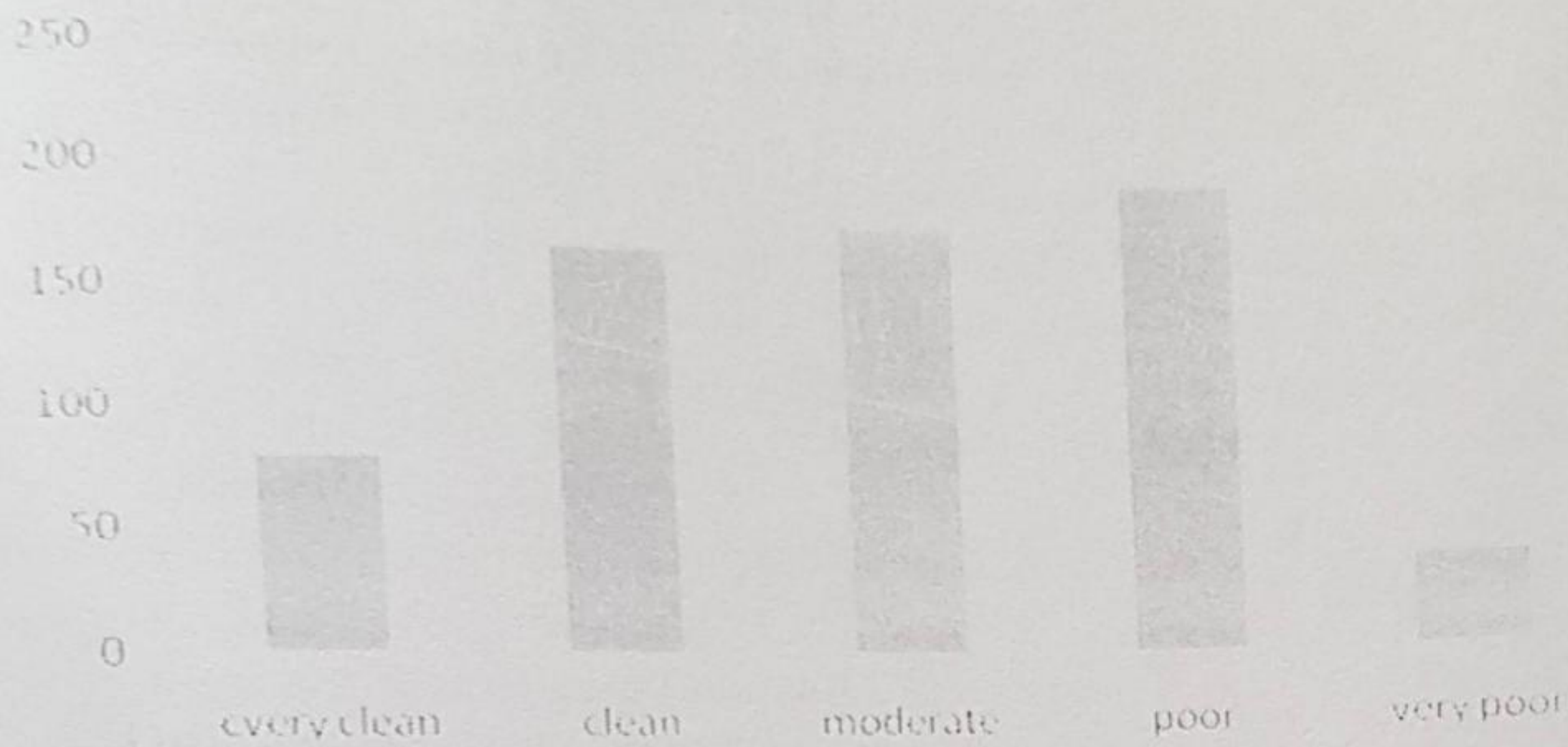


Fig6. the rating of Bosso water works by the community

As a result of degradation of the Bosso dam, the communities have to search for alternative water source so as to supplement there domestic water needs. Another effect of the degradation of was the fall in the supply level of the bosso water works. This is mostly common in the anguwan Biri area as well as El-waziri Where the supply level ranges from twice a week to about once a week. From the figure5 below:

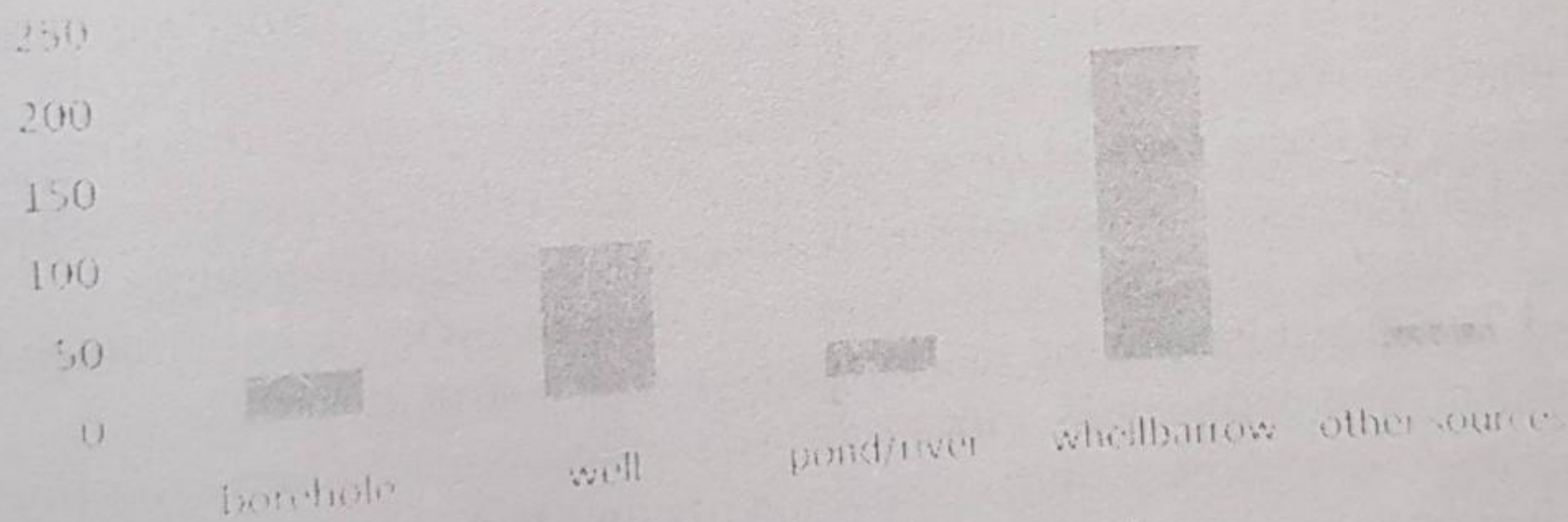


Fig7. Different Alternate Source For the Community.

Source: field work 2008

Therefore, as the community search for alternate water source, cost ranging from fifty to two hundred and fifty are involved in order to satisfy there water needs. Another finding of the research was that more than half of the community admitted that they are not satisfied with the water supply level from Bosso dam. As shown from the figure 5 below.



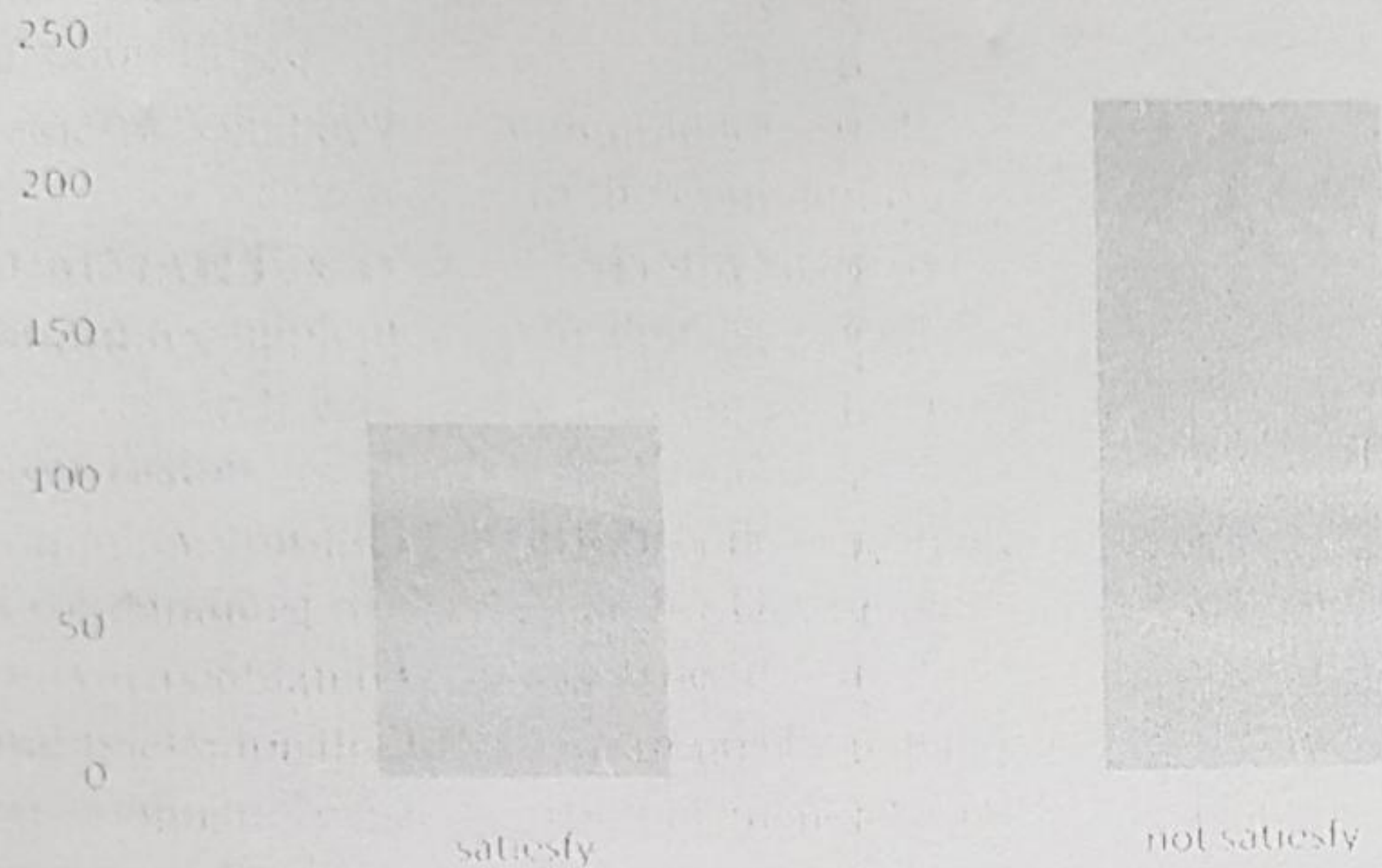


Fig 8. number of those satisfy and not satisfy with the level of water supply

Source: field work 2008

Therefore, in conclusion from the survey, it can be deducted that- the quality of water supply from bosso water works is of low quality as well as lower than the domestic need of the community.

## SUMMARY, CONCLUSION AND RECOMMENDATION

### Summary

This research was design to identify the impact of degradation of Bosso Dam on the neighboring community. With the aims of identifying the impact of the dam to the community, relevance of Bosso Dam to Bosso development. Factors responsible for degradation of the Dam suggest ways to improve the present state of the dam. Data was obtained from the field, as well as journals, textbooks, news paper, libraries and questionnaire. The questionnaire use in this research was a structure questionnaire which proved pertinent as a means of data collection. Random sampling of the study area was done with each of the community is the study area having an equal chances of been selected and administer a questionnaire. The community includes Tudun Fulani, Bosso Estate/Lowcost, EL-Waziri, Anguwan Biri Mypa junction Bosso.

The research shows that degradation of Bosso dam, have significantly reduce the quality of water supply to the community. This coupled with the poor filtration facilities in Bosso water work this lead to the community to seek for alternative water source to supplement their domestic need.

### Conclusion

A considerable effort had been made to achieve the aim and objectives set at the beginning of the research. The reconnaissance survey has enable the delineation of various land use and land cover. This provides the biophysical information necessary for the identification of the causes of the degradation of Bosso dam. One of the major observations from this research is that factor such as agricultural land use, types of land cover and grazing by animals have been the major initiating factors responsible for the degradation of Bosso dam. Hence, there is need to conserved Bosso dam because it plays an important role in socio- economic development of Niger state.

## REFERENCES

- Abubakar, A. S. (1997); Environmental impact assessment of Shiroro Dam on some Meteorological Variables in Kaduna River Basin. (PhD Thesis, Fed. University of Technology Minna, 1997)
- Abramovitz, J. 1996. Imperilled waters, impoverished future: The decline of freshwater ecosystems. Worldwatch Paper No. 128, p.59. Worldwatch Institute, Washington DC.
- Adefolalu D. O, (1986) Mean State During the Onset of the West Africa Monsoon Arch. Met. Geoph. Bioci. Ser A33, 327-343.
- Acreman, M. and Hollis, G..(Eds.) 1996. Water Management and Wetlands in Sub-Saharan Africa. IUCN, Gland.
- Areola A.(1982) ;Geography and Management Ayers, W.S., Busia, A., Dinar, A., Hiriji, R., Linter, S.F., McCalla, A.F. and Robel R.1996. Integrated Lake and Reservoir Management. World Bank Technical Paper No. 358. The World Bank, Washington, DC.Cairo, 1996.
- Buttling, S. and Shaw, T.L. 1973.Predicting the rate and pattern of storage loss in reservoirs. Transactions of the Eleventh International Congress of Large Dams, Madrid, Spain Vol 1. International Commission on Large Dams 565- 580.
- Chien, N and Wan Z (1999) "Sediment transport capacity of flow mechanics of sediment transport" ASCE press
- Fournier, F., 1960. Climat et erosion: la relation entre l'erosion du sol par l'eau les precipitations atmospheriques, Paris, France 201 pp.
- Galay, V.J. 1983. Causes of river bed degradation Wat. Resour. Res. 19, 1057-1090
- Gore, J.A. 1994. Hydrological change In: Calow, P. and Petts, G.E. (eds) The River Handbook. Hydrological and Ecological Principles, Vol 2. Blackwell Scientific Publications, Oxford. 33-54.
- Gregory, K.J. and Walling, D.E. 1983. Drainage Basin Form and Process: a geomorphological approach. Edward Arnold Ltd. London, UK. 458 pp.
- Gregory L. Morris, Jiahua Fan ., Reservoir Sedimentation HandJook, 1997 Ofoezie I. E. (2002). Human Health and Water Resources Development in Nigeria: Schistosomiasis in Artificial Lakes. Natural Resources Foru. 26: 150-159
- Mahmood, K. 1987. Reservoir sedimentation: impact, extent and mitigation. World bank technical Paper 71
- McCully, 1994. Damming the Rivers: the World Bank's lending for large dams. International Rivers Network.
- McMahon, T.A. and Finlayson, B.L. 1995. Reservoir system management and environmental flows. Lakes and Reservoir Management 1, 65-76.
- Omojola and Sonoye (1985)problem of water in Nigeria. A report on water management in Nigeria.
- Tee D. P. (1988) Ground Water, Surface Runoff and Erosion. How related? Proceedings of the International Symposium on Erosion in Nigeria Vol. 1 No. 1
- Ward, J.V. and Stanford, J.A. 1995. Ecological connectivity in alluvial river ecosystems and its disruption by flow regulation. *Regulated Rivers: Research and Management*, 11, 105-119.