

Spatial Analysis of Dam Water Distribution in Ero Region, Nigeria

¹Omoniyi, O.J. and ²Basorun, J.O.

Department of Urban and Regional Planning
Federal University of Technology Akure, Nigeria
Email: 1omoniyoj@gmail.com 2nbason2003@yahoo.com

Abstract

Ero dam in Ekiti State, Nigeria, is big enough to supply water to the people of Ekiti, yet the problem of water in the region keeps increasing every year. This paper, therefore, examines the spatial distribution of Ero dam water in its catchment which is the study region. Six hundred and twenty one dwellers were randomly selected and interviewed in the existing sixty residential quarters in the region. Data analysis was carried out using simple descriptive statistics such as percentages and the Pearson's Product-Moment Correlation test. Findings reveal that water reticulation from Ero Dam covers almost all the settlements in the region, but its inadequate management and shortage of equipments used in the Dam are major problems that hinder the effective distribution of water from the dam. Policy measures were offered based on research findings.

Keywords: Ero, Dam, Water Distribution, Reticulation, Spatial Analysis

Introduction

Water is one of the most valuable natural resources vital to the existence of any form of life (Olajuyigbe and Fasakin, 2010). Adequate supply of safe and clean water is the most important precondition for sustaining human life, maintaining ecosystems that support all life and achieving sustainable development (Topfer, 1998). The sources of water are rivers, lakes, streams, reservoirs, watersheds, aquifers, springs and dams. In order to solve the problems of water, the government of the Old Ondo State embarked on the construction of a Dam in Ero Ekiti (Adefemi *et al*, 2008), now in Ekiti State, Nigeria.

Wikipedia (2011) defines dam as a barrier that impounds streams or underground water. It is also a barrier built across a water course to hold back or control the water flow (Hassam, 2011). Some dams divert the flow of river water into a pipeline, canal, or channel. Others raise the level of inland waterways to make them navigable by ships and barges. Dams generally serve the primary purpose of retaining water, while other structures such as floodgates or levees (also known as dikes) are used to manage or prevent water flow into specific land regions.

Ero dam is a dual-purpose dam commissioned in 1985 to provide potable water and serve as tourist attraction in Ekiti State (Anisulowo, 2010). This dam supplies inadequate potable water to seven Local Government Areas (LGAs) in Ekiti State viz: Oye, Moba, Ido-osi, Ilejemeje, Irepodun/Ifelodun, Ijero, and part of Ekiti West LGA. These LGAs constitute Ero Dam region in this study. The region is a portion of Ekiti state which is internally homogeneous with regard to Ero water consumption. The objectives of study,

therefore, are to: (i) identify the water reticulation network in the region, (ii) examine the level of functionality of the reticulation, and, (iii) determine the relationship between the spatial distribution of the reticulation and accessibility to water in the region.

Literature Review

Dam is an essential component of a region - “an area that displays a coherent unity in terms of the government, language or possibly the landform” (Lisa, 1998). The region is an artificial construct used by planners to divide the world into sections which can then be compared with other units (Langdon, 2008). Encarta Dictionary (2009) defines a region as a large area of land that has geographical, political or cultural characteristics that distinguish it from others, whether existing within one country or extending over several. In this vein, Ero dam in Ikun, Ekiti State Nigeria is a regional project created for the purpose of water supply (Anisulowo, 2010) in Ero region.

Yang et al. (1999) explained that the first constructed dams were gravity dams, which are straight dam made of masonry (stone brick) or concrete that resists the water load by means of weight. The second type of dam known to have been built was an earth dam called Nimrod's Dam in Mesopotamia around 2000 BC (EAHC, 2009). Earth dams are massive dams similar to gravity dams except that they are made of soil. The dam is made watertight, with a core wall and filled with an impervious center usually made of clays. Nimrod's dam was built north of Baghdad across the Tigris and was used to prevent erosion and reduce the threat of flooding. The intention was to divert the flow of the river and help irrigate the crops.

Some of the general purposes for which dams are created are flood prevention, land reclamation, navigation, power generation, recreation and aquatic beauty; stabilize water flow / irrigation, water diversion and water supply. Dams are expected to affect water quality and quantity for millions of downstream users (Lori, 2009); the reason why large dams and reservoirs are essential for water supply systems (GEL, 2011). Major sources include deep upland reservoirs of high dams across deep valleys such as the Claerwen series of dams and reservoirs (Wikipedia, 2011). In the context of this regional planning, Ero region shares a physical element and attribute which is the water supplied by Ero Dam to seven local government areas. It therefore, represents a functional region with Ero dam as a node which services significant part (38.4%) of Ekiti State population through a water supply system.

Materials and Method

Research Locale

Ero dam is located at Ikun Ekiti in Moba Local Government Area of Ekiti State. The dam is constructed on Ero River which takes its source from the highland region of Orin-Ekiti in Ido-Osi Local Government. The enlargement of the dam water as it flows is as a result of the contributions of the river tributaries as it is usually small at its source. These tributaries include Afintoto, Ayo, Igo, Igbegbe, Ipu, Irara, Ilogbe eran and Ofu rivers (Adedeji, 1993). Geographically, Ero Dam is located on the intersect of latitude $7^{\circ} 35'N$ of the equator and on longitude $5^{\circ} 31'E$ of the Greenwich meridian. The dam site at Ikun-Ekiti is bounded in the North by Kwara state, in the West by Ikosu-Ekiti, in the South by Ijesamodu-Ekiti and in the East by Ilejemeje Local Government Area. Ikun –Ekiti is a border town between Ekiti state and Kwara state and it is located at about 70km from Ado, the Ekiti state capital.

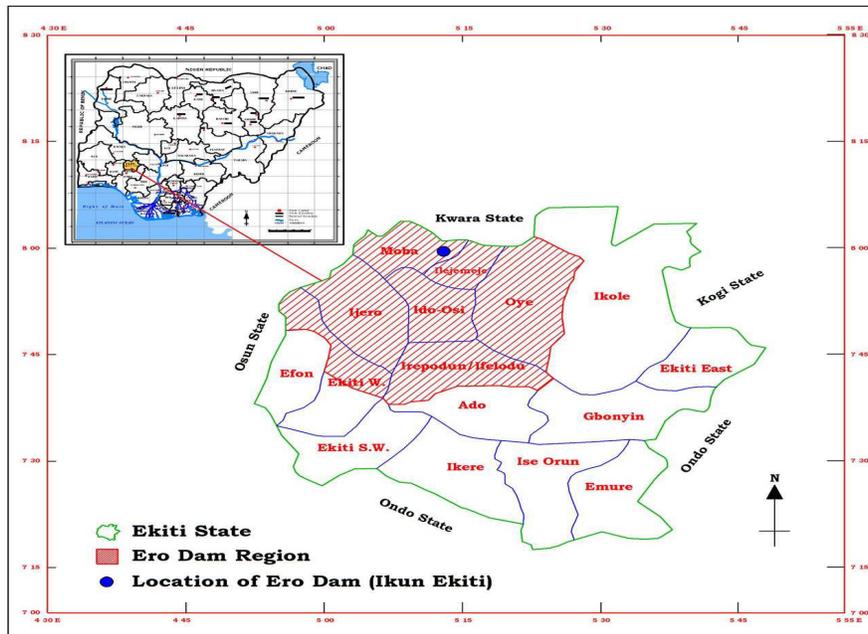


Fig 1: The Study Region

Source: Ministry of Lands and Housing Ado, Ekiti State, Nigeria, 2013

Method

This study employed the use of structured questionnaire to examine the spatial analysis of water distribution in Ero Region of Ekiti State. The questionnaires were distributed and administered to the Heads of Departments of Operations and Maintenance of Ero dam and the people in the seven LGAs of the study region. There are 64 wards within the region of influence (Ekiti State INEC, 2011) of which 16 were randomly chosen using the random table. Still ensuring a sample proportion of not less than 25 percent in the selected wards, 60 residential quarters were chosen altogether. These residential quarters represent a clearly demarcated research blocks. Since the last population census was not distributed to these quarters, the component buildings were used as proxy population from where a respondent, preferably a head of household of age 18 and above was picked for interview. There are 1,242 buildings all together in the 60 selected residential quarters, 50% of these buildings were sampled giving a sampling size of 621. To achieve accuracy in the processing of data collected, the use of computer aided Statistical Package for Social Science (SPSS) version 16 was engaged.

Results and Discussions

This paper concentrates on examining the spatial analysis of water distribution in Ero Region. It therefore, entails an assessment of accessibility to water in the region, review of the reticulation system of the dam, an assessment of the functionality of the reticulation and the regularity in the flow of water from the reticulation among others.

Sources of Water within the Region

The thought that Ero dam is the only source of water supply in the region of study is not logical. In actual fact, dam is not the only source of water supply neither is it the only water resource development in the study region. Other sources of water supply are; well, stream/river, rain and bore hole among others

(NIS, 2007). In Ido/Osi LGA, majority of the people (62.5%) source water from pipe borne taps, 16% from borehole and 21.5% from well. This shows that the influence of Ero dam is felt in the LGA. In Oye LGA, Well water was acknowledged by the majority (46.6%) as the main source of water followed by boreholes (42.0%). Ero dam has little influence (11.4%) on this LGA probably due to the distance of the LGA from the dam's location. Although Ero dam is located in Moba LGA, yet 47.4% of the residents in the area rely on borehole as their source of water, 45.3% on Ero dam and a few (7.4%) on well water.

The situation is different in Ilejemeje LGA where everybody (100%) enjoyed Ero dam water. This is expected for the reasons that the LGA shares boundary with the dam and is under-populated unlike others in the region (Nigeria Population Commission, 2006). In Irepodun/Ifelodun LGA, none of the people has access to Ero dam water, rather, 26.4% use well water and the majority (73.6%) source water from boreholes. In Ijero LGA, the influence of Ero dam is also not felt. This is because majority (67.7%) of the residents in the area fetches well water, 19.4% depend on borehole, 12.9% on stream/river and none enjoy water from Ero dam. Most people (75.4%) in Ekiti west LGA depend on borehole while 24.6% rely on well. The impact of Ero dam as a source of water is not felt in this sub-region (Irepodun/Ifelodun, Ijero and Ekiti west LGAs) probably as a result of the faulty water mains in the area (Jegade, 2011).

In the entire region, however, it is obvious that the influence of Ero dam is very low (29.8%). Generally, 29.5% of the people source water from well and 1.9% from stream and river. The greater percentage (38.8%) depends on bore hole for water supply which were both private and public. Private are those developed by individuals for personal use but shared by the public (72.8%), while public are those developed by governmental or non-governmental organizations for the use of the community where they are located (27.2%). By implication the distribution from the dam is insufficient considering the position of Olofin (2010) that the dam has the capacity to supply portable water for the whole of Ekiti State.

Availability of Water Pipe (Reticulation) in the Region

Availability of water reticulation in the study region was investigated to be able to relate information with the source of water earlier identified. Greater percentage of the population (97.8%) in Ido/Osi LGA confirmed the availability of the underground pipe (reticulation) from Ero dam in their communities while a few (2.2%) were not sure of the existence. In Oye LGA, 63.4% residents confirmed the availability while 35.1% were not sure with a few (1.5%) claiming non-existence of the reticulation in the area. This situation is different in Moba and Ilejemeje LGAs where every resident (100%) confirmed the availability of the underground pipes in their communities. In Irepodun/Ifelodun LGA, 56.0% testified to the availability of the reticulation while only 7.7% declared that it was not available. Most of the people (94.6%) in Ijero LGA agreed to the availability of the underground pipe except a few (5.4%) that were not sure of it. In Ekiti west LGA, 62.3% acknowledged the availability in their communities, 10.2% disagreed while 27.5% were not sure of the presence.

A regional overview shows that, 15.0% of the population makes use of the reticulation system through personal connection into their buildings. This eradicates the problem of distance and time in sourcing the pipe borne water. Private connection encourages the availability of the dam water within the house without any additional effort. About 51.0% of the people in the study region use the reticulation system through public tap points. These public tap points are constructed by Ero dam Agency, the Community, UNDP through its MDG's water project among others. No wonder the greatest proportion of the regional population is aware of the availability of the water reticulation (underground pipe) in their communities. Only 2.5% claimed non-availability while the remaining 16.2% were not sure if the reticulation is available in their communities or not.

However, it is evident that the reticulation system from Ero dam covers almost all the communities in the seven local government areas of the region (Ekiti State Ministry of Resources, 2011). The few (2.5%) that claimed the non-availability in their communities may probably be strangers who are unaware of the development over time. Using the consumption standard as stated by Gbadegesin and Olorunfemi (2007), settlements with 5,000 population and above are qualified to have reticulation. The settlements in the region that are qualified to have reticulation but are presently lacking the provision, therefore, include; Iworoko, Afao, Are and Igbemo.

Functionality of Reticulation

Functionality of water reticulation is an important variable in this research. Certainly, if the functionality is low then the provision of water supply by the dam will reduce. In the study region, 67.4% of the residents of Ido/Osi LGA agreed that the reticulation is functioning well, 15.7% partially agreed and 16.9% disagreed completely. In Oye LGA, 15.3% agreed, 23.7% partially agreed while 26.0% disagreed and 35.0% strongly disagreed with the adequate functionality of the reticulation in their communities. Greater percentage (55.8%) in Moba LGA strongly agreed that the reticulation is functioning well while 26.2% agreed, 3.0% partially agreed, 4.0% disagreed and 10.5% strongly disagreed. In Ilejemeje LGA, many people (68.4%) strongly agreed and 31.6% agreed that the reticulation is functioning well. Majority (44.0%) in Irepodun/Ifelodun LGA strongly disagreed that the reticulation is functioning well while 2.2% partially agreed, 2.2% agreed and 51.6% strongly disagreed. The situation in Ijero LGA shows that more residents (72.0%) partially agreed, 20.0% strongly agreed while 2.2% disagreed and 5.4% strongly disagreed. The situation is different in Ekiti west LGA where everybody (100%) strongly disagreed that the reticulation in their different communities were functioning well.

Generally in the region, 16.6% strongly agreed that the reticulations within their communities are functioning well, 29.4% agreed while 18.1% partially agreed. Only, 8.5% disagreed while 27.4% strongly disagreed with the adequate. In summary, significant percentage of the regional population (35.9%) disagreed that the water reticulation in their communities are functioning well. This is not in doubt, going by the earlier discovery of Ifedayo (2012) on the challenges of water supply in Ekiti State. According to him, water reticulation within the State have been so long idle in the ground that most of them are rusty and brittle, thus, reducing the functionality of the reticulation in the State.

Regularity in the Flow of Water

Regularity in the flow of water from the dam is a variable that can be used to determine the functionality of the dam in the region. From the information gathered, 33.7% residents in Ido/Osi LGA affirmed that water from Ero Dam flows continuously in their communities, 29.2% claimed bi-weekly, 10.1% attested to once a while and 27.0% hardly see it flow. In Oye LGA 15.3% confirmed that the water flows continuously, while 3.8% affirmed that it flows only bi-weekly. Greater percentage of the residents (66.4%) attested that water flows once a while in their communities. Majority of the people (66.3%) in Moba LGA revealed that water from the dam flows continuously, 10.5% attested that it flows bi-weekly, 5.3% indicated weekly and 17.9% affirmed that it does not flow at all in their communities. In Ilejemeje LGA all the residents (100%) testified that the dam water flows continuously in the area. In Irepodun/Ifelodun LGA, majority (60.8%) acknowledged that the water flows once a while in their communities while 39.2% attested strongly that the water does not flow. In Ijero LGA, 50.5% of the people affirmed that water flows once in a while in their communities while 49.5% hardly see it flow. The situation in Ekiti west is different because the totality of the residents (100%) confirmed that the dam water does not

flow in their communities. As noted by Nwaoko (2013), this could be attributed to the damaged pipes during road rehabilitation in the LGA.

All over the region, 29.7% testified that water flows continuously from the reticulation, 6.3% attested that it flows bi-weekly while 0.8% claimed weekly flow. Those who revealed that water flows once in a while were 29.7%, while 33.5% affirmed strongly that it does not flow in their communities. According to the Head of Maintenance Unit at the Ero dam station, there were 56 reservoirs, a 3-million-litre water storage capacity tank and four booster stations located at Isan, Ayetoro, Aramoko and Igede within the region, and that the dam is currently pumping as much as it can in a day without a particular time of operation. Conversely, the regularity in the flow of water from Ero dam is a major challenge faced by the people in the region. This was attributed to degradation of facilities below designed capacity and lack of adequate maintenance (Ifedayo, 2012).

Relationship between the Spatial Distribution of Water Reticulation and Accessibility to Water within Ero Region

This section examines the relationship between availability of reticulation and accessibility to pipe borne water within Ero dam region using the Zero-order Pearson Product Movement Correlation Matrix of five (5) key variables as shown in Table 1. These variables are: accessibility to water (W-ACCESS), availability of reticulation (A-RETICU), functionality of reticulation (F-RETICU), regularity in the flow of water (R-FLOW), and distance to public taps (D-PUBTAP) within the region of influence. These variables were picked and correlated against one another to reveal the bilateral relationship existing among them and the level of significance at which such relationships occur.

Table 1: Correlation Matrix of Variables influencing Accessibility to Water by Ero Dam

Variable Code	W-ACCESS	A-RETICU	F-RETICU	R-FLOW	D-PUBTAP
W-ACCESS	1	.196**	.340**	.613**	-.004**
A-RETICU		1	.530**	.323**	.435**
R-RETICU			1	.713**	.621**
R-FLOW				1	.323**
D-PUBTAP					1

** . Correlation is significant at the 0.01 level (2-tailed).

Source: Authors’ Fieldwork, 2012

The Accessibility to pipe borne water within the region has significant relationships with four other variables viz: availability of reticulation, functionality of reticulation, flow of water and the distance of public taps from the residents in the region. W-ACCESS has 0.196 correlation coefficient with A-RETICU at 0.01 level of significance. This strong relationship conforms to a prior expectation based on the argument of Ezmeralda (2012) that for an effective supply of pipe borne water in a community, water reticulation must be available within the community. This appears to be the only means of effective supply of Ero dam water to its region of influence. However, W-ACCESS also maintains positive significant relationships at 0.01 level with F-RETICU with a correlation coefficient of 0.340. F-RETICU is another critical factor in water supply, because availability of the reticulation is important to the functionality. The strong correlation is expected since what is paramount to the supply of water from the dam is a functioning reticulation system. At present, production level of Ero dam appears inadequate. Majority of the consumers of Ero dam water are not satisfied with the irregularity of the flow of water from the reticulation thereby sourcing for other means

of water supply apart from the dam. This explains the strong relationship between W-ACCESS and R-FLOW with 0.613 correlation coefficient at 0.01 significant level.

D-PUBTAB on the other hand maintains a negative correlation coefficient (-0.004) with W-ACCESS. This is anticipated because the relationship between distances of water from main source to homes of consumers often determines the amount of water in litres the consumers can get. Therefore, a reduction in D-PUBTAP to a walkable distance will surely enhance accessibility to pipe borne water in the region. The results of the correlation test indicate that the spatial distribution of the water reticulation from Ero dam, the functionality of the reticulation, the regularity in the flow of water from the reticulation and distance of available public taps to consumers' homes contribute significantly to accessibility to water distributed by the Dam in the region. As argued by Jaarsverld (2000), a functioning reticulation system, regular flow of water from the reticulation and available water taps are determinants of water supply in a community.

Policy Recommendations

Water is an essential resource for sustaining human, animal, and vegetable life. Agriculture is absolutely dependent on water to produce food crops and livestock. Water is crucial to tourism, navigation, and industry. Large quantum of water is used to generate power and mine materials, produce goods and for domestic activities. This paper has examined the spatial distribution of water from Ero dam to its catchment in Ekiti State. The paper also discovers that ineffective and inadequate booster stations, poor and inadequate network of reticulation contribute to the low level of water distribution in the region.

Improvement in the management and provision of more and adequate infrastructure will help in achieving the aim of the scheme in the region if a Special Water Task Force (SWTF) is constituted by Ekiti State government. This will comprise of professionals (planners, geologists, engineers among others) in the State Ministry of Works and Housing, and Water Corporation and Ero Dam Agencies to monitor the availability and the functionality of the existing reticulation. Where the reticulation is damaged (e.g Oye, Ido-Osi and Ijero LGAs), an instant corrective measure can easily be taken and where the reticulation is inadequate within the region (Ekiti West and Irepodun/Ifelodun LGAs), the State Government can embark on possible extension of the reticulation to such places for regular water supply.

The people of Ero dam region should be encouraged by the SWTF to make private use of the reticulation through private connections to their homes with the assistance of Ekiti state Water Corporation Agency (EWCA). An additional 3-million-litre water storage capacity tank should be added to the existing one to enhance water storage after treatment and help the scheme achieve regular pumping of water to the people in the region. To complement this, a booster station should be provided in Iworoko to supply Iworoko-Ifaki-Afao-Are axis. With all these in place, the regular distribution of the pipe borne water within the region will be achieved sustainably.

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