



## **An Assessment of Small-Scale Water Harvesting Systems in Uruan Local Government Area, Akwa Ibom State**

by

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### **Abstract**

*Following the shortfall in water supply from public agencies in rural areas of Akwa Ibom State, small scale water supply system seemed to provide a more reliable water to all residents. The study investigated the role of local water reservoirs in scaling up water availability to middle and low income earners in Uruan LGA. Twelve communities were sampled and copies of questionnaire were administered to all the sampled units. The study identified the role played by local water reservoir in the growth of small and medium scale enterprises such as cassava processing industry, oil palm processing industry, cosmetics, eateries, bakery factory, poultry farming, piggery farm, hairdressing salon, fish farm etc. In the study, the highest number of small scale water provider was found in Nwaniba and the outcome of such statistics was traceable to increasing population of migrants who support local dwellers in constructing and harnessing water from local reservoirs. The study equally examined the number of local water reservoir, the highest number of permanent dug well was recorded at Ita Uruan while the least number of permanent well was found at Ifiayong Obot. Nwaniba recorded the highest number of stagnant water sources while Nung Ikono Ufok had the least number of stagnant water sources. Community streams and rivers were equally identified in the study. Ifiayong Usuk had the highest number of community streams and rivers, followed by Ekpene Ukim and Nwaniba. The study further examined the variation between the level of water supply and small scale water providers in Uruan LGA, Akwa Ibom State using Kruskal-Wallis H non parametric analysis of variance test. The result indicated that there was a remarkable difference between the mean square shown by the degree of freedom. It was recommended that as a result of the prevalence of water borne diseases local water users in Uruan faces in the management of local water reservoir, more public enlightenment should be redirected toward improving hygiene and sanitation practices in the Uruan LGA and residents in Uruan should be encouraged to dig boreholes given the shallow of water table in the region for steady water supply.*

**Key words:** Critical Assessment, Small Scale, Water Supply System

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## **1) Introduction**

Water resource exploitation being considered as the extraction of water for human consumption has an intricate connection with agricultural, industrial, recreation, transport, tourism development and economic development. Freshwater resources provide the main source of safe drinking water for the human population and also support agricultural activities through natural feeding, and irrigation practices, it is far cheaper to use freshwater for industrial purposes. In many cases, fresh water resources, particularly rivers and lakes also perform recreational and transportation functions.

The proportion of total water used for any specific purpose is controlled by socio-economic conditions, traditions, culture and water availability. Communities where agriculture is the sole income generating sector, water is excessively needed to support irrigation, food processing and development of agro-allied industries. In the aspect of domestic water supply, there are diverse sources for rural consumption. Communal water sources are limited by the competitiveness of users, frequent damages of facilities and low attention to hygiene practices. Brett et al (2007) justified communal water for its improved water quality and adoption of high level technology like drilled boreholes equipped with hand pumps, collection tanks and protected springs. Similarly, conventional communal water facilities may not altogether be sustainable due to their high rate of breakdown from operation and maintenance. The major potential of water resource in a rural setting is associated with farming and fishing alongside other informal sector. The sources may be generated from rivers, streams, rainfed wells and other reservoirs as well as stagnant water sources specifically pond and brooks. Sustainability in water supply would have been questionable without the contribution of small scale water reservoirs.

Uruan Local Government Area in particular and Akwa Ibom State in general receive a colossal quantity of water from local sources including stream, river, protected/unprotected well, retention pit, swamp/marshes, seasonal and permanent standing water-pond and lake among others. However, little or no attention is directed towards reviewing the relevance of local water reservoir as a complementary option in meeting the envisaged sustainable development goal.

Small-scale water supplies are usually predominant in rural areas and could have limited coverage. They include piped water, borehole, dug well (protected and non-protected), spring (protected/non-protected), tanker truck, river, stream, lake, pond, rainfed water sources and many others (WHO/UNICEF, 2021). They are the backbone of water supply in rural areas in the entire Akwa Ibom State specifically Uruan LGA. According to World Health Organisation (2011), Small-scale water supplies are defined on the basis of legislatively specified criteria, such as population size, quantity of water provided, number of service connections or the type of supply technology used. It can be characterized by the group of people responsible for operation and management as well as and the number of users they supply. Small-scale water supplies comprise the types of supplies listed:

- i. Private or individual wells: They are categorized as point sources, such as boreholes, dug wells, springs or rainwater collection, potentially piped into private houses which typically serve a single family or a small number of households and which are operated by the users themselves. Some may be seasonal while others may be permanent.
- ii. Community-managed supplies: They are systems administered and managed by the community members. They range from point sources (such as dug wells, boreholes or

springs, streams, rivers) from which community members collect water and carry it home, to more sophisticated systems that may involve treatment, storage and piped distribution.

iii. Public supplies: They are systems administered and managed by a distinct public entity (such as a municipality or water board association) responsible for the provision of drinking-water to the public in a spatially limited area. The strength of public water supplies in Uruan is limited, but since the establishment of Akwa Ibom State Rural Water Supply and Sanitation Agency (AK-RUWATSAN), the status of rural water supply has dramatically improved.

From a global scale, water supplied from small scale reservoirs have fed a greater number of people for many centuries. Before the emergence of public water utilities, local dwellers have intentionally proffer solutions to their water needs either by digging wells, channelization, direct consumption from rivers and streams. A report from Hulsmann as at 2005 noted that a greater number of people within European Community previously had tap drinking water from small scale water reservoirs. For instance, about 7.6% of the population (or approximately 780 000 people) received water from local reservoirs in Czech Republic. As at 1989, there were approximately 750 000 private wells in the Czech Republic. Within this timescale, there were about 16% of the total population who rely on private water supplies in Estonia, 6.4% of people depended on local reservoirs in former Yugoslav Republic of Macedonia, 25% of the total population of people in Lithuania were supplied with water from individual (dug) wells, while around the region of Scotland, a population of around 144 000 people were served by approximately 17 500 private water supplies.

Local streams have been responsible for the productivity in vegetable production in communities and it guarantee all-year-round harvest. Sadly, enough, issues of climate variability had affected the sustenance of local water sources with specific emphasis on streams and ponds. Some healthy rivers and ponds have either lost their volume, dried up or threatened with toxic substances. Ame et al (2020) examined the current state of natural ponds of North Unguja, Zanzibar, seeking to understand the degree of local water perturbation from climate change and anthropogenic events. According to their findings, ponds in the northern Unguja ponds is decreasing in areal extent following settlement encroachment and change in vegetation cover.

Natural pond is considered a small body of freshwater that is usually shallow enough for sunlight to reach the bottom and allow rooting plants to grow barely reach 12 to 15 feet in-depth within a confining enclosure with an area between 1 square meter and 8 hectares or quite smaller than a lake which may be seasonal or permanent (Biggs et al., 2005). Ecological studies highlight that natural ponds are multifaceted regards to their functions. What makes pond a unique habitat and specialized water reservoir is its species richness and easy access to fetch without stress. As mentioned earlier, pond provide other services apart from being a source of water, fishing, swimming and other recreational activities are benefitted from a natural pond.

Syndhia and Hélène (2015) addressed ecosystem service perceptions in the case of pond fish-farming systems in Brazil, France and Indonesia. In France, specifically Lorraine and Brenne, management of pond is associated with recreational activities (angling, walking and nature observation) (Mathe, 2015). Due to the congestion of visitors, human activities in these regions are heavily regulated by environmental standards, especially the European Water Framework Directive. In Brenne, where

thousands of ponds are situated, ponds have become part of a Regional Natural Park where local people harness water and equally enjoy the beauty of nature.

In Akwa Ibom and Cross River States, local water reservoirs is used by a wider population mostly in rural areas and peri-urban centres. Vegetable farmers across Akwa Ibom and Cross River State some decades ago had their self-supplied water sources to boost their farming business especially in event of unpredictable weather condition. Local wells have supported subsistence farming in most part of Akwa Ibom State including Nsit Atai, Nsit Ubium and Nsit Ibom LGA. In addition, the place of local streams cannot be completely underestimated. Small-sized rivers help farmers to secure reliable water being that the depth is shallow for easy access and the distance to the farm is relatively shorter.

Martin (2015) highlighted the contribution of natural stagnant water specifically lake and pond on tourism development. The implications are that local water reservoirs serve numerous functions like boating and aquaculture. In Akwa Ibom State, they are numerous depressions like lakes and ponds that are yet to be transformed into revenue generating business including the inundated flood around Udo Udoma Avenue, Ikot Akpan Abia Axis, IBB Avenue and many others. Places with active flood risk could be translated into tourism by connecting the water into a multi-purpose lake.

Stagnant water for rural dwellers is a good source of irrigated water system owing to the low capital investment and affordability. Akwa Ibom State like other States in Nigeria had gain much from artificial water sources –local wells, local water retention pit (*udoo*) and concrete rain fed reservoir. Local water retention pit is constructed by channeling water from household and in some cases runoff along streets into a large earthen pit. The pit may range from 12ft depth and 6ft breadth. Water is thereafter fetched by using a container tied to a rope. In the case of concrete rainfed reservoir, a roofing material (locally called cutter) is constructed around the roof in such a manner that no single drizzle from the roof escape down to the earth surface. The ability to capture rain water from the roof without letting it reach the surface of the earth provide a source of water. The captured water is connected to a concrete pit which has been carefully filtered and covered. This water can serve household for many weeks. In most cases, the water is treated with alum, chlorine and other materials so as to become suitable for drinking.

Scaling up service delivery in water sector has been the focus of contemporary water resources managers. The services rendered by Small Scale Private Service Providers (SPSPs) has filled the lacuna where public utility fails specifically in remote areas characterized by poor topography, power outage, over-crowded users and delay in maintenance. SPSPs can be seen as independent entrepreneurs who finance, develop, and manage the delivery of small scale water services. They play an important role in advancing water supply services in rural areas and small towns.

The most widely cited work on small scale providers is Kariuki and Schwartz (2005), which is based on an extensive review of the literature on local water resources. Other researches done in this direction are studies by the Asian Development Bank on small water providers in Asian cities (McIntosh 2003; Conan and Paniagua 2003); work published by Building Partnerships for Development on small scale providers in water in Africa (Valfrey-Visser et al. 2006); case studies financed by the Water and Sanitation Program in Africa (Mehta and Virjee 2003) and Manila (WSP 2004); a study of informal water vendors and the urban poor by the International Institute for Environment and Development (Mcgranahan and Kjellen 2006).

Ryan (2009) studied community-managed rural Water supply systems in the Dominican Republic in an attempt to address water scarcity in local areas. Dube (2012) examined the Emerging issues on the sustainability of the community based rural water resources management approach in Gwanda District of Zimbabwe. The study analysed the experiences of rural communities using 685 households in Gwanda district across five wards. Findings were that 67% of the surveyed rural communities in Gwanda depended on community managed water resources mostly in the form of boreholes and protected wells. In Gwanda district, some protected water sources were seasonal and even those communities that used protected water sources often resorted to unprotected sources at some point especially during the dry season.

Chilima et al (2019) studied water management systems within Lake Chilwa basin in Malawi. What makes small scale water project effective in Malawi is the full participation of the beneficiary community at nearly all phases of project cycle (inception, planning, designing, construction, operation and maintenance). This brings about a sense of local ownership and trust.

Small-scale water supplies are faced by a number of challenges related to their regulatory environment; administration; management; operation; and available technical, personnel and financial resources. Water supply in a small scale system are often not regulated or managed differently compared to larger supplies. Apart from this, there is often a low level of awareness and knowledge of potential health risks arising from the consumption of locally supplied water. Some misconception like: “My ancestral parent drank our local water reservoir and never got sick”.

It can be argued that small-scale water supplies are often vulnerable to contamination. Issues related to source protection; hygiene practice is often inadequate; protection zones are often not established; and most times users do not prioritized the need to effectively manage the water point.

World Health Organization (2011) acknowledged the health and sanitation gap in small scale water supplies in Croatia, *E. coli* and coliforms were identified from the study involving small scale water quality assessment. Series of studies done over the years attest to the fact that there is a correlation between public health risk and utilization of local water reservoirs. Out of 1750 samples taken from private water supplies in Scotland between 1992 and 1998, 41% failed compliance for total coliforms, 30% failed for *E. coli* and 15% failed for nitrate. Between 1 January 2006 and 15 October 2008 there were 48 confirmed clinical cases of *E. coli* O157 infection, in which *E. coli*. O157 contamination of a private water supply was either confirmed or suspected.

## 2) Objectives of the Study

The study aimed at assessing small-scale water supply systems in Uruan Local Government Area, Akwa Ibom State with a view to understanding the relevance of local water reservoirs and small scale water service providers in Uruan Local Government Area, Akwa Ibom State. The following objectives are discussed:

- i. To identify the various local water reservoirs and small scale private service providers in Uruan LGA
- ii. To assess the contributions of small scale private service providers on water supply in Uruan LGA
- iii. The challenges facing small scale water supply in Uruan LGA

Uruan Local Government Area is strategically located south east of Uyo urban centre being the administrative headquarters and commercial hub of Akwa Ibom State. The creation of the State in September, 1987, paved way for astronomical urban growth in Uyo spreading across the Local Government Areas sharing its boundaries. This urban sprawl into parts of Uruan, causing it to reflect an urban and rural characteristic as water use demand increase with increase in population creating more opportunities for water supply business franchise. This has brought the need for an assessment of small-scale water harvesting systems in order to determine the existing conditions and opportunities for improvement and development.

### **3) The Study Area**

The study area, Uruan Local Government occupies a landmass of 349.371km<sup>2</sup> (NPC, 2006). It situates between latitude 6° 40` and longitude 7° 20` E in the North and West. It is bounded in the East by Odukpani Local, Government Area in Cross River State, in the South by Okobo Local Government Area, in the West by Nsit Atai and Ibesikpo Asutan local government areas and in the North by Itu Local Government Area. Based on the 2006 Population census result as released by National Population Commission, the population of Uruan Local Government Area is 118,300 (62,897 male and 55,403 female) (NPC, 2006).

Uruan Local Government Area was created in 1988 from the Uyo Local Government Area. It covers an approximate land mass of 349.371km<sup>2</sup> (NPC, 2006). It has 52 villages. The people of Uruan are largely fishermen, farmers and traders. In the colonial days, they were engaged in business with multinational commercial outfits like John Holt, and UAC at Ifianyong Usuk, which was once an important trading spot. The Area also specializes in canoe building and production of fishing inputs. Investment opportunities exist in the Area of Agriculture in the area of agriculture (including livestock and fish farming). The rolling hills in the north and water fronts in the central and southern parts of the Local Government Area provide beautiful scenery. The leading hotel in the State, Le Meridien Ibom Hotels and Golf Course/Resorts, is located in the Area. It is a great tourist attraction. There are 52 villages in the Area. Fishing, farming, trading, clay moulding, arts and crafts, canoe/boat building.

Uruan lies in the tropics and enjoys a humid tropical type of climate with heavy rainfall, high temperature and high humidity. It has both the wet or rainy season and dry seasons. The rainy season begins in March and last till early November with storms of lengthy durations and high intensity causing flooding and serious erosion menace. The dry season continues from November to March characterized by dry and hazy winds called hamarttan. The mean annual rainfall in Uruan ranges from 2000mm to 3000mm. Its mean annual temperature varies from 26°C to 28°C and a high relative humidity which fluctuates between 70 to 80%.

Uruan geology lies around 70m or 230ft above sea level. Uruan is undulating and in the rolling sandy plain built zone of the state, a gently rolling landscape.

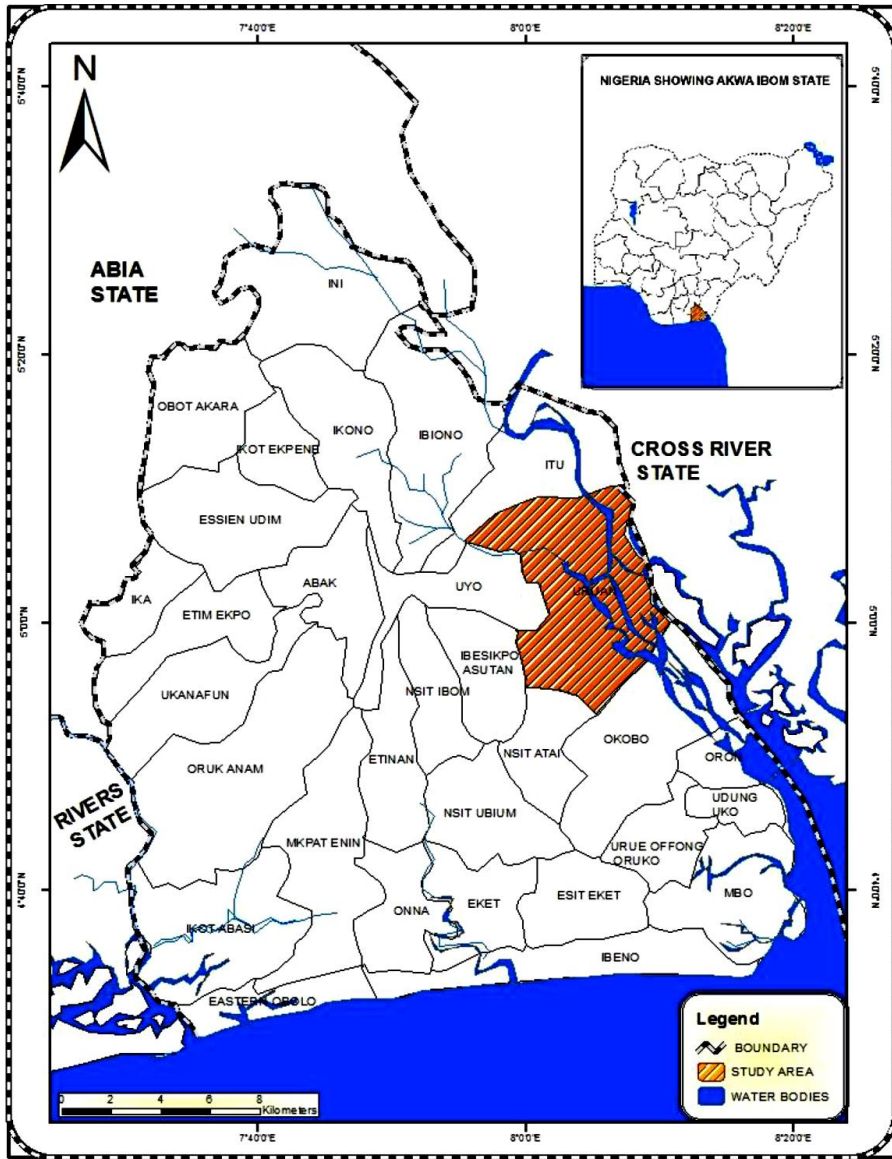
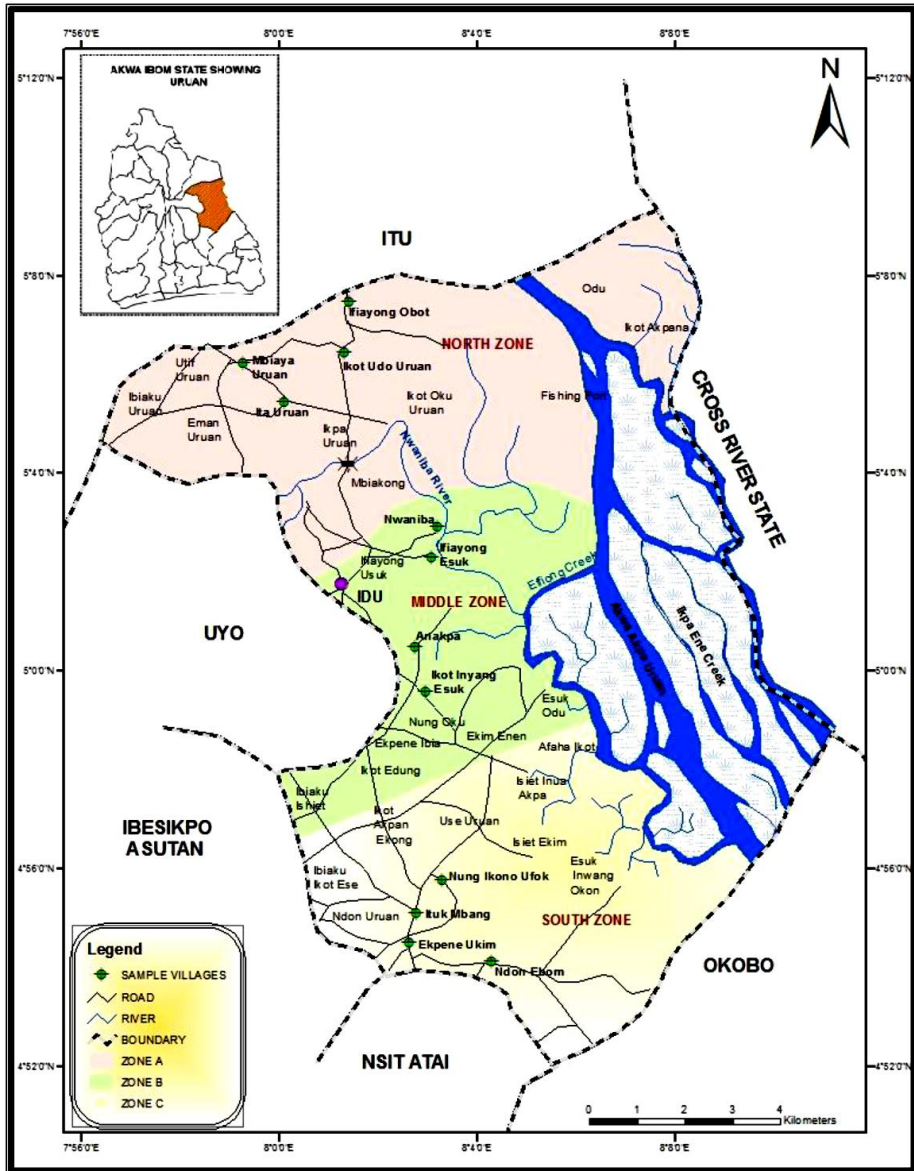


FIGURE 1: AKWA IBOM STATE SHOWING STUDY AREA (URUAN)

Source: Department of Geography, GIS Unit, University of Uyo



**FIGURE 2: URUAN LOCAL GOVERNMENT AREA SHOWING SAMPLED VILLAGES**  
 Source: Department of Geography, GIS Unit, University of Uyo



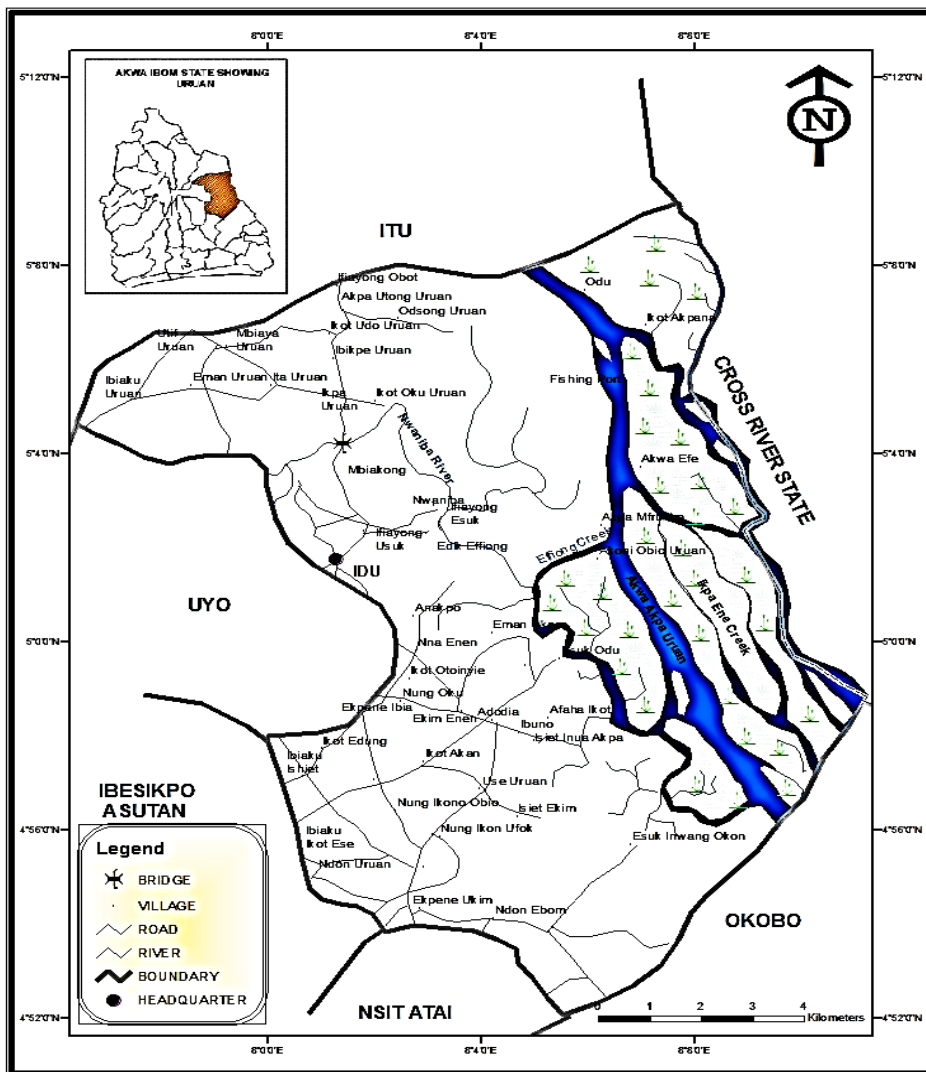


Fig 3: Map of Uruan showing drainage

Source: Department of Geography, GIS Unit, University of Uyo

#### 4) Materials and Methods

The study was conducted in Uruan Local Government Area, Akwalbom State. The Multi-staged sampling technique was utilized. The first sample stage utilized the stratified sampling technique where the local government was stratified geographically into three different segments namely; the Northern axis, Middle axis, and Southern axis. The second stage involved our purposively choosing Mbiaya Uruan, Ikot Udo, Ifiyong Obot, out of the several northern villages to represent the Northern axis. These villages were chosen based on our perception of the communities with active and non-active local water reservoir and its role in influencing the growth of small and medium scaled enterprises. This standard was used to adopt Nwaniba, Ifiyong Esuk, Anakpa, and Ikot Inyang Esuk villages for the Middle axis with the Southern axis; Nung Ikono Ufok, Ituk

Mbang, Ekpene Ukim and Ndon Ebom. These communities were selected and an indepth investigation carried out.

The study area was stratified into Northern, Middle and Southern part. Four villages were purposively sampled from each sub-division as revealed below:

Northern Axis: Mbiaya Uruan, Ikot Udo, Ifiayong Obot and Ita Uruan

Middle Axis: Nwaniba, Ifiayong Esuk, Anakpa and Ikot Inyang Esuk

Southern Axis: Nung Ikono Ufok, Ituk Mbang, Ekpene Ukim and Ndon Ebom

The study employed both descriptive and quantitative method of data analysis. A total of 25 copies of structured questionnaires were distributed to heads of household in Twelve (12) selected communities making a total of 300 copies of the questionnaire. One-way Analysis of Variance on ranks using SPSS package was used to ascertain the Analysis of variance (one way-classification) was employed to examine the variations between the level of water supply and small-scale water providers in Uruan LGA, AkwaIbom State. The variables used for data computation were staffing number, targeted number of water users, affordability of quality water, safety of water sources, operating and maintenance budgets, quantity of water supplied and number and sources of water used. These were determined from the research instrument administered to the sampled respondent.

## 5) Results and Discussion

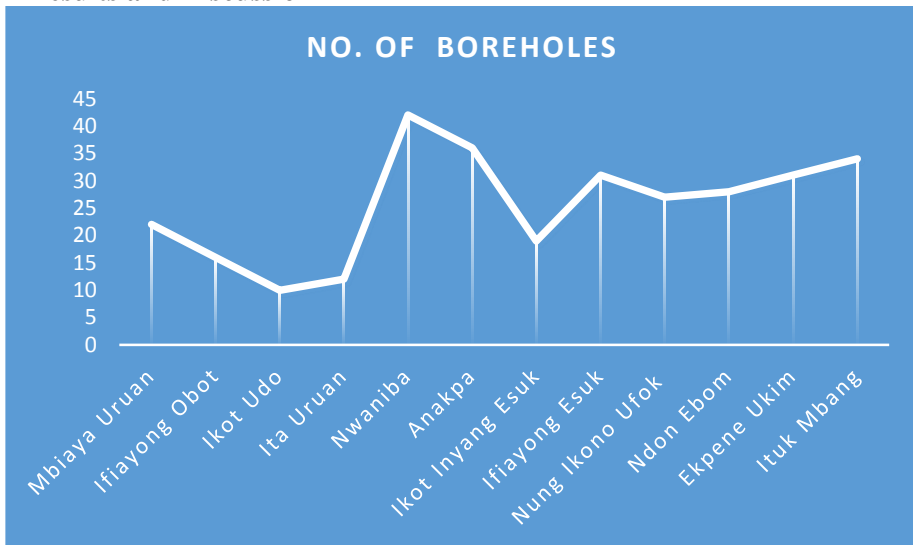


Fig. 4.1: Survey of small-scale water providers

In the figure, the highest number of small-scale water provider was found in Nwaniba due to the increasing number of migrants. Small scale water providers were limited in places like Ikot Udo, Ifiayong Obot and Ita Uruan. Household survey was conducted in each community to determine the number of small-scale water providers who offers water supply services. Numbers of private boreholes was counted excluding household with water facilities but are unwilling to offer water services to the community residents.

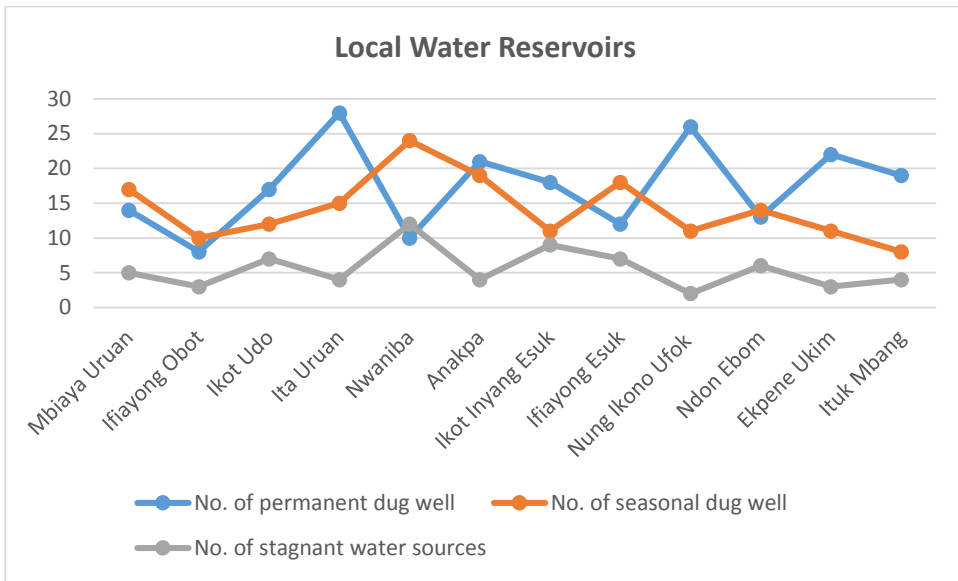


Fig. 4.2 local water reservoirs

From this figure, the highest number of permanent dug well was recorded at Ita Uruan while the least number of permanent well was found at Ifiyong Obot. The highest number of seasonal dug well was recorded at Nwaniba and the least figure was recorded at Ituk Mbang. As for the number of stagnant water sources which included swamps, pond, lakes and many others. Nwaniba recorded the highest number of stagnant water sources while Nung Ikono Ufok reported the least.

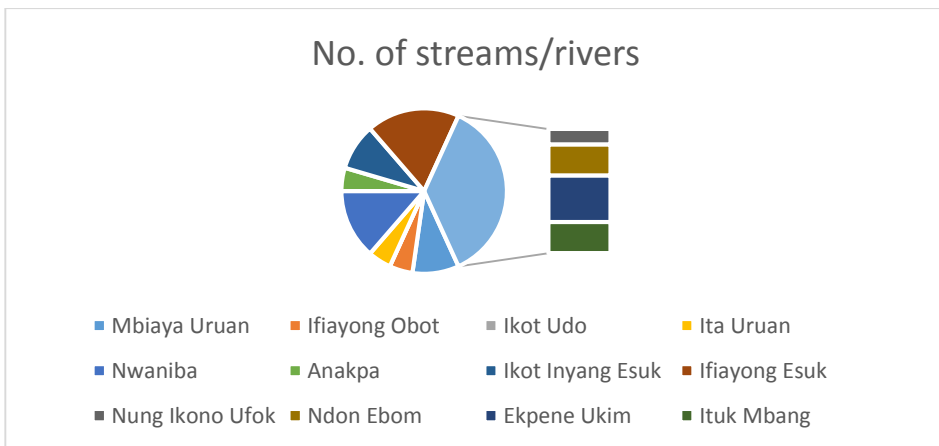


Fig. 4.3 Availability of Community streams and rivers

In the chart, Ifiyong Usuk had the highest number of community streams and rivers, followed by Ekpene Ukim and Nwaniba. On the other hand, Ikot Udo had neither stream nor river rather it depended on dug wells and boreholes.

The ANOVA technique introduced by R.A. Fisher allows us to compare the means of three or more sample distributions (Udofia, 2022). The Kruskal-Wallis H Test, a non-parametric statistical analysis was utilized in this study in order to rank our data

collected for the Northern, Middle, and Southern Uruan and statistically analysed the significant differences between them.

This technique was used because the study had data that satisfied the basic assumptions of non-parametric statistical analysis. It provided a method for testing the hypothesis through means of ranking data across the sampled populations. It was used to investigate variations between our three stratified groups.

***Kruskal-Wallis H One-Way Analysis of Variance.***

IBM SPSS Statistical Data version 25 was utilized. The Test Statistics table below presents the result of our Kruskal-Wallis H test. The first row reveals the Chi-Squared statistic row, the second reveals the degree of freedom row of the test while the last row reveals the statistical significance of the test.

Table 4.1: Kruskal-Wallis H One-way Analysis of Variance between the level of water supply and small scale water providers in Uruan LGA, AkwaIbom State.

<b>Average Mean Rank</b>			
Middle	12.33		
Southern	10.74		
Northern	11.32		
<b>Test Statistics<sup>a,b</sup></b>			
	Middle	Southern	Northern
Kruskal-Wallis H	7.286	6.147	4.027
Df	2	2	2
Asymp. Sig.	.024	.042	.063

a. Kruskal Wallis Test

b. Grouping Variable: WaterSupply

Following the premise for the test, the result of the analysis of variance indicated that there was a statistically significant difference in water supply between Northern, Middle and Southern Uruan. This was indicated by  $\chi^2 = 7.286$ ,  $p = .026$ , with mean rank score of 12.33 for the Middle, 10.74 for Southern and 11.32 for Northern Uruan. In other words, the null- hypothesis is rejected since the p-values were lesser than our significance level. .

Water resources are critical public and economic goods that deserve utmost attention. Residents within the study area have harnessed water for various uses including agriculture, domestic use and industrial purposes. In Uruan Local Government Area, small and medium scale enterprises depend heavily on water for their services most especially the agro-allied industries although others may include Cassava Processing industry, oil palm processing industry, cosmetics, eateries, bakery factory, poultry farm, piggery farm, hairdressing salon, fish farm etc. agro-allied industry specifically agro-processing and animal production are the most water-expended sector. The study indicated that the highest number of small-scale water provider was found in Nwaniba and the outcome of such statistics was traceable to increasing population of migrants. Small scale water providers were limited to places like Ikot Udo, Ifiayong Obot and Ita Uruan. Household survey was conducted in each community to determine the number of small-scale water providers who offers water supply services. Number of private

boreholes were counted excluding household with water facilities but are unwilling to offer water services to the community residents. The study equally examined the number of local water reservoir, the highest number of permanent dug well was recorded at Ita Uruan while the least number of permanent well was found at Ifiayong Obot. The highest number of seasonal dug well was recorded at Nwaniba and the least figure was recorded at Ituk Mbang. As for the number of stagnant water sources which included swamps, pond, lakes and many others. Nwaniba recorded the highest number of stagnant water sources while Nung Ikono Ufok had the least number of stagnant water sources.

In the study, community streams and rivers were identified in the study. Ifiayong Usuk had the highest number of community streams and rivers, followed by Ekpene Ukim and Nwaniba. On the other hand, Ikot Udo had no stream neither river rather depend on dug wells and borehole.

From the result of the analysis, Kruskal-Wallis H One-way Analysis of Variance was used to determine the variation between the level of water supply and small-scale water providers in Uruan LGA. The result indicated that there was a remarkable difference between the p-value and the significant level. In other words, the null-hypothesis is rejected since the p-values were lesser than our significance level.

## **6) Conclusion and Recommendations**

The study entitled ‘critical assessment of small-scale water supply systems in Uruan LGA’ explored the sources of water for various users, water resources potential, the challenges facing water resources utilisation and management of small-scale water sources as well as approaches to ensure effective water use. Water has been considered to be the driver of economic development in Uruan Local Government Area due to the fact that almost all the businesses depended on water for their day-to-day activities. Shop owners, factories, schools and hospitals were functional because water was made accessible for their operation. Uruan is blessed with a great number of water sources ranging from beaches, seasonal/permanent water, streams, rivers, protected/unprotected dug wells as well as man-made sources: boreholes, pipe borne water and private water distribution services. Sea food harvesting is very common in Uruan in places like Ifiayong and Nwaniba. Other livelihood harnessed from small scale water system in the study are but not limited to irrigation, tourism, aquaculture and strengthening of small and medium scale enterprises. However, among the challenges facing management of small-scale water systems in Uruan were mentioned including pollution from industrial facilities, inadequate water infrastructure, poor service delivery, poor sanitary culture and income differential. In this wise, stakeholders in water sector need to reconsider the place of small-scale water supply services in the attainment of equitable, affordable and sufficient water supply for residents in Uruan and environs.

Considering the relevance of small-scale water supply services, the following measures are encouraged;

- i. Government agencies should support the rural water sector with adequate power supply so as to promote constant water supply to the poor
- ii. Training and symposium should be organized by stakeholders in the water sector on topical issues ranging from contemporary issues of rural water supply as well as management of local water reservoir in the era of changing climate.

- iii. There is need to scale-up water supply in rural areas given the fact that much attention on water supply is tilted toward expanding water supply coverage in metropolis.
- iv. As a result of the prevalence of water borne diseases community faces in the management of local water reservoir, more public enlightenment should be redirected toward improving hygiene and sanitation practices in the Uruan LGA
- v. Residents in Uruan should be encouraged to dig wells since the water table is relatively shallow. Excavation of more wells would improve water supply and will reduce the constraint people face in getting access to water from boreholes which is driven by electricity.

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