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Linkages Between Changes In Climate Elements, Institutional Capacity and Community Access to Water In Iju, Lagos

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Abstract

Synergies between climate elements, institutional capacity and percieved community access to water based on the current effect of climate change appears complex since such synergy are often times informed by multiple factors such as social, economic, political and environmental. Better understanding of the complexities as it relates to the multiple natural and political drivers if well adopted could inform change in action and further reduce water stress. This paper examines the relationships between micro climatic elements, institutional (iju water works) capacity and community perception on access to portable water in Iju. Seasonal rainfall and temperature data were collected and analysed. Available seasonal information on water levels and abstraction activities were determined. Structured interviews were conducted with officials of water works while questionnaires were administered to communities to ascertain community access to portable water supplied by the institution. The result shows direct correlations between rainfall pattern and the water level but not with water abstraction activities. However the ability of the institution to abstract water was found to be influenced by varied factors such as the state of the pumping machines , absence of power plant and obsolate equipments in the face of rising water demand due to increasing population.

Key words: Linkages, climate variables, institutional capacity, perceived community access

Background

Water is one important natural resource required for life and ranked second to air. According to Ayoade (1997), about 70% of the surface of the earth is covered with water in form of oceans, river, lakes and ice. Yet access to water has become critical globally, due to variations in climatic elements as temperature and rainfall and other human factors. In Lagos, only 30% of the entire population has access to water supplied by government institutions in spite of increasing water demands due to soaring population and geographical location of the city (Gandy, 2005). With a population growth of about 4% annually, the demand for water is set to double to over 2 million litres and 440 million gallons per day by year 2020 (LSWC, 2011). This situation raised concern on the extent of government capacity to provide water for all by the year 2020. As depicted on Table 1, projections into the future revealed that, water demand will exceed water production between 2010-2013 and 2014-2017.

Table 1: Projected population and water demand

Year	Population	Water demand (Mgd/Mld)	Water production (Mgd/Mld)	Demand gap (Mgd/Mld)
2010-2013	20,837,250	625/2,835.03	362/1,643.48	263/1,194.55
2014-2017	25,327,808	633/2,873.19	622/2,823.26	11/49.93
2018-2020	29,320,103	733/3,327.83	745/3,382.30	12/54.47

Source: LSWC, 2011

The complexities and linkages between the identified climate variables coupled with the state of institutional capacities and ability influence perceived community access to water. The complexities and linkages also depict lack of adequate research and information that is Lagos State specific, considering Lagos location as a coastal city. Thus, this paper examines the relationships between climatic elements (rainfall and temperature), the challenges of the Iju Water Works in terms of capacity to abstract and distribute water, and the perception of the community to access water using Iju water works in Lagos, as a case study.

Study Location

Iju community is located in Ifako Ijaiye Local Government Area, located within longitude $3^0$19'58E and latitude 6 ^{0}40'30N (DMS). As depicted in Figure 1, the study area straddles two states, namely Lagos State (Ifako Ijaiye LGA) and Ogun State (Ifo LGA). Iju water works has evolved through several stages. It started with the building in 1910 along with the first treatment plant with a capacity of 2.42 million gallons per day (11,000m3/d) designed and executed to serve the residential reservation of the colonial administrators living in Ikoyi area of Lagos. Subsequent expansion was made by increasing its capacity to 27,000 m^3/d (6 mgd) in 1943, 50,000 m^3/d in 1954, 109,000 m^3/d in 1965, and 159,000 m^3/d in 1973. Today, Iju water with its major influence being the Ogun River, has the capacity of 689,272.04 m^3/d (45 Million Gallons per day) since 1985, and second to Adiyan water works with the capacity of 318,181.82 m^3/d (70 MGD). River Ogun has an average level of 3.5 m in the rainy season and 1.0 m in dry seasons. The Ogun River serves as a drain for mostly organic wastes from abattoirs, industries, agricultural and municipal drains along the river's course. The need for adequate institutional capacity to manage water abstraction and supply to meet the need of growing population in Lagos especially those in Iju immediate environs has become a major research concern.

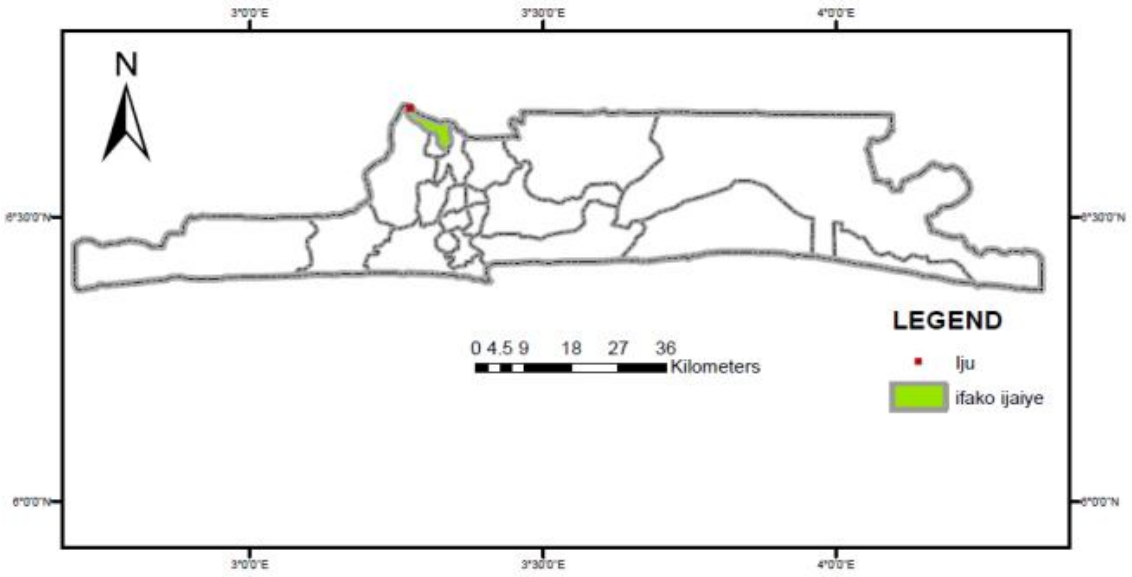


Fig. 1: Location of the study area

Methodology

Materials used for this study include available rainfall and temperature information collected from Ikeja synoptic stations which was the closest to the study location and data from the Nigeria Metrological Agency (NIMET). Others include seasonal water level of the Ogun River and Monthly water abstraction (2000-2010) data gathered from the Lagos State Water Corporation (LSWC). The primary data used included the administration of 200 questionnaires to households using random sampling method to determine community perception on access to water from Iju water works. Measure of central tendencies was adopted to determine mean monthly rainfall and temperature of the area.

Results and Discussion

Iju lies in the humid tropics and experiences the bimodal rainfall pattern with first rainfall peak occurring in June-July and the second occurring in September. Rainfall onset (with rainfall >50mm) is around March to April and rainfall cessation occurs from late October to November. The months of December to February (DJF) are typically dry and hot with very little or no rainfall. The month of August represents the "little dry season" characterized by decreased rainfall and moist cold wind (Figure 2). Comparison with the seasonal water level as depicted in Figure 2 and 4, reveals a linear relationship between rainfall pattern of the area and water level of the Ogun River. However it is further revealed in Figure 4 that high water level availability of raw water does not mean high water abstraction from the Ogun River.

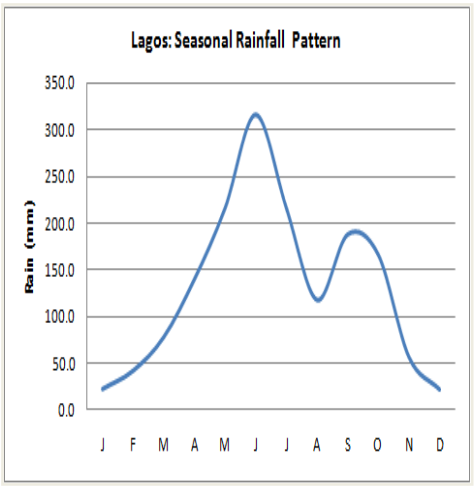


Figure 2: Seasonal Pattern of Rainfall in Lagos

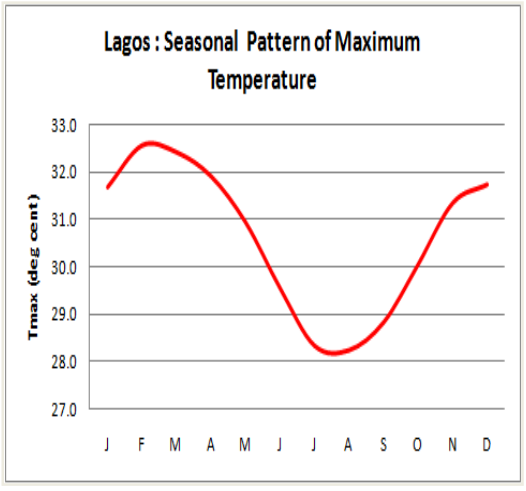
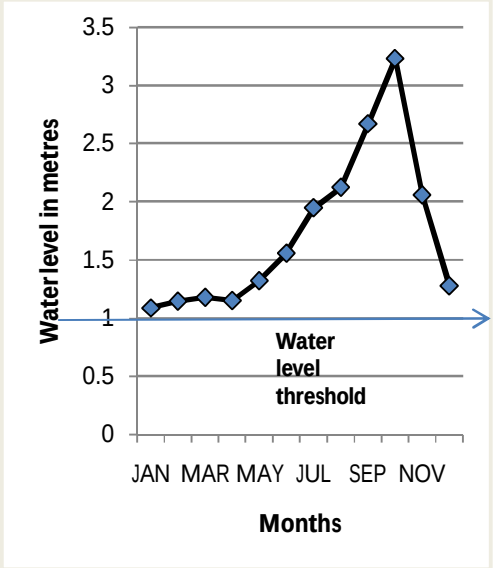


Figure 3: Seasonal pattern of maximum temperature in Lagos

For temperature, the annual mean maximum temperature for the Iju community is indifferent from that of the Lagos area, which is about 30.6^{0}C, although, micro-climatic studies reveal variation from one location to another. However the highest maximum temperature which is normally recorded in the month of February could reach 32.6^{0}C. The months of July and August are the coolest month with maximum temperature of about 28.2^{0}C (Figure 3).



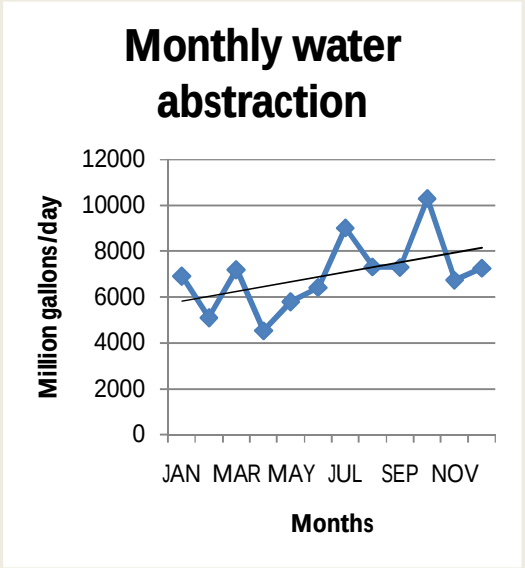


Figure 4: Seasonal water level of the Ogun River Figure 5: Seasonal water abstraction By Iju water works.

Further analysis suggests an inverse relationship between rainfall and temperature in the sense that when rainfall is high temperature is usually low and when temperature is high, rainfall is also low. At the institutional level and as depicted in Figures 4 and 5, the month of October recorded the highest water level which also affect the volume of water abstraction for that month too.

The analysis as suggested in Figure 4 reveals that the water level is always above 1.0 m in both dry and wet seasons. And the water works is only able to abstract water when the water level is above 1.0 m threshold. A threshold below this put stress on the water production equipment. This suggest that ability of the water work agency to produce depends on the working condition of the abstraction machines and other equipment, human capital necessary for pumping raw water from the river and purifying and distributing water to neighbourhood. It also implies that the ability and capcity of the the water works to produce water is more of economic, political and human than climatic factors.

Currently, there are about six big and five small machines abstracting water at the rate of 12 million and 6 million gallons per machine each day respectively. But as a result of the design capacity of reservoirs, only 2 big and 2 small machines are currently in use, pumping 12million×2 gallons and 6 million×2 gallons per day.i.e (24million +12million gallons daily). In other words, the Iju water works abstract a total of 36 million gallons daily, that is about 39% of its installed capacity. Several factors have been identified for the low perforemance of the water works. These include inadequate maintenance of equipment, lack of independent power plant, and high cost of fueling, low water pressure, pipe rupture, and low capacity of staff and bad road network for distribution (Nigeria Tribune, 2010).

In order to determine community access to the various sources of water in the study area, perception analysis was carried out. As depicted on Figure 6, the result revealed that only

39% of the community members have direct access to water from the Lagos State water Corporation while 61% have access to water sources through other as well, borehole, water vendors and rainwater.

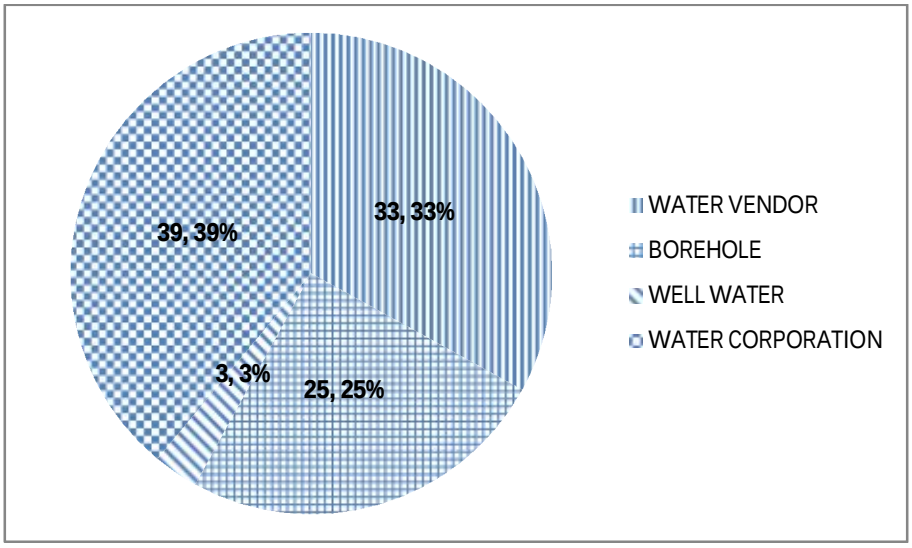


Figure 6: Source of water supply tolju community.

Conclusion

The analyses showed a direct relationship between climate elements and water level, but indirect relationship with water abstraction activities by the water works institution. This means that increase in rainfall and decrease in temperature means increase water level but does not necessarily mean increase in water abstraction. This implies that the water production capacity of the water agency does not increase with water demand soared by population. Hence, this study concludes that current capacity in terms of skills and equipment of the lju water works should be enhanced to achieve equipment efficiency, independent power plant output, and low cost of fueling, high water pressure in order to meet the demand of the increasing population. Measures in reducing water theft and leakages and also swift response to broken down and exposed water pipes are needed to reduce wastage.

References

Achakpa, P.M. and Okoye.J.K, (2007): Background study on water and energy issues in Nigeria to inform the national consultative conference on dams and development: society for Water and public health protection, March, 2007 p 11

Adefolula D.O (1986): Rainfall Trends in Nigeria: Theoretical and Applied, Climatology," Springerlink Verlag, Vol. 37, No. 4, Germany, pp. 205-219.

CSIRO (2010): Understanding how climate change affects water,http://www.csiro.au/science/climate-and-water_supply.html#

Gandy, M. (2005), Learning from Lagos" *New Left Review* 33 *London*, pages 36-52.

Ishaku, H.T & Rafee, M.M. (2010): X-raying Rainfall Pattern and Variability in North-eastern Nigeria: Impact on Access to Water Supply, Journal of water resource and protection, vol.2 No 11, 2010, pp. 952-959.

LSWC, (2001): Lagos State Water Corporation Annual Reports 2001. http://www.lagoswater.org/bidding

NIMET (2010): Climate and Water information for safety and sustainable Development, Drought and flood monitor bulletin, Abuja, Nigeria, pp1-2

Olaniran.O.J (1990): Changing Patterns of Rain-Days in Nigeria, Kluwer, Geo Journals, Vol. 22, No. 1, Academic Publishers, p. 99.

Oyediran, O., Oni, F.O and Ogunkunle, O. (2003): Implications of Climate Variability and Climate Change on Water Resources, Availability and Water Resource management in West Africa. Water Resource System - Water Availability and Global Change. Proceeding of Symposium 1 ISO 2a held during IUGG 2003, Al Sapporo, pp 37-38

UNICEF (2005): "Global Water Supply Assessment Joint Monitoring Program for Water Supply in Developing Countries," United Nations International Children's Emergency Fund, p 4