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Effect of Climate Change on Water Resources in the Yewa–Awori Zone of Ogun State, Nigeria

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Abstract **Case Studies**

Climate change is a global phenomenon that has become a major environmental challenge affecting different aspects of the socio – economic development of community and nations globally. The situation is therefore not without having its toll on the water resources in the Yewa – Awori zone of Ogun State of Nigeria. The global effect of the climate change has contributed immensely to the escalating water stress that is being witnessed in the region. This has resulted in significant influence on water availability and quality because of variations in rainfall patterns, rising temperatures, and increasing frequency of extreme weather events. The focus of this chapter is to examine the shifts in rainfall patterns, groundwater recharge, and surface water availability in the region.Additionally, the study examines how climate change affects water resources in the Yewa–Awori zone. Highlights of the influence of climate variability on the availability of surface and ground water; increase in flooding and drought occurrences as well as the effect on water quality and public health are considered.Based on the foregoing, the study concludes that drip irrigation, rainwater harvesting, and solar pumps offer viable solutions. The study provides actionable recommendations to enhance water security and climate resilience in the critical agro-ecological zone. The recommendations aqre made with regards to integrated water resource management, climate adaptation strategies, and improved environmental monitoring to ensure sustainable water supply in the region.

Keywords: Climate change, Water resources, Yewa–Awori, Ogun State, Water management, Nigeria.

1.0 Introduction

Yewa– Awori zone of Ogun State, is one of the essential agricultural hub in Ogun State, Possible adaptation strategies are also outlined. The use of geospatial data and community surveys from previous studies reveals that water tables declines by about 0.5–1.2 m/year. It was also ascertained that due to erratic rainfall there is decrease of about 12% in the annual rainfall since 2000.The rising demand from agriculture and population growth has greatly impacted on the water resources in the region. Based on the foregoing, the study concludes that drip irrigation, rainwater harvesting, and solar pumps offer viable solutions. However, it is pertinent to state that these requires policy support and community engagement by both the State and federal government.

Climate change is one of the most pressing concerns of our age. It has far-reaching effects

on the ecosystems and human progress in all sectors of the planets. According Zhang et. al (2022), the various the impacts of climate change are extensive, they includes the exacerbation of poverty, breakdown of infrastructure, loss of environmental, political, economic, and social security. Climate change has been characterized by the United Nations Framework Convention on Climate Change (UNFCC) as the outcome of human activity which has altered the composition of the global atmosphere. This in turn is accompanied by observed fluctuation in natural climatic conditions spread over considerable time periods. It is also referred to as a long-term shift in weather data. Crucial components of farmers' livelihoods, such as water, food, farmland, and health has been negatively been impacted. Hydrologic balances has been identified as one the features affected by climate change (Intergovernmental Panel on Climate Change (IPCC) (2022). In the same vein, water resources were also highlighted by another features significant influenced by climate change Okon et. al. (2021). Fadairo (2021 asserted that the impact of climate change on water resources is evidenced by late rainfall and the drying up of streams and small rivers that normally flow year-round in the country Nigeria

Water is one of the most essential natural resources required for human survival, agricultural production, industrial development, and ecosystem sustainability. However, the availability and quality of water resources are increasingly threatened by climate change across the world. Climate change has been identified as one of the most significant environmental challenges of the twenty-first century because of its impact on global hydrological systems (Intergovernmental Panel on Climate Change, 2021).

According to Aribisala et al., (2015) the effect of climate change on water resources occurs due to alterations in rainfall patterns, increase in `temperature increased frequency of extreme weather conditions such as floods and droughts. Consequently, these climatic variations pose a lot of challenges for water resource management. Such challenges include lower level of surface water flows, groundwater recharge, and water quality. These effects are more critical in developing countries such as Nigeria as a result of rapid population growth, poor infrastructure, and inadequate environmental management practices.

2.0 Study Area: Yewa–Awori Zone of Ogun State

The Yewa–Awori zone otherwise referred to in the political terrain as Ogun West Senatorial distrct is located in the western part of Ogun State. It is bounded by the Republic of Benin in the west, Egba zone (Ogun Central) in the East and Lagos State to the South. The region comprises of five Local Government Areas. They are Ado-Odo Ota,Imeko Afon, Ipokia, Yewa North, Yewa South Local Government Areas. It has an estimated population figure of about 1.8. Ogun State is part of the South Western State of Nigeria which according to Omopriola and Adeala 2026 has a bimodal raining season. The zone predominantly consists of agrarian rural communitieswith over 70% of its population dependent on rain-fed agriculture. Hence the zone is particularly vulnerable to climate variability. Consequently, the role of water availability is critical to the sustenance of livelihoods in the region. The water resources of the area are majorly from rivers, streams, rainfall, wells, and boreholes. However, increasing urbanization, population growth, and climate variability have placed pressure on these water resources.

3.0 Hydrological Characteristics of the zone

Adelana & MacDonald, (2008), posited that the dominant geological formation of the Yewa – Awori zone is the Coastal Plain Sands (Benin Formation), Ilaro Formation, and recent alluvial deposits. These formations are generally highly porous and permeable, enhancing groundwater infiltration and storage. According to Ojo et al., (2022), both formations are underlain by both unconfined and confined conditions. Hence aquifer productivity is adequately enhanced by groundwater occurrence due to the sandy formations depending on lithological variations and depth.

The climatic variability and basin characteristics of the zone exhibits great influence on the hydrological pattern of the zone. It was stated by

Apantaku et al., (2003) that the average annual rainfall of the region is over 1,100 mm through which river flow and groundwater recharge is supported. Salami et al., (2025) highlighted the contribution of high drainage density and runoff to erosion and sediment transport within the basin. Adeaga et al, (2019) also implied that the water demand in the zone exceeds the supply with deficits of more than 45% in some cases. The situation as highlighted above is an indication of the vulnerability of the water resources of the zone to climate change and human activities.

According to (MedCrave, 2017), Yewa River has several socio-economic functions to the zone. History has it that the river serves as a major transport route linking inland communities to coastal trading centers such as Badagry. These functions include support for agriculture through irrigation, enhancement of fishing activities and source of domestic water supply. These functions underscore the importance of rivers in sustaining livelihoods in the region.

4.0 Water Resources InYewa – Awori Zone

The major water resources in the zone can be obtained from seasonal rainfall, surface water, groundwater, and. These resources are increasingly strained by erratic weather patterns, population growth, and expanding agricultural activities.

4.1 Seasonal Rainfalls: The water resources of Yewa – Awori zone of Ogun State like other parts of Nigeria are largely depends on rainfall. Hence the zone is particularly vulnerable to climate variability. Studies have shown that changes in rainfall intensity and distribution across Nigeria have led to irregular water supply, seasonal water scarcity, and increased flooding in several regions (Eruola et al., 2012). These changes threaten agricultural productivity, domestic water supply, and the overall socio-economic wellbeing of communities.In recent years, communities within the Yewa–Awori zone have experienced increasing environmental challenges such as irregular rainfall, flooding, water pollution, and declining groundwater levels. These conditions are largely linked to climate change and environmental degradation, which continue to threaten the sustainability of water resources in the region.

4.2 Surface Water:

The principal river in the zone is Yewa River. The river has its source in Republic of Benin and flows through major towns like Ilaro and Ayetoro draining into the coastal lagoon. It supports irrigation, fishing, and domestic activities. It is the major drainage channel in the zone (MedCrave, 2017). According to (Salami et al., 2025), the drainage pattern of the river is dendritic in nature. This implies that there is an efficient surface runoff typical of regions with a relatively uniform geology. The authors further posited that there is increased water degradation and sedimentation as a result of human activities. Such human activities may include sand mining, deforestration and agricultural runoff.

Ogun River: Although Ogun River do not flow thgrough the region, however it exerts a strong hydrological influence on the zone. According to Wikipedia, (2024), the river takes its source from Oyo State and flows through an approximately 480 km to Lagos Lagoon. Its influence in the zone is through its tributaries and basin dynamics which contribute immensely to the regional water availability and flood patterns.

Major Tributaries of the Yewa River

Apantaku et al., (2003) posited that there are numerous minor streams and tributaries that flow into the Yewa River system. It was further stated that these streams are largely seasonal and depend on rainfall patterns. Although these streams and tributaries are small, they contribute to groundwater recharge and provide water for small-scale irrigation. Hence they are crucial for rural livelihoods and local ecosystems.Theflow regimes of these streams and tributaries are largely seasonal as they respond to the bimodal rainfall pattern typical of the zone.Their benefits in the water resources management in the zone include enhancement of local irrigation systems, support for rural livelihoods and contribution to groundwater recharge.

The Yewa River basin is characterized by a network of perennial and seasonal tributaries,

with the Oyan River being the most significant. Other tributaries such as the Ilaro and Owode rivers, along with coastal creeks, collectively sustain the hydrology of the Yewa–Awori zone.

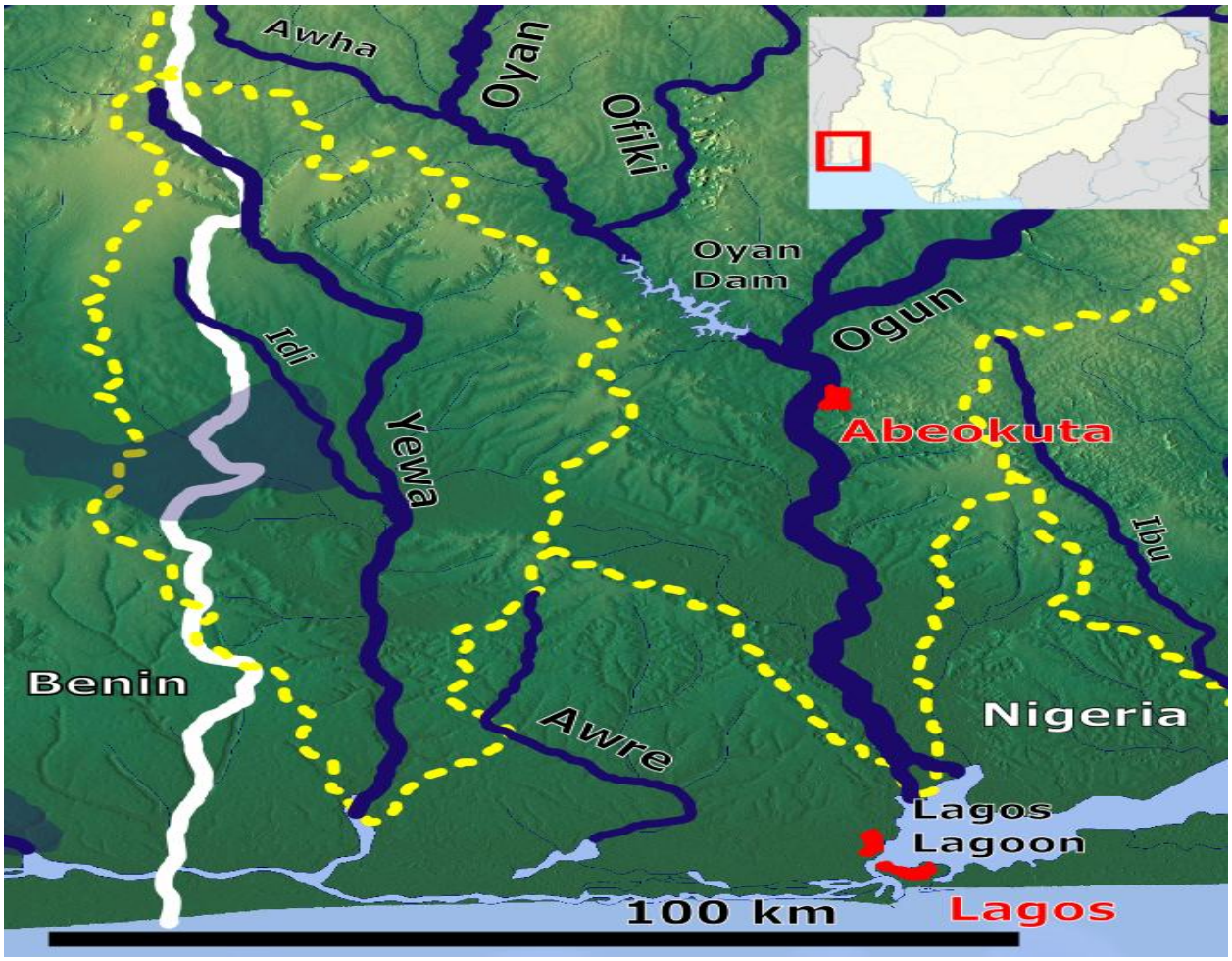
1. Oyan River: The **Oyan River** is the most prominent tributary of the Yewa River. It is impounded by the Oyan Dam. It contributes significantly to water supply, irrigation, and flood control in the basin.

3. Owode River: The Owode Rivers flows through rural settlements such as OwodeYewa and environ. It also plays a role in surface drainage and sediment transport.

4. Iwopin / Coastal Creek Systems: In addition to the seasonal streams and tributaries, the Yewa River connects with Badagry Creek system and coastal lagoons linked to Lagos Lagoon near its lower course. These include a network of tidal creeks and distributaries near the coast these are not tributaries in the strict upstream sense, but they interact hydrologically with the river and influence tidal flow and sediment exchange.

5. Other Minor Streams and Seasonal Tributaries

There are numerous ephemeral (seasonal) streams contribute to the Yewa River, especially during the rainy season. These streams originate from uplands in the zone and carry runoff, sediments, and nutrients into the river. These streams and tributaries are important for flood dynamics, groundwater recharge and basin hydrology.



Source: https://upload.wikimedia.org/wikipedia/commons/4/4e/Yewa_River_OSM.png

4.3Ground Water Resources

Groundwater Resources in Yewa–Awori Zone

One of the principal sources of portable water supply for agriculture, domestic and industrial use in the Yewa–Awori zone of Ogun State is groundwater recharge. The zone falls within the eastern part of the Dahomey Basin. According to Adelana & MacDonald, (2008), the basin is characterized by sedimentary formations that favour groundwater occurrence.

Orebiyi et al (2010) posited that several studies have shown that groundwater in this zone plays a critical role in domestic, agricultural, and industrial water supply. In this section presents empirical case studies that have evaluated groundwater availability, hydrogeological characteristics, and quality in the zone are presented.

5.0 Report of Previous Studies

The followings are findings from some of the studies previously carried out:

Orebiyi et al., (2010) and Adeyemi et al., (2017) conducted the hydrochemical analyses on groundwater samples collected from hand-dug wells and shallow boreholes in rural communities across Yewa North and Ipokia Local government Areas of the zone. The findings are as follows:

i. The PH value of the groundwater in the areas are slightly acidic to neutral
ii. Several locations in the areas show an elevated concentrations of iron (Fe)
iii. There is detection of trace levels of heavy metals such as lead (Pb) and cadmium (Cd) in some samples of ground water samples tested in the areas.
iv. Total dissolved solids (TDS) were mostly within WHO permissible limits

According to Adelana & MacDonald, (2008), Adeyemi et al., (2017) and Orebiyi et al., 2010), the presence of heavy metals and iron is attributed to both natural and anthropogenic factors such as weathering of host rocks, agricultural runoff and fertilizer application and poor waste disposal practices and septic leakage.

Orebiyi et al., (2010) further opined that shallow aquifers were found to be highly vulnerable to contamination, particularly in densely populated areas.

Ojo et al., (2022) highlighted the implication of these findings by stating that while water obtained from deeper boreholes tapping confined aquifers tend to yield better quality, those obtained from shallow wells should be treated before consumption.

In the study by Adelana & MacDonald, 2008), Ojo et al., (2022) and Adeyemi et al., (2017) on the hydrogeology and Groundwater Potential in Ipokia it was stated that the axis consisting of Owode, Idiroko, Ajilete and environ is underlain by Coastal Plain Sands, which are highly permeable and conducive to groundwater accumulation. The findings from the study are that:

i. The surface materials in the study areas consist mainly of medium to coarse sands.
ii. There are thick and laterally extensive Aquifers in the study area
iii. Groundwater in the areas provide a reliable source because of the moderate to high yields of the boreholes.

Additionally, Adeyemi et al., (2017), observed that there are alteration to the surface hydrology as a result of gully erosion leading to land degradation which greatly affects water infiltration and recharge processes These according to the authors influence groundwater recharge and sustainability. Although the areas possess high aquifer potential, the effect of environmental degradation can result in reduced effective recharge, increase sediment transport into aquifers and long-term groundwater availability.

Geophysical investigations by Ojo et al., (2022) and Adelana & MacDonald, (2008) in Yewa – Awori zone by reveal that the zone has a multi-layered aquifer system. The subsurface layers include topsoil, clay/shale confining units and sandstone aquifers which are the main water-bearing formations. Further findings are thatproductive aquifers occur at depths of 60–120 m, confined aquifers yield cleaner and more

reliable groundwater and clay layers act as protective barriers against contamination. The significance of these findings are the confirmation that deeper aquifers are less vulnerable to surface contamination and that they are more suitable for sustainable water supply.

Summarily, from the various studies highlighted above, the zone exhibitsmoderate to high groundwater potential because of thefavourable sedimentary geology. However, there are groundwater quality concerns of iron enrichment, heavy metal Heavy metal contamination and microbial pollution in shallow wells. The factors that are responsible for the possible poor quality of water in the zone include:

i. Lithology and stratigraphy
ii. Land use practices
iii. Waste management systems
iv. Rainfall and recharge dynamics.

6.0 Environmental Challenges

Notwithstanding the socio economic importance of the Yewa River and its tributaries, there are numerous environmental challenges faced in the Yewa–Awori zone. Some of the challenges are:

i. Increasing demand as a result of population and industrialization growth
ii. Climate variability as a result opf climate change
iii. Pollution from agricultural runoff, domestic waste, and industrial activities
iv. Riverbank erosion and habitat destruction result of sand mining as and deforestation{Adeaga et al., (2019), Salami et al., (2025) and Laniyan et al., (2025)}

Effects of Climate Change on Water Resources in Yewa – Awori

6.1 Alterations in Rainfall Patterns

Variability of rainfall is one of the most noticeable impacts of climate change in southwestern of Nigeria in which the Yewa Awori zone of Ogun State belongs.It is marked with irregular rainfall patterns and this affect the availability of surface water and groundwater recharge. Similarly, due to the unpredictable rainfall pattern, water shortages during dry periods and excessive runoff during heavy storms are inevitable and this can affect water supply systems and agricultural activities. (Akiyode, 2024)

6.2 Increased Flooding

One of the hazardous effects of climate change is the increase in the intensity of rainfall events leading to increase the likelihood of flooding. The effect of flooding aside loss of life and properties include damage to water infrastructure, contamination of drinking water sources and displace communities. Although the zone has not witnessed cases of flooding in recent times, environmental reports indicate that southwestern Nigeria has experienced increased flooding and prolonged dry seasons, which are clear indicators of climate change impacts on the environment. It therefore follows that if proactive measures are not put in place, the zone may experience flooding in the nearest future

6.3 Reduction in Groundwater Availability

The major source of drinking water in rural communities are streams, ponds and rivers, while dwellers in urban settlements rely on ground water supply through digging of wells and sinking of bore holes. Both sources are greatly affected by ground water recharge However, climate change influences groundwater through changes in rainfall and temperature.

Higher temperatures increase evaporation rates, reducing water infiltration into aquifers and lowering groundwater levels over time. Aribisala et. al. (2015), Eruola.

6.4 Decline in Water Quality

As a result of climate change there is increase in the quantity of runoff and flooding which in turn the affects water quality and environmental pollution. Contaminants such as waste, chemicals, and pathogens are often carried by

floodwaters into rivers and groundwater systems.

These contaminants pollute both surface and underground and can to increased risk of waterborne diseases such as cholera and diarrhea, especially in rural communities with limited access to treated water.

Studies conducted in parts of Ogun State also indicate that environmental pollution and industrial activities contribute to water contamination and negatively affect the livelihoods of rural dwellers. Aqua (2024) Anwan et.al. (2016)

7.0 Socio-Economic Impact of Climate Change on Water Resources of Yewa–Awori zone

All the afore mentioned have an untold negative impact on the socio – economicdevelopment of the zone. Some the effects are:

- Reduction in agricultural productivity as a result of scarcity water: Prior to the global experience of climatic change, farmers in the zone begin planting operation around March of every year. However, since the climatic change takes effect the commencement of early rain has been unpredictable. Also in the past, when rain starts in the month of March, it falls consistently up to July, there is a short break in July/August, and consistent rainfall between September and early December. But now the period of rainfall has been unpredictable, inconsistent and erratic. This has led to loss of farm produce.
- Increased cost of water supply and infrastructure maintenance
- Higher incidence of water-related diseases
- Disruption of livelihoods dependent on water resources

These challenges highlight the need for sustainable water management strategies.

The vital role of water in the life of man cannot be overemphasized. A popular slogan that amplifies this assertion is “Water is life”. Its availability is essential in the socio-economic development of any community, state or nation. Both the quantity and quality f water is necessary consideration when talking about water resources. It is therefore necessary that vital resource should be properly managed. This can be done by incorporating environmental concerns that is essential for its sustainability. It is also imperative that supply shortages, pollution, land degradation and associated health hazard should be minimized. In order to ensure sustainability of water resources, strategies and definite plans should be put in place for water resources management and conservation. The plans to be put in place should be for both short, medium and long term taking into consideration the national framework, people’s demand for it and its availability.

Recommended Strategies

The strategies to achieve this should include:

i. Government agencies should promote integrated water resources management to ensure sustainable use of available water resources.

ii. Communities should be encouraged to adopt rainwater harvesting systems to supplement water supply during dry seasons.

iii. There should be regular monitoring of groundwater levels and water quality to detect environmental changes early.

iv. Environmental education programs should be implemented to raise awareness about climate change and water conservation.

v. Authorities should implement flood control measures and improved drainage systems to reduce flood impacts.

vi. Further research should be conducted to examine long-term climate trends and their implications for water resources in Ogun State.

vii. An effective regulatory mechanism to monitor the activities of the agencies providing water so that water quality standards are adequately met to ensure safe water supply should be Established;
viii. Adequate support and finance should be provided for hydrological data collection on continuous basis to monitor surface and groundwater level changes and strengthening the Agency or Ministry in charge of water resources to establish solid hydrological database;
ix. Active and effective state participation in the implementation of the National Policy on Water Supply and Sanitation should be nsured;
x. There should be the establishment of adequate irrigation and water control schemes in areas of water surplus to check flooding, erosion and other related disasters;
xi. Necessary guidelines for water resources inventory, collection, treatment, flood routing and control as well as techniques for predicting and minimizing the impact of natural disaster should be provided;
xii. The private sector should be involved in sustainable water resources management;
xiii. Users of both underground and surface waters for commercial purpose to check over exploitation of the aquifer should be registered;
xiv. Environmental impact studies of water use and management should be provided.

Conclusion

The study examined the effects of climate change on water resources in the Yewa–Awori zone of Ogun State. The findings show that climate change has contributed to irregular rainfall patterns, declining groundwater levels, increased flooding, and deterioration in water quality within the region.

These impacts pose serious challenges to domestic water supply, agriculture, and public health. The increasing pressure on available water resources highlights the need for effective water management strategies and climate adaptation measures to ensure sustainable water supply for communities in the Yewa–Awori zone.

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