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Coping Strategies, Cultural Practices and Policy Implications on Domestic Water Supply in an Erosion Susceptible Rural Community, Nigeria

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Abstract: Solving water-related problems in remote regions, especially in the developing world, is context-specific and demands knowledge and attendant support of local processes and practices. Most rural communities in developing countries have basic water and other socioeconomic challenges common to them. However, the additional constraints that come with incessant landslides and gully erosion menace necessitates a holistic investigation of how the inhabitants of Nanka, a rural community in the southeastern part of Nigeria, tend to cope with shortages in the domestic water supply and other stress associated with water. This work tries to examine the domestic water coping strategies in the community in terms of water access, sources, practices, barriers, cultural influences, and other environmental issues. These factors were investigated through qualitative research methods. Major water sources in the community include surface sources, rainwater harvesting, and sachet water, while the main water coping practices are water storage, water sharing, and buying water from vendors. The current study further makes policy recommendations along the way forward.

Keywords: developing country; resource scarcity; environmental management; aversion behavior; drainage regulation



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1. Introduction

There has been an exponential increase in the global population in the last few decades. In exact terms, the world population increased from three billion people in 1960 to five billion in 1987 and was estimated at 7.7 billion in 2019 [1]. The expansive and cumulative rise in the global population has led to growth in the general human demand for water. Water being an essential need of mankind is a critical determinant of healthy living and has proved fundamental in our day-to-day activities [2]. In modern times, the massive production of water for domestic use easily targets the urban areas in most nations of the world. The reason is not difficult to understand, since most urban areas are often characterized by high population densities, government presence, and economic opportunities. Rural areas, especially in low- and middle-income countries, receive lesser attention concerning domestic water supply provisions because of the opposite of the reasons mentioned above. For instance, it was estimated in the year 2000 that roughly 42% of the Nigerian urban population have access to a safe and drinkable water supply, while the rural population that had water supply access was barely 29% [3]. Nigeria's Demographic and Health Survey report of 2013 documented that the proportion of Nigerian rural and urban households that use unimproved drinking water supply is 50.8% and 14.4%, of which surface water sources are the main sources for 20.9% and 3.7% of rural and urban households, respectively [4]. Furthermore, when considering the disparity that exists in the rural–urban population

index in some states in Nigeria, the situation rightly points to worse-case scenarios. For instance, Enugu state in the southeastern part of Nigeria has over 80% of its population living in rural areas [5].

However, water coping strategies and aversion practices is a developing world concept that has been majorly situated in the literature as a problem for urban and semi-urban areas, usually perceived to be caused by the failure of the urban water authorities (public operated water supply system) in rising to the responsibility of adequate water supply [6,7], or as a result of shortcomings of neoliberal water policy regimes [8]. The aim of analyzing water coping strategies is mainly to provide insight into the policy and water intervention needs of the studied locations and to understand the roles that the institutions and stakeholders will play in devising solutions [9].

Nevertheless, the provision of adequate and sustainable water supply in modern times requires critical capacities in terms of finance, technology, knowledge, and other resources, which simply signifies that the rural areas that share lesser economic and political capabilities require more attention and efforts towards water supply provisioning, monitoring, and continuous evaluation. Another reason is that rural communities are predominantly inhabited by poor people, and this class of people is the most vulnerable to environmental externalities. They face the externalities often in two ways: (i) they are more prone to environmental negativities such as floods, erosion, drought, etc., and (ii) they live and depend more directly on the environmental/natural resources [10]. Developing countries are frequently faced with the problem of severe soil erosion and depletion of the soil resource base. As they struggle to feed an increasing population, steeper and less suitable lands come under cultivation. The result is increased soil erosion and landslides, which have triggered socioeconomic challenges, especially for poor rural dwellers [11]. The Nanka community under investigation has been affected by extreme negative environmental effects (i.e., erosion and landslide) and, as a rural community, is still dominated by the class of people that make more direct demands on natural resources. The studied location is, therefore, more suitable to be investigated for domestic water practices and surviving strategies towards understanding the Nigerian rural domestic water issues. The relevance of this work is further informed by the fact that solving water-related problems in remote regions, especially in the developing world, is context-specific and demands knowledge and attendant support of the local processes and practices that already exist in the location [12].

2. Literature/Theoretical Framework

The proclamation of right to an adequate, safe, accessible, and affordable water supply as a fundamental human right to all humanity by the United Nations in 2010 [13] and, also, capturing of an adequate and unhindered access to water supply in Goal 6, targets 1 and 4 in the Sustainable Development Goals 2030 [14] are all strong indicators that water supply access has become a critical determining parameter for measuring sustainable development. Assessment at the global level shows that an improved water supply contributes to equity by diminishing the link between poverty and diseases [15]. It is also quoted to have prevented an estimated 2.4 million deaths annually and averts approximately 7% of the global burden of diseases and about 19% of the child mortality rate worldwide [16]. The global water accessibility statistics show that sub-Saharan Africa has the worst water situation, with barely 24% of the population having access to safely managed drinking water as of 2015, compared to 65% in Latin America and the Caribbean, 90% in West Asia and North Africa, and 94% in East Asia and South-East Asia [17]. This is simply because various governments in the African subregion are still largely unable to provide sufficient and good-quality drinking water to their rapidly increasing populations [18].

According to the Millennium Development Goals (MDG) reports, about two-thirds of Nigeria's population (67%) gained access to improved drinking water supply by 2015 [14]. Though this roughly shows a ten percent deficit of meeting the global MDG target of 77% and is also reasonably comparable to the 69% average for less-developing countries, it is

far below the global average of 91% [19]. However, the responsibility of water supply provisioning in Nigeria is shared among the three tiers of government: federal, state, and local. The federal government is charged with the responsibility of water resources management, state governments have a basic role in urban water provisioning through various state agencies and institutions, and the local government, together with the host communities, is in charge of the rural water supply [3,20]. The federal government, through the Federal Ministry of Water Resources, also formulates and implements policies, legislations, regulations, and programs that will guide water supply services at the national level. The state water boards are responsible for the urban water supply within their various areas of coverage. Their work is to plan, coordinate, develop, and manage water infrastructure in the state, as well as to regulate the private water service providers.

The water supply policy regime in the country also recognizes two additional stakeholders in rural water provisioning, which include non-governmental organizations (NGOs) and the private sector [21]. Despite the laudable water policy landscapes, the majority of rural communities in Nigeria still do not have access to an improved water supply system in the form of piped water networks, water obtained from a tap within a dwelling or yard, boreholes, or hygienically harvested rainwater [14]. Even where such facilities exist, they are either dysfunctional or completely grounded, which, on occasion, has forced rural households to rely on any available sources to meet up with their domestic water demand [22].

In developing countries such as Nigeria, the three major water resources for the domestic water supply are rainwater, groundwater, and surface water. The surface water sources can include rivers, ponds, and lakes, while groundwater sources include protected springs, hand-dug wells, tube wells, and boreholes. The production of a domestic water supply through other sources, such as fog, seawater, and/or reusing wastewater, is not common in low- and middle-income countries, because it requires sophisticated and high-cost technologies. The technologies rampantly used in developing countries for the transportation of the water abstracted from various sources are gravity-flow water systems, hand pumps, solar pumping systems, rope pumps, water storage, and water kiosks [23].

At the domestic level, water is essentially needed for all basic household purposes, such as drinking, sanitation, bathing, and food preparation [7]. Water that would be suitable for these purposes is meant to meet the following criteria: (i) quality in the form of purity; (ii) availability in the form of quantity and ease of access; and (iii) equity, which is the fair and just inclusion in sharing the economic, social, and environmental benefits of the water supply system. These factors, coupled with the high technological cost associated with public water provisioning, partly inform the reason why the public water supply services in most cities of the world are monopolized by the public sector. It is dominantly perceived that a free-market structure could undersupply or abuse critical social services in the populace [24]. However, in Nigeria, apart from the relatively low level of financial commitment to water supply development in general, successive governments in Nigeria over time have emphasized the urban water supply, while the rural areas are almost completely neglected [25]. Additionally, many rural water supply projects and programs, especially the ones that involve international donor agencies and private sectors, focused on the distributive outcome (service coverage) through the implementation of new water systems and facilities, without adequate attention to the crucial aspects of sustainability, such as maintenance and cost recovery [22]. It does not also always consider the existing local practices that can provide insight and knowledge [26].

In general, Nigeria's water supply challenges have never been adequately tackled either at the urban or rural community level. This is largely evidenced by the fact that:

- (i) The Demographic and Health Survey (DHS) conducted by the Nigerian government every five years starting from 1990 has recorded a slight improvement in the water indicators, but said improvement has been hugely undermined by the continuous upsurge in population, as shown in Figure 1.

- (ii) The literature both in the past and the current era is still largely replete with discussions and deliberations on the poor water situation in the country in both rural and urban areas. Some of these research efforts are compiled in Table 1 below.

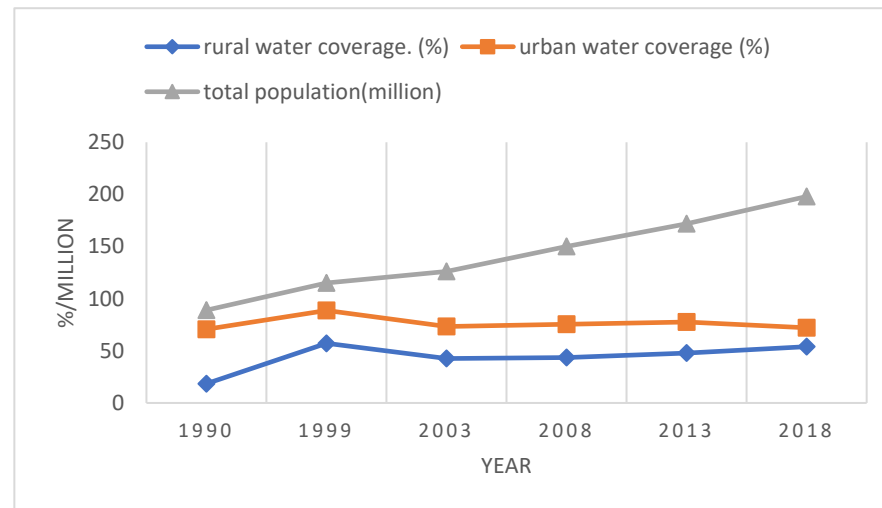


Figure 1. Nigeria's population growth vs. water coverage from 1990 to 2018. Data Source Population Reference Bureau and National Population Commission.

Table 1. Some reviewed literature on the water supply challenges in Nigeria.

Reference	Study Area	Urban/Rural	Issues and Challenges Discussed
[27]	Ado-odo Ota, Ogun State	Urban–Rural	Lost faith in the government water facilities
[7]	Abuja	Urban	Water scarcity, frugal water coping strategies
[28]	Nigeria	Urban–Rural	Rainwater harvesting
[29]	Oke-Ogun	Rural	Technical water coping options and behavioral water coping options
[21]	Nigeria	Rural	Challenges of private for-private rural water supply
[30]	Nsukka	Semi-Urban	Water supply and consumption status
[31]	Lagos, Benin	Urban	Household responses to water supply problems
[22]	Nigeria	Rural	Poor contribution of water supply to the well-being of the rural dweller.
[26]	Akwa-Ibom	Rural	Water meaning and local practices
[32]	Aguata-Awka	Urban–Rural	Harvesting Rainwater for alternative domestic use
[25]	Oyo State	Rural	Rural water management strategies

The key elements, findings, and implications of these studies are summarized as follows:

- (i) Both surveys conducted by the Nigerian government and/or in corroboration with international agencies [4,33,34], and the reviewed academic literature strongly infer that the country has enormous water challenges, with little or no prospects of resolution in the nearest future [7,28,30]. As a result, the majority of the work deals with studies on strategies (how the residents tend to cope) for coping with water stress. This is common among low-income countries, as related studies are equally conducted in

other developing locations, such as Delhi, India [35]; Kathmandu, Nepal [36], and Bandung, Indonesia [6].

- (ii) The chief culprit for poor urban water supply provisioning in Nigeria includes the absent and nonfunctional water institutions, planning, and development of cities without onset articulation of the basic infrastructures, fast-growing slums, ghettos, and shanties within the cities and poor water policy implementations [7,37].
- (iii) In the rural area, improper community structure, poor facility maintenance and cost recovery, high technological cost, illiteracy, and policy constraints are the dominant factors responsible for the inadequate rural water supply [5,21].
- (iv) The constantly advocated means of water provisioning in the Nigerian rural and urban areas include: rainwater harvesting, exploration of surface water sources, and bore-holes/well water systems, while the coping strategies include: water vending, water sharing, begging for water, and adoption of low-cost technology water facilities [7,28].
- (v) It was also found that the water coping mechanism in various Nigerian studied locations is context-specific along the social, economic, demographic, and geographical lines [29].

In Nigeria's context, there is a dearth of literature on the nexus between natural disasters (gully erosion and landslides) and the domestic rural water supply and the attendant response of the rural households to these challenges. In other words, the dimensions of domestic water coping strategies and practices as a function of natural disasters have not been adequately explored at least in the rural Nigerian context. [29] studied the water coping strategies in the rural region of Nigeria caused by climate variabilities. [38] analyzed the water adaptive capacity of women in the rural area of the Ekiti state in Nigeria due to climate change. Several research works have studied rural water coping strategies in the world's developing locations [39–42]. More available reviews mainly investigated how households in the urban/semi-urban areas seek to reduce the challenges of poor water access through 'aversion behaviors' (coping strategies) as a response to inadequate or inconsistent public water supply systems [6,7]. Also investigated along with the discussions is how these water practices and coping strategies are influenced by 'socioeconodemographic' factors such as income, education, occupation, household size, neighborhood type, and cost [2,9,29,30,42–44]. The current study aspires to contribute to the existing literature by building on the previous works to investigate domestic water practices and coping strategies (i) where the community is faced with natural disasters in the form of gully erosion and landslides and (ii) where the community is typically rural. The conceptual framework is shown in Figure 2.

Furthermore, opinion has been conveyed that effective water resource management and utilization is a critical success factor in Nigeria's efforts toward reducing poverty, growing the economy, ensuring food security, and maintenance of ecological systems [25]. We therefore believe that this work will be a practical contribution to this effort by informing the policy and water intervention actions in Nigeria.

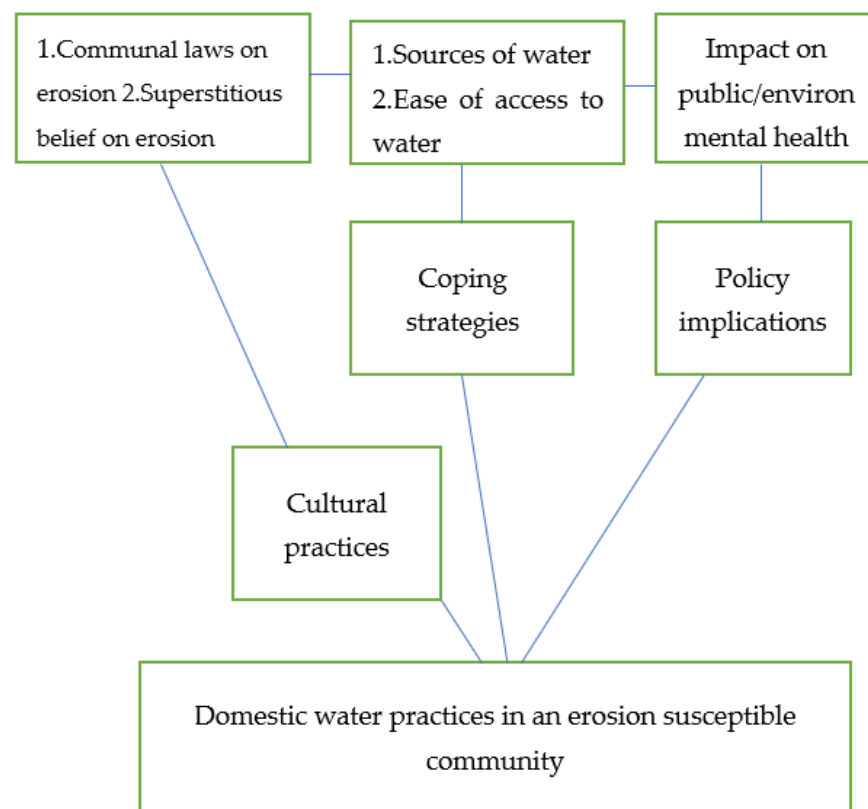


Figure 2. The conceptual model.

3. Materials and Methods

The Study Area

Nanka is a town located in the Anambra state in the south-eastern part of Nigeria. The official population figure was not documented in the 2006 national population census, but available records kept by the community leaders suggest that the current population is about 41,000. It is a typical rural community with minimal social amenities, such as a post office, primary and secondary schools, health centers, churches, and a few factories. Economic activities in the town are partly based on agriculture that produces crops such as palm trees, plantain, cassava, and yams. As a result, there is the existence of palm oil and other agricultural processing mini-factories that have some employees. The indigenes are predominantly farmers and local traders [45], while a larger part of the population consists of elderly family members that are hugely dependent on relatives that are living abroad (cities and overseas) for their livelihood through remittance. Urban–rural remittance practice is common in the entire south-eastern part of Nigeria [46].

The Nanka community has constantly been featured in local, national, and international news because of constant landslides and severe gully erosions that have, on occasion, been described as having huge potential as national environmental disasters [47,48]. Ref. [49] described the operational mode of the erosion menace as the land area being gradually and continuously eaten away by landslides and gully advancement processes. The gully was estimated to have a mean advance rate of 150 km every three to four years. Historians have dated the origin of these frequent landslides as far back as the early nineteenth century but without well-documented evidence on the evolutionary causes. Scientifically speaking, the major topography of Nanka, which is characterized by hills and valleys with high steep slopes, is likely the chief cause of this erosion, as it aids high-speed surface run-off that results in a quick wash away of the soil surface while weakening the soil strata [32], though several studies conducted in the past on the cause of the erosion predominantly attributed it to factors such as fragile geological formations, high-intensity tropical

rainfall that often lasts up to eight months in a year, historical settlement deforestation, hydrogeochemical features of the land area, and historic land-use practices [50–52]. The ecological impact of the erosions and landslides on the community can be summarized as: a rise in the loss of forests, farmlands, pastures, soil structures, and textures. These ecological impacts have inversely triggered socioeconomic challenges for the community inhabitants, which include water shortages and scarcity, loss of houses, population displacement, and the creation of a tense social environment [45,49,53]. Figure 3 shows the location of Nanka in Nigeria.



Figure 3. Map showing the location of Nanka in Nigeria (Source: [53]).

4. Data Collection and Analysis

Rural areas, especially in the developing locations of the globe, are quite different from urban areas in many aspects, such as socioeconomic, cultural practices, local tradition, and improper community structure, which makes it often difficult to study water practices in the areas by applying only quantitative or survey-based research methods of pure science [26]. This perspective is supported by the World Health Organization (WHO) report on drinking water, which noted that, in some Asian countries, people’s understanding of what could be referred to as ‘good portable water’ often does not consider chemical, organic, or bacterial pollutants [54]. This is due to the local knowledge of water that reflects long-standing norms, relationships, and consequent behaviors [26,54]. This work therefore adopts a qualitative methodology for data collection that includes documented evidence (literature), in-depth interviews, and field observation. Additional reasons for adopting the qualitative method over the quantitative are (i) to gain an understanding and richness of a phenomenon, quantitative methods such as experimental and survey methods are less capable of capturing details and providing insights, which makes the qualitative method more appropriate [55], and (ii) the use of multiple data sources (documented evidence, observation, and interviews) in qualitative research gives room for data triangulation, which enhances the validity and reliability of the research result [56].

5. Study Design

An initial reconnaissance visit was conducted in July 2018 to understand the physical terrain and the structure of the study area. On this visit, the study team was introduced to and familiarized with the residents through identified village heads and heads of clans, and appropriate permission was obtained from the town’s authorities. This was considered a critical success factor to the research outcomes, as the cooperation and unbiased participation of the inhabitants are key to the optimal research outcomes. Informal interviews were first conducted to ascertain the leadership and authority structure of the town and also to understand how the town is segregated. The identified village and clan heads were informally interviewed, which also included the local government councilors represent-

ing the town at the local government council, the president general of the community's paramount union, and the traditional ruler's representative. During this visit, the major community's water sources/facilities (both private and public) were also inspected.

On the second visit, the households were sampled. The number of households in the Nanka community was not documented in the 2006 census report of Nigeria, but because most communities in Southeastern Nigeria are organized according to clans and kinsmen, the heads of the clans have official records of the number of households within their domain. This documentation has helped in local community governance, such as the allocation of levies, communal lands for agriculture, and community labor. The local governments also rely on these records for optimal resource allocation. The total number of households in the Nanka community according to this record is 4336 households.

Using the Simple sample size formula:

$$Ss = N / (1 + N(e/100)^2) \quad (1)$$

where N is the number of households (population size), and e is the level of precision (10%) that gives 98 households as the sample size. Fourteen (14) households were selected from each of the seven villages through purposeful sampling, which is a criterion-based selection method that allows information-rich cases to be selected [57]. The criteria for including a household for the study were that the household must make up a head (either mother or father) and other dependents living in a secluded housing unit, and they must have been residing in the current residence for four years. In all, 105 households were selected for an in-depth interview. The number was above the minimum of 30–45 recommended for the qualitative research [58]. The interview questions were designed to capture socioeconomic and demographic information, water supply sources, water supply practices, water preservation techniques, challenges, preferences, and coping strategies. Since the majority of the rural dwellers were not literate, research assistants were trained in the administration of the interview. Interpreters were also hired and deployed. In general, the confidentiality of the respondents was guaranteed and ensured by not allowing the respondents to mention their names, and the interview questions were semi-structured (a mix of open-ended and closed-ended). A total of 105 household heads, which included 81 women and 24 men, agreed and participated in the interview sections, which lasted for an average time of 1 h from September 2018 to January 2019. This time was intentionally selected to fall within the Christmas period when the majority of the indigenes that live abroad would be around to also capture additional observations.

The second formal interview was administered to the community leaders to capture questions on the existing local traditions; bylaws; and myths associated with water supply, water sources, and water surviving techniques. The questions are formulated to capture the perspectives of these leaders from an authoritative point of view. These local leaders today are seen as the custodians of the culture and ordinance of the community. They are the forces behind the local laws, their implementations, and enforcements. Selecting them as respondents was considered useful in extracting information on unclear cultural practices and beliefs existing in the community. Again, most of these categories of the respondents are elderly and are considered eligible, because some of their positions are inherited by default as a result of them being the oldest member of a particular clan. In essence, age-long practices and traditions could also be extracted.

The third set of interviews was addressed to the individuals and officers representing the community at the local governments, state town union committees, and other literate representatives such as retired civil servants and the leaders of thought in the community. The main idea behind this was to obtain their perspectives based on their level of exposure. However, the officials of state ministries of public utility and environments and local government supervisory councilors in charge of welfare were also interviewed. The essence of these was to ascertain the level of either the government's awareness or involvement in these practices, and their responsiveness or readiness to implement a rural water supply,

policy, assessment, and monitoring was also evaluated. Table 2 presents the types, methods, and processes of the interview.

Table 2. Types, methods, and number of respondents.

Respondents	Methods of Sampling	Number of Respondents
Households	Purposive sampling	105
Community leaders	Purposive sampling	25
Leaders of thought	Purposive sampling	7
Government Officials	Purposive sampling	3

The data that emerged from the interviews (recorded with a voice recorder) were transcribed and analyzed using grounded analysis. This entailed developing themes based on the relationship between the data collection and analysis and themes evolving from the analysis [59]. The initial analysis was done by coding the transcript to answer the following three questions: (i) What are the various sources of safe drinking and usable water in the community? (ii) What are informal practices/coping strategies in the community that have helped in ensuring a sustainable water supply in the community? (iii) What is the resident's perception of the domestic water availability status in the community? The second coding was done using the axial coding methodology to categorize the code towards establishing relationships, causes, and effects between them.

Field observations documented during the reconnaissance visit and specific findings from the reviewed literature were further assembled, analyzed, and interpreted to augment and corroborate the interview findings to provide a common ground for the inquiry [58]. The data collected from the three sources were triangulated for consistency, hence meeting the basic criteria of multiple data sources required for qualitative research [58]. The investigation plan is described in Table 3.

Table 3. Description of the investigation plan.

Instrument	Technique	Sampled Respondents/Sites/Documents	Focus
Semi-structured interview	A mix of open-ended and close-ended questions	1. Community residents	Water sources, water practices, water coping strategies, cultural/traditional practices, policy landscapes
		2. Community leaders	
		3. Leaders of thought	
		4. Government officials	
Documented evidence (Literature)	Literature/Document analysis	1. Academic literature	Water policy literature documented water coping strategies
		2. Project document of agencies/NGOs	
		3. Documents produced by community-based organizations (CBOs)	
		4. The community's documented bye-laws/rules and regulations	
Exploratory field observation	Jotting notes photographs videos	Water facilities Erosion/Gully Sites	Water collection methods Water accessibility methods Effectiveness of the methods

6. Research Findings

6.1. Sources of Domestic Water, Coping Strategies, and Informal Practices in the Community

The community has variant sources and means of the domestic water supply, but this is largely dependent on the purpose for which the water is meant and the period when the water is needed. The major identified sources are rainwater harvesting (86%) (roof water connected to tank/flood water channeled to ditches), surface water—public streams and rivers (73%), and water vendors (57%) (water tankers and private factory-packaged sachet water sources from boreholes at the urban areas). The details are shown in Table 4.

Table 4. Sources of domestic water and coping strategies in the community.

Sources of Domestic Water in the Community	Respondent (%)	Coping Strategies
1. Rainwater harvesting (roof water connected to tank/flood water channeled to ditches)	86	-
2. Surface water—public stream/river	73	
3. Water tanker/Sachet water	57	
	64	Water Sharing
	48	Fetching from the stream/river
	26	Buying water from the vendors

6.2. Rainwater Harvesting

Due to the high susceptibility of these areas to erosion and landslide, there is an existing communal law that forbids the construction of boreholes or wells. The community's decision to ban boreholes or wells was a result of the traditional belief of the community that the deities that cause landslides are living beneath the ground; therefore, it is forbidden to drill deep holes down the Earth's crust.

There are other existing communal laws on the environmental quality, adopted by the community in their attempt to checkmate the menace of erosion and landslides, and they somehow influence the domestic water availability in the community. For instance, there is a practice known as '*mgbacha ogwugwu*', which means 'clearing of ditches'. By this practice, every premise or housing unit is mandated to have a fairly deep ditch by the corner of the premise. These ditches are meant to be serviced and maintained by the owners, especially during the onset of the rainy season. The essence of this is that the whole flood water emanating from the premise at the instance of rainfall is meant to be channeled and collected inside this ditch. Flood water is not allowed to leave any premises/housing units to the community roads during and after the rain. The local authorities enforce these laws strictly and mete out strict sanctions to defaulters, ranging from monetary fines to community service. During the interview of the leaders of the clan and villages, one elderly member of the community noted that:

"The community did not record major erosion and landslides in the far past because houses were in the past majorly constructed with thatched roofs and mud, and they were relatively scant in number as a result of lesser population. But the increase in population has come with a huge modernization and aluminum sheet roofing has become rampant. This has resulted in a large collection of water during rainfalls and has subsequently resulted in a huge volume of floodwater seen in the community and hence the cause of incessant erosion and landslides."

The floodwater collected from these ditches is a major source of domestic water supply in the community. It is treated with alum and used for several domestic purposes, except for drinking. All of the respondents ($n = 0$, 0%) refute drinking it. The majority of households ($n = 92$, 88%) also keep domestic livestock and backyard farms, and they are often watered from this ditch-collected water.

In the second method of rainwater harvesting, the households will have either surface and/or underground concrete tanks, where the rainwater from the building roofs is directly connected (Figure 4). The capacity of these water tanks could range from 5000 to 30,000 L. In some instances, submersible water pumping machines are being installed in the underground tanks to pump the water to surface tanks and even overhead tanks connected to showers for the comfort and convenience of the households. Favorable climatic conditions bring rain from April to October, which is stored in the underground/standing tanks, and it sustains some households throughout the dry season (Okpoko et al. 2013).

The erosion menace caused by unmanaged floodwater during the rainy season has often topped the agenda of the community's autonomous union. Beyond the practices discussed above, the community has a law that any eligible male adult of the community (both living at home or abroad) attends annual general meetings held every August (peak of rainy season) or sends a male representative, the failure of which attracts a fine. The top agenda of this annual session is the control of erosion in the community. During this period, committees are appointed to inspect the entire community and supervise the adherence to the erosion and water laws, implement sanctions, and report back to the community general assembly. During this period, each clan within the villages is mandated to make ditches for flood water collection at the strategic junctions within their areas. The water collected through these ditches is treated with alums by the people living close to the ditches and used for any other purposes except drinking and cooking. This is an additional water source for the clans beyond the ones they have within their premises.



(a)

Figure 4. *Cont.*



(b)

Figure 4. (a): Rainwater from the building roof directly connected to the underground concrete tank. Source [32] (b) Rainwater from the building roof directly connected to the surface tank.

6.3. Water Sharing

It is further discovered that most households with larger underground water storage capacities are benevolent in sharing the harvested rainwater with relatives, extended families, and neighbors. About 64% of respondents reported having indulged in water sharing. Urban–rural migration is dominantly practiced in this community. Of the population investigated, 98% ($n = 103$) have one or more family relatives living outside the community and, most probably, in the city. As a result, it was observed that many housing units are under lock, with no one occupying the houses. The owners of the houses reside in cities/abroad and visit home occasionally, especially during the festive periods, and most of the houses are expensively built, with larger underground tanks for water storage. Several of these houses have tanks connected to outside taps, where the community residents fetch water at no cost.

In another arrangement, because of the long yearly absences of the migrated residents, their premises are often managed by relatives and neighbors that have access to the stored

water on the premises. This point was collaborated by one of the interviewed women, as she noted:

“We make use of the stored waters in exchange for rendering services such as cleaning and sweeping of the premises.”

Throughout the community, it is rightly observed that rain-harvested water is majorly used only for non-drinking purposes, such as washing, cooking, sanitation, cleaning, and bathing. Although few people mentioned that they consume it after boiling 11% ($n = 12$).

6.4. Surface Water

Most households living closer to the local streams fetch their domestic water from the streams and rivers (48%). In the same vein, certain rivers and streams were also forbidden to fetch water or fish from. This river/stream is believed to belong to the deity that protects the land, and fetching water or fishing from the river could trigger the wrath of the gods and, hence, results in more erosions and landslides. Only the male respondents 23% ($n = 24$) were interviewed on this (The community views it as taboo for women to speak on deity-related matters).

6.5. Water Vendors

It is equally observed that about 26% ($n = 27$) of the respondents source their drinking water from commercial water vendors all year round. These vendors sell portable water in tankers and also sachet-packaged water. The class of population that buys water from the vendors cannot be classified as either wealthy or poor. Hence, it appears that a vast majority of the community members buy water from water tanker vendors during festive periods and during ceremonies when a large quantity of water is demanded, such as during burial ceremonies, marriage ceremonies, etc.

7. Community's Awareness of the Domestic Water Challenges

However, at the community level, there is no central community-sponsored water supply available, and almost none of the respondents view this as an issue (based on the interview conducted). This is also evidenced by the fact that water supply provisioning has never at any time appeared on the agenda of the community autonomous union, as confirmed by some of the interviewed community leaders. An interviewed town union leader noted that:

“One of the topmost agenda in the development needs in the community is bringing the government's attention to the gully erosion and landslide menace. We have never discussed water challenges in any of our town meetings.”

This position was collaborated by the interviewed local government official who noted that the state government has, in the recent past, allocated funds directly to town unions to tackle their immediate and most pressing needs in all the 177 communities in the state. He further said that:

“All the funds received by Nanka town union within this period, none has been channeled to community water projects. It rightly shows that water challenges are not among the collective priority need of the community.”

Though nearly all the respondents 98% ($n = 103$) reported a high level of awareness of the problems and issues associated with water sourcing in the community, especially during the dry season, a large number of the respondents (75%, $n = 79$), did not recognize the problem strongly enough to attract intervention actions either from the government or international aid agencies. The entire community, especially women, all seem to have engaged in the aged-long practices of water sourcing, preservation, and sharing, as mentioned in the foregoing section. This has seemed similar to tradition and practice. Women are generally responsible for water availability in most households (96%, $n = 77$). This is explained by the culture of the Igbo people of Southeastern Nigeria, which allocates domestic affairs solely to women, while the men are seen as the head of families and whose work is to provide financial upkeep for the household.

8. Discussions

In this section, we discuss the socioeconomic and environmental health implications of the findings.

Incessant erosion and landslide in the community necessitate a ban on drilling of a borehole and the exploitation of underground water sources. The construction of underground concrete tanks for storing harvested rainwater was favored by the community as an alternative. Our findings show that households that possess large underground water tanks are also linked to expensive buildings/housing units, while the poorer households have smaller storage tanks. This goes to say that there are likely direct correlations between the income of households and the size of the water tank they can afford. By extension, it also determines the quantity of domestic water they could store/access throughout the dry season. Upon exhaustion of their stored water, poor households either resort to sharing with those that have a larger tank capacity and/or other means such as buying or fetching from streams. Economically, productive time will be lost and cause inconveniences, leaving their houses to fetch water from neighbors/streams. A study conducted in Maputo, Mozambique noted that households that have their own water facilities spend significantly lower time and money costs in getting water, enjoy a greater number of hours of the service day, use more water, and express greater satisfaction compared with those without water facilities [60]. Sharing water with neighbors has been reported as a common water coping strategy in developing countries, and it has also been referred to as ‘water begging’ in the literature [7,39,60]. The second means of storing harvested rainwater was through ditches made for controlling erosion. From our observations, these ditches, which are not always properly covered, pose a threat to children and roaming household animals that stand the risk of being drowned.

Private boreholes have been identified as one major source of accessing improved water in Nigeria [2], and their cost of construction, though high, could be comparably at par with the cost of large underground concrete tanks. The majority of the respondents that own large underground tanks noted that they prefer to own boreholes over concrete tanks, since the water from boreholes could be used for household purposes with minimal or no treatments compared to tank-stored water. Stored water from the underground tanks and ditches is treated with alums and/or boiled before domestic usage. Water treated through these means might still not be of good quality, and there are no indications that further due diligence is taken before putting the water into use in the community. Other scientifically reliable water treatment methods such as chlorination [6] were never practiced by the respondents. This could be probably a result of high costs and poor knowledge. Household income and time are wasted on the tank construction, buying overhead tanks, and other logistics for water treatment, such as fuel for water boiling and alums, while productive time is spent on water treatment [7].

Some households source their domestic water from surface sources (streams and rivers), and it involves trekking far distances with a container to be carried on the head. Previous studies noted that distances of up to 1 to 2 km could be covered to fetch stream water [32]. Women and children are dominantly involved in stream water fetching, as documented in the 2013 DHS report, which noted that more female adults (26%) than male adults (21%) are likely to be involved in fetching water for the household [4]. About 80% of the interviewed respondents that adopted this measure were a result of them either not being able to afford sachet water/vended water or having exhausted their tank-stored water. The social and health impact is that school/work time is lost, and body stress could induce other health issues [32]. The pathways to the streams are usually lonely and bushy paths that expose children and women to harm, attack, and rape. Though the public streams in the community are observed to be preserved and managed against garbage and other anthropogenic pollutants, there is still the risk of contamination during collection and storage in open containers by heat, dust, and disease pathogens [7]. The study further reveals that certain rivers/streams are forbidden to fetch water from based on superstitious beliefs. These traditional regulations, though centered on belief systems

and cultural norms, have been seen as an effective tool for nature conservation in Nigeria throughout the precolonial times [61]. However, restricting fetching water from certain streams may have deprived those living close to the stream of having access to water and might result in them moving far distances to access alternative streams or spending the household income on buying water.

Vended/sachet water sources are another main coping strategy adopted by the vast majority of the community residents, and they are in two forms: (i) sachet-packaged water and (ii) tanker-vended water. According to [7], buying sachet and bottled water is the second-most adopted strategy for coping with an inadequate water supply in Abuja, Nigeria. Sachet water, popularly known as ‘pure water’, is a very important means of drinking water for most households in Nigeria both in rural and urban areas [62]. It is readily available, convenient, and cheap, as a bag of 20 sachets sells for = N = 100 (USD 0.4 as of 2019). It becomes logical to argue that it will no longer be cheap when it is to be relied on as the only source of drinking water. About 50% of the respondents depend on sachet water for drinking water all year round, and this hugely impacts the household income negatively. A study conducted in the city of Kathmandu, Nepal showed that about 1% of the household’s monthly income amounting to USD 2.94 spent on water-coping strategies [63]. The vended water through tankers is also adopted by the households in the community as a water-coping strategy but mostly during events and functions that require access to large quantities of water such as burials, weddings, Christmas, etc. It increases the cost of hosting social functions, and as the water vendors source this water from boreholes located far in the metropolis, the exorbitant price charged by the water tanker vendors was reported in a previous study [32].

The packaging material for this sachet water is made of nonbiodegradable synthetic polythene. This is a huge environmental challenge, because solid waste management services in Nigeria are only available in urban areas, and the sachet water polythene waste generated in this rural area is likely not to be properly disposed of and serves as a potential pollutant for surface and underground water sources. Other potential environmental threats linked to the improper disposal of sachet water waste include the blockage of water channels and undermining of the aesthetic environment [64].

9. Policy Implications

First is that the United Nations Human Settlements Programme (UN-Habitat) report in 2003 noted that the key challenges of water provision in developing countries are water stress often generated by the scarcity of freshwater due to prolonged and extreme droughts, seasonal variations in rainfall, and the degradation of water resources [65]. These specific challenges seem to have been articulated, with a focus partly on publicly operated water supply systems. Compared with the findings of the current research, the water challenges in the Nanka community are caused by different factors altogether. The implication is that the generalized or conventional solution approach may not apply to the water problem in the studied community, thereby requiring context-specific analysis towards identifying the key water governance bottlenecks and priority policy interventions for adequate and sustainable water solutions in the rural community. Water provision in the community is interwoven with local practices, culture and belief systems, and environmental challenges (erosion and landslides). Providing meaningful solutions must take into account all the aforementioned factors in an integrated manner.

Secondly, several local practices identified from the research findings have proved some level of accurate and sincere commitment on the side of the community towards combating their water and environmental challenges. These practices have ensured the continued availability of both usable and drinking water in the community all year round through rainwater harvesting, storage, and water sharing. However, a proper evaluation of these available water sources needs to be conducted to ascertain the water quality. The storage of the rain-harvested water through underground concrete tanks for a long time, sometimes reaching one year, could lead to contamination and adverse health impacts.

Several water-borne diseases in developing countries such as dysentery, cholera, diarrhea, and typhoid have been linked to the consumption of these variants of unimproved water sources [18]. We recommend that the responsible government agency should mount a sensitization campaign on the community of health risk implications of drinking water from unimproved sources. Another major reason for advocating massive sensitization for the community on the water supply is that the study findings point that the community is faced with a high level of water stress, yet the majority of the inhabitants have not recognized it as a challenge, probably as a result of poor awareness in the adverse socioeconomic and health implications.

Though households fetch domestic water from the surface water sources, the location of the river and stream are not within the recommended distance and thereby cannot be classified as easily accessible. Poor accessibility to water and sanitation facilities leads to reduced labor productivity, physical stress, and missed opportunities for child education [66]. In specific terms, the global adverse impacts of poor and inadequate access to sanitation and water facilities have been statistically put at 1.5 million deaths of children under the age of 5 and over 443 million school days lost annually [67]. The corroborative effort of the concerned stakeholders is needed towards providing a good alternative.

It could readily be observed that the community has a well-structured local leadership framework that oversees the internal governance of the community, and they are duly recognized by both the local and state governments. The perspectives here are two-fold; the first is that it has created an easy avenue to administer water and other environmental projects in the area and provides a means for the easy dissemination of information and social inclusiveness in the local environmental management. Secondly, factors related to corruption, partiality, and local governance effectiveness are influential in reaching the optimal environmental water outcomes [10]. Efforts to enhance community well-being, such as an improved and adequate water supply, must go hand-in-hand with the efforts to reduce corruption and impartiality if they are to have the intended effects. Our reason for holding this view is that, from the research outcomes, there are obvious water challenges in the community, but none of the intervention funds said to have been received from the state government by the community leaders for tackling the community's most pressing needs has ever been invested in water projects. It is either that the community has picked their priorities wrong due to a lack of availability of information, such as it is provided in the current research, or the leaders have a biased interest in other developmental projects due to corruption or partiality. It is our opinion that enforcing transparency and public participation can minimize the risk of corruption in local environmental governance.

One of the recognized parties to rural water development in Nigeria, according to the policy and institutional structure, is the non-governmental organizations and bilateral and multilateral agencies. They have invested in the rehabilitation and development of water infrastructures in Nigeria [21,68]. They are also involved in the construction of rural water supply infrastructure, the distribution of new technologies within the existing system, and rehabilitation of the dilapidated water facilities. The private sector initiated by individuals, firms, and community-based organizations (CBO) are also part of the stakeholders recognized in the rural water supply in Nigeria [69]. There was no significant presence of these agencies in the studied community. The most cogent explanation for this could be that the overemphasized issues of gully erosion and landslide menace in the community might have overshadowed the challenges of poor water availability. Hence, attention of the international aid agency may have been directed more to the natural disaster and therefore overlooked the vital issue of inadequate water availability in the community. We believe that the current work would provide firsthand information on the responsible NGOs of the apparent water needs of the Nanka community.

10. Conclusions

Water availability is generally dependent on many factors, which include environmental, socioeconomic, cultural, hydrologic, and even geologic. These factors could influence

the adequate water supply, especially in the rural area either positively or negatively and, thus, need to be understood towards providing water intervention actions. The environmental disaster of gully erosion and landslide has adversely impacted the Nanka community in the area of water availability. Thus, the current work has provided useful information on various cultural practices, coping strategies, and policy implication in the rural community. Some of the cultural practices include the mandatory clearing of ditches and water channels, prohibition of boreholes, and fetching of water from certain streams. The community's effort in proffering solutions to their ecological challenges led them to impose laws and rely on traditional practices. Reasonable or unreasonable as their efforts may be, there is a need for a comprehensive geological study on the soil quality to ascertain its suitability for possible underground water exploitation. This work also exposes many dimensions of water challenges in the community faced by households in accessing domestic water from socioeconomic and environmental health risk angles. Hence, this has shown many coping strategies adopted by the community residents, such as water sharing, buying water from vendors, and fetching from surface water sources. Although many residents recognized the scarcity and challenges associated with accessing drinking and usable water, the majority of them seem not to have recognized it as a strong enough problem to attract intervention actions. Rather, the entire community resorted to age-long practices towards tackling their water challenges. Amidst all these practices, due diligence is also a recommended necessity for ensuring a good water quality, optimal health standards, and social equity in the studied location.

Finally, this work, which is based on water-coping strategies and practices in a rural setting, rightly also shows that the poor rural dwellers with lesser economic opportunities equally expend the household income on water, and this is a factor that could impoverish them more and, therefore, requires urgent policy attention.

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