Mal-urbanization in Cameroon: Addressing public water service deficits and health risks in the Nkie hydrographic basin in Yaounde.

1NGOUH Abdou Nasser, 2ESSAPO Daniel 3TAN SANGNYUY Wiryiliveh, 4NYEMBE ETAME Ghislain
1,2,3,4 National Institute of Cartography-Cameroon,

Abstract

The city of Yaounde, like many urban metropolises in sub-Saharan Africa, experiences drinking water supply issues. In 2017, public water service arrived at the peak of 150,000 m³ (CAMWATER, 2017), an equivalence of the available water resource. This shortage of water is clearly perceptible in the Nkie catchment area located in the Yaounde IV municipality, where the population is confronted with both water shortage and a weak sanitation network (less than 50m per km²). Faced with this almost permanent shortage of public water service, the populations turn to run-off water, streams, and subsurface aquifers (wells and springs) whose quality and physical-hydrodynamic characteristics are very little known. This research, raises the following questionings: How do the populations of the Nkie catchment area live? What are the physical and hydrodynamic characteristics of the water consumed by the population in the absence of a real sanitation network?, what are the main consequences that arise from the consumption of this water on the population’s health and the urban water governance system? The data produced by this study came from field observations and a considerable documentary review which mainly focused on some content analysis derived from the work of Njiemoun Manfon A. (2012) and Ngouh Abdou N. (2014), which dealt with the environmental and socio-economic constraints in the supply of drinking water in Yaounde. The physical and hydrodynamic characteristics of subsurface water in this urban area were also examined in the laboratory. Besides, 62 randomly selected households in the different neighborhoods of the study area were questioned both on their dwellings and issues regarding their health vulnerability linked to the quality of the water consumed. As a major expected result, this work high light the impact of the deficit of certain basic public services on the quality of private urban production.

Keywords: Mal-urbanization, sanitary vulnerability, Open aquifer, Nkie Catchment area, urban governance, Yaounde.

Résumé

La ville de Yaoundé, comme de nombreuses métropoles urbaines d'Afrique subsaharienne, connaît des problèmes d'approvisionnement en eau potable. En 2017, le service public de l'eau a atteint le pic de 150 000 m³ (CAMWATER, 2017), une équivalence de la ressource en eau disponible. Cette pénurie d'eau est clairement perceptible dans le bassin versant de la Nkie situé dans la commune de Yaoundé IV, où la
population est confrontée à la fois à la pénurie d'eau et à un faible réseau d'assainissement (moins de 50 m par km²).

Face à cette pénurie quasi permanente de service public de l'eau, les populations se tournent vers les eaux de ruissellement, les cours d'eau et les nappes souterraines (puits et sources) dont la qualité et les caractéristiques physico-hydrodynamiques sont très mal connues. Cette recherche, soulève les questionnements suivants : Comment vivent les populations du bassin versant de la Nkie ? Quelles sont les caractéristiques physiques et hydrodynamiques de l'eau consommée par la population en l'absence d'un véritable réseau d'assainissement ?, quelles sont les principales conséquences de la consommation de cette eau sur la santé de la population et le système de gouvernance urbaine de l'eau ?

Les données produites par cette étude sont issues d'observations de terrain et d'une importante revue documentaire qui s'est principalement concentrée sur certaines analyses de contenu issues des travaux de Njiemoun Manfon A. (2012) et Ngouh Abdou N. -les contraintes économiques dans l'approvisionnement en eau potable à Yaoundé. Les caractéristiques physiques et hydrodynamiques des eaux souterraines de cette zone urbaine ont également été examinées en laboratoire. Par ailleurs, 62 ménages sélectionnés au hasard dans les différents quartiers de la zone d'étude ont été interrognés à la fois sur leurs habitations et sur les enjeux de leur vulnérabilité sanitaire liée à la qualité de l'eau consommée. Comme résultat attendu majeur, ces travaux mettent en évidence l'impact du déficit de certains services publics de base sur la qualité de la production urbaine privée.

Mots clés : Mal-urbanisation, vulnérabilité sanitaire, Aquifère ouvert, Bassin versant de Nkie, gouvernance urbaine, Yaoundé.

Introduction

Ensuring sufficient availability of water for human and environmental needs is one of today’s most pressing global challenges. The demand for water for human consumption, sanitation, power, industry, agriculture and livestock, and other uses has accelerated more than twice as fast as the rate of population growth over the last century (United Nations, 2005; 2013). As a result, domestic water use has become the prime societal water need in both urban and rural areas. Household water supply has become an important public policy issue because safe water is mainly an essential component of primary health care. In fact, access to improved water sources and sanitation is related to the health and survival of human capital (Mangyo, 2008; Tang et al., 2008; Mishra & Newhouse, 2009). According to Meva’a Abomo (2006), sanitation varies according to the type of neighborhood and the quality of road access. Hence, today’s challenge of providing and governing water supplies in sufficient quantity and quality, and across diverse temporal and spatial contexts and scales, involves multiple, interrelated water crises (Linton 2010; Bakker 2014). These crises likely will continue to deepen in complex and unpredictable ways, exacerbated by dramatic shifts in population, demand for water, droughts, severe weather events, and other changes associated with global climate change (Pahl-Wostl 2015).
In Cameroon, the rate of access to drinking water and sanitation services is estimated at 3.9% and 34% respectively (Ps-Eau, 2013). Yaounde, the political capital and Cameroon's second-largest metropolis after Douala, faces various challenges amongst which that of the accessibility to safe and sufficient drinking water under acceptable, assessable, socially and economically affordable, and equitable circumstances. With nearly 2000000 inhabitants (MINHDU, 2015), CAMWATER (Cameroon Water Utilities Corporation) estimates its drinking water needs at around 300 000 cubic meters per day (m3/d). Being only able to supply 160,000 m3/d with the water treatment plants of Akomnyada and Mefou, the daily deficit amounts to 140,000 m3/d (Njiemoun Manfon, 2012; Tchamagam, 2014). Here, less than 40% of the population of this city Cameroon has access to pipe-borne potable water (Tanawa et al., 2002). The vast majority is thus compelled to turn to alternative sources like springs, wells, and streams whose chemical and microbial qualities are greatly compromised by their proximity to both point and diffuse sources of pollution. Cases of water-borne diseases such as typhoid, cholera, and amoebic dysentery are recurrent in large and important agglomerations like Yaounde and Douala in Cameroon (Kuitcha et al., 2010; WHO Regional Office for Africa, 2012).

Faced with this almost permanent shortage of public water service, the populations turn to use as their major water supply sources runoff water, stream water, and subsurface aquifer water (wells and springs) whose quality and physicochemical and hydrodynamic characteristics are very little known. As argued by Nola (1996), it has been traced that the use of water from shallow, unprotected hand-dug wells are the most commonly used household water supply modes in both urban and rural areas in Cameroon. Hence, although access to water is one of the human rights (UNESCO, 2003), the government is called upon to uphold, a high proportion of this vital resource for Yaounde city dweller, especially those around slumps where the sanitary condition is embryotic. This is the case of households around the Nkie catchment area on the south-eastern side of the city.

From the present issue of the deficit of the public water service and a reliable sanitation network, how do the populations of the Nkie catchment area occupy this area with little or no public water service? What are the physical-hydrodynamic characteristics of the groundwater they consume? What problems does the consumption of this water pose both for the health of the populations and, consequently, for urban governance? Through the vision of works with outstanding findings and interesting perspectives like that of Njiemoun Manfon (2012), which examines the quantity and characteristics of water consumed in African cities in general and Cameroonian cities in particular, this study mainly aims to provide lacking information to improve local urban governance concerning the provision of public water service. The choice of the Nkie catchment area, which partially drains the water from the Yaounde 4 municipality, is part of the work undertaken by geographers and geologist in the understanding of water spatial dynamics.
in cities of the south, to contribute to the optimal management of water resources in the urban perimeter of Yaoundé to reduce as much as possible the risks linked to the consumption of unclean water.

**Methodology**

The data and statistics provided in this paper were obtained from field observations, laboratory analysis on the water quality consumed in the Nkie catchment area, and an extensive documentary review. Concerning previous scientific works exploited, particular attention was given to the academic dissertations of Njiemoun Manfon A. (2012) and of Ngouh Abdou N. (2014), which dealt with the environmental and socio-economic constraints of drinking water supply and the physicochemical and hydrodynamic characteristics of subsurface water in the urban area of Yaounde respectively. Besides, Esse Ndjeng M. (2013) on the politicization of the supply of public water service in Nkondjock and Nguendo Yongsi and Assako Assako R.J. (2016) on the issues of morbidity linked to drinking water in Cameroon's major cities were essential literature guides for our reflections.

Concerning the field survey, it consisted of initially delimiting by the means of GPS (Global Plan of Surface) and identifying the various objects that makeup space through the processing of a QuickBird 2012 satellite image. In the second phase, an inventory of hydraulic structures, watercourses, and a typology of the soils that constitute the Nkie catchment area was produced through a reliable map of the local aquifer. At this stage of the investigations, it is necessary to specify that the soil and water analyses were carried out in the laboratories of the Faculty of Science of the University of Yaounde I and at the Laboratory of Geochemical Analysis of Water (LAGE) of the Institute of Geological and Mining Research (IGMR). As for the third phase, 62 households 'deprived' of public water services, were randomly selected in different neighborhoods of the study perimeter. Here semi-structured interviews and questionnaires were administered to various household heads on their dwellings and issues related to the sanitary vulnerability of their living environment and the quality of the water consumed. At the end of the field surveys and laboratory analyses, three major aspects emerge. They constitute the main articulations through which the results are presented and interpreted. They are the poor urbanization of the Nkie basin, the examination of subsurface water resources, and the health vulnerability of populations not supplied with public water services.
Figure 1: Location and settlement of the Nkie catchment area
Results

1. The state of urbanization in the Nkie catchment area.

In referring to the concept of ‘mal-urbanization’ as the mode of settlement within an urban environment that instigates a decline in human development. The Nkie catchment area, is characterized by the anarchic construction of houses, the non-existence of a formally identifiable and recognized road network, and the almost chronic lack of sanitation facilities. As in some popular and populous neighborhoods that cover 50% of the urban perimeter of Yaounde (Yaounde City Council, 2010), housing construction in the Nkie watershed does not comply with any regulatory and operational urban planning standards. In this environment, precarious and semi-structured housing constitutes about 75% of the buildings dedicated to housing for the population (Household surveys, 2016). The table below shows the number of people with access to various networks (water and sanitation in particular), based on a sample of 62 dwellings.

**Table 1:** Number of households having access to some networks in the Nkie catchment area.

<table>
<thead>
<tr>
<th>Type of Settlement</th>
<th>Precarious</th>
<th>Semi-Structured</th>
<th>Structured</th>
<th>Total from the type of networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passable Track</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>10/62</td>
</tr>
<tr>
<td>Water</td>
<td>-</td>
<td>4</td>
<td>5</td>
<td>9/62</td>
</tr>
<tr>
<td>Electricity</td>
<td>3</td>
<td>8</td>
<td>4</td>
<td>15/62</td>
</tr>
<tr>
<td>Sanitation</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>2/62</td>
</tr>
<tr>
<td>Total from the Type Settlement</td>
<td>6/17</td>
<td>19/33</td>
<td>11/12</td>
<td>62</td>
</tr>
</tbody>
</table>

**Source:** Field Survey, 2017.

The table above indicates a very low level of access to different types of networks, especially in the case of lower quality dwellings (settlements). Those built with hard materials (structured settlements) have a coverage rate of 11 out of 12, i.e. more than 90%. However, even in this category, less than 50% of dwellings have access to water and electricity, and only 16% are served by a road. It is therefore important to point out that only 2 out of 62 dwellings surveyed have access to a private sewerage system.
In light of the facts mentioned above, it can be observed that the Nkie catchment area is true "poorly urbanized" in terms of access to services offered through the various roads and networks. However, this urban fabric made up of almost 55% (33 dwellings out of 62 approached) of housing made of semi-hard materials (semi-structured settlements) shows that the population is not very miserable compared to other areas of Yaounde, which are largely dominated by precarious materials. This means that the "poor urbanization" of the Nkie catchment area is more or less related to the non-application of urban planning policies. The approximately developed networks could therefore be the main cause of the inaccessibility to urban amenities, particularly public water services.

In addition to the accessibility to the various networks, the poor urbanization of the Nkie basin could also be taken into account through the viability of its environment. This could be determined through the use of household waste and the development of water supply points. About the use of household waste, the surveys revealed that the nature of the waste management system is in a very poor state. This could be confirmed by the lack of waste discharge agents (waste collectors) employed by HYSACAM (Hygiène et Salubrité du Cameroun), the company approved by the public authorities prepositioned in the areas targeted by the study. In an area of 517 hectares, populated by about 41921 inhabitants (Ngouh Abdou N., 2014), there were barely 28 formal household waste collection points in January 2017 that is an average of one point every 18 hectares. This spatial distribution has considerably decreased to only 16 formal household waste collection points in January 2020. Given that households in Cameroon have an average of 5 to 6 people (BUCREP, 2010), one collection point is expected to serve nearly 250 households or around 1,500 individuals. By way of comparison, the National Center for Independent Information on Waste (NCIIW)) indicates that in France, this ratio hardly exceeds 300 inhabitants in residential areas. In many northern countries such as France, the general trend is towards an optimal reduction of this ratio. This means that household waste collection is problematic in the Nkie catchment area because of the lack of formal collection points and that of the long distances to be covered to access them.

As much as the collection system is deficient, the treatment of this waste is a cause for concern. In fact, in this urban area, the "uncontrolled" waste dumps generally located in the Nkie valleys and its tributaries serve as dumping grounds for 70% of the households surveyed. Thus, from an environmental point of view, this catchment area is unhealthy. There are no incineration, recycling, or even biological management stations for household waste. It goes without saying that these materials infect surface and even subsurface water in the event of infiltration.

Concerning the development of water supply points for running water, it can simply be stated that it is rudimentary. This accentuates the health vulnerability of the populations who are practically forced to
consume this water. Image 1 below presents the type of development of the “natural” water supply points that provide this precious and vital resource to the majority of the inhabitants in this catchment area.

![Image 1: A natural source of drinking water supply.](image)

**Source:** Field Survey, 2018. **Picture credit:** NGOUH Abdou Nasser,

Picture 1 above shows a stagnant water source. It is a scene of water being drawn from a place open to all kinds of external aggression. The pond in which the containers lie offers no security in terms of infection by germs or pathogens. In other words, the populations that consume the water drawn from this type of source are effectively exposed to waterborne pathologies. Mal-urbanization leads to environmental pollution that degrades the quality of surface and subsurface water in the study area. This is all the more of a problem as subsurface water resources are spatially poorly distributed, resulting in a high vulnerability linked to the inaccessibility of running water for consumption. Thus, in addition to the shortage of public service water, which is accentuated by poor urbanization, the unequal distribution of subsurface water exacerbates the risks of morbidity for the inhabitants of the Nkie catchment area.

2. Examination of subsurface water resources

Three components mainly constitute our examination of surface water resources. They are the spatial distribution of subsurface waters, their availability throughout the year, and their Physico-chemical and bacteriological characteristics.

2.1 Uneven distribution of subsurface water

The uneven distribution of subsurface water in the Nkie catchment area aggravates the vulnerability of populations to the unavailability of drinking water. In fact, although well irrigated by the Nkie and its many "small" tributaries, this urban area has only three underground water reservoirs. Figure 2 below shall better illustrate this reality. However, the hydrometric and piezometric characteristics obtained within the framework of this work are similar to those generally observed in the majority of the alteration layers of the basement formations, a humid tropical sub-climate. They also indicate that the landscape
model of the basin studied is induced by the hydrographic network (Bitom et al., 2004). Also, underground flows are modeled on this morphology, with flows from high points to low points. The regime of these groundwater flows is related to the inertia and the continuous character of the aquifer reservoir (Bon; Ndam et al., 2016).

Source: Ngouh Abdou Nasser, 2021

Figure 2: The open aquifer of the Nkie catchment area.
Figure 2 above presents a map of the unconfined aquifer with hydroisohypse curves. These curves indicate the underground topographic level. Here, groundwater flows from the highest to the lowest isohypse curves. We observed that the surface of the open aquifer of the Nkie catchment area is marked by a converging flow towards the Nkie river as shown by figure 2. This, therefore, shows that the areas of the map characterized by more or less regular circular or elliptical curves with converging current lines are the most favorable for the installation of water catchment structures. These reservoir zones could be observed in the northern part of the catchment area around Ekounou, in the east at Ekoumdoum, and in the south at the Mvan neighborhood all part of the Yaounde four municipality. Given the distances between these different reservoirs (more than 1Km) and the settlement nature being intensive over time and space, we could assert that the Yaounde 4 municipality faces a serious water service deficit which is a direct consequence of the urban water crisis in Yaounde.

2.2- Availability of groundwater in reservoirs

The permanent availability of water in the reservoirs is far from being guaranteed all year round. Analysis of the water balance (Thornthwaite, 1954) shows that the period of excess rainfall is from March to November. During this period, the open aquifer is recharging, while from December to February the open aquifer is being depleted as shown in Figure 3 below. During this period of emptying, there is a gradual decrease in the flow rate of the water supply source. Hence, during the dry season (December to February), the populations of the Nkie basin suffer more from the lack of water.

**Source:** Ngouh Abdoul Nasser, 2014

**Figure 3:** Water balance established according to the method of Thornthwaite (1954)

This result consequently joins Kuitcha et al (2010; 2013) who argued that though groundwater is the main source of drinking water for the population of Yaounde, the lack of monitoring of the evolution of quality of this water and ignorance of comprehensive hydrochemical characteristics are not worthy.
2.3- Physico-chemical and bacteriological characteristics

Managing the chemical and microbial aspects of water quality control is a major issue in the humid tropics as it has a direct effect on human health (Roche, 1993). An important aspect to take into account is that of the hydrochemical evaluation of potable water sources during the rainy season. This should be done in order to check NO₃- contamination which may arise from domestic waste discharges and agrochemicals into shallow groundwater. As argued by Kuitcha et al (2013), groundwater recharge is recent and is done directly by infiltration of precipitation without any significant change due to evaporation. This recent water is confirmed by the low values of bicarbonate. The high nitrate levels in the groundwater show that they are chemically unsuitable for human consumption and require a pretreatment. This confirms the tests carried out in the laboratories of the Faculty of Sciences of the University of Yaoundé I attest to the effective presence of nitrates (NO₃- 93.37 mg/l), fecal coliforms (CF 280 CFU/100 ml), and fecal streptococci (SF10 CFU/100 ml) whose concentrations are above the toxicity limits defined by the WHO (2004). These elements are evidence of effective bacteriological and chemical pollution of subsurface waters. They, therefore, require prior treatment before any consumption. Hence, due to the microbial contamination of the water sources, it will be necessary to treat the waters before consumption (Egome et al., 2013). Indeed, the Physico-chemical and bacteriological parameters are taken into account in Table 2 below shows that the groundwater in the basin is of poor quality.
**Table 2:** Physico-chemical and bacteriological parameters of spring waters according to climatic seasons and WHO standards for 2011

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Dry Season</th>
<th>Raining Season</th>
<th>WHO Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>22</td>
<td>23,3</td>
<td>-</td>
</tr>
<tr>
<td>pH</td>
<td>4,5</td>
<td>4,5</td>
<td>6,5 à 8,5</td>
</tr>
<tr>
<td>C.E (µS/cm)</td>
<td>243</td>
<td>251</td>
<td>-</td>
</tr>
<tr>
<td>Chloride Cl- (mg/l)</td>
<td>59,27</td>
<td>22,25</td>
<td>35</td>
</tr>
<tr>
<td>Silica SiO2 (mg/l)</td>
<td>9,67</td>
<td>4,12</td>
<td>-</td>
</tr>
<tr>
<td>Sulphate(SO4)2- (mg/l)</td>
<td>1,74</td>
<td>0,3</td>
<td>400</td>
</tr>
<tr>
<td>Nitrate NO3- (mg/l)</td>
<td>92,53</td>
<td>93,37</td>
<td>40</td>
</tr>
<tr>
<td>Calcium Ca2+ (mg/l)</td>
<td>1,75</td>
<td>1,94</td>
<td>500</td>
</tr>
<tr>
<td>Magnesium Mg2+ (mg/l)</td>
<td>1,53</td>
<td>1,58</td>
<td>500</td>
</tr>
<tr>
<td>Iron Fe (mg/l)</td>
<td>0,12</td>
<td>0,26</td>
<td>0,3</td>
</tr>
<tr>
<td>Sodium Na+ (mg/l)</td>
<td>38,04</td>
<td>8,15</td>
<td>200</td>
</tr>
<tr>
<td>Potassium K+ (mg/l)</td>
<td>2,4</td>
<td>2,31</td>
<td>-</td>
</tr>
<tr>
<td>Bicarbonates HCO3¯ (mg/l)</td>
<td>0</td>
<td>1,83</td>
<td>-</td>
</tr>
<tr>
<td>Fluorine (mg/l)</td>
<td>1,59</td>
<td>0,06</td>
<td>1,5</td>
</tr>
<tr>
<td>TZ⁺ (µéq/l)</td>
<td>1928,72</td>
<td>640,47</td>
<td>-</td>
</tr>
<tr>
<td>TZ⁻ (µéq/l)</td>
<td>3198,25</td>
<td>2168,98</td>
<td>-</td>
</tr>
<tr>
<td>Ionic Balance (en %)</td>
<td>-24,76</td>
<td>-54,41</td>
<td>-</td>
</tr>
<tr>
<td>SF (UFC/100ml)</td>
<td>0</td>
<td>10</td>
<td>absence</td>
</tr>
<tr>
<td>CF (UFC/100ml)</td>
<td>0</td>
<td>280</td>
<td>absence</td>
</tr>
</tbody>
</table>


3- The health vulnerability of population not supplied with public water service.

Insufficient access to safe drinking water and inadequate sanitation has serious consequences for human health. It also exacerbates poverty and hinders development (Ousseini, 2015). This third section of our results focuses on the morbidity directly linked to the consumption of poor quality water. The surveys conducted among the 62 household heads and some health centers within the Nkie catchment area present waterborne infections as the most occurring health challenge in this area. Here, amoebiasis, diarrhea, bilharzia, and, to a lesser extent, cholera are regarded to be the most frequently occurring health treats. These are generally parasitic infections that attack the digestive and circulatory systems. In these households, children and adolescents are the populations most at risk. In the 0 to 5 age group, the morbidity rate related to these infections rises to 70% every six months. This rate decreases to 45% in the 6 to 16 age group and stabilizes at 25% in adults over the same period of time. According to the heads of households surveyed, they spend almost 10% of their monthly income on the purchase of de-worming pharmaceutical products. This is because, in this area, doctors and pharmacists recommend deworming children once every two months. In August 2014 and September 2018, the inhabitants of this area highly
suffered from the cholera epidemic after three cases and 5 other cases were detected respectively in 2014 and 2018. As a result of consuming subsurface water without prior treatment, the populations of the Nkie basin are effectively exposed to waterborne diseases, the most recurrent of which is diarrhea. This high vulnerability to health risks is a significant burden on modest household incomes.

It can therefore be said that the lack of public water supply is an aggravating factor in the poor urbanization of this catchment area. This situation, therefore, accentuates poverty in this part of Yaoundé. The heavy cost of pharmaceutical products for the permanent de-worming of the inhabitants not only hinders the investment capacity of the heads of households but also weakens the social body whose attention is focused on the problem of the dangers linked to the water consumed, forgetting other threats such as environmental pollution.

Discussion

The issue of the public service water deficit is as acute in the Nkié basin as in other parts of Yaounde and elsewhere in Cameroon's cities. It clearly demonstrates once again the inability of public authorities to provide good quality water to all populations, whether urban or rural. Admittedly, the government and the deconcentrated administrations lack all kinds of means to solve this problem, but it must be recognized that there is no real efficient policy to supply the populations with this so vital commodity. In the absence of such a policy, the success of which is closely linked to a judicious prior assessment of needs, one is justified in expressing reservations as to the relevance of the results expected from the implementation of water supply projects (Akomnyada, Mefou, and Sanaga) in sufficient quantities in the Yaoundé metropolitan area. It should also be stressed that the mal-urbanization characterized mainly by the anarchic construction of housing does not favor the establishment of a water supply network in conformity with the urban planning regulations, nor the systematic servicing of all real estate properties and therefore, all households.

There is basically no exciting specific structure defining the sanitation policy in urban areas in Cameroon, i.e. design, construction, management and maintenance of works, discharge standards, etc. (Assako Assako, et al., 2005; Assako Assako, 2006). To this end, it is important to reorient and better define this legislation by taking into account individual or group representations and behaviors (Assako Assako et al., 2005). However, the failure of urban and municipal policies in terms of the distribution of good quality water is perceptible in the Nkie catchment area, it must be recognized that the populations also have a share of responsibility that they have never been able to assume. Indeed, they could create associations to work together for the sanitation of natural water points and even of the entire district. By grouping in development cooperatives, they can better protect springs, develop them, and modernize their exploitation. This would enable them to obtain good quality water and to supply other parts of Yaounde that do not have such aquifer reserves. Clearly, the subsurface water available in the Nkie watershed is a
wealth from which the populations should benefit the most. Rather than burdening incomes by carrying
disease, it should generate income and contribute to improving the quality of life in the area. And it is at
this stage of the analysis that it is important to call on the responsibility of the urban and municipal
authorities, one of whose essential missions is to supervise the populations. This supervision should not
be limited to the maintenance of order, but should also extend to the promotion of collective development
initiatives, because good urban governance is also perceived through the capacity of the city to create
wealth, independently of the taxation system.

Moreover, supporting grassroots initiatives and encourage the development of community projects
regarding water and sanitation is a way out to this water crisis. However, inhabitants of densely populated
informal settlements have many resources and a lot of creativity that could be used to help them improve
their living environment. The heads of some households surveyed for example were willing to participate
financially in the construction of a community water supply system (installation of standpipes, springs,
etc.). Also, they are part of associations, which is are a great asset in collecting funds. In this respect, the
state and NGOs could simply support these popular initiatives (Mpakam et al., 2006).

Besides, there is an urgent need to educate the dwellers of the Nkie catchment area. According to
Djuissi Tekam et al (2019), the need to educate and raise awareness among the population about the
quality of water distributed by CAMWATER and the benefits of safe drinking water is vital. Also,
wastewater that is discharged into the wild or stagnant gullies in concessions is the evidence of
continuous and permanent environmental degradation that will strongly support the use of sound
approaches to improve sanitation coverage through affordable, efficient, and environmentally friendly
technologies.

Conclusion

Settlement along the Nkie catchment area is described as unplanned. In fact, poor urbanisation and the
lack of public service water that undermines the health of the population is bringing back into focus the
capacity of our cities in the south to resist the pressure of an ever galloping and demanding demography
in demand for all kinds of services. Since the city is an institution responsible for providing services that
are likely to improve the living conditions of city dwellers compared to rural areas, it is at this point
curtail to question the essence of our cities, since they do very little to fulfil this mission. Moreover, this
question is of particular interest when it comes to a political capital city, like the case of Yaounde in
Cameroon. The health vulnerability of the inhabitants of the Nkie basin could be considered as a
sufficient proof that Yaounde does not offer enough drinking water, does not treat all waste and does not
guarantee decent housing for all households. The previous comment simply aims to remind the urban and
municipal authorities of their heavy task of the imperative need to carry out the urban project, which is to
guarantee the well-being of all the populations. Because they have the power and political means,
however, they have a responsibility to take advantage of the demographic dividend that is part of our cities. It is a matter of fertile imagination and development strategy. The large urban population must be managed in such a way that it produces wealth.

**BIBLIOGRAPHY**


