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Water in Nairobi: Unveiling inequalities and its causes

L'accès à l'eau à Nairobi : des inégalités socio-économiques et spatiales

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Water in Nairobi: Unveiling inequalities and its causes

Martin Ledant¹

Water and Sanitation in Nairobi face problem common to many cities of the developing world which grow too fast. The water supply is unable to meet fast growing demand. Water is unreliable even to the small majority who has direct connection to tapped water. For those who cannot get enough, reliance on alternative unregulated service suppliers is a necessity, but these practice prices which are much higher than the legal rate. For those with the means, investment in storage tanks helps harvesting more water at the expense of everyone else in the community. This situation allows the stark differences in socio-economic between the wealthy and the poor to translate into unequal and inequitable consumption of the available water (Bakker, 2007). How deep is the gap between the serviced and the water-starved? How strong is water inequality in Nairobi (map 1)? What are the roots of the problem? How much water is available? Is it fairly shared? Following which mechanisms?

Map 1 – Piped Water Coverage (cf: illustrated notebook)

To try to promote development of Water and Sanitation in Africa, the Global Water Operators' Partnerships Alliance (GWOPA - United Nations Habitat) relies on the power of numbers. Their tool is the public display of utility performance also known as benchmarking. If performance is usually compared between individual cities, few initiatives have tried to monitor inequalities in the very heart of cities. The French Institute for Research in Africa (IFRA) attempted to answer to this challenge in this partnership pilot-project with GWOPA by using a hybrid methodology of remote sensing, household survey and spatial analysis to map the variation of the operator's

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performance inside the city of Nairobi. This study identifies different types of neighborhoods judging at how they look from space. Data collected on the field was then analyzed in order to check if these different types of places also had specific water and sanitation profiles (Ledant, 2011). This allowed seeing the general variations that exist from one type of place and another and drawing the following observations:

64 % of the population of Nairobi has access to an individual tap or a yard tap as their main source of water. In reality, some neighborhoods have universal coverage while others barely have any at all. Between those two extremes, evidences show that the piped network can also be deficient in certain areas. A Nairobiian living in a middle or higher income class neighbourhoods surely has a connection to the piped water network (coverage 85-95 %) even if some areas still experience problems. Another resident living in a lower income area might not have an individual tap and surely rely on other sources to access water (coverage: 70 %). Finally, they are those (mostly in the slums) for which having a tap is a luxury (coverage: 12 %) and who entirely depend on other sources. This striking figure really shows the level of neglect which characterises these areas.

Households which cannot access water with a metered Nairobi City Water & Sewerage Company Limited (NCWSC) connection at the Increasing Block Tariff (IBT: subsidized rate of 18.71 Kenyan shillings (KES) for each of the 10 first cubic meters, then increase by block up to a maximum of 53.80 KES per cubic meter), must rely on alternative suppliers. These are much more expensive in Nairobi: water kiosks tariff fluctuate around 400 KES/m³, handcarts around 1 000 KES/ m³ and tankers and private boreholes are even more costly alternatives. Hence, the result of unreliability and inaccessibility of Water Supply service is the inflation of the cost of water. The higher and middle income areas usually pay the regulated NCWSC tariff although reliance on tankers and private boreholes exists. In the low-income neighbourhoods, many households are not connected. And those who are seem to experience unsatisfactory service because they also use alternative water suppliers, particularly handcarts. As a result average cost of water reaches up to ten times the lifeline NCWSC tariff. In the very-low income areas (i.e. the slums and old colonial African quarters), water delivery is almost entirely provided by water kiosks which tend to hike the price up to 25 times the subsidized rate despite the fact NCWSC operate a special rate for water kiosk (Map 2).

Map 2 – Average Cost of Water (cf: illustrated notebook)

Map 3 – Average Daily Consumption of Water Per Capita (cf: illustrated notebook)

As a result, consumption patterns also show striking disparities (Map 3).

Residents of the better-off neighbourhoods tend to consume 200 to 300 litres of water per day per capita (lpcd), whereas, a slum dweller will only use 15 lpcd. Between these extremes, a middle class customer generally consumes a comfortable quantity of water (130 lpcd), but the rest of the city dwellers have to deal with an average less than the equivalent 20 to 30 lpcd, although differences exist between connected households which consume more (up to 50 lpcd) than others. Different households with different life-style, and different access to water, have different water needs. Hence, it is “normal” that water supply is designed in a way that provides more water to certain than others. However in Nairobi, the better off consume more than designed for and the poor are delivered less than their designed level. 40% of the distributed water is supplied to the 7% biggest consumers and the 45% smallest consumers share 15% of water available. In other terms it seems that in Nairobi, the wealthy have such a demand that it creates a water shortage of which the cost is mainly born by the less privileged people. (Fig. 1)

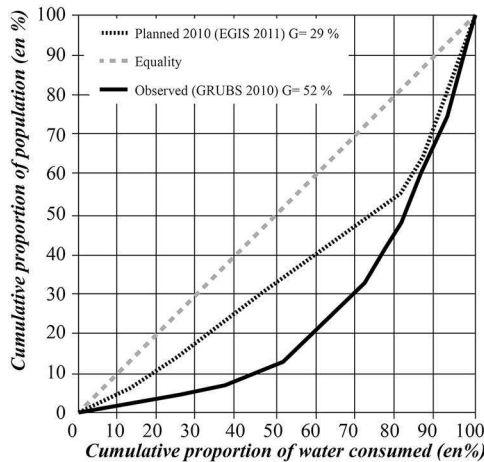


Figure 1 – Cumulative proportion of water consumed

Behind this situation are several causes, each of them is part of a complex system of interactions of technical, economic and political factors. We will however try to synthesize and investigate various hypotheses individually to try to see the underlying causes and possible solutions.

Is water problem purely an urban growth problem (map 4)? For sure, the speed Nairobi grows – one of the highest rates experienced worldwide – is at the core of this issue. In a hundred years a simple colonial railway depot has turned into to a three million metropolis. The population, doubling in size on

average every 15 years, has put tremendous pressure on WS infrastructure which cannot keep pace (Government of Kenya, 2009). These strains are exacerbated by the underlying socio-economical segregation of the city. Over independence, colonial segregation has changed name but has mutated into a socio-economical segmentation. Structurally, the lifestyle and privileges of the wealthy, occupying the upper forested areas, jeopardize the water resources of other less privileged classes, living in the lower areas. Locally, the urban planning standards required for operating a water network efficiently are rarely met. Enforcement of building by-law is weak and informality is endemic to all neighborhoods of Nairobi and epitomized by its numerous slums or what Huchzermeyer (2007) called the “tenements cities”. Once informality has settled, upgrading informal areas is more costly than building from scratch (Baross *et al.*, 1990). In other words, although it does not explain it all: fast growth, colonial heritage, and lack of formal urban planning constitute a ground on which inequality can prosper.

Map 4 – Residential Typology (cf: illustrated notebook)

Could the water supply be expanded to bring more water to the city? Nairobi is situated relatively high, at the top of a small tributary basin of the Athi River with small amount of water harvestable locally. Accordingly, since Nairobi creation, the struggle has been constant to expand the water supply to always more distant river basins, in greater proportions and at greater pace in track with the fast growing demand of the metropolis (Nilsson, 2011). Despite three consecutive large scale water supply projects completed in 1995 (total design capacity of supply: 524,800 m³/day) (World Bank, 1996), demand in Nairobi has already outstripped supply sometimes around 2007. Hence Nairobi is in a situation of structural water shortage likely to worsen until further expansion. This fact has tremendous implications on all the other aspects of water management, especially on the fact that water has to be rationed. Today, another major expansion of the system is needed without which water situation in Nairobi will deteriorate further. The “Northern Collector” is presently being designed and should gradually bring the total raw water supply up to 1,3 Mm³/day by 2035 (Njoroge, 2011). This might bring relief to Nairobi’s population in the short term. But as population keeps on growing exponentially, supplies will have to follow the same trend in finding always larger water resources at always greater pace in always more remote locations. In a place like Eastern Africa, where water isn’t abundant, a strategy based on supply expansion is simply unsustainable. (Fig. 2)

How does the utility plan for the demand of its customers? Are the poor considered? Calculations made at the planning stage for new supply accounts

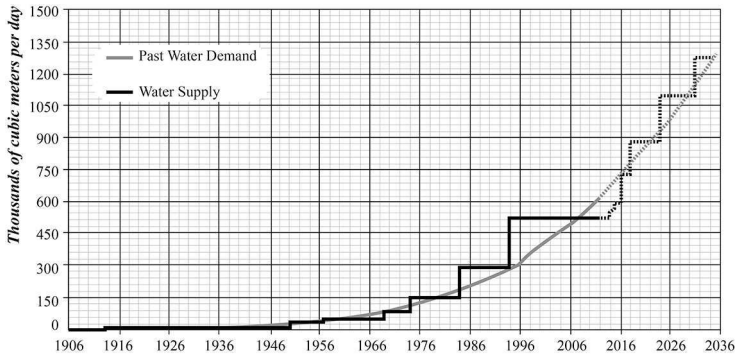


Figure 2 – Water Demand and Water Supply (1906-2006)

for increase in population projections and the varying needs of different customer profiles. Since Independence, high-income earners have always been allowed large volume of water (250 lpcd) whereas the lower income, assumed to be disconnected from the network never more than 20 lpcd (WHO recommends 40 lpcd for basic needs) (Nilsson, 2011). This allocation pattern, formalized in an official manual Warrant/Investment (MWI) manual, represents *a certain unequal reality* of past consumption patterns (EGIS, 2011). Nevertheless, if its appropriateness is not discussed, it may perpetuate an unequal situation and lock up an entire group into ‘designed’ inequality. However, the consultant in charge of the Northern Collector has taken the initiative to increase the allocation of the poor to 30 lpcd while assuming that large parts of this population will connect to the network in the near future and be allowed 60 lpcd. In other words, the philosophy seems to change as plans now aim for a higher, hence closer to reality, design demand. It only remains for these assumptions to turn into reality (EGIS, 2011).

Is inequality taking its roots in an uneven configuration of the water network? Clearly, during colonial times, water supply and distribution network were mainly centered on the upper and wealthier areas through Kabete reservoir (East Africa Royal Commission, 1955; van Zwanenberg *et al.* 1975). However, the most recent upgrade of the network concluded in 1995 in collaboration with the World Bank were mainly meant to service the new rapidly expanding eastern parts of Nairobi. In fact, this upgrade really favored the eastern and more popular areas and large public housing schemes were developed with pre-existing WS infrastructure. In addition, 85% of the water supply is now channeled directly to the lower areas through Gigiri Reservoir which is a hundred meter lower in altitude than Kabete (World Bank, 1996, African Development Bank, 1998). In truth, it favors the lower areas so much that the operator struggles to pump up enough water to feed the very-high demand of the high income earners living on the hills. The apparent inequality

of service in Nairobi is hence not fed by the general configuration of the network. However, the first upgrade of the upcoming Nairobi Water Supply IV (WS IV) will be to double up the pumping capacity which shows the willingness to rebalance the flow of water towards the wealthier areas.

Is the operator deliberately giving more water to some parts of the city? Water allocation in Nairobi is operated at the global city-level through “the corridors” and at the local level through “the regions” along with billing, customer care and technical assistance. The city-level rationing reveals the only obvious instance of rationing favoring a specific income group (Personal Interviews). Out of the four corridors dividing the city only one is never closed: the corridor supplying the upper and wealthier area. This can be justified by the fact that the wealthy have higher consumption habits, but is it fair when the poor barely have the minimum water quantity needed for domestic use according to World Health Organization standards (WHO/SEARO, undated)? The three other corridors servicing the lower area are rationed nearly equally which means their valves are turned open for the same period of time. However, to fairly allocate the water coming from the corridors down at the neighborhood scale, the operator requires the technical capacity on top of the political or commercial will. Equitable rationing of available water should consider areas’ needs, their capacity to store water, and population density. Beyond proper planning, the operator requires a convenient and efficient network. Different pressure zone must be well separated along with bulk meters and valves designed in the right locations.

Does the operator have the capacity to operate a fair share of the available water? Despite the general configuration of the network which might favor the lower area, the utility recognizes that the network is dysfunctional and does not allow operating an intermittent water supply efficiently (AWSB, 2010). Without this system, households are left to their own capacity, chances and self-interest when it comes to harvesting to available water. Physical, socio-economical and geographical disparities of Nairobi are free to emerge: denser neighborhoods (map 5) must share the pressure with a greater number of households. Amongst these households the ones which have invested in the greatest storage capacity will capture more, leaving the others with less pressure (Choe *et al.*, 1997). Interestingly, it is often the slums which benefit from the remnant pressure in the pipes once they are closed. Indeed, these settlements are often located near river in depression where pressure is at its peak. Despite this, it seems that this water is most often sold to the neighboring better off quarters rather than consumed by the locals. Concerning the general configuration of the network, it is also known that

entire areas are located too far downstream of the network (east and south-east) do receive less pressure (Personal Interviews).

Map 5 – Population Density (cf: illustrated notebook)

Population density Why is so little done for the slums where live most of the people that remain to be connected? First of all, let us repeat that in the present supply situation, it cannot expand its services in new areas without compromising service everywhere else. This fact aside, there are also obstacles at the local level: the cost of getting connected can reach up to one year of water supply for a slum household. For structures owners, upgrading is very risky: no legal status, no warranty that the slum will remain, and the costs associated with maintenance (Bakker *et al.*, 2007). For the utility, installing and operating infrastructure comes at greater cost in slums than in formal areas. Investment is risky as land-tenure is unsecured and it is costly: public space left available is small, physical layout rarely complies with conventional technology, people must be moved and many stakeholders must be involved (Mukhija, 2001; Fernandez 2011a). In addition the cost of administrating such areas is much greater than in formally planned areas, with well planned, demarcated and identified plots (Personal Interviews). Basically, in the slums everything is more complicated financially, legally and technically. However, the existence of slums is a question which goes beyond access to water and sanitation and which involves lots of political and financial interests... or disinterest.

Is the water pricing efficient for regulating water demand? Some scholars have argued that the price of water should be put at its right value to promote an optimal use (Roger *et al.*, 2002). In Nairobi, a “pro-poor” increasing Block Tariff (IBT) is in effect which allows the high-end consumers with higher purchasing power and more marginal use of water to subsidize the low-end customers with lower purchasing power and more vital water needs. However, in addition to the fact that most poor cannot access the IBT because of lack of metered connection, the IBT is actually too low, one of the lowest in Kenya in fact, to promote equity (Atkins, 2007). The last price rise, which came more than ten years after the last indexation, allowed the company not to fall below its operation and maintenance costs. And many evidence show that households are willing to pay more to access more water: they invest in storage capacity and pumps, and pay much more to the unregulated alternative suppliers. Pushing the price to a higher level could lower high-end customers demand and bring more water to the poor... but it requires political will and technical capacity.

Is the institutional setup favoring the development of a better water and sanitation sector? Certainly, in the mid-1990s, the Kenyan water sector was performing very poorly and had become completely unsustainable. However, by 2002 a new formal institutional framework was put in place through the Water Act to address this downward spiral of service delivery (Nilsson and Nyangeri, 2009 ; Government of Kenya, 2002 ; World Bank, 2011). The idea was to decentralise water management from the ministry and promote corporate governance and commercial orientation. Regulation was passed to the Water Services Regulatory Board (WASREB). Responsibility over service delivery and asset holding was passed to eight regional water services board (i.e. AWSB instead of Nairobi City County, NCC). The actual operations and maintenance of WS was contracted to a non-public commercial company (i.e. NCWSC instead NCC). Despite this new framework, doubts remain whether the spirit of the act has been translated into reality: first, both the water company and the assets remained in the hands of NCC (Global Credit Rating Co., 2008). Second, the City council drains 50% of the Board revenues as a lease fee although it does not maintain nor develop nor repay these assets and regardless the fact that the Board has carried out consequent investments in Sasumua Dam (Personal Interviews). According to WASREB (2010), National Water and Sewerage Corporation (NWSC) achieved an Operating Cost Coverage Ratio of 126% in 2010. This could be seen as good news if this did not open the question whether Nairobi Water Lease fee to the Board isn't too low. Furthermore, Nairobi Water which holds 96 % of the Athi Water Services Board (AWSB)'s cash often carries out work of maintenance on the system under AWSB approval. However, for reasons due to time and work pressures these works are often carried out without express permission, resulting in disputes over payments (Global Credit Rating and Co., 2008). In other words, it seems that although the Act is pushing the sector towards better management practices, it mainly profits to the Operator and the Council but not to the Board nor to the necessary investments in water infrastructures.

Does the operator have incentives to promote equity in its services? Nairobi Water must operate on commercial basis. This means it has incentive to maximize profit by increasing sales (expanding coverage), increasing their revenue (lowering Non Revenue Water (NRW), increasing collection and metering efficiency, increasing the tariff) and reducing their operational and maintenance costs (by reducing staff). On the other side, AWSB has no financial incentives to improve the service, subsidies are not linked to performances and the lease fees defined in the tripartite agreement are not directly linked to capital investment. All in all this does not engender a conducive environment for the Board to carry on its job of improving the network (Personal Interviews). AWSB and NCWSC are on the other hand regulated by WASREB which

collects, analyses, rank and publish Key Performance Indicators (KPIs) in a yearly report called IMPACT (WASREB, 2010). These reports are meant to “name and shame” the good and bad operators and are the strongest tools in the hand of the regulator since it has no financial means for reward and sanctions. In addition to the weakness of the tools in the hands of the Regulator, the selected KPIs mainly focus on commercial and operational efficiency. Very few impact directly on the poor, and those which do are given little attention in the weighting scheme. As a result it can be said that the regulatory framework although weak tends to reinforce the commercial orientation rather than providing a guard against its possible negative side effect such as less service to the poor. As for now, it seems that the poor appear in the reports only to clear the operators’ consciences and it is very unlikely in the current incentives framework that more will be done to promote equity through regulation.

Could tackling Non-Revenue Water be a good solution to bring more water to the less privileged? In Nairobi, the volume of water that is not billed to the customers because it physically leaked or because it was not metered is frighteningly high. The more optimistic estimate is at 40%: twice the yields of Sasumua and Ruiru dams combined gone unbilled every day (GWOPA, 2012; IBNET, 2012; Karanja, 2011). NCWSC has officially embarked into a crusade to reduce drastically NRW. First through capacity building and better management tools: mapping the network and meters, computerized mobile billing, and expansion of the motorbike fleet of the meter-readers. Second through illegal connections reduction: by investing in the problematic areas and gaining control over alternative unregulated suppliers. Fewer illegal connections and fewer leaks should translate into more water at affordable price. But in practice on a day-to-day basis they are mainly two ways to reduce NRW in problematic areas: the first one is difficult, dangerous but necessary in the long run: it consists in gaining control over illegal connections and alternative suppliers through a lengthy battle against informality. The second one is easy, effective but unsustainable: it consists in shutting the pipes which supply problematic areas where the water spills the most. This practice, although not officially used is clearly an underlying principle of water distribution in Nairobi (Personal Interviews). And at this game, it is often the lower-income areas which lose since they commonly have more illegal, more physical leaks, and are less reliable clientele. NRW fighting can be a solution, notably to bring down the price for those who cannot access the subsidized rate. But only if it goes hand in hand with more service to the poor or it might instead mean no more water for them at all.

Conclusions: is inequity of service in Nairobi planned for or there by default? Inequity of service can be explained by a variety of reasons: *Some of*

which the utility has little influence on: The tremendous uncontrolled growth of Nairobi and its various forms informality put pressure on infrastructures and inflate its operating costs. Nairobi historical context has seen a minority of wealthier people accumulating privileges. Increasing supply in line with booming demand is tricky: constructing dams is costly and requires time. However, for the first time the new up-coming supplies are designed in a way which considers the poor. *Some for which it fails to take actions:* By designing an efficient institutional framework which consider the right to water for all (and especially the poor), not only promote commercial orientation and operational efficiency. By proposing an efficient water demand management framework allowing the poor to get their share. By adopting a real pro-poor water tariff, which can lower the high consumers demand, discourage wasteful use of water and allows more water to be tapped to the poor. By making sure NRW reduction is translated into effective investments in problematic areas and not less water into these. By allocating available water equitably in a way which considers people's needs, density and capacity to store water. *Some which are openly discriminative:* The configuration of the supply and distribution system favors the lower and more popular areas. The operator is constantly struggling to pump enough water to the never rationed upper and high consuming areas. The doubling of the pumping capacity from Gilgiri to Kabete is the first major upgrade of the system and is a clear priority. This clearly shows that despite recent change state of mind concerning the rights of the poor, servicing the wealthy which consume and pay more, and are more politically influent is still high in the agenda.

Recommendations: how to promote more equity of service in Nairobi? *By Operating a shift from the traditional "supply based" to a "demand based" management:* Despite the traditional reliance on new supply to alleviate Nairobi water problems, once again translated in the nonetheless necessary Northern Collector, the water sector should learn to rely on demand management to tamper the negative effects of water shortages which will inevitably return as population and demand grow. Seeing the means which will be mobilized in this upcoming water project, planners should realize that another Northern Collector will soon become impossible. *Sharpen the regulatory incentives for equity:* The constitutional Right to Water is not yet translated into the regulatory framework. The Water Act undoubtedly allowed to improve the sector by promoting commercial and operational efficiency, it should nevertheless be amended to also promote equity. The regulator should be given stronger 'sticks and carrots', notably by financial means and not uniquely by 'naming and shaming'. *Strengthen the 'long route of accountability':* The WSBs are responsible for service delivery, although customers have barely any influence on them. The board should be held

accountable to them by the promotion of tools bringing their voice up such as the Citizen Report Cards, Geo-Referenced Utility Benchmarking System (GRUBS) City-level or MajiData. *Engage a debate on fair water pricing: Water price should be subject to a debate to increase the price for the biggest consumers in order to strengthen the cross-subsidies of the Increasing Block Tariff (IBT). Equity requires technological change and investments on the network: The network should be upgraded to allow efficient and equitable water allocation. Innovative financial and technological solutions should also be adopted to overcome the obstacles specific to problematic areas like the slums.*

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Personal interviews featured:

- Gakubia Robert (Water Services Regulatory Board Kenya - Wasreb, Nairobi)
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- Muguna Nehemia (Nairobi City Water and Sewerage Company - NCWSC)
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- Owuocha Ken (Athi Water Services Board - AWSB, Nairobi)
- Ruihu John (Nairobi City Water and Sewerage Company - NCWSC)
- Timothy Ngunyangi (Nairobi City Water and Sewerage Company - NCWSC)
- Vilovic Dennis (Water Services Trust Fund - WSTF, Nairobi)

| **Abstract** |

Water and Sanitation in Nairobi face problem common to many cities of the developing world which grow too fast. This situation allows the stark differences in socio-economic between the wealthy and the poor to translate into unequal and inequitable consumption of the available water. To try to promote development of Water and Sanitation in Africa, GWOPA (United Nations) and IFRA attempted to depict the inner urban inequities in terms of water consumption, water supply and water access. They used a hybrid methodology of remote-sensing classification, household survey and spatial analysis to map the variation of the operator's performance inside the city of Nairobi. This study identifies different types of neighborhoods judging at how they look from space.

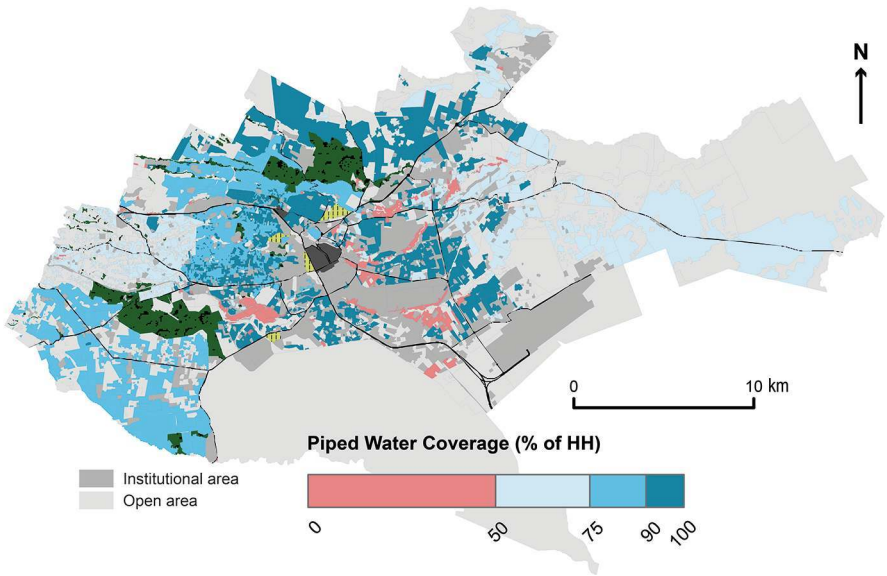
Keys Words: Water, Equity, mapping, Nairobi, Kenya

| **Résumé** |

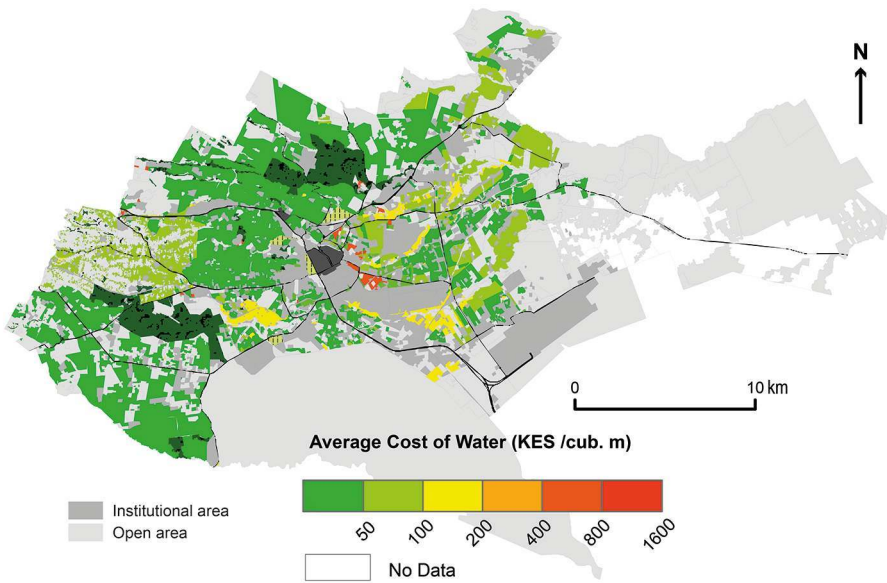
L'accès à l'eau à Nairobi : des inégalités socio-économiques et spatiales

La contribution présente les résultats d'un projet de recherche mené en partenariat entre l'Institut français de recherche (IFRA) de Nairobi et le Centre des Nations Unies pour les Établissements Humains (UN-Habitat). Elle s'intéresse aux inégalités d'accès à l'eau dans la ville de Nairobi. La croissance de la ville a été si rapide qu'elle a pris de court les autorités responsables de l'approvisionnement en eau potable et qu'elle a induit des inégalités socio-économiques et spatiales importantes. Utilisant une approche hybride mélangeant le traitement d'une image satellitaire, une enquête à l'échelle des ménages et les méthodes de l'analyse spatiale la contribution cartographie les nuances géographiques des performances de l'opérateur d'eau de la ville de Nairobi.

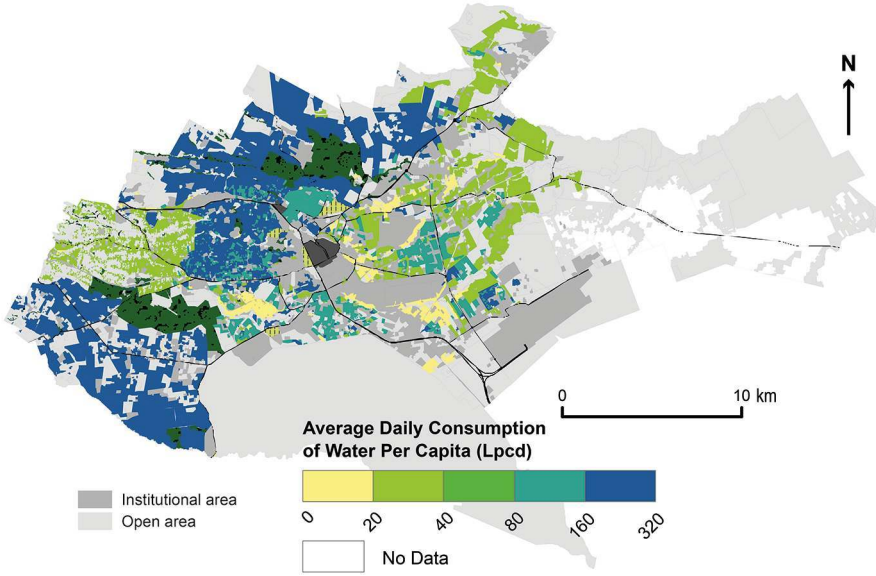
Mots-clés : Eau, équité, cartographie, Nairobi, Kenya



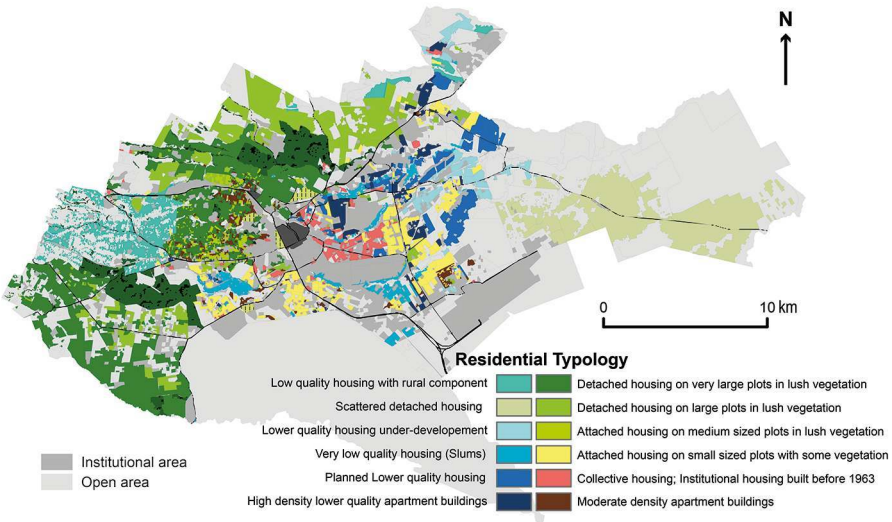
Article 3: Map 1 – Piped Water Coverage



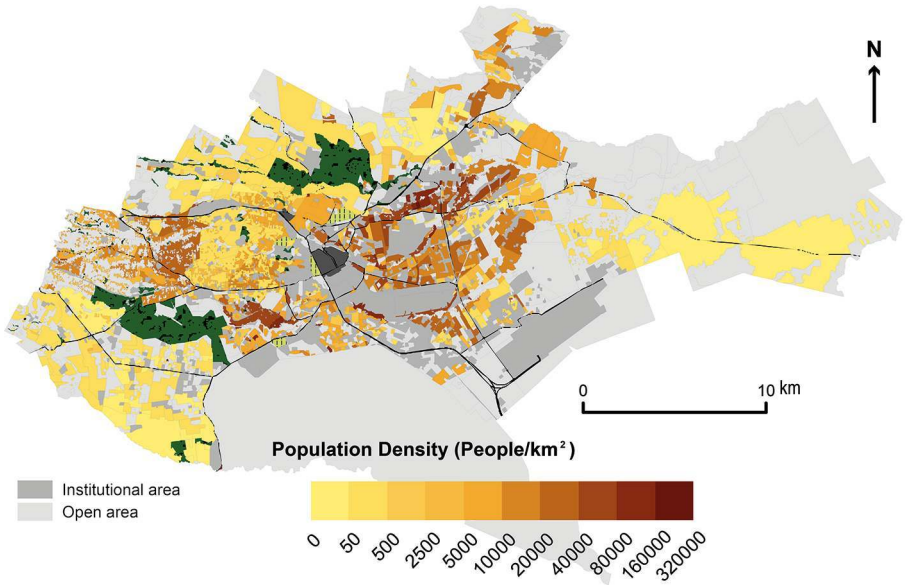
Article 3: Map 2 – Average Cost of Water



Article 3: Map 3 – Average Daily Consumption of Water Per Capita



Article 3: Map 4 – Residential Typology



Article 3: Map 5 – Population Density