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The Inequality of Climate Change on the 'Water Poor' in Nairobi's Informal Settlements, Kenya

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Abstract: Water is vital for sustainable development and has unlimited importance for human survival, socio-economic stability and environmental sustainability. Access to water is a basic human right and water equity requires that each person shares access and entitlements to water, and benefits from water use. As competition for water increases, so does the risk that water resources will be captured by the powerful, with the marginalized people losing out. The city of Nairobi has a population of more than 6 million and requires 700 million litres of water every day; however, it is only able to supply 400 million litres. Only 22 % of informal settlement households have access to direct water connection and consume significantly less than the wealthy minority. The use and access to water is thus linked to class and wealth. The current drought situation has brought attention to the inadequate water resources in face of climate change and the unequal way in which it impacts on the citizens in Nairobi. Since January 2017, there has been water rationing after water levels at the Sasamua dam, which supplies 80 % of domestic water to city residents dropped to its lowest since 2011. A climate risk analysis of Nairobi indicates that drought caused by climate change will exacerbate the water crisis in the city. Rising temperatures and shifting rainfall patterns are hazards that threaten fresh water availability. Climate change will consequently aggravate water resource constraints for the urban poor, while growing demand, decreasing availability and quality will increase water prices impacting on people's rights to dignity, health, and safety. This paper outlines the inequity in water access in Nairobi and the need for integration of climate change adaptation measures within the development agenda, ensuring water rights for those living in poverty.
Keywords: Climate change, Water inequity, Water scarcity, Urban poor.

INTRODUCTION

The human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses. Water's role in sustainable development is further emphasized in Sustainable Development Goal 6 whose target it to achieve equitable access to safe and affordable drinking water as well as adequate and equitable sanitation and hygiene for all. Kenya's National Water Strategy commits to ensuring that every citizen has a right to water; that all people are covered by the formal water supply system and that poor Kenyans pay tariffs that they can afford [1]. Considerable progress has been made in facilitating access to water since the enactment of the 2002 Water Act which brought policy reforms that separated asset ownership from service provision, regulation, and policy formulation in order to facilitate access to clean water and sewerage services to all Kenyans. Despite these positive developments, improved water access, quality and affordability by the urban poor is hampered by a number of factors: including poor and uncoordinated implementation of policies and laws, weaknesses on the policy, legal and institutional frameworks, inadequate investments in the sector, poor targeting and coordination of development programmes, mismanagement of resources and institutions, corruption, and political interference in the development of the sector and management of water service boards [2].

Nairobi is the capital and largest city of Kenya with a population of 4 million and inclusive of the suburbs, the population rises to 7 million. Nairobi is facing rapid urbanization and 60% of residents now live in informal settlements which are characterized by poor infrastructure, overcrowding, few resources and poor sanitation facilities. These large segments of the population are highly vulnerable to climatic, economic and social shocks. WSRB [3] indicates that about 80% of the poor in Kenya do not have sustainable access to affordable safe drinking water. The reason is that service provision to the poor is mostly left to the informal service providers not operating under regulation and according to standards. In addition, the ground water sources in urban settlements are highly contaminated and protected wells and boreholes in these

areas can no longer be regarded as safe and used for service provision.

Nairobi City Water and Sewerage Company (NCWSC) is mandated with the provision of clean water and sewerage services to the residents of Nairobi County. Figures from the utility indicate that on normal days, Ndakaini dam supplies 540,000 cubic metres of water a day to the city, against the demand of 740,000 cubic metres. The situation creates challenges that constrain equal water access for the residents. Currently, of the 4 million residents of Nairobi, only 50% have direct access to piped water and 60% of the population lacks reliable water, obtaining their water from kiosks, vendors and illegal connections. Many households, both poor and non-poor, experience water scarcity even when they are within areas that are well covered through mains connections and water kiosks.

Rapid population growth and an extreme rate of informal urbanization will continue to substantially increase Nairobi's risk to water crisis. Over the past decades, water demand increased twice as fast as the population growth, leading to widespread water shortages and water crises. Increased water consumption levels have been as a result of expanding industrialization, rapid growth in the peri-urban areas and a rising middle class with higher incomes living water-intensive lifestyles. Water supplies in Nairobi are further threatened by pollution as the four main rivers: Ngong, Nairobi, Kirichwa and Mbagathi have been turned into channels due to the huge amount of waste thrown into them, depriving the water in the rivers of oxygen. Increased water demand comes without modern technology for water saving and pollution control. The aging water networks and infrastructure has exceeded its operational life resulting in disproportionate and perpetually increasing maintenance costs. As the population and economy grows, this infrastructure is struggling, requiring substantial investments for expansion. However, limited financial resources, often stemming from low efficiency and subsidized tariffs, reduce the ability of the utility to address priorities to improve service delivery [4]. The situation is further worsened for urban residents as volumes of unaccounted for water (Non-Revenue Water), through leakages, illegal connections, and corruption-fed supply disruptions, remain unacceptably high at 40% [5].

Effects of climate change on Nairobi's water supplies

Models of climate change in the East African sub-region project temperature increases of 1.5 to 2 degrees Celsius between now and 2050, increasing to between 2 and 4 degrees Celsius between 2050 and 2100 [6]. The projected temperature rise will affect water availability, and both short and long term operations of urban water supply systems. Growing evidence indicates that the water sector will not only be affected by climate change, but that it will deliver many of its impacts through floods, droughts, or extreme rainfall events. A climate risk analysis of Nairobi indicates that drought caused by climate change will exacerbate the water crisis in the city [7].

Drought has already has resulted in reductions in water supply, causing NWSWC to implement water conservation measures, including the unpopular water rationing and intermittent supply. From January 2017 there has been water rationing blamed on drought conditions affecting the water reserves in the Ndakaini–Ng'ethu system which accounts for 85% of Nairobi's water [8]. Ndakaini dam traps three rivers that flow from the Aberdare mountain range and releases the water in the dry season, has been only 37% full. The rains in October–December 2016 delivered just 268mm of water compared to about 700mm expected from rainfall patterns in recent years. The March–May rains in 2017 were late and when the rains came in May, only 440mm of the 1,000mm expected during the rainy season was delivered [9]. As a consequence, the water available to the city has reduced with NWSWC distributing 400,000 cubic metres a day, 150,000 less than it used to and 350,000 less than the city needs.

Climate change is also likely to modify water quality and quantity. Urban flooding will damage water treatment works and flood wells, pit latrines and septic tanks. Sewage treatment systems and solid waste disposal areas can also be affected, contaminating water supplies. Droughts and floods will present a recurring challenge as NCWSC will have to adapt its operational systems and institutional arrangements to account for increasing climatic variations. This type of operational approach is costly as intermittent supply and associated hydraulic shocks cause long-term damage to existing water systems, networks, pumps and gates and shorten the functional life of water infrastructure [10]. This will manifest in difficulties in operations to disrupted services and increased cost of the water. The effects of climate change will also require NCWS perform more frequent technical maintenance, undertake unscheduled rehabilitation and in some cases scale down operations at their facilities, and by extension reduce service to their clients. All of this implies additional cost for the utility.

Rising temperatures and shifting rainfall patterns will threaten fresh water availability. A climate change scenario indicates that higher temperatures and reduced precipitation levels will cause shortages in available supply due to slower replenishment rates of underground water resources the normal sources of water supply. Where overall rainfall decreases, droughts will likely compromise the replenishment of the water tables. Of 78 public boreholes, only 48 work in the city. Water shortages will be particularly acute in informal settlements where 60% of Nairobi's citizens reside [11]. The Fourth Assessment Report observes that socially and economically disadvantaged and marginalized people are disproportionately affected by climate

change [12]. The links between climate change and inequalities indicate that socioeconomic inequalities determine the disproportionate adverse effects arising from climate change. The urban poor have greater exposure and vulnerability to climate hazards and have the least ability to cope with increasing variability in water supply.

As temperatures rise, people will need more water to maintain their health and thrive. Many businesses and industries also require water which will be less available as competition for water resources increases. Climate change increases the risk of illness through changing water quality and quantity. Health impacts may include gastrointestinal illness like diarrhea, effects on the bodies nervous and respiratory systems, or liver and kidney damage. Climate impacts can affect exposure to waterborne pathogens (bacteria, viruses, and parasites); toxins produced by harmful algal and cyanobacteria blooms in the water; and chemicals that end up in water from human activities [13]. Changing water temperatures also mean that waterborne bacteria and harmful algal toxins will be present in the water in places where they were not previously threats. Runoff and flooding resulting from increases in extreme precipitation will increasingly contaminate sources of drinking water. Extreme weather events and storm surges can damage or exceed the capacity of water infrastructure (such as drinking water or wastewater treatment plants), increasing the risk that people will be exposed to contaminants.

Effects of climate change on water access for the city's poor

In Nairobi City, water access is highly unequal with low income and informal communities often relying on water kiosks, shared household connections, boreholes, and/or water vendors. This trend emerged in the colonial times when water supply and distribution network were mainly centered on the upper and wealthier areas through the Kabete reservoir [14]. Today, the colonial segregation has mutated into a socio-economic segmentation whereby the high-income areas in the leafy suburbs enjoy easy water access as compared to the low-income areas. 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. However, upgrade of the water network in collaboration with the World Bank has brought more water to the rapidly expanding eastern parts of Nairobi.

Inequities in access to water are observed by the differences between the wealthy and the poor in the unequal and inequitable consumption of water. Different households with different life-style, and different access to water, have different water needs, and often the water supply is designed in a way that provides more water to certain households than others. In Nairobi, the better off consume more than designed for and the poor are delivered less than their designed level. Thus, the wealthy have such a demand that it creates a water shortage of which the cost is mainly born by the less privileged people. Only 22% of informal settlement households have access to direct water connection and consume significantly less than the wealthy minority. 40% of the distributed water is supplied to the 7% biggest consumers and the 45% smallest consumers share 15% of water available [15]. Experts worry that global warming will compound these problems, enlarging a category of people they call the "water poor."

This situation presents a huge burden to poor households as fetching water is time consuming. A typical household in the informal settlements makes 4-6 trips daily to fetch water. A 20-liter jerry can is the common container used to collect, transport, and store their water. Further, they buy water at a cost many times higher than the price paid by non-poor consumers who have access to piped water. According to CRC [15], people in urban areas obtaining their water from a water kiosk pay two to five times more than those who get their water delivered to their homes through the network. In Nairobi's Kibera neighborhood, for instance, people pay up to 18 times more per unit compared to what middle and higher income residents pay [5]. The NWSWC recommends that the price for a jerry can of water be Ksh 1. However, with water rationing, a 20-litre container sells between Ksh 20-50. High prices are also made possible by the concentration of water sales to a select number of kiosks, whose water supply is unreliable and water shortages are common. Consumers spend long hours queuing for water which is not controlled/tested and water prices are 5-20 times higher than tariffs charged by formal providers to connected customers.

Many of the informal water vendors are organized in cartels, profiting from their monopoly power by distorting competition and creating artificial shortages for their own benefit. A report by KACC [2] noted that various water company providers cause artificial shortages that allow water vendors to thrive drawing water from public supply lines and selling it to under-supplied citizens at much higher costs than mains-supplied households. The report noted that most water vendors are company employees or their relatives and they sell water at a fee much higher than the normal tariff. Some of the water classified as "unaccounted" (47% according to the World Bank [16] is, in fact, sometimes diverted through these means. As a result, those who can least afford to pay, pay the highest price and persistently have the worst access. In comparison the non-poor most often benefit from water delivered to their homes, often at very low prices. Water from private sources, such as private boreholes is also more expensive and because of this economic burden, water inequality perpetuates economic inequality. Further, to cope with water scarcity, many households incur costs

by purchasing and installing storage tanks. Those who cannot afford to do so are forced to survive with the little water available, to use unsafe water, or to pay much higher prices for the little water available.

Many of the health burdens suffered by the city's poor are related to water-borne diseases. Insect vectors breed in standing water found in water storage containers such as pots, small tanks, cisterns or small cans around the house. These areas of standing water provide breeding grounds for *Anopheles* mosquitoes that spread malaria, as well as for *Aedes* mosquitoes that spread dengue fever, dengue hemorrhagic fever, and yellow fever [13].

CONCLUSION

The world is now defining new targets for water in the Sustainable Development Goals, which include levels of service such as accessibility and reliability. There is also increasing pressure on water utilities worldwide to increase their levels of service to the rapidly growing numbers of people with lower incomes who reside in urban informal settlements. Initially, the discussion on climate change focused mostly on the physical impacts (i.e., nature), however, the social consequences have received more attention, and evidence regarding the relationship between climate change and poverty has begun to emerge. Water scarcity is expected to increase as the climate changes and the consequences include reducing access to drinking water, threatening food security and bringing about adverse health effects. The city's poor are currently underserved, drink unsafe water, or are forced to use minimal quantities of water as distance, waiting times, and cost make water inaccessible. Economic factors force people to live in the informal settlements of the city often located in high-risk areas from climate change related hazards. Climate change will aggravates water resource constraints for the urban poor as growing demand, decreasing availability and quality will increase general water prices and have profound impacts on people's health. A climate change scenario will lay bare the differences in socio-economic between the wealthy and the poor to translate into unequal and inequitable consumption of the available water. In Nairobi, water inequity is linked to water quality and quantity, as well as to price, reliability, and convenience. With water scarcity becoming a reality because of climate change, the wealthy may be able to protect themselves from disease by buying bottled drinking water and the poor not being able to afford this luxury.

RECOMMENDATIONS

Nairobi County needs to re-examine development processes in the water sector and adapt strategies to incorporate climate change into infrastructure design, capital investment projects, service provision planning, and operation and maintenance. The county will have to invest in water infrastructure to prevent wastage and expand the public delivery of treated water to informal settlements. Solving the inequality issue will also require restructuring subsidies on public water so they don't favor the upper and middle classes and leave the poor with a hefty bill. Monitoring and research on climate variability and change and related impacts on water utilities including the regulatory changes required to ease operational and financial burdens; changes in traditional water services operation and delivery reflecting variations of available water and costs of its provision; technological changes that take the growing costs of water and its management into account and acceptance of these changes and the cost burden borne by utilities and by the public they serve.

The water company needs to adopt innovative ways to harness and conserve water, moving away from traditional sources of water supply; dams and boreholes that are expensive and prone to weather changes to rainwater harvesting, large-scale wastewater recycling, deliberate efforts to cause groundwater recharge, restore water-related ecosystems including wetlands, rivers, lakes and aquifers, extensive water tower conservation, regular tree planting, drastic reduction in river pollution and radical reduction of water wastage among middle and upper class city residents. Public health safeguards to reduce risk of exposure and illness from contaminated need to be done including water quality monitoring, drinking water treatment standards and practices, and issuing advisories for boiling drinking water.

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