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The Water Crisis in Kenya: Causes, Effects and Solutions

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Abstract

Located on the eastern coast of Africa, Kenya, a generally dry country with a humid climate, is enduring a severe water crisis. Several issues such as global warming (causing recurrent and increasingly severe droughts as well as floods), the contamination of drinking water, and a lack of investment in water resources have enhanced the crisis. This article provides an overview of Kenya's water crisis, along with a brief review of the literature and some empirical background. It reviews the main causes of the water crisis and how it affects the health of millions of Kenyans. Furthermore, the article summarizes some of the main solutions proposed to overcome the crisis.

I. Introduction

There are about 40 million people living in Kenya, of which about 17 million (43 percent) do not have access to clean water.[1] For decades, water scarcity has been a major issue in Kenya, caused mainly by years of recurrent droughts, poor management of water supply, contamination of the available water, and a sharp increase in water demand resulting from relatively high population growth. The lack of rainfall affects also the ability to acquire food and has led to eruptions of violence in Kenya. In many areas, the shortage of water in Kenya has been amplified by the government's lack of investment in water, especially in rural areas.

Most of the urban poor Kenyans only have access to polluted water, which has caused cholera epidemics and multiple other diseases that affect health and livelihoods. Despite the critical shortage of clean water in Kenya's urban slums, there also is a large rural to urban discrepancy in access to clean water in Kenya. According to the World Bank (2010), slightly less than half of the rural population has access to water, as opposed to the urban population where 85 percent have access to safe water. Due to continued population

[1] See World Bank (2010).

growth, it has been estimated that by the year 2025, Kenya's per capita water availability will be 235 cubic meters per year, about two-thirds less than the current 650 cubic meters.[2]

This article is about the causes, effects and solutions to the water crisis in Kenya. The next section provides a brief review of the literature on the Kenyan water crisis. The subsequent section provides some empirical background on Kenya. The fourth and fifth sections discuss, respectively, how the water crisis developed and what effects it has on the country. Section six summarizes some recent suggestions for solutions before the last section provides some conclusions.

II. Brief Literature Review

There is a large and growing literature addressing a variety of issues related to Kenya's decade old water crisis. One of the first systematic analyses of Kenya's water resources had been undertaken by the British Crown in 1934 (when Kenya was a colony of the British empire).[3] The literature experienced some growth after Kenya gained independence in 1963, with various seminal contributions in the early 1970s.[4] By the 1980s, much of the literature addressed specific issues, like for example the report by the Kenya Water for Health Organization (1985), focusing on the implications of the Kenyan water crisis on women. By 1990, the first annotated bibliography on soil and water conservation in Kenya had been provided by Karanja and Tefera (1990).

In the more recent years, the focus of Kenya's water crisis has shifted to the impact of climate change and climate variability; see for example the detailed study by Mogaka, Gichere, Davis and Hirji (2006). Furthermore, after decades of policy neglect, the Government of Kenya's (2008) *Poverty Reduction Strategy Paper (PRSP)* has finally recognized the importance of safe water for its goal to reduce poverty. The PRSP discusses the water situation, challenges to overcome the water crisis, and multiple approaches to tackle the problem.

Among the most recent contributions are various informative news articles which illustrate the severity as well as the complexity of Kenya's water crisis. Several articles focus on how water contamination leads to illnesses and death. Other articles touch upon different factors of the crisis and some stick to one specific factor, such as recurrent droughts, which have affected millions of Kenyans.

One very interesting article, devised by the *Women News Network's* Kenya correspondent Gitonga Njeru (2010), focuses on how the water crisis in Kenya has had a tremendous impact on maternal care. The Kakamega Provincial District General Hospital in Kenya lacks the sufficient supply of clean water. Njeru says that the patients' health conditions are made worse by severe water shortages. Due to the water shortage, hospitals like Kakamega Provincial District General Hospital have to collect buckets of water, which is then provided to its patients. The water is polluted with bacteria, viruses and parasites and many patients develop different diseases such as typhoid and cholera. Not being able to

[2] See Wafula (2010).
[3] See Kenya Colony and Protectorate (1934).
[4] See for example Padfield (1971) and Carruthers (1973).

provide safe water results in a serious threat to the health of expectant mothers. “The facts are clear,” Njeru states, “climate change, water supply and sanitation play a responsible role in many of these deaths.”

Similar to Njeru’s article, there is a blog posted in 2008 that is entitled “Cholera Outbreaks in W. Kenya Blamed on Contaminated Water”. According to the blog, health officials said the main reason for cholera outbreaks was because of seepage from the latrines. Senior Deputy Director of Medical Services in Kenya’s health ministry, Shahnaaz Sharif, said: “In Kisumu, many wells are built near the latrine; eventually the sewage seeps into the wells.” One of the leading causes of diseases among Kenyans, such as cholera, is due to a lack of access to safe water.

An appealing article posted by *Global Voices* author, John Liebhardt (2010), reflects on the harsh conditions Kenyans now face due to the long-lasting drought. The drought, Liebhardt says, has forced people to move from their home, caused violence, posed educational issues and has burdened people with rebuilding their communities. The drought has forced people living in rural areas to move in order to find water because there is an insufficient amount for them and their animals. Migration has forced children out of school, which has negative implications on their education. Moreover, the severe drought in Kenya affects the total living quality of many families, as many can no longer support their daily needs.

III. Empirical Background

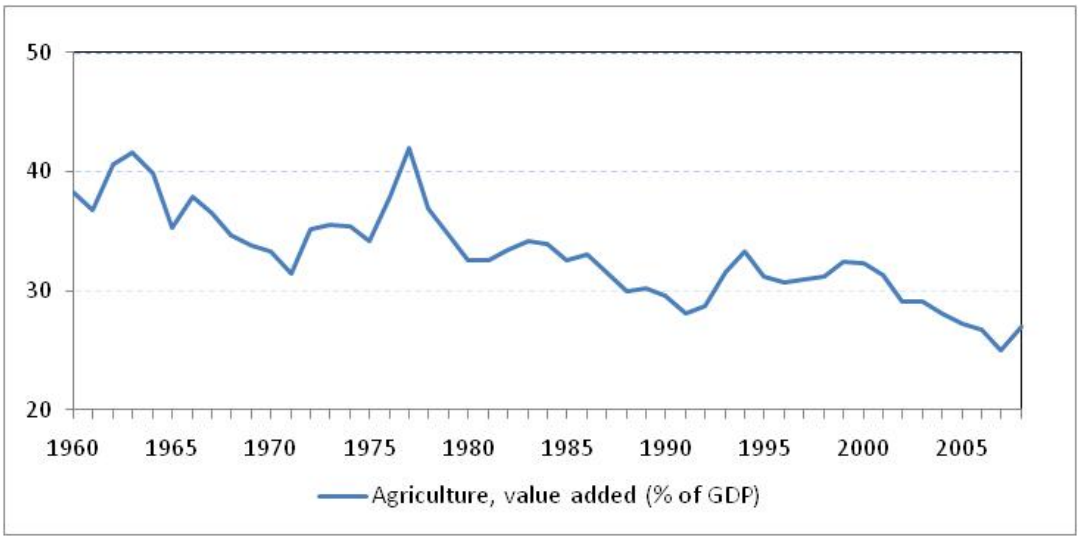
Kenya is a generally dry country, as about 80 percent of the country is arid and semi-arid. The high potential agricultural land amounts to only 17 percent, which sustains 75 percent of the population. The average annual rainfall in Kenya is 630 millimeters (mm) with a variation from less than 200 mm in Northern Kenya to over 1,800 mm on the slopes of Mt. Kenya.[5]

Kenya’s economy is based around an agricultural hub, with agriculture providing about one third of the country’s income (see Figure 1, showing the share of agriculture in Kenya’s gross domestic product (GDP) from 1960-2008). When a drought occurs, this has severe implications on the entire economy and the people’s livelihood. The high volatility of the agricultural share of GDP (clearly visible in Figure 1) is mostly reflecting weather-related impacts on Kenya’s agricultural productivity.

As shown in Figure 2, Kenya has made no progress in raising its GDP per capita during the last 20 years. GDP per capita was slightly below US$1,500 (expressed in purchasing power parity and in constant 2005 dollars) in 1990 and still was below US$1,500 in 2008. Figure 2 also shows that Kenya is poorer and did worse than the average of Sub-Saharan Africa (SSA), which—as is well-known—stands out among the world regions as having made the least progress during the last 20 years.

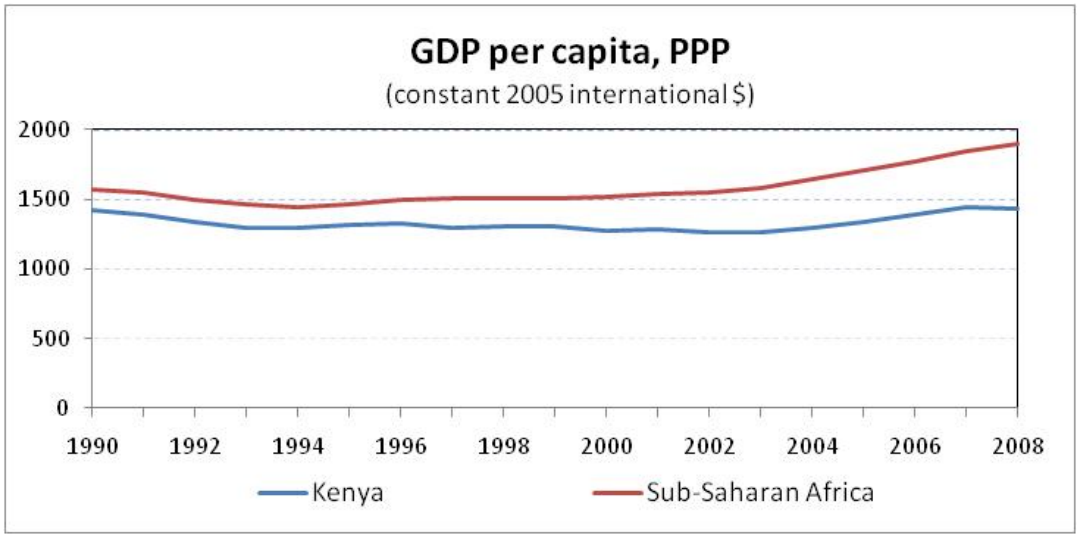
[5] See The Encyclopedia of Earth (2008).

Figure 1: Share of Agriculture in Kenya (percent of GDP), 1960-2008



Source: World Bank (2010) *World Development Indicators*
(as posted on the World Bank website; downloaded on October 5, 2010).

Figure 2: GDP per capita (in constant 2005 international dollars), 1990-2008

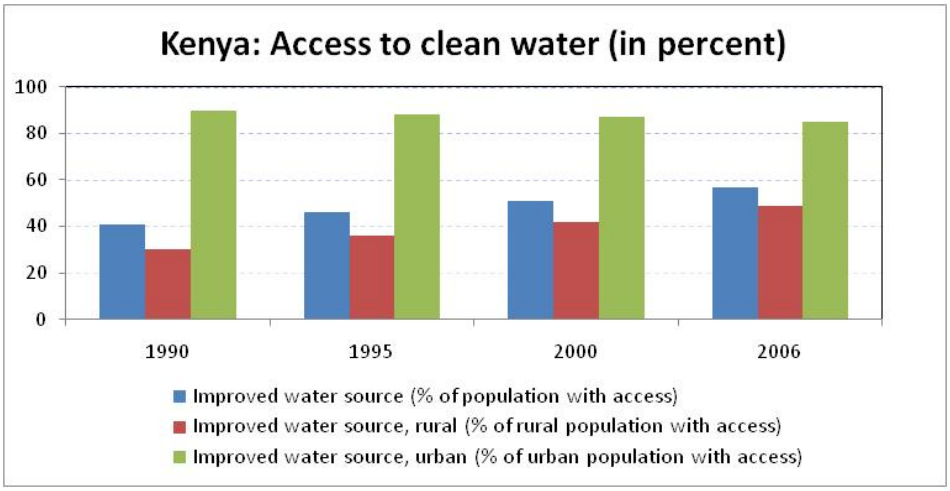


Source: World Bank (2010) *World Development Indicators*
(as posted on the World Bank website; downloaded on October 5, 2010).

Figure 3 shows the access to clean water by Kenya's total, urban, and rural populations (in percent). First of all, we can see the huge difference in access rates to clean water between the rural and urban population. In 1990, only 30 percent of the Kenya's rural population had access to clean water, while the access rate for the urban population stood at 90 percent. During the last two decades, the gap between rural and urban access rates has decreased.

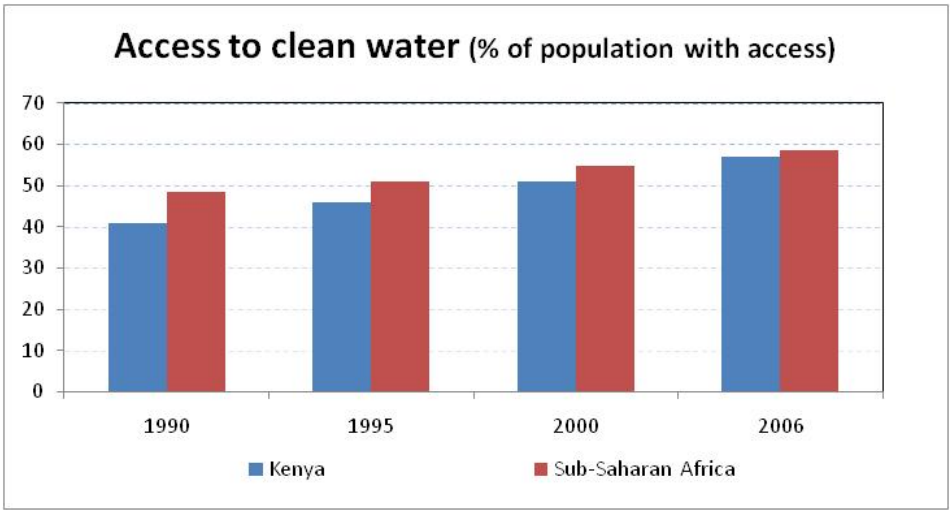
Still, Kenya's rural population remains to have a much lower access rate than the urban population in 2006, respectively 49 percent and 85 percent. Much of the progress in rural access rates and the decreasing urban access rates can be attributed to rural to urban migration and rapid urbanization. A second important observation is that Kenya has overall made some progress in the percentage of people having access to clean water. Access rates have increased from 41 percent of the total population in 1990 to 57 percent of the total population in 2006.

Figure 3: Access to Clean Water in Kenya
(for available years during 1990-2006)



Source: World Bank (2010) *World Development Indicators*
(as posted on the World Bank website; downloaded on October 5, 2010).

Figure 4: Access to Clean Water in Kenya and SSA
(for available years during 1990-2006)



Source: World Bank (2010) *World Development Indicators*
(as posted on the World Bank website; downloaded on October 5, 2010).

While these numbers remain far too low, Figure 4 shows that Kenya has made more progress in improving access rates to clean water than the average SSA-country. During the last two decades, Kenya has increased its access rate for the total population by 16 percentage points, while SSA has increased its access rate by only 10 percentage points (from 48 percent to 58 percent). Furthermore, comparing Figure 4 with Figure 2, we can see that Kenya has made more progress in increasing access rates to clean water than SSA, despite of Kenya having made far less progress in terms of raising income per capita than SSA.

IV. Causes of the Water Crisis

Despite the progress made, it is important to review the causes of Kenya's water crisis in order to improve the situation further and to prevent future disasters. In this section, six essential causes of Kenya's water crisis will be discussed: droughts, forest degradation, floods, poor management of water supply, water contamination (especially in slums), and population growth.

IV.1. Droughts

Over the past decade Kenya has experienced a severe drought. Global warming is one critical factor that has prolonged the drought and as a result, millions of Kenyans are unable to grow their crops and keep their livestock alive. Because most Kenyans rely directly or indirectly on agriculture, when severe droughts occur, many Kenyans are left to starve unless food aid prevents a famine. Box 1 shows that in the last decade alone, there have been four major food crises, all due to drought. A map of Africa, which portrays the impact global warming has had on different countries, is shown in Figure 5.

Box 1: Food Crises (1997-2005)

Four Food Crises

January 1997: the Kenyan Government declared a state of national disaster after a severe drought threatened the livelihoods of 2 million people.

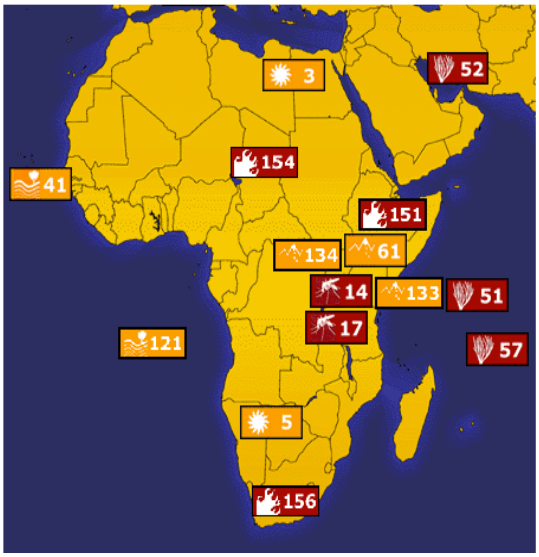
December 2000: 4 million people were in need of food aid after Kenya was hit by its worst drought in 37 years.

2004: the long rains (March–June) failed and the subsequent crop failure left more than 2.3 million people in need of assistance.

December 2005: President Kibaki declared yet another "national catastrophe" in reference to the famine that affected 2.5 million in northern Kenya.

Source: Union of Concerned Scientists (1999).

Figure 5: Impact of Global Warming in Africa



Source: Kandji (2006) p. 18.

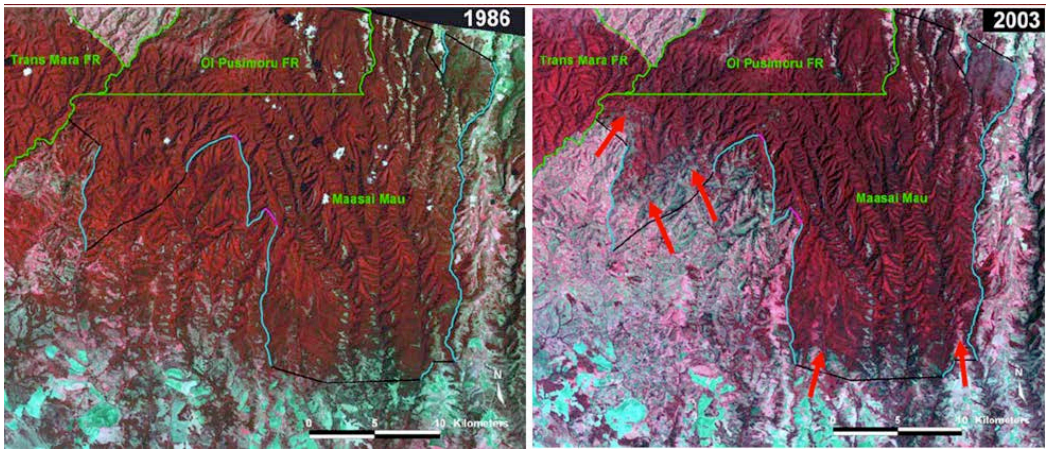
Each number on the map represents a specific effect global warming has had on a certain country. The red icons symbolize the types of impacts likely to become more frequent and widespread if global warming continues. The icon labeled number 151 represents the drought that occurred in Kenya in 2001. This drought was labeled the worst drought in 60 years, which affected over four million people because of a severely reduced harvest, damaged livestock and weak sanitary conditions.[6]

IV.2. Forest Degradation

Another main reason for why droughts have prolonged is due to deforestation. The largest forest in Kenya, Mau, distributes water to six lakes plus eight wildlife reserves, and some 10 million people depend on its rivers for a living. However, loggers and farmers have destroyed a quarter of Mau's 400,000 hectares.[7] The problem with deforestation is that it almost always leads to increased runoff, which has negative implications in both the rainy as well as the subsequent dry season.

Figure 6 compares two satellite images of Mau forest. The image to the left is from 1986 and the image to the right is from 2003. Both images portray the loss of forest cover (which is shown in red) and the infringement (arrows) into the Mau forest reserve. As shown in Figure 6, the extent of deforestation has increased from 1986 to 2003 because the arrows symbolize the increase of settlers and clearers into the Mau forest, which has had a huge impact on the loss of forest cover.

Figure 6: Massai Mau Forest Degradation



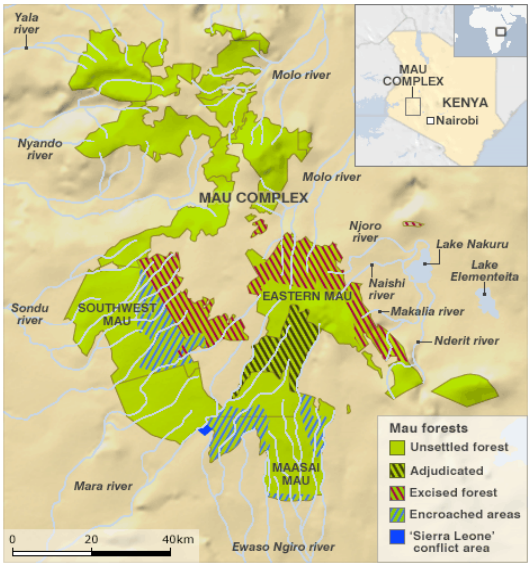
Source: Morgan (2009).

According to Morgan (2009), since 2001, when 60,000 hectares of Mau forests were given to settlers, it has been hard to control the amount of forest degradation. Figure 7 provides a layout of the Mau complex and information about which areas have been consumed. The Mau area covered in red stripes represents the excised forest, which belongs to farmers, local officials and settlers. Almost 20,000 hectares were handed out to farmers by the

[6] See Union of Concerned Scientists (1999).
[7] See Morgan (2009).

government for political reasons and about 2,000 hectares were illegally purchased with the help of local officials. The dark green-striped areas represent a part of Mau that was adjudicated to local people who have traditional rights to the forest. The remaining encroached areas, represented by blue stripes, were taken over by settlers. Figure 7 helps to explain why such a large amount of Mau forest has suffered degradation and how difficult it will be for Kenya to rebuild the forest to overcome the water shortage in the rivers around it.

Figure 7: Mau Forest Complex



Source: Morgan (2009).

IV.3. Floods

Somehow contradictory is the fact that Kenya also suffers from floods, though either at different periods or in different regions (especially in the narrow tropical belt along the Indian Ocean). Most parts of Kenya have two rainy seasons, March to May (long rains) and October to November (short rains), with the intensity of these rains having increased recently due to an increased climate variability.[8] According to a report of the Government of Kenya (2001), in addition to annual local floods, the country experienced major floods in 1961 and in 1997/1998.

IV.4. Poor Management of Water Supply

For many years there has been an increased need for (i) funding, (ii) management and (iii) development of water resources in Kenya because of the increasing population as well as the country's increasing use of water for agriculture. However, the actions taken have not been effective because organizations in charge of managing water resources have failed in multiple ways:

[8] See Mogaka, Gichere, Davis and Hirji (2006).

- According to the Government of Kenya's National Water Development Report of 2006, Kenya's water resources have been mismanaged through unsustainable water and land use policies, laws and institutions, weak water allocation practices, growing pollution, and increasing degradation of rivers, lakes, wetlands, aquifers and their catchments.
- According to Ngigi and Macharia (2006), Kenya's government devised a plan in 1974 to ensure safe water to all households by the year 2000. The government established many different plans along the way to manage water effectively, such as the National Water Conservation and Pipeline Corporation (NWCPC). By the year 2000 the NWCPC was managing piped water systems in urban and rural areas, which served about 3.8 million people. Other people benefited from the NWCPC, but it was not enough, as less than half the rural population had access to clean water and in urban areas only two thirds of the population had access to clean water. This can be explained through a process called "handing over." The government experienced budget problems in the 1980s and knew it would not be able to meet its goals by the year 2000. The government "handed over" rural water systems to people of communities and urban water systems to departments within local authorities, where they would take responsibility for controlling and preserving the water systems.

Related to the government's mismanagement is a problem of private investors not willing to provide water services in Kenya. Paul Wafula (2010), a journalist for *Business Daily* (a newspaper published out of Nairobi, Kenya), discusses the lack of investment in water in Kenya. He writes that according to Mr. Julius Seloke of Westwood Management Ltd. (a brokerage firm in East Africa) "the view that water is a human right has contributed largely to investors shying away" as investors fear that the government may interfere in business decisions, like dictating the price investors can charge. He also quotes Professor Mumma Albert (a senior lecturer of the University of Nairobi), stating that "[t]he Water Act 2002 depends on State-based legal frameworks, its effectiveness in meeting the needs of the rural poor are limited, particularly given the limitations of technical and financial resources facing Kenya."

IV.5. Contamination of Water

The disability to maintain clean water in Kenya is another main reason for the worsening of the water crisis in Kenya. Many Kenyans use wells to obtain domestic water and also use pit latrines that are often close in distance to the wells. This causes contamination of the wells because the microorganisms travel from the pit latrines to the wells. The wells should be placed in elevated areas (at least 2 meters above the water table) and at least 15 meters from pit latrines, which however is not the case in most overcrowded urban slums.

An excellent case study undertaken by Elizabeth Wambui Kimani-Murage and Augustine M. Ngindu (2007) provides an explanation for the severe contamination of drinking water in Kenya. The study argues that the severe contamination is largely due to the close distance between pit latrines and wells. This study focuses on residents of a Kenyan slum because the majority of urban residents in sub-Saharan Africa live due to rapid urbanization in

slums. The following quote summarizes what was collected from the study:

> This cross-sectional study involved 192 respondents from Langas slum, Kenya. Forty water samples were collected from the water sources used by the respondents for laboratory analysis of coliforms. Of these 40 samples, 31 were from shallow wells, four from deep wells, and five from taps. Multiple-tube fermentation technique was used to enumerate coliform bacteria in water.[9]

The results from the study show that most people in urban slums (91 percent) used wells as their main source of water and the rest used tap water. The majority of people in urban slums said they used pit latrines for disposal while 30 percent of children said that they emit in open fields. As Table 1 shows, the problem is that many wells are very close to the pit latrines. Out of 175 wells, about 39 percent of the wells were less than 15 meters from the latrines, about 59 percent were located within 15 and 30 meters and only about 3 percent were located 30 meters or more to pit latrines. All the samples taken from shallow wells were positive for total coliforms, which is fecal contamination. Three out of four samples taken from the deep wells were contaminated and none of the tap water samples were contaminated.

Table 1: Distance between Pit Latrine and Wells in Langas Slum

Distance	Number	Percent
1–15 m	67	38.3
15–30 m	103	58.9
30 m and above	5	2.9
Total	175*	100

Source: Kimani-Murage and Ngindu (2007), Table 1 (p. 833).

Other possible sources of water contamination in the area were also examined by the study. People of the area said that contamination can be a result of children dipping dirty objects into water sources (34 percent), drawing water from the source with dirty containers (27 percent), domestic animals excreting around water sources (19 percent) and people washing their clothes at the water source (5 percent). In any case, this study shows that the drinking water in Langas urban slum is contaminated and unsafe to drink, yet, the slum dwellers continue to drink it as they have no other alternatives.

IV.6. Population Growth

Kenya's relatively high population growth has had another negative impact on having access to safe water. According to the World Bank (2010), the population in Kenya in 1990 was about 23 million and in 2008 the population increased to about 40 million people. With an increase in population, water is less accessible. In Kenya there are more people that live

[9] See Kimani-Murage and Ngindu (2007), p. 829.

in rural areas than urban, however, the percent of total population that live in rural areas went down from about 82 percent (in 1990) to about 78 percent (in 2008). Due to this migration from rural to urban areas, there has been increased pressure on the rural water supply.

V. Effects of the Water Crisis

While at the global level about 1 billion people are locked out of having access to safe water due to poverty, inequality and government failure, it is also clear that not having access to clean water is a main driver of poverty and inequality.[10] In Kenya, largely due to recurrent droughts, millions of families that rely on crops and livestock are threatened and thousands of people die each year as a result of thirst and hunger. According to the World Bank (2010), the mortality rates of adult males, adult females, children under five, and infants has increased from 1990 to 2008.

In Kenya, the water crisis has severely affected millions of lives in many ways as contaminated water resources are extremely unhealthy and typically result in multiple illnesses. According to a report by the Government of Kenya (2006), there are three main categories that include different types of diseases related to unsafe water:

- **Water-based:** this category includes diseases such as malaria and infestinal worm diseases (schistosomiasis).
- **Water-borne:** this category includes diseases such as typhoid fever, cholera, diarrhea and dysentery.
- **Water-washed:** this category includes diseases such as eye infections and skin diseases.

Malaria (a water-based disease) is currently one of the most serious health problems in Kenya. An estimated 26,000 children under five die every year from malaria and an estimated 3.5 million children under the age of five are at risk for developing malaria. Malaria is contracted through areas of Kenya's western highlands and around the coastal and lake regions, where the malaria-carrying mosquito settles.[11] As shown in Figure 8, malaria is the most common disease among the different provinces of Kenya. However, it is most common in the Coastal, Eastern, Western and Nyanza provinces, which are all near large bodies of water: the Western and Nyanza provinces are located by Lake Victoria, and the Coastal and Eastern provinces are located near the Indian Ocean.

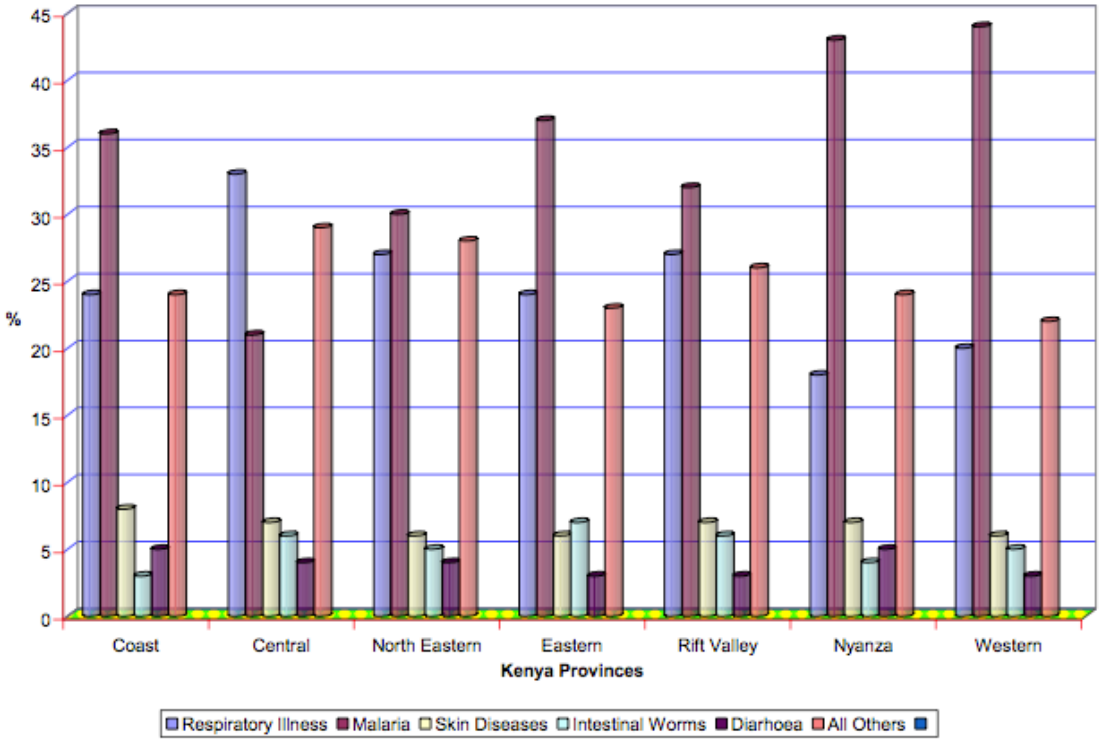
Schistosomiasis (also known as *Bilharziosis* or snail fever) is another water-based infection, caused by two parasitic snails/worms called *Bulinus* and *Biomphalaria*. This disease, which is transmitted through all major water bodies in Kenya, affects especially people between the ages of 10 to 20 due to increased contact with infected water bodies and also through defecation. The *Bulinus* worm is usually found in streams, small pools, water holes and dams. The second snail genus, *Biomphalaria*, can be found in faster

[10] See United Nations Development Program (UNDP) (2006).
[11] See Government of Kenya (2006).

moving water and also in irrigation channels and dams, where it buries itself in the bottom for several months.[12]

Cholera, a water-borne disease resulting from being in contact with contaminated water, is also very common in Kenya. Cholera is mostly contracted by the use of water drawn from wells that has been contaminated. As was illustrated above, the water contamination is largely due to close distances between wells and pit latrines.

Figure 8: Top Five Causes of Outpatient Morbidity by Province in 1999



Source: Government of Kenya (2006) *Kenya National Water Development Report*, Figure 4.8 (p. 157).

VI. Some Recently Proposed Solutions

The *Poverty Reduction Strategy Paper (PRSP)* of the Government of Kenya (2008) provides a short-term recovery strategy that includes rehabilitation of Kenya's water infrastructure and the provision of water to Kenya's people. The PRSP devised a variety of flagship projects to be completed over the long-term period, which include almost 20 different projects that range from securing wildlife to protecting forests in the five water towers. The following four are some of the most promising plans and projects which Kenya's PRSP aims to implement until 2012:

[12] See Government of Kenya (2006).

- **Rehabilitation and protection of indigenous forests in the five Water Towers (Mau Escarpment, Mt. Kenya, Aberdare Ranges, Cherangany Hills and Mt. Elgon):** This plan aims to promote sustainable management of the forests and preserve cultural and religious sites, medicine sources, water catchments and habitats for widespread and threatened flora and fauna. The main goal of this project is to establish a forest cover of 4 percent by the year 2012. This project will involve joint management with stakeholders, such as local communities, civil societies, and development partners, through forest preservation committees around each tower.
- **Water resources information management:** This plan aims to restore and attain a new hydro-metric, which will be installed in surface water and groundwater resources. Also, 600 hydro-metrological stations will be rehabilitated and systems will be built in order to collect records and monitor the data of the instrument.
- **Water storage and harvesting:** This plan aims to develop two multi-purpose dams with a storage capacity of 2.4 billion cubic meters along the Nzoia and Nyando rivers. Another 24 medium-sized multi-purpose dams, with a total capacity of 2 billion cubic meters, will be established to supply water for domestic, livestock and irrigation use in the arid and semi arid lands (ASAL) areas of Kenya.
- **National water and supply sanitation:** This project aims to expand the Mzima pipeline to meet the demands of the coastal towns and also cover urban water supply and sanitation in the satellite towns around Nairobi, Mombasa, Kisumu, Nakuru and Kisii along 26 medium-size towns that have the capability to support manufacturing and tourism activities.

In addition to specific projects, it will be important to adopt a variety of institutional reforms, which according to Mogaka, Gichere, Davis and Hirji (2006) should be based on the principles of decentralization, participation, and sustainability.

VII. Conclusion

Kenya suffers from a severe water crisis due to multiple causes, including droughts, forest degradation, floods, a lack of water supply management, the contamination of water, and population growth. While problems like forest degradation, poor water management and the contamination of water are potentially solvable, the number and severity of droughts and floods is due to the ongoing climate change likely to increase in the foreseeable future.

Similarly, Kenya's population is projected to grow for the next few decades. Given these realities, Kenya will also need to tackle some of the effects of the water crisis. For example, it has been shown that the consistent use of bed nets can significantly reduce the malaria infection rates.

Finally, in addition to specific projects and the tacking of some effects, it will be important to raise awareness among the Kenyan population about the dangers of contaminated water. Water filtration at the household level is a relatively simple and cheap option to reduce the illnesses resulting from the consumption of unsafe water.

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