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# Water Management in Kenya: Toward an Ethic of Sustainability

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## Authors' contributions

*This work was carried out in collaboration between the authors. Author LWH performed the literature review, and wrote the first draft of the manuscript. Authors JAH and LWH reviewed and revised successive drafts of the manuscript. Both authors read and approved the final manuscript.*

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## ABSTRACT

To promote water security of all countries worldwide, the United Nations established the Millennium Development Goals (MDGs) in 2000. MDG goal number seven requires that the number of citizens worldwide who lack access to safe water and improved sanitation be reduced by 50% by the year 2015. The need for improved water quality and sanitation is heightened in the water-insecure countries like Sub-Saharan Africa, as rural communities lack adequate infrastructure, and urban migration strains existing safe water supply and sanitation facilities. Kenya provides a profound example where the government practices water use ethics that are manifest in unsustainable water use policies. Water security for the citizens of Kenya is not likely attainable under the current government mandated management paradigm. However, recent developments in the laws and constitution of Kenya, education of citizens, and improvement in agricultural water management practices have prepared the country for an aggressive movement toward sustainable water use policies and an improved water ethic.

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## **1. INTRODUCTION**

The United Nations established the Millennium Development Goals (MDGs) in 2000, which were designed to improve the baseline quality of life, health, and education for all citizens worldwide [1]. Among other objectives, the MDGs seek to promote global water security [1]. MDG goal number seven focuses on the water ethics of developing countries, and is intended to ensure environmental stability by the year 2015 through a target to reduce by half the number of people worldwide lacking access to safe drinking water and sanitation facilities [2]. Worldwide, an estimated 768 million people still did not have access to potable water by the end of 2011, and 2.4 billion people lacked access to improved sanitation facilities [2]. In sub-Saharan Africa, where less than half of people living in rural areas have access to safe drinking water and sanitation, climate change further threatens water security, especially in arid and semi-arid biomes [3].

Fresh water management policies are to a great extent guided by cultural philosophies and ethics. A water ethic is therefore multi-dimensional, influenced by political, social, agricultural, industrial, and environmental dynamics, but often determined by economics [4,5]. For example, the government of a developing nation with limited financial resources may practice a water ethic that affords little consideration to issues of water-borne disease or pollution, favoring instead an approach to water management that maximizes national income [5]. While water ethic greatly influences water policy, economic gain (or hardship) often dictates policy despite it being in the best interest of most entities (national or otherwise) to be proactive to changing water use, demands, expectations, anticipating changes in demographics, security of water resources, long-term climatic patterns, or government structure [4,5]. The intent of this article was to present a focused and brief review of the primary literature relevant to the contemporary (i.e. approximately the last fifteen years) water ethic of Kenya. The timing of this review is important, as various factors have aligned in such a way that the government and citizens of Kenya are positioned to make a shift in water ethic, and consequently water policy, toward a more sustainable future of water management.

## **2. THE WATER ETHIC OF KENYA**

Kenya is a water scarce sub-Saharan country with water management policies that are incompatible with current demographics and threats to water security [3]. Understanding the water ethic espoused by the government of Kenya begins with an examination of the historical context in which the ethic was developed. Kenya was a British protectorate from 1895 to 1920 and subsequently a British colony until 1963 [6]. A coastal nation, Kenya was considered a gateway to resource-rich countries in the interior of the African continent. From 1896 to 1901 a railroad was constructed across Kenya to allow British access to Uganda's natural resources [6]. The first large scale water infrastructure in Kenya was constructed and managed by the railroad company, providing service to the towns that were built around the major depots [7]. Eventually the British colonial government took over management of water delivery, expanding the infrastructure for the benefit of European settlers in primarily urban areas [7].

In 1963, the independent nation of Kenya inherited the colonial water infrastructure, which was aging and in need of repairs as well as expansion to service all citizens of the country [6]. A survey of water coverage by the World Health Organization in 1963 overestimated the number of urban residents in Kenya who had access to safe water, leading to initial shortfalls in plans for population expansion [6]. The miscalculation was just one of many factors contributing to the inadequacy of water infrastructure in present day Kenya.

The historical context provided above should be distinguished from the culture and traditions of the Kenyan people with respect to household water use. In rural agricultural communities in sub-Saharan Africa, it is the customary role of the women in the household to procure potable water for domestic use [8]. However, due to the lack of water infrastructure in rural communities, women must often travel great distances to collect water. The water collected may be of poor quality, containing nutrients from agricultural runoff, human and animal waste, and other forms of pollution from Kenya's largely unregulated freshwater network [9]. Multiple trips may be required per day to meet the needs of the household [8]. Young girls often join the women in water procurement, which perpetuates the custom through generations [10]. Children living in urban slums face many similar obstacles related to water collection and lack of infrastructure [11].

Solutions to problems of clean water and sanitation differ depending on the demographics of those in need. During the British colonial period, the rural poor comprised the vast majority of the population without access to safe water and sanitation in Kenya [6]. The demographics in Kenya have changed since Independence. For example, the rural poor have been migrating to the cities in search of economic opportunities to improve their livelihood [12]. The resulting "urbanization of poverty" has led to the creation of mass informal settlements on the outskirts of large cities [13,14]. These so called slums are water scarce largely because the government has not provided adequate water infrastructure or provision to include sanitation [11]. For potable water, residents must rely primarily on local waterways or private water vendors. Unfortunately, waterways near slums are very often contaminated with human waste and many other pollutants due to lack of sanitation facilities [15]. It is unsurprising that there is a high incidence of water-borne disease in city slums [9,15].

Obtaining water from private vendors presents another set of problems. Private vendors charge more than government supported water sources and the price increases if water is in short supply, putting more pressure on the marginalized urban population [16,17]. Private vendors may obtain their water supply through sabotage of the limited water infrastructure, leaving consumers with no alternative source of water [18]. In addition, the source of water sold by vendors is often not known, giving rise to further health risks [19]. Between the years 1990 and 2008, the population of Kenya grew from 23 million to 40 million people [3]. Provision of safe water in the urban setting may become more of a priority for the Kenyan government in coming years, given that urban population continues to grow [5]. Due to population growth and the potential effects of climate change, the 650 cubic meters of water available per person per year in 2011 is expected to decrease to 235 cubic meters per person per year by 2025 [3].

The Kenyan government has enacted several major pieces of legislation in recent years to improve supply and regulation of water. The first of these was the Poverty Reduction Strategy Program in 2000, which provided a series of goals for the improvement of the quality of human life in Kenya, as well as a plan to elevate the country's position in the global economy [20]. One of the program goals was to improve delivery of potable water to citizens, while enabling communities to manage and control their own water resources [20]. Although

the interim report on the status of the program shows some improvement in water delivery and local management, the Kenyan government does not appear positioned to meet the United Nations' MDG 7 provisions for safe water and sanitation to its population by 2015 [21]. The Kenyan government revised the country's Water Act in 2002, and endorsed a complicated set of regulations allowing for privatization of water distribution, spreading the cost of water distribution among private or community organizations. The amended Water Act reinforced government ownership of all water resources, but allowed private vendors to sell water via a permitting process [22]. However, privatization has not achieved the desired goal of providing water to more people in Kenya due in large part to continued governmental control of water resources [17]. Most recently and arguably most significantly, Kenyan legislators amended the country's constitution to incorporate water as a basic human right in 2010 [23]. The timing of the constitutional amendment suggests a response to a movement among developing nations to recognize the United Nations Declaration 15 (2002) declaring the human right to water [24].

In spite of revised legislation and constitutional amendments, the Kenyan government has not been successful in meeting water distribution and human sanitation goals. There appear to be a number of obstacles to the adoption of sustainable water use policies. Changes in Kenya's water ethic require that many levels of society recognize and agree to a need for change including, but not limited to the citizens, business sector, scientists, and government. Solutions must be broad-based and flexible so that the basic needs of all citizens can be met, regardless of social structure and economic status. Environmental concerns also must be taken into account. For example, government should protect water resources for wildlife, a valuable source of tourism in Kenya [25].

A formidable obstacle for the broad adoption of a sustainable water ethic in Kenya has been related to economic incentives. Upgrading water and sanitation infrastructure throughout the country is a very large scale and costly undertaking. In the past, the government sought to obtain payment for water improvement projects directly from the community benefitting from the service [6]. Currently there are problems facilitating viable methods for payment to the water companies [26]. Cost recovery for individual projects has also been complicated by the level of poverty in many areas. Maintenance of existing infrastructure is lacking, leading to deterioration, collapse of existing infrastructure, and large repair costs [18]. In more impoverished areas of Kenya, residents who have piped water can only rely on service for a maximum of 5 hours per day [18]. In some areas, non-governmental organizations (NGOs) have stepped in to assist in water delivery and sanitation development by drilling wells or constructing sanitation facilities [27,28]. Many of NGO projects eventually have failed when boreholes run dry or there is a malfunction with the pumping equipment [29]. The general strategy has been for the NGO to provide a facility, and educate the people how to use the system, and then move on to the next project. However, the strategy does not translate to a smooth transition or provide for short or long-term community management of the resource [29]. A 2009 report indicated that 46% of the rural population had access to wells for drinking water supplies, but that 30% of the wells were not operational [30].

Another obstacle to the adoption of a sustainable water ethic seems to be related to tradition [6]. The traditional social structure in rural Kenya has evolved around the role of women in procuring water. Although efforts have been made to educate rural women about the health dangers of poor quality water and the need for sanitation practices such as hand washing with safe water, return visits by social workers find repeated use of contaminated water in homes, even when water purification products have been provided [31]. Water vendors have an established role in the rural villages and urban slums, just as other small merchants do

[18]. Corruption, tradition, relationships and networks of the Kenyan people are invisibly woven into the fabric of society which keeps the current, inadequate water delivery system in force. These problems are worsened by corruption at various levels of government, which has created barriers to water delivery and sanitation improvements [32]. Government kiosks have been shut down in favor of private vendors whose water is more expensive or of lower quality [19]. Funds from NGO's intended for aid or construction of infrastructure often do not reach their intended targets [28].

In Kenya's agricultural sector, the government water ethic does not mandate or promote sustainable irrigation practices. Traditional farmers in Kenya have diverted increasingly large volumes of water from rivers and streams to water crops that provide food for the expanding human population [33]. Water is removed upstream, to the detriment of those downstream. For example, expanded agricultural production and additional water withdrawals for the cut-flower export industry is increasing the pressure on already strained water resources [33-35]. In many areas, irrigation water is wasted as farmers use outdated and inefficient management practices. A recent study showed that pump irrigation systems using furrows maintained an average water application efficiency of only 25.5% [36]. Runoff from irrigation or rainfall mixes with nutrients from fertilizers contaminating water sources for people and wildlife [37]. To become sustainable, agricultural water use in Kenya must shift toward identification and adoption of best management practices to conserve water resources.

Climate change threatens both the environmental and political aspects of water security as it brings an increasing variability to climate patterns and a higher incidence of extreme weather events. Increasing periods of drought are a particular threat in the lowland areas of Kenya, and have been a driving force behind rural-urban migration in recent years [14]. Drought and water scarcity have led to conflicts over land ownership. For example, the nomadic Maasai tribesmen who traditionally roamed through the lowlands of Kenya seeking food and water for their herds of cattle have settled historic rangelands, leading to violent disputes over land and water rights between the nomads and current landholders [38].

### **3. IMPROVING WATER ETHIC**

Due to their cultural role for procurement of water in Kenyan households, many NGOs have determined that the education of women regarding safe water and improved sanitation will facilitate the evolution of a sustainable water ethic throughout Kenya [39,40]. For example, education of women can be conducted indirectly, by education of school-age children about safe water and hygiene. Girls returning home from school educate their mothers about water and sanitation, and create a ripple effect, as women communicate the message to other households and villages [41]. Increased education leads to improved conditions. Previous research indicated a positive correlation between the availability of clean water and sanitation in schools and school attendance, particularly by girls thus creating a positive feedback loop [42]. Studies are currently underway in Kenya to identify the most effective means of directly educating women living in rural villages, and the requisite level of management and monitoring of safe water and hygiene practices in rural households after education [32].

Agricultural irrigation practices are increasingly efficient in some regions of Kenya. In arid or semi-arid regions, best management practices require upgrading irrigation practices for efficiency of water use, given that water demand for agriculture is expected to increase by 40% by the year 2030 [34]. Drip irrigation has been effective in areas where it has been implemented. However, this practice requires relatively high initial investment, which has

been prohibitive to widespread acceptance of the practice [34]. Small-scale farms are critical to food production for the growing population of Kenya, yet remain below production capacity [43]. Therefore, small scale farmers are changing their agricultural practices preemptively in response to growing demand and potential future climate change. For example, farmers are planting different varieties of crops, experimenting with different methods of tillage, and shifting planting times in an attempt to cope with reduced rainfall and drought conditions [44,45]. Although research institutions have stepped in to assist farmers with implementing new agricultural practices, a great deal of additional research is needed to find solutions to problems of water scarcity in the agricultural sector.

Cell phone technology has become broadly available and more affordable which provides an easier, faster method of payment for water services. Cell phone towers have been installed throughout Kenya, and recent technology has allowed rural users to make regular payment of water bills via cell phone [26]. Where infrastructure does exist, such as metered standpipes for use by a school or village, it is much easier and faster for people to pay for water. Internet access and technical support also provides rural communities with the ability to calibrate or trouble-shoot water pumps at local wells, which helps maintain existing water infrastructure [46].

#### **4. CONCLUSION**

Although there remain many obstacles to a sustainable water ethic and corresponding policies in Kenya, there are signs of an emerging shift in the philosophy of government, citizen traditions, and the agricultural sector with respect to water resources. The government of Kenya has organized a comprehensive legal framework for the realization of water as a human right for the population of Kenya. Citizens of the country are updating traditional water procurement practices as a result of education of school children about safe water and sanitation practices. Changes to water management practices are beginning to take hold in the agricultural sector, as small scale farmers are using drip irrigation and choosing more weather tolerant crops. In the coming decades, government, citizens, and the agricultural sector will need to work together to achieve sustainable water management.

#### **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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