



FUTURE WATER (IN)SECURITY: FACTS, FIGURES, AND PREDICTIONS



Global Water Institute

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Future Water (In)Security: Facts, Figures, and Predictions

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1. Introduction

More than 2.8 billion people in 48 countries will face water stress or conditions of scarcity by 2025. By the middle of this century, this will have reached almost 7 billion. As water investment increases, the lives of billions of people continue to improve in developing countries: more than 2 billion have gained safe access to drinking water in the last two decades. Better sanitation services have also improved the lives of 1.8 billion people across the globe.¹

However, despite these improvements, the stress on the world's water supplies is escalating. Approximately 700 million people in 43 countries are currently suffering from water stress and scarcity. It is projected that by 2025 water withdrawals will have increased by 50%, mainly in low-income nations or in countries and regions with absolute water scarcity. Two-thirds of the world population is at risk of being stunted by water scarcity.² In developing countries, poor water and sanitation facilities are the source of health problems for almost half of the population and can be linked to 80% of disease. Each year, five million people, mainly children under five years of age, fall victim to illnesses directly related to polluted water—the leading cause of death in this age group.³

Currently half of the world's population lives in cities, and by 2030, this figure will grow to 60%, most notably in Africa and Asia where urban populations are predicted to double between the years 2000 and 2030. Populations in poverty stricken areas are also harder hit by the costs and difficulty of accessing water and are, in many cases, also the areas where the need for water will grow. Today, urban dwellers in certain developing cities in Africa pay 5 to 7 times more for water than the average price paid in the United States or Europe.⁴

Providing sustainable access to water will be the greatest humanitarian challenge in the coming half century. Compounding this is the rapid growth of urban populations as well as the disparity in cost for water access. This paper provides an overview of some basic facts and societal challenges related to water. Its emphasis will be on water availability and the impact of climate change on water resources in Africa, and will discuss the problems and predictions related to water and sanitation services, the status of women and children, water in cities, water and energy production, and the governance of water. This will be followed by some questioning related to these topics.

¹ Dan Jones, "The Threat of a Global Water Shortage" *US Infrastructure*. January 7, 2010.

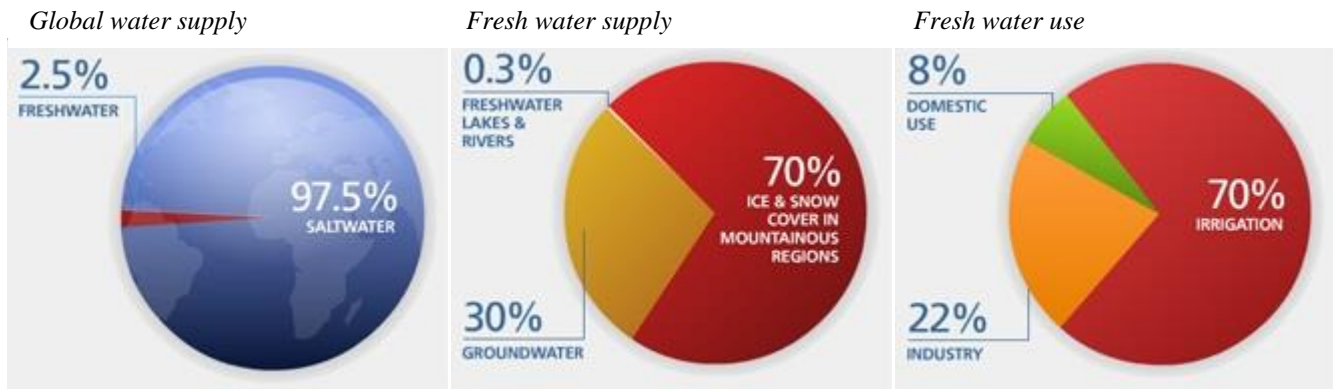
² United Nations Development Program, *Water and Ocean Governance* (Environment and Energy: focus areas, 2012); International Decade for Action 'Water For Life' 2005-2015, *Water Scarcity* (Focus Areas: United Nations Department of Economic and Social Affairs, 2012).

³ Ibid.

⁴ UN-HABITAT, *Water and Sanitation* (Programmes: Water and Sanitation, 2013).

2. Water availability

The earth's water supply (both salt and freshwater) totals 1.4 billion km³, of which 97.5% is oceanic. The remaining 2.5% (35 million km³) is fresh water, of which 70% (24 million km³) is frozen, 30% (11 million km³) is groundwater, and only 0.3% (105,000 km³) is accessible as surface water. Of available renewable freshwater resources, about 54% is already appropriated by humanity for various uses—irrigated agriculture (70%), industry (22%), and domestic use (8%).



Source: UN-Water

As projected by the UN Development Program, water withdrawals are expected to increase by 50% and 18% in the developing and developed world by 2025, respectively, due to both population and industrial growth. Currently there are billions of people in the world that are living in water stressed conditions, in which they face distinct challenges.⁵

3. Water in Africa

3.1. Availability of water

Africa is the second driest continent in the world after Australia, despite its significant water resources. Africa has over 160 lakes that are larger than 35 km² and more than 22 large river basins. Estimations have been made that renewable fresh water resources total between 4050 and 4590 km³ per year, of which about 15 to 51% becoming groundwater. Approximately 75% of Africa's total surface water is concentrated in six river basins, including the Congo/Zaire River, the Nile, Lake Chad, the Niger River, the Zambezi, and the Orange.⁶

⁵ United Nations Development Program, *Water and Ocean Governance*.

⁶ African Climate Policy Centre, *Climate Change and Water in Africa: Analysis of Knowledge Gaps and Needs* (United Nations Economic Commission for Africa: working paper 4, November 2011), 2-3

| <i>Major basin name</i> | <i>Total area of basin (km²)</i> | <i>% of continental area</i> | <i>Riparian countries</i> |
|-------------------------|---|------------------------------|--|
| Congo/Zaire River | 3,789,053 | 12.51 | Congo, Central African Republic, Angola, Zambia, Tanzania, Cameroon, Burundi, Rwanda, Zaire |
| Nile | 3,112,369 | 10.28 | Sudan, Ethiopia, Egypt, Uganda, Tanzania, Kenya, Congo, Rwanda, Burundi, Eritrea, Central African Republic |
| Lake Chad | 2,381,635 | 7.86 | Chad, Niger, Central African Republic, Nigeria, Algeria, Sudan, Cameroon |
| Niger River | 2,227,946 | 7.51 | Nigeria, Mali, Niger, Algeria, Guinea, Cameroon, Burkina Faso, Benin, Ivory Coast, Chad |
| Zambezi | 1,351,365 | 4.46 | Angola, Zimbabwe, Mozambique, Malawi, Tanzania, Botswana, Namibia, Congo |
| Orange | 896,368 | 2.96 | Botswana, Namibia, Lesotho, South Africa |

Source: FAO Land and Water Development Division

In Africa, 90% of river basins and lakes are transboundary. About 62% of the continent consists of river basins, of which five are shared by eight or more countries. More than 80 rivers are shared by two or more countries and many of them depend on the water downstream. This means that large-scale water infrastructure projects can worsen the impacts of flooding and droughts in another country, which then can threaten people's livelihood and reduce their access to water. Countries that build dams, for example, thus need to recognize that their actions will have consequences downstream.⁷

A country is regarded to be water scarce when there is less than an estimated 1,000 m³ of freshwater per capita and is considered to be water stressed when there is less than 1,700 m³ of freshwater per capita. In Africa, 14 countries have already been experiencing such conditions and another eleven are expected to be water stressed by 2025—predictions show that by this time, 50% of Africa's population of 1.45 billion will be experiencing either water stress or scarcity. Such conditions severely limit agricultural productivity as well as domestic water access. Millions of Africans suffer from water shortages, which are often linked to problems with uneven distribution and management of existing supplies. Disparity in water availability can, for example, be seen in the Congo River Basin, where 30% of the region's water drains are inhabited by only 10% of Africa's population.⁸

3.2. Water and sanitation

Over 1.5 billion people do not have access to clean water and over 2.6 million lack adequate sanitation facilities. Half of the world's hospital beds are filled by people suffering from a water-related disease and is the leading cause of death in children under five years old. Over 80% of disease in developing countries is related to poor drinking water and sanitation and

⁷ Ibid., 3; Michel Camdessus, "How to Beat Africa's Water Crisis" *CNN*. August 23, 2012: Global Public Square.

⁸ World Wildlife Fund, *The Facts on Water in Africa* (Living Waters, July 2002).

90% of wastewater is discharged into rivers or streams without any treatment.

Countries that still have less than 50% coverage in water supply and sanitation facilities are almost all in sub-Saharan Africa. In this region, 330 million people lack access to clean water and 565 million lack access to adequate sanitation facilities. This translates to half the population suffering from a waterborne disease, such as diarrhea, cholera, or typhoid.

Every day, 650 people die from diarrhea in Africa, mainly children under five years of age. Such diseases are the leading cause of death in this age group.⁹ In sub-Saharan Africa, a child's chance of dying from diarrhea is over 500 times greater than in Europe. Less than one in three people in Sub-Saharan Africa have access to a proper toilet. According to the UN, the incidence of diarrhea can be reduced by up to 47% when hands can be washed with soap.

3.3. The status of women and children

Women and girls are disproportionately impacted by scarcities of clean water and adequate sanitation. Women comprise 43% of the agricultural workforce in developing countries, yet they have less access to productive resources and opportunities. Rural women are responsible for water collection in almost two-thirds of households in developing countries. In Africa, 90% of the work of gathering water and wood, for the household and for food preparation, is done by women. Estimates have been made that women and girls spend 40 billion hours a year collecting water in sub-Saharan low-income countries.¹⁰ On average, women walk 4 miles each day to collect water and the average weight that women carry on their heads is approximately 44 pounds.

Every year, around 60 million children in the developing world are born into households without access to sanitation. Children carry the main responsibility for collecting water in 12% of households, with girls under the age of 15 being twice as likely as boys their age to be the family member responsible for fetching water. Unclean water and poor sanitation is the world's second biggest killer of children.

Over half of the developing world's primary schools do not have access to water and sanitation facilities. GWI chapters in Africa continue to observe the lack of water in primary schools, of which some are not even equipped with latrines. For instance, primary schools and health centres visited by GWI personnel in 2011 did not have toilets or tap water. Without toilets, girls typically drop out of school at puberty. The lack of adequate sanitation facilities in primary schools results in lower attendance for girls, which perpetuates the cycle of gender inequality and poverty. 443 million school days are lost each year due to water-related diseases.¹¹

⁹ WHO/UNICEF, *Progress on Drinking Water and Sanitation 2012 Update* (2012), 8, 18.

¹⁰ International Decade for Action 'Water For Life' 2005-2015, *Human Right to Water and Gender and Water*.

¹¹ Ibid.

4. Predictions on water and climate change

Changes in climate can threaten “to derail and even reverse development achievements on many fronts” in Africa if they are left unchallenged. Vulnerable countries will experience the effects of climate change, despite its causes and impacts being global in nature, as the poorest communities often go through difficulties in adapting to changing circumstances.¹²

Climate change is likely to have an effect on food security in Africa, in its availability, accessibility, utilization and systems stability. Its impacts will be felt in health, livelihood, food production, and market flows. There are already agriculture-based livelihood systems that are vulnerable to food insecurity and have immediate and growing risks, which can be seen in “increased crop failure, new patterns of pests and diseases, lack of appropriate seeds and planting material, and loss of livestock.”¹³ There are also more indirect effects of climate change, such as the consequence that “low-income people everywhere, but particularly in urban areas, will be at risk of food insecurity owing to loss of assets and lack of adequate insurance coverage.”¹⁴ Such increased pressures could lead to both global and regional food systems being affected through resource-based conflicts, civil unrest, and migrations flows. An increased disparity in water availability is another factor that could lead to conflicts over water, particularly in arid and semi-arid regions.

Estimates have been made that between 75 and 250 million people in sub-Saharan Africa will not be able to meet their water needs if warming in the atmosphere continues and these numbers could increase to 350-600 million by 2050. Water and sanitation scarcities will worsen as new challenges, such as a changing climate or rapid urbanization take effect. This will put additional pressures on the availability, accessibility, and demand of water in Africa. The effects will be seen in agricultural production: predictions have been made that yields from rain-fed agriculture could be reduced by up to 50% by 2020 in some countries and could even drop by as much as 90% by 2100. As a result, agricultural production will be severely compromised in many African countries, which then will lead to imminent food crises, food price volatility, and exacerbation of malnutrition.¹⁵

Water availability will continue to be a contributing factor to migration, particularly in those regions “where compounding factors of poverty and vulnerability to natural hazards are present.”¹⁶ In fact, such pressures are likely to intensify and alter existing patterns of water availability and quality. This will have different impacts in rural and urban areas—millions of vulnerable people in rural areas are expected to move to cities, because they are unable to

¹² UN Industrial Development Organization, *Africa Adaption Programme* (Country Office in Kenya: Selected Activities).

¹³ UN Food and Agriculture Organization, *Climate Change and Food Security: A Framework Document* (FAO, 2008), iii.

¹⁴ Ibid.

¹⁵ African Ministerial Conference on the Environment, *Fact sheet: Climate Change in Africa—What is at Stake?* (AMCEN Secretariat: 2009).

¹⁶ UN-Water Decade Programme on Capacity Development, *Water Related Migration, Changing Land Use, and Human Settlements* (5th World Water Forum: Topic 1.2, 2009).

maintain their livelihood or even subsist. A lack of strategic water security will force farmers to migrate in search of wetland or resign their lot to an urban existence.¹⁷

Migration

Climate change will induce water crises and large-scale migration, thereby reinforcing present trends of instability and conflict while, at the same time, drawing new lines of conflict.

Lack of freshwater resources is a massive threat and seasonal migration has already become permanent. It will remain a primary reason for cross border migration in the future. In the existing climate change scenarios, water scarcity in arid and semi-arid places on the African continent will displace between 24 and 700 million people.

Due to sudden increases in demand, massive influx of migration puts excessive pressure on scarce resources where migrants relocate, thus heightening competition and conflict over resources.

Climate change-induced migration causes vicious cycles, whereby climate change leads to water stress, which can lead to conflict, which may trigger internal displacement or migration across borders. This may in turn, lead to increasing pressures on water resources at the source of water stress and conflict, which can further fuel migration.

Rural development should be reprioritized by governments in order to secure and improve the livelihood of their own citizens. It would be beneficial to incorporate migration into capacity development approaches, which can especially be strengthened for women. Regulation of seasonal migration to urban areas can benefit the rural population. At the same time, a new concept as “rural cities” can make rural life more attractive and can reduce pressure on the formation of “megacities” in a country.¹⁸

5. Water and cities

More than half of the world’s population lives in cities. Between 1990 and 2004, Africa saw an 85% increase in its urban population and a doubling in the number of urban dwellers without access to water and sanitation.¹⁹ This has imposed additional pressures on the availability, accessibility, and demand of water in cities.

Cities are prone to experiencing water supply disruptions from strained infrastructure, especially in periods where urban areas experience rapid growth. Underdeveloped infrastructure affects mostly slums and informal dwellings in cities with large populations of urban poor, which continue to be the most heavily affected by both the cost of clean water, which often needs to be purchased in bottles, as well as the unhygienic conditions near public fountains.

¹⁷ Global Water Institute, *Without Strategic Water Security, Farmers Will Migrate in Search for Wetter Lands* (2012). Available at www.gwiwater.org.

¹⁸ The definition of a “megacity” vary from cities with over 5 million to over 20 million inhabitants. In its State of the World’s Cities 2010/2011 report, UN-HABITAT defines a “megacity” as a city with 20 million or more inhabitants.

¹⁹ WHO/UNICEF, *Meeting the MDG Drinking Water and Sanitation Target: The Urban and Rural Challenge of the Decade* (2006), 6.

Water and sanitation systems in cities will struggle to provide for an urban population that is expected to double between 2000 and 2030—the FAO estimates that the number of people living in cities in sub-Saharan Africa will reach approximately 600 million by 2030, almost double of what it was in 2010. Past experience demonstrates the stress that this increased demand will place on water and sanitation services. According to the UN, 80% of the global population will be living in urban areas by 2050.

Water access for agriculture, in rural areas, as well as for urban use, pertains to the leading-edge problems of water management. On the trailing-edge, sewage treatment presents another array of challenges and opportunities that cities need to take into account. Particularly in Africa, the difficulty of treating waste water increases as populations become rapidly urbanised. In certain cases sewage ponds serve to recuperate waste water and excrement from so-called “bucket toilets.” For cities, this poses several problems as well as constituting a missed opportunity.

As 2.6 billion people lack access to basic water and sanitation, the risks of contaminated water supply in urban areas are considerable. The ill-effects of not properly treating wastewater and sewage include health risks for nearby populations and environmental degradation. These cesspools, whether covered or in the open air, are breeding ground for waterborne diseases that could infect the safe drinking water supply when raw sewage is left to drain through aquifers.²⁰

Sending untreated wastewater into watersheds, rivers, or the sea has long term consequences on marine life and the liveability of urbanized areas. Untreated sewer contains infectious pathogens and chemical constituents that deplete the oxygen level of natural water bodies. Conversely, proper treatment of sewage and wastewater offers a source of methane and sludge. Methane gas can be used for energy production through combustion and sludge can be used as fertilizer provided it is clear of harmful pharmaceutical waste. One initiative that paves the way to better wastewater management is to decentralise the process. The Bill and Melinda Gates Foundation, for instance, launched an initiative to improve the use of water by calling for the invention of latrines that can work independently from sewage infrastructure at low cost.

Ethiopia

Climate-induced water insecurity can have a serious negative impact on rural livelihoods, societal stability, and overall security. Because of such insecurity, the mobile and rural poor migrate to urban areas as a sort of adaption strategy.

A GWI study of the Ethiopian capital of Addis Ababa reveals the fate of many developing cities: population increase paired with a high rate of water loss and spillage between the reservoir and the consumer has resulted in supplies for Addis Ababa that amount to about a third of the water per person than the African average.

²⁰ Goska Romanowicz, “Raw Sewage Polluting South Africa’s Drinking Water” *edieWaste*. March 21, 2006.

Migration to cities has aggravated the social conditions of people living in Addis Ababa. There are increased chances of potential social conflicts erupting due to the hazardous urban environment in which people live. Water demands exceed supply by about 50% and its water and sanitation distribution network reaches only about 55% of the capital. Approximately half of its population have less than 12 hours of water service a day and a quarter even has no service at all.

Other cities across Ethiopia have similar supply constrictions and in the case of all 10 of the country's secondary cities, the daily average per person is around 20 litres—roughly one tenth of urban water use in most European cities.

However, such increased concentrations of people in urban areas do offer more effective and efficient opportunities for securing water and managing both water supply and sanitation services.²¹

6. Rethinking waste water management

Water usage can be transformed and waste can be reduced by using technologies that do not dramatically affect lifestyle, such as through the usage of new toilets that utilize 75% less water than older ones and through the use of gadgets like more efficient washing machines and computer-controlled sprinklers. Water use in developed countries can be reduced by a third through waste reduction. Access to clean water can radically be improved through sensible investment and well-applied development aid, which can lead to a reduction in death and disease as well as an increase to the quality of life for billions of people.

Considerable amounts of water are required for energy production, whereas water treatment and distribution necessitates dependable, low-cost energy. Evaluating both sustainable water and energy management can contribute to a more comprehensive evaluation of supply and demand challenges. The “virtual water” angle should also be taken into account. For example, an effective way to conserve water is through the reduction of the amount of water that is necessary to create energy for food packaging and consumption. Estimations have been made that it actually takes 1,200 litres of water to only produce a modest breakfast and a cup of coffee, which equals approximately three bathtubs. “Virtual water” consumption can significantly be reduced by increasing the consumption of products that are not heavily-packaged and, when possible, are found more locally.

The usage of water for food will continue to develop critically because populations and demands for food production will increase and competition for water supplies will rise. Agriculture, livestock, and fisheries will also see growing demands for water. In order to curtail such demands, better water and rangeland management as well as more efficient irrigation approaches, less water-intensive crops, and less meat production need to be explored.

²¹ Valerie Ndaruzaniye, “Water Security in Ethiopia: Risks and Vulnerabilities’ Assessment” (Global Water Institute, 2011), 6. Available at www.gwiwater.org.

The impact of cities on the topography and hydrogeology change as they develop. A city with fully developed drainage infrastructure systems will be less efficient or unable to release rainfall into the soil where it has a chance to infiltrate groundwater storage and aquifers underneath. This is because concrete and sealed surfaces in cities typically direct the rainfall to the sewer networks where it is merged with wastewater. It is then passed through water treatment plants before being returned to rivers or the sea. Both this rainwater and polluted wastewater could be returned to the city's water users as so-called "grey water."

According to Janez Potočnik, the European Commissioner for Environment, only 20% of water used by the sectors receiving a public water supply is actually consumed, when the other 80% is returned to the environment, it is primarily as treated wastewater. For the most part, this amount is "grey water"—water that is safe for re-use in non-potable activities, such as flushing toilets, cleaning public areas, or irrigating parks. It could also be led directly to a ground water recharge in cases where cities are over or near an aquifer. In cities with an existing complex hydrological infrastructure, changes will be required to adapt urban water systems to re-use this grey water. In developing cities as well as all new developments, these changes can be programmed into city planning which will allow for better future groundwater replenishment around cities.²²

The growing interconnectedness of the global production, trade, and economic systems means that disruptions caused by water shocks are felt all over the world. Communities can be more prepared for such effects through new funding sources and proactive planning. Questions need to be asked on how to address these issues and in what way that needs to happen, on whether current or planned mechanisms for adaptation are adequate enough to deal with the challenges ahead, on how governments and business should balance the cost of resilience with the cost of response to, and recovery from, disasters, and on who should be the one to pay for this.

7. Questions to be asked

1. What effects does water scarcity and climate change have on a local, regional, and global level?
2. With the continued water scarcity, what will happen in terms of local governance and both human and environmental security?
3. What will happen if there is a continued lack of water? (think locally and then globally)
4. What are the consequences if women are the mostly negatively affected by the lack of access to water and sanitation?
5. Suppose the global financial crisis perpetuates, who will take the risks of supporting water development in countries where water is scarce?
6. Who is able to support a doubling population with increased water withdrawals?

²² Janez Potočnik, "The Imperative for, and Progress Towards an Inclusive Green Economy" Speech/12/931). December 6, 2012.

7. Are there strategies available in water scarce and climate-affected areas for the next 10 to 20 years?
8. What should be the contingency plan for governments in 2025? In what should governments be investing today?

8. Concluding remarks

A target of halving the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015 was set as part of the Millennium Development Goals (MDGs). In the WHO/UNICEF 2012 Update, it was stated that the “target has been reached” as “[o]ver 2 billion people gained access to improved water sources from 1990 to 2010, and the proportion of the global population still using unimproved sources is estimated at only 11 per cent.” The target has “thus become one of the first MDG targets to be met.”²³

However, the fact remains that “huge disparities” continue to exist. As it is stated in the update, “[w]hile coverage of improved water supply sources is 90 percent or more in Latin America and the Caribbean, Northern Africa and large parts of Asia, it is only 61 percent in sub-Saharan Africa. Coverage in the developing world overall stands at 86 percent, but it is only 63 percent in countries designated as ‘least developed.’”²⁴ Additionally, other inequities exist between rich and poor people and between those who live in either rural or urban areas that there is no “complete information about drinking water safety [...] for global monitoring.”²⁵ This refers back to the problems stemming from the fractured nature of water resource management, which makes it difficult to monitor and govern water sources. Another fact remains that “more than 780 million people remain underserved.” As stated in the update, “[m]ore than one tenth of the global population still relied on unimproved drinking water sources in 2010.”²⁶

Proper water allocation requires a mechanism to provide clean water in sufficient quantities to satisfy the sanitary and nutritional needs for populations. The difficulty on a planetary scale is to distribute these resources equitably and sustainably to all populated areas. The quantity of fresh water available is sufficient to satisfy the global need, the real problems lie in the supply chain.²⁷ Disruptions in this supply chain can result from strained and undeveloped infrastructure or deliberate interferences in water supply. This can pose difficulties in finding solutions to increasing population pressures and diminishing resources to channel water from scarcer sources. Water can, in itself, become the cause of both conflict and peace; its supply or constraint can also be used to coercive ends—by rerouting it, stealing it, of rendering it unsafe to drink.

²³ WHO/UNICEF, 2012 Update, 4.

²⁴ Ibid.

²⁵ Ibid.

²⁶ Ibid., 5.

²⁷ International Decade for Action ‘Water For Life’ 2005-2015, *Water and Cities*.

GWI is familiar with the problems of urban poor and difficulty and expense of bringing water and sanitation into rural areas. GWI is experienced with engaging combatants and palliates the post-conflict tensions that lead to relapse by giving them the opportunity to serve their communities and bringing value to their existence. GWI has applied its models in Africa to both urban and rural communities in post-conflict zones to prevent relapse into violence and in countries where water scarcity poses a future threat that could lead to conflict. In cooperation with international and local partners, GWI helps governments, as well as other actors, reform their water policies and ensures that the importance of both human and environmental security is understood. There is a need for advocacy and continuing public awareness in order to secure such changes.

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