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Yemen, Factor 2: Water Scarcity

Introduction

Located on the southern tip of the Arabian Peninsula, Yemen is a mountainous, desert country with an arid to semi-arid climate. It has long been the poorest country in the Arabian Peninsula, however within recent years its situation has significantly worsened. Early 2014 began what is named by many "the forgotten war", due to the lack of coverage and international attention it has received. Yemen is currently in the midst of a civil war, which has brought severe turmoil to its residents.

The war was sparked after a transfer of power from former president Saleh to current president Hadi. After Hadi took office, citizens grew tired of his inability to manage the country, which led to an attack on the capital by a northern rebel group called the Houthis. The rebels successfully took control of the capital, forcing Hadi and the internationally recognized government to flee Yemen. Backed by the Saudi Arabian government, Hadi launched a counterattack on the rebels beginning in early 2015, which included a violent bombing campaign in hopes to regain control. The war is seen as a conflict between Saudi forces who are helping Hadi, and Iranian forces who are smuggling weapons to the rebels (Laub).

Before the war began, Yemen already had the Arab World's lowest GDP (gross domestic product) per capita, according to the World Food Programme. They ranked 160th out of 188 countries for human development. During the past two years of fighting, thousands of Yemenis have been killed, and 3.2 million people have been internally displaced. The continuous airstrikes and bombings have left the infrastructure in shambles, and left citizens out of work and out of a place to live.

The war has become a human rights disaster, with innocent civilians caught in the middle of dangerous political conflict. However, one of the most dangerous and life-threatening parts of this conflict is the impact it has had on Yemen's already scarce water resources. 13 million Yemenis- half of the entire population- struggle every day to find enough safe, clean water to drink or grow food (Whitehead). Due to Yemen's hot and dry climate, it has always had trouble providing enough water for its population, however the problem has become even worse due to an increasing population, poor water management, and a lack of governmental structure during a time of civil war. The nation's capital, Sana'a, is predicted to be the world's first capital to run out of water, and this could happen within the decade (Hincks).

Typical Family

The average family size in Yemen is 6.7 members- two parents and four to five children (Yemen). It is a patriarchal society with men running the majority of family affairs. Some staples to the Yemeni diet are lentils, peas, and sorghum, and their meal commonly include bread or porridge. Pork and alcohol are prohibited in Yemen because of Islamic beliefs (Yemen).
Yemen's education system includes a free, compulsory program for six to fourteen-year-old children, however only 46% of eligible children overall and 30% of eligible girls are able to attend school. After completing this, students may choose to attend secondary schooling, and then one of the 12 universities in Yemen (Education in Yemen). Yemen ranked 150th out of 177 countries in education according to the 2006 Human Development Index, and their situation is worsening due to the current conflict in the region. 3,600 schools in Yemen have closed due to the conflict beginning March 2015, because they are destroyed in bombings or used as military training facilities (Marshall). Prior to the conflict, Yemen's

investments in education saw great improvements, however their current state reflects low-quality teaching facilities and staff, and high rates of student absences.

Yemen's World Health Organization (WHO) Representative Dr Ahmed Shadoul describes their health system as "on the brink of collapse" (Health System in Yemen). According to UNICEF, less than one third of Yemen's population have access to health facilities, and at least 1000 children die every week from preventable diseases such as diarrhea (Al- Zikry). Also, epidemic diseases such as cholera and measles are becoming more prevalent. This is mainly due to the constant attack of airstrikes and fighting, damaging facilities and making it dangerous for citizens to gain access to healthcare. Yemen is very dependent on humanitarian aid from organizations such as WHO, due to a severe shortage of supplies and equipment. Shadoul says, "Almost 23% of the health facilities in Yemen are no longer functional either because they were hit, they were already in poor condition or they happened to be close to military targets" (Health System in Yemen). Health service workers put their lives at risk in order to serve the population, and citizens avoid healthcare centers that are located in dangerous areas.

Typical Farm

Agriculture provides jobs for about half of the population in Yemen. Although it employs such a large proportion of the population, it only contributes 15 percent to the GDP (gross domestic production). Different regions vary in land ownership, so the northern sections are 90 percent private farms, while the southern section's land belongs to the state (Abdulmalek Alabsi). Yemen has 1.3 million hectares (ha) of arable land, which is distributed to 1.2 million farmers, making the average farm size 1.1 ha (2.7 acres). However, the distribution is grossly uneven, with 80 percent of the farmers owning less than 1 ha, and only 4 percent with over 5 ha. 76 percent of farming is private, 21 percent is shared, and sharecropping makes up the last 2 percent (Crop and Food Security Assessment). Livestock such as sheep, goats, cattle, camels, and poultry are the main source of income for family farms (Country Profile-Yemen). The most common crops are sorghum, wheat, millet, and barley, occupying 58 percent of the area. Cash crops are the second biggest category, occupying 17 percent of land, including qat, cotton, coffee, sesame, and tobacco. There has been a shift away from cereal crops such as wheat, rice, and maize since the 1980's, and towards high value cash crops such as fruits, vegetables, and qat. Cereals have been imported to make up 75 to 85 percent of domestic use (Crop and Food Security Assessment). Qat is the most dominant cash crop, as it is 10 to 20 times more profitable than any other. Qat is a water-intensive drug that is chewed for recreation, and is an important part of Yemeni culture. Its production has greatly increased in recent years, and it accounts for about 15 percent of the employment in the country. It is vital to rural economies, and is responsible for 6 percent of the national GDP and one third of agricultural GDP (Crop and Food Security Assessment).

Barriers

There are many factors that decrease agricultural productivity in Yemen. First, livestock farmers are hindered by a lack of fodder, water, and veterinary services available to them, and the prevalence of diseases and pests that can infect their animals (Country Profile- Yemen). This is impactful because of the large prevalence of livestock farming in Yemen. Second, the small fraction of arable land in Yemen makes it very difficult for the extensive rural population to sustain itself. Only 3 percent of Yemen's land is arable, but 70 percent of the population lives in rural areas (Country Profile-Yemen). On top of these factors, the one that constrains agricultural productivity the most is water scarcity. Close to 90 percent of all water is used for agriculture, and inefficient irrigation techniques lead to the majority of this waste (Alazzany and Sharp). Also, the expansion of qat cultivation has strained water resources even further, because this crop alone accounts for 70 percent of groundwater extracted, according to USAID (Crop and Food Security Assessment).

The conflict in Yemen is the main barrier to accessing adequate nutrition, and it is causing widespread starvation due to the poverty it has caused. According to the World Food Programme, 14 million Yemenis are food insecure, including 7 million which are severely food insecure. Prior to the war, Yemenis struggled to provide for their families in this poor country, but now Yemen is on the brink of famine. According to UNICEF, 2.2 million children across Yemen suffer from malnutrition. In a war torn country accessing food is hard enough, and accessing employment is just as difficult. Millions of Yemenis are displaced from their homes, putting them out of work so they are unable to provide for their families.

Impact of Water Scarcity

The factor that impacts the Yemeni people the most is the lack of available water in their country. The luxury of turning on the tap and having access to water at any time is unknown to the majority of citizens in Yemen. Only 40 percent of homes are connected to the municipal water supply in the capital Sana'a, and water rarely comes out of the tap twice a week. Also, these state-run water companies are no help to the 70 percent of people living in rural areas, who are connected to no sort of municipal supply. Those left out of the government water system must buy water from tankers or trucks, who sell it at ridiculously high prices, sometimes 10 times the state cost (Whitehead). The piping system is also so old that an estimated 60 percent of the water is lost through leaks, squandering this resource that is already so scarce (Whitehead).

The people hardest hit are those living in rural areas, who may spend up to five hours a day collecting water for their family. Many girls are unable to attend school and get an education because they spend their days collecting water to survive, and children's lives are put in danger when traveling across battlegrounds in order to get water. The water system in Yemen is incredibly unfair, providing the rich with water supplied to their houses, while leaving the poor in informal settlements to fend for themselves (Whitehead).

Lack of water causes violent disputes, especially in rural areas. An estimated 70-80 percent of conflicts in rural areas are because of water, leading to the death of hundreds in recent years, according to a report in Al-Thawra, Yemen's pro-government newspaper. Yemen also has one of the world's highest population growth rates, at 3 percent (Crop and Food Security Assessment), adding to the conflicts of shared water resources, as they must be divided up amongst more people.

Yemen's inefficient water harvesting techniques are worsening the problem. Since they have decreased rainwater collection, the increased use of drilling and modern wells has taken a toll on the finite supply of groundwater in the region. Groundwater aquifers are being reduced by one to seven meters per year. The Yemen Times reported that the water table dropped from 30 meters below the surface in 1972 to 1,200 meters below surface in some areas in 2014. According to the U.N. Development Programme, Yemen is withdrawing almost 169 percent of its renewable water resources, meaning that it is pumping water far quicker than it can be replenished. Before the war began, laws prohibiting arbitrary drilling of wells were enforced by security services and local councils, and a permit had to be obtained before drilling began. However after the fighting broke out, the instability and chaos in the country has led to a large number of wells being drilled without permit or supervision, depleting the resources before they can be naturally restored. (Al-Kamali). A lack of centralized government makes enforcing water conservation measures and protecting aquifers ineffective. Illegal wells may work as a short term solution to get lots of water fast, but they lead to the water level of underground sources lowering at a rate that cannot be sustained.

Solutions

While Yemen is in the midst of civil war, there are limited solutions that can successfully be implemented. Without a strong government, making changes would be very difficult, and Yemen does not have extra funds at the moment to invest in water management. However, immediately after control of the country is regained, water supply must be the first issue that is fixed in Yemen because the situation is so dire, and this resource is so vital. There are many paths that Yemen can take to improve their situation and it will be necessary to utilize multiple different methods:

- Managing qat production
- New irrigation techniques
- Government intervention
- Desalination
- Improved infrastructure

As previously mentioned, 90 percent of water in Yemen is allocated to agriculture. This means that it should be the focus when trying to solve their water problems, because reducing this usage even slightly could bring significant benefit to their situation. To begin, the cultivation of qat must be managed in order to make the use of water more efficient. This could be done in various different ways. First, farmers could be persuaded to cultivate alternative crops that are less water-intensive, with the incentive of government subsidies. This would mean returning to traditional crops that were shifted away from in the 1980's. However, this solution would be difficult to implement, because qat is so ingrained in the Yemeni culture, with 80 percent of the population using it. The idea of producing less would be met with resistance. Also, its extreme profitability would be hard for farmers to pass up. Another way to solve the qat problem in Yemen would be exporting its production to another country. According to USAID, Yemeni officials and international groups have suggested exporting qat production to Ethiopia, so Yemen's water resources wouldn't be strained, however Yemeni groups would still be allowed the benefits of importation and distribution. Lastly, more efficient irrigation techniques can be implemented for qat and other crops.

Drip irrigation is a technique that supplies water directly to the roots of plants, and is much more water efficient than spray irrigation, which uses a machine to spray water all over the field, leading to high evaporation rates and wasted water. Daniel Hillel, 2012 World Food Prize winner, did significant work with a technique called "micro-irrigation", which supplies a steady drip of water to plants through a tube positioned at its roots. His research helped increase crop production and conserve water in 30 arid countries, many of them in the Middle East such as Israel. This is much more efficient than the traditional flooding of cropland that is used for irrigation (Krajick). If this technique was used in Yemen, it could greatly decrease the 90 percent of water that is used for irrigation, and it could also combat food scarcity with greater production of crops.

Another strategy that would be key to improving Yemen's water state would be increased government oversight and lawmaking in regards to drilling wells and using water resources. As previously stated, the lack of regulation on drilling operations has led to illegal activities that deplete Yemen's resources too quickly. Laws must be enforced that prohibit any further drilling to groundwater sources that are too depleted to be sustainable. In 2012, the water previous minister of Yemen estimated that 99 percent of water that is extracted is unlicensed, and 800 drilling operations are being used illegally (Giesecke). According to US AID, the water minister blames "weak government institutions as the major factor in creating and perpetuating the water crisis" (Giesecke). To replace the water gained from these harmful operations, new techniques would have to be used, such as focusing on projects to collect rainwater, or making a long term investment in a desalination facility.

Desalination is a costly but effective way to increase a country's water supply, and with Yemen's 2,200 kilometer coastline along the Red Sea and the Gulf of Aden, it has plenty of space and available water. Desalination is a process of removing the salt from seawater so it can be used for drinking and agriculture. This method has been ruled out by many Yemenis due to perceived high cost and effort needed to construct the facility. In 2008 the Yemeni government began thinking about building a facility in the city of Taiz, but decided not to because it would take several years for the plant to start meeting the city's needs. However, if it had been built, the 100,000 cubic meters of water produced per day would have been more than enough to meet the needs of the city. According to Yemen Times, the Yemeni government hired a British firm specializing in the environment to look into the feasibility of this type of water treatment. The two studies they conducted proved that desalination would help to solve the water crisis in Taiz, and would provide the citizens with water cheaper than they are currently paying. Despite this response, the Yemeni government has shot down the idea because extraction of groundwater is a cheaper option, despite the fact that groundwater sources are being depleted at unsustainable rates (Hodge and Junaid). If Yemen invested in a desalination plant, it would not only be environmentally beneficial, but it would prevent the citizens from having to purchase expensive water from tankers. Also, as energy generation technology becomes more advanced, desalination is becoming more reasonable of an option due to a decrease in price to produce the water.

Improving the infrastructure is another solution that would take an investment of government money which would be difficult in the country's current state. However, the immense amount of water lost to poor infrastructure is not something that can be ignored. According to Abdullah Saleh, the former head of the National Water Resource Authority (NWRA), "A lot of water gets wasted and lost due to degraded infrastructure, broken pipes and a lack of proper equipment" (Hodge and Junaid). Conservation of existing sources of water is a smart and efficient way to increase the country's supply. Yemen cannot afford to lose their scarce water supply to leaky pipes and bad management, and making the best use of their current supply should be prioritized higher than finding new sources of water. If the government invests in improving the travel of water to its destination, more water will be leftover to be able to supply a greater number of citizens.

Aside from these solutions, the current political conflict in Yemen must be resolved to improve water scarcity. As previously mentioned, the war has two sides; president Hadi and Saudi Arabian forces, and the Houthi rebels supporting former president Saleh backed by Iran. After two years of battle, no side is looking closer to victory. The pro-government forces are still unable to remove all rebel control from Yemen, especially from the northern sections of the country. The UN has arranged three rounds of peace talks; however, none have been successful in creating a compromise between the two sides. This conflict is raising regional tensions to a point that is dangerous to the rest of the world, calling for immediate action. For this conflict to end, both sides must take less radical stances, and come to an agreement about how to govern the country, although the current outlook is not seeing much progress.

Yemen is in a time of emergency. With a majority of the focus on political issues in the region today, water scarcity is a lesser known but even more harmful problem. Water stress in this country is at an all-time high, affecting all parts of life. Not only is the country running out of water, but they are on the brink of famine. Water management needs to be prioritized in this country to save their population, and the solutions explained must be implemented as soon as possible, immediately when the conflict ends.

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