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Yemen, Factor 2: Water Scarcity.

Yemen: Sustainable Solutions to the Water Crisis

Yemen is a country in the Middle East, suffering from the largest humanitarian crisis in the world due to internal conflicts since 2015. The Houthi Movement and political unrest have taken a toll on the lives of the nation's civilians. Unfortunately, this is not the only crisis affecting the lives of Yemenis. Water scarcity has greatly impacted food security in Yemen, a nation that relies highly on agriculture as the main economic activity. Water scarcity—exacerbated by climate change and the cultivation of crops that consume excessive amounts of water—has further affected the lives of Yemenis.

Yemen was once called 'Arabia Felix' or 'Fertile Arabia', known for its fertile lands and abundant produce. Its staple commodities consist of rice, wheat, and lamb. Additionally, a crop known as Qat is also grown extensively throughout Yemen. Even with hunger and malnutrition plaguing the country, Yemen's healthcare, and the access thereof, is extremely low (especially in rural areas). Measures are only now being taken by the Yemeni government and other relief organizations. On the other hand, education has improved in the past three decades by a great amount, with a majority of the population attending primary school, and some—but not most—attending secondary school. Even with farm families making up most of the Yemeni population, their wage is still at a low. According to an article by the International Food Policy Research Institute titled 'Climate Change and Floods in Yemen'^[1], they earn 16% of all household incomes, compared to the 47% by non-farm families and the 27% by the urban households.

The water crisis has led to a decrease in crop productivity, therefore leading to food insecurity. Wheat is one of the most extensively cultivated crops in Yemen. According to the UN Framework Convention on Climate Change^[2], Wheat cultivation is projected to decline drastically by 2030 in Siyoum, a district located in the Hadramout Governorate in Yemen, due to the reliance of local farmers on improved cultivars which are extremely sensitive to hot and dry conditions. With not enough water supply for agriculture, crops will deteriorate. This is likely to have a great impact on Yemenis, as wheat is a staple crop in the country, as are many others that will be affected by the water scarcity. This is only one of the many effects of this crisis. According to research conducted by M. Haidera et al. ^[3], 70-80% of rural conflicts are related to water in Yemen... (and) much of the country's rising militancy can be tied to a conflict over resources—either land, oil, or water. Since food insecurity is a significant consequence of conflict, this is also an important issue to be recognized.

Even though water scarcity highly impacts Yemen's agriculture, it poses a severe threat to its economy. Not having enough water for agriculture has forced Yemen to import most of its food from other countries and with the help of foreign aid organizations. Yemen relies on external sources (imported goods) for 90% of its food and basic sustenance; but with 70% of its residents relying so heavily on the agricultural sector for their income, Yemen's poverty rates have risen drastically^[4]. Unfortunately, the percent of the population under poverty is even higher than this number, due to conflict, the coronavirus pandemic, and high inflation rates. Food poverty, too, plagues a similar percentage of the population.

Currently, approximately 56% of the Yemeni population still is under the food poverty line, according to the World Food Programme. Child malnutrition rates in Yemen are particularly high, and approximately one out of every three families has gaps in nutritional diets. The humanitarian crisis has further exacerbated this situation^[5]. Apart from this cause, though, having limited and still decreasing amounts of water available for agricultural purposes has severely impacted food security— especially during recent times. The coronavirus pandemic has led to several countries backing out of giving aid to Yemen through both food and other resources. For instance, The UK decided to cut Yemen's foreign aid from £87m this year, down from £164m in 2019-2020, according to an article by BBC^[6].

The water scarcity not only affects the food security in Yemen, but also the per capita availability of water itself. According to the article titled 'Yemen's Environmental Crisis Is the Biggest Risk For Its Future' on The Century Foundation^[7], the per capita availability of water was just 95 cubic meters in 2018, which is projected to decrease to 55 cubic meters by 2031, well below the 500 cubic meter threshold for absolute water scarcity. With the water supply per capita decreasing drastically, people could not only have less or no water to drink, but may develop or risk developing diseases like cholera, dysentery, and polio. This will magnify the existing food insecurity and malnutrition of Yemenis.

Not only do Yemenis have a severe fresh water shortage, but the most populated areas of Yemen have the least access to water. In Taiz, Yemen's third-largest city, 25 years ago, 40% of the households were supplied with water only once every 30-60 days^[7]. Even with the existing high population for a country facing multiple crises, the population of Yemen continues to grow steadily at the rate of 3.5% annually with average annual growth of 4.9% in urban areas^[5]. With the population increasing, the overexploitation of water has increased drastically, also. From cultivating crops that require large amounts of water to incessantly drilling boreholes to have access to groundwater, Yemenis have elevated water shortage levels even further.

Depletion of freshwater is partially consequent to the increasing cultivation of Qat. Even though Qat cultivation makes up just 15% of Yemen's cultivated area, it consumes roughly 70% of the groundwater extracted (M. Haidera et al.) ... According to the World Bank^[8], this is approximately 3.9 billion cubic meters of water, compared to the renewable supply of 2.5 billion cubic meters per year. This is especially an important issue because even though Qat is extensively cultivated, it does not provide food for Yemenis, as it is a stimulant drug with a narcotic effect. Since it uses 70% of the 90% of the extracted water needed for agriculture in Yemen (FAO, 2014^[9]), it needs to be cut down to significantly lower amounts to preserve the water, which can then be used for other food crops.

Climate volatility has played key roles in leading to water scarcity in Yemen. Changes in rainfall patterns and rising sea levels have led to the deterioration of water in some areas. Rising sea levels due to global warming have increased the salinity of aquifers, causing deterioration of water supply, as well as agricultural production on the coastal plains (The Century Foundation, 2020). This is compounded with the fact that as Yemen lies under the 25° N latitude, climate change is likely to bring storms and floods, adding to the rising sea levels. By 2050, between 80,000 to 270,000 people could go hungry due to climate change^[5]. Water scarcity, compounded with climate change, can damage the already frail lives of Yemenis. To solve these crises, two major systems need to be implemented. Several resources for sustainable agriculture first need to be accommodated in not only areas most vulnerable to water scarcity, but also those where it can be prevented. Another system that needs to be enforced is government control of water use in both agricultural and domestic areas.

Resolving this issue could not only lead to an increase in water supply throughout Yemen, but will also help achieve economic stability. With sufficient water distributed throughout the country, farmers will be able to have more and better yields, and will see an increase in income of farmers. This will also help conserve fuel, and so, will help the environment, as it decreases carbon emissions. Using drip irrigation conserves up to 250 liters of diesel in comparison to flood irrigation systems. Implementing these systems could also be an avenue for new jobs and sources of income in rural areas of Yemen.

Firstly, farmers need to be provided with sustainable agriculture resources like drip irrigation systems. This will help the nation use its water resources sustainably and not extensively. Additionally, since 90% of all extracted groundwater is currently used for agriculture, using drip irrigation more extensively will provide more water for domestic, everyday use. According to the World Bank, a project conducted by Sustainable Groundwater Use and Soil Conservation implemented drip irrigation systems in Yemen. The results showed that 80 million MCM of water was conserved per year, and the pumped water productivity increased by 43%. Drip irrigation, already extensively implemented in coastal regions, where water scarcity is even higher, can save substantial amounts of water and also cut back on money spent on agriculture. By extending these facilities to mountainous and even urban regions can help maximize the existing resources of the nation.

To achieve this, the Yemeni government should collaborate with foreign aid organizations to set up these systems in the mountainous regions of Yemen. Although the water shortage is not as prevalent in these areas, these steps must be taken to prevent it from happening. The government should also set limits on the amount of water that can be used for agriculture, therefore eliminating flood- and promoting drip-irrigation systems. Foreign and even local Yemeni corporations can help promote this by educating farmers not only on the sustainability and conservation aspect of installing these systems, but also the aspect of saving fuel spent on irrigation, therefore increasing the farmers' profits.

For the same reason, drip irrigation is one of the most appropriate of the advanced technologies or solutions that can be implemented to conserve water. Yemen—historically and culturally—is rooted in an inherently agriculture-based society. Rather than uprooting this system by means of extensive foreign aid imported goods, implementing drip irrigation can help preserve Yemen's traditional economy while implementing sustainable practices to conserve water from depletion. However, foreign aid, to an extent, will be required to handle other factors impacting food security—like conflict.

Another system that can be carried out, especially in coastal regions, is desalination. According to The Water Project^[10], desalination plants are used in many other Middle-Eastern countries, including Saudi Arabia, the UAE, Kuwait, and Bahrain. These countries also have water scarcity issues similar to those in Yemen. Desalination, contrary to drip irrigation, has several downsides. This is essentially because of its impact on the environment, high costs, and the improper dependency of consumers on these plants to be their main source of water. These issues can also be fixed by executing proper methods to prevent desalination from negatively affecting Yemen. Excess costs can be covered partially by foreign aid, as Yemen is largely a financially unstable nation. This will lead to lower costs in the production of clean water and also for the consumers.

As desalination has a greater negative impact than many other systems, it needs to be implemented only in areas that are extremely impacted by water scarcity. To control the improper use of it, the government

must put in place quotas or ration systems. This is the second major factor to prevent water from depleting further. Lack of government control, policy, and intervention in the water crisis has had a great impact on it. As aforementioned, 70% of the extracted groundwater used for agriculture is consumed by Qat. Practices like these, including the drilling of boreholes to extract water, can worsen the scarcity. In coastal areas, more than 5000 boreholes have led to the overexploitation of groundwater^[5]. The government must implement regulations on the amount of water that can be used for each crop, allotting more for staple and highly-consumed crops, and considerably less for non-food and non-staple crops. They should also determine how much water is safe and renewable to be extracted.

In addition to the government having more control over agriculture and the decrease in the cultivation of crops like Qat, drought-resistant cultivars should be grown— especially in areas severely affected by water scarcity. Drought-resistant crops are more likely to increase crop productivity by increasing their resistance to dry conditions. According to a paper on ‘Coping With Water Scarcity’ by FAO in 2008, when one plant variety or species yields better than another one under a severe strain of drought, it is relatively more drought resistant^[11]. With all of these systems being executed, Yemen’s water crisis will increasingly decline, giving rise to more productive yields in a more sustainable manner.

In conclusion, the Middle Eastern country, Yemen, is going through one of the biggest humanitarian crises in the world, which is already impacting the food security of Yemenis. Compounding this is the water scarcity that has been caused by the overexploitation of water in several areas in Yemen by the cultivation of crops like Qat that take up too much water, using unsustainable irrigation methods, an increase in population, and climate volatility. This has led to not only just food insecurity, but an overall decrease in the economy, and decreased crop productivity. This can be solved by introducing sustainable irrigation systems— like drip irrigation and desalination plants— to rural areas, and by using the government and foreign aid organizations to regulate the area, amount of water and fuel, and type of irrigation methods used for crop cultivation. This will restore the more sustainable and productive nation which was once Arabia Felix.

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