

# Yemen between the Impact of the Climate Change and the Ongoing Saudi-Yemen War: A Real Tragedy

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## Introduction

Climate change is one of the global inevitable challenges that face societies in

our time. The process of global warming shows no signs of decreasing and is expected to bring about long-term changes in weather conditions. Climate change poses a fundamental threat to the places, species and people's livelihoods. It affects countries' economies and food security through a variety of channels. Rising temperatures and changes in rainfall patterns affect agricultural yields of both rain-fed and irrigated crops. A higher frequency of droughts may impair hydropower production and an increase in floods can significantly raise. Such sector-level impacts will have knock-on effects on other sectors and thus influence economic growth, food security, and household incomes.

For Yemen, War has had a devastating effect on Yemen's people and its infrastructure, many civilians have been killed in the fighting and parts of the country stand on the brink of famine. 12,000 of 14,400 schools in Yemen have been shut down and teachers' salaries have not been paid. Around 2600 schools were partly or destroyed by the Saudi-led coalition. Health, water and sanitation systems have been bombed to the point of collapse leaving over 15 million people without adequate access to clean drinking water and safe sanitation. Millions more are hungry and need help in getting a decent meal. Waste is piling up on the streets and in the settlements of displaced people because sanitation services, severely damaged by the two-years' war. International aid agencies tackling the cholera crisis are in danger of being overwhelmed by the scale of the outbreak. Up to the time of writing this report, there are around 956,000 discovered

cholera cases, mostly among children. More than 50,000 children are expected to die of starvation and disease by end of year 2017.

Both global and local climate change impacts are likely to matter for future development, given the country's high levels of food import dependency, food insecurity, and poverty. Yemen imports between 70 and 90 percent of cereals and is a net importer of many other food items. Yemen is also the poorest country in the Arab world, with an estimated 65 percent of its people living in poverty, and is among the most food-insecure countries in the world, with 32 percent of the population hungry, that is, without access to enough food. Rural-urban inequalities are high. The number of food-insecure people living in rural areas (37.3 percent), is more than five times higher than in urban areas (17.7 percent). Within rural areas, rural nonfarm households have higher food-insecurity rates than farm households. The ongoing war is hitting the Yemeni economy, society the poor hard. There are sharp declines in oil exports, foreign aid, and tourism plus double digit inflation. Since the beginning of 2011, there is a huge increased number of poor and food-insecure people, as today 70% of the total Yemeni population rely on aid to survive. Nearly 400,000 children in Yemen are at risk of death from severe acute malnutrition.

This paper assesses the impact of climate change and Saudi-Yemen ongoing war on Yemen's economy, agriculture, households and health and the proposed solutions for adaptation to climate change.

## Geographic location, Land Area and the resources of Yemen

Yemen is an arid Middle Eastern country, occupying an area of 527,970 km<sup>2</sup>. It has a

2,250-km coastline along the Gulf of Aden and the Red Sea. Yemen is characterized by 5 major ecological systems as follows: Hot-humid coastal plain, temperate highlands, Yemen high plateaus and Hadramout and Al-Mmahrah uplands, The Desert Interior and the Islands Archipelago.

Agriculture sector mainly depends on primitive methods and rain steams which make it vulnerable to extreme climate changes such as drought and floods. The sector also faces various challenges, the most important of all is the scarcity of water resources. It absorbs almost 50 percent of the work force and accounts for 11.4 percent of GDP (current prices) in the average during the period 2001-08. Rainfall varies widely across the country, from less than 50 mm along the coast, and rising with the topography to between 500 and 800 mm in the Western Highlands, and dropping again to below 50 mm in the desert interior.

The water sector in Yemen faces formidable challenges, and water table is declining in average by about 6-7 meters annually due to groundwater over-abstraction. The capital Sana'a is one of top ten water scarce cities in the world and its groundwater is being drastically depleted. The increasingly growing water crisis in Yemen has severe socio-economic and environmental consequences including decreased agriculture productivity, reduced food security, increased conflict over resources and accelerated land degradation, and increased livelihood vulnerability. With the current weak adaptive and institutional capacity, climate change associated impact including more frequent, and prolonged droughts under specific climatic sceneries will push livelihood vulnerability of the poor into further declines, leading to further environmental resource degradation, increased ecological scarcities, and hardship, and hence increased poverty expansion.



### The Current Political Situation in Yemen

The Houthis took an active role in the 2011 uprising. They used the period between 2011 and 2014 to organize their military and

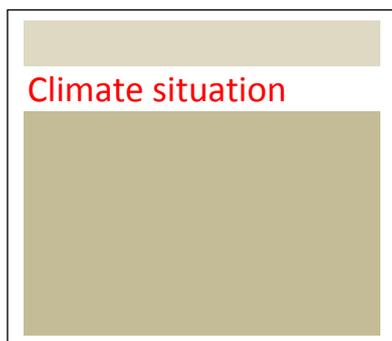
political wings, with some advice and support from Iran and the Lebanese Hezbollah, and to extend their influence into neighboring governments using their militias but also by persuading tribes to ally with them. They aimed to root out the influence of Islah, which in 2012/ 2013 seemed likely to be the most important player in the post-Saleh Yemen. During 2014 they took over Amran and then Sana'a, targeting military units associated with General Ali Mohsen and Islah and allies of the Sadiq and Hamid al-Ahmar family (who they thought had sent tribal militias to assist the fighting against them in the 2000s). In doing so they formed an unstated alliance with Saleh, who used his strong influence in parts of the army and in tribes North of Sana'a to assist the Houthis advance. By September, 2014 the Houthis had occupied Sana'a and controlled much of Northwest Yemen. They did not want to occupy the South. Their move on Aden was directed against current international recognized President, Hadi, not the Southern Movement.

The 'Southern Movement' has gained momentum in its calls to split from the Republic of Yemen. It is known as Al-Haraak (the movement) within Yemen. The southern movement also known as Al-Haraak Al Januby composes of several loosely affiliated organizations and activists in the southern governorates that were protesting the injustices of the northern based regime.

In March 2015, Saudi Arabia and a coalition of Arab allies initiated a series of air strikes

against Yemen, especially Houthi targets in Sana'a, and other parts of Yemen, leading to an ongoing conflict between pro-government forces backed by the Saudi-led coalition, and Houthi militias allied with units of the armed forces loyal to former President Ali Abdullah Saleh. The situation is made more complex by the presence of Al Qaeda in the Arabian Peninsula (AQAP) and of an affiliate of Islamic State in the east of Yemen, each of which has carried out attacks against the forces embroiled in the conflict .

The humanitarian situation in Yemen begins to deteriorate. The naval blockade enforced by the Saudi coalition and airstrike damage to Yemen's airports and other infrastructure are serious impediments to the delivery of humanitarian aid and exacerbated serious fuel shortages. Multiple attempts to implement ceasefires to allow delivery of fuel, medical supplies, and food by international organizations have been unsuccessful, and delivery of humanitarian aid to those most in need has been difficult and sporadic.



Climate changes since the 1960s include:  
Increased temperature (1.8°C+) at a rate of approximately

0.39°C per decade, with most rapid rate of increase occurring during the summer months (June-August); rate of warming is more rapid than the global average. Decrease in average rainfall at a rate of 1.2mm per month (-9%) per decade, generally affecting the drier seasons, with declines particularly noted in the Highlands.

Projected Changes might include: Mean annual temperature increasing by 1.2°C to

3.3°C by 2060, with warming occurring more rapidly in the country's interior than in the coastal areas. Substantial increase in frequency of hot days and nights (exceeding temperature of hottest 10% historical days/nights); decrease in frequency of cold days and nights. Wide range of projections (increases and decreases) for rainfall, with probable increases in September-November rainfall. Proportion of total rain falling in heavy events occurring September-November is expected to increase. Amounts of rain in maximum 1- and 5-day events occurring September-November are expected to increase. Increase in sea level rise of 0.30 m to 0.54 m by 2100.



Oil and agriculture are the two mainstays of the Yemeni economy, but both are under threat thereby

increasing the country's vulnerability to global commodity price changes.

Oil reserves are set to run out by the beginning of the next decade, and aquifers upon which irrigated agriculture depends have been seriously depleted in recent years. Although oil is still the dominating sector, production is on a declining trend indicating that other sectors in the economy will have to increasingly contribute to growth. In the absence of new oil discoveries, it is estimated that Yemen may become a net importer of oil as soon as 2016. This will have a significant impact on the economy given that oil revenues account for 60 percent of government receipts and almost 90 percent of exports. Yemen is also a net importer of major food items, including maize, wheat, other grains, livestock, fish and processed food. Agriculture's trade orientation is very uneven, with imports accounting for more

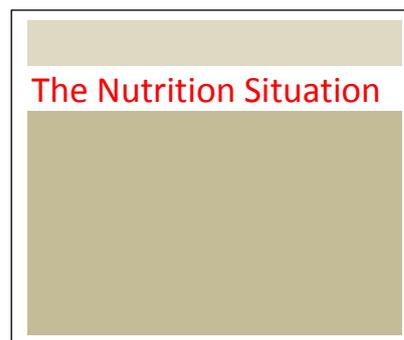
than a third of total domestic consumption and exports accounting for less than five percent of domestic production.

Beside oil production, agriculture is an important part of the Yemeni economy. Agriculture and related processing contribute about 13 percent to GDP, about three quarters of which is produced in the highly populated Upper and Lower Highlands, with 30 and 40 percent of the total population, respectively, living in these agro-ecological zones. Qat- a mild narcotic -accounts for more than one-third of agricultural GDP; vegetables and fruit make up another one third. Livestock and cereals contribute about 20 percent and 10 percent to agricultural GDP, respectively. Qat is almost exclusively concentrated in the Highlands, while other water-intensive crops such as fruit and vegetables are also grown in the Red Sea and Tihama Plain. Upper and Lower Highlands are the two main contributors to agricultural and overall GDP, followed by the Red Sea and Tihama Plain, the Internal Plateau, the Arabian Sea Coast and the Desert zone. The flood-affected Internal Plateau and Arabian Sea Coast together account for only 7.3 per cent of agricultural GDP, yet 20 per cent of Yemen's fruit is produced in the Internal Plateau and one third of total fish catch stems from the Arabian Sea Coast. Food and agriculture-related processing makes up about 50 per cent of household consumption expenditures.

The food security situation in Yemen is highly vulnerable to shocks such as food price surges and climate variability. Its estimated in 2009 that the Yemeni population accounts for about 23 million people, Food insecurity affects 32.1 percent of the population, almost one-third of the population, or 7.5 million people, do not have enough food. Food insecurity among the rural population is almost ten percentage points higher than it is among the urban population. The absolute

number of food-insecure people living in rural areas is more than five times higher than in urban areas. About 6.4 million rural people are suffering from food insecurity, while in urban areas 1.1 million are deficient in food.

The vulnerability is demonstrated by the relatively small difference between what Yemenis consume every day and what they need to stay off hunger at their current level of activity less than 300 kcal/day nationwide. This means that the average Yemeni consumes only 15 percent more than the 2,019 kcal/day needed to avoid hunger. People in rural areas are more likely to fall into food insecurity than people living in urban areas. Although the average per capita calorie consumption in rural areas is 200 kcal/day higher than in urban areas, the average per capita calorie gap is lower by about 130 kcal/day. This difference is the result of the significantly higher calorie needs of rural people (2,106 kcal/day on average) compared with urban people (1,708 kcal/day on average). Rural people need more calories for fetching water from wells, carrying goods to and purchases from markets over long distances, and working hard on farms and in fisheries.



Nearly half of all children under five years old in Yemen are chronically malnourished (67 percent)

and 23 percent suffer from acute malnutrition. With rates of chronic malnutrition this high, the physical and mental development of Yemeni children is severely at risk, a disadvantage from which they cannot recover. Children lose their identity in Yemen because of aggression. Some of them lose their families and some of

them lose their physical organs and become permanently disabled.

It is recommended that infants receive animal protein daily (or receive iron supplementation) and consume vitamin A daily. In Yemen, only 15 percent of infants consumed vitamin A rich foods and 33 percent consumed meat, fish, or eggs. The situation does not improve for young children (aged between two and five years) where only 11 percent consumed vitamin A rich foods and 33 percent ate animal based proteins. It is reported that undernourished Yemeni mothers had higher rates of children who were malnourished than healthy mothers. Eighteen percent of children born to undernourished mothers suffered from acute malnutrition compared to twelve percent in healthy mothers. Chronic malnutrition was also higher among children with undernourished mothers, with 54% stunted compared to 45%. The largest difference was found in terms of underweight: 46% of children born to undernourished mothers were malnourished compared to 33%.

### The Saudi-Yemen War and Water Scarcity

The civil war in Yemen seems to be politically motivated competition for power among many actors with varying motives. The players include Houthi rebels, al-Qaeda in the Arabian Peninsula, western backed Saudi and UAE troops, mercenaries, and millions of Yemeni civilians caught in the middle. Local and Tribal conflicts are not new to Yemen, but these have increased in recent decades. Underneath these political and societal tensions there lies a more basic tension: Water.

The Syrian civil war has been held up as one

of the first clear examples of a large-scale armed conflict where in resource scarcity, linked to climate change and natural resource mismanagement played a role. Yemen faces strikingly similar risks. It's among the most Water-stressed countries in the world, brought on by regional drought, a naturally dry climate and failed attempts at management. Moreover, Fuel prices, closely linked to the price of water in Yemen helped to spark the protests in 2014.

In rural Yemen, identity is connected to land and water rights, and conflicts over these rights could be the spark for larger tribal disputes. It is therefore no surprise that the pressure is being felt locally from the lowering water supplies. The Yemeni government has made attempts to address water issues, but these attempts have mostly failed. In the late 1990s and early 2000s the Yemeni government implemented five demand management measures: increases in the diesel price; elimination of credit subsidies for agriculture; modification of the fruit and vegetable ban; regulation and taxation of groundwater; and projects to support increased water productivity in agriculture. Despite these measures, the Yemeni government lacked an effective tool to implement and enforce them.

Water shortages have increasingly been at the center of humanitarian concerns during the civil war. There have been reports of both the Houthi and Saudi forces blocking deliveries of humanitarian aid consisting of food and water. In February 2016, there were reports that Saudi planes bombed and destroyed a reservoir that held the drinking water for 30,000 Yemenis; roughly 5,000 cubic meters of water. There have also been reports of guards confiscating water from civilians at Houthi-controlled checkpoints around the city of Taiz. Neither side sees water resources as off-limits. The total number of Yemenis without a clean water

supply and sanitation to at least 16 million – almost two-thirds of the population. Houthi rebels have laid siege to the southern city of Taiz since April 2015, and residents of the city have had restricted access to medical supplies, food and water. In a place as dry as Yemen, combatants are treating water as a resource to be withheld from the enemy.

**Cholera Outbreak in Yemen**

Declining agricultural productivity, water scarcity, and ongoing conflict contribute to the fragile state of Yemen's health

sector. Yemenis suffer from serious vector-borne diseases, including malaria. Climate change may affect the prevalence and morbidity and mortality rates of such diseases. Recent outbreaks of cholera in Yemen have resulted from declining availability of safe drinking water sources. Damage from the war has turned Yemen into a fertile environment for cholera, a bacterial infection spread by water contaminated with feces. As garbage has piled up and sewage systems have failed, more Yemenis are relying on easily polluted wells for drinking water. Heavy rains since April accelerated the wells' contamination. In developed countries, cholera is not life-threatening and can be easily treated, with antibiotics if severe. But in Yemen, rampant malnutrition has made many people, particularly children, especially vulnerable to the disease. It's reported that more than 960,000 suspected cases of cholera in a six-month period, topping Haiti's 340,000 cases after an earthquake in 2011.

The United Nations warned that one third of Yemen's 22 provinces are on the verge of famine. An estimated 17 million people are currently food insecure, including 5.3 million people who urgently need immediate assistance to save their lives from death due to famine and severe food

insecurity and 7 million people who do not

**The famine Crisis in Yemen**

know where their next meal will come from. This represents a 33 per cent increase since late 2014. Agricultural

production, employing more than half of the population, has also drastically declined due to insecurity, high costs, and sporadic availability of agricultural inputs. The fishery sector has also been heavily impacted with a near 50 per cent reduction in the number of fishermen due to the impact of the crisis. About 3.3 million children and pregnant women are acutely malnourished, including 462,000 children under 5 suffering from severe acute malnutrition. This represents a 57 per cent increase since late 2015 and threatens the lives and life-long prospects of those affected.

Food is available in the markets, including Sanaa. Yet, Yemenis throughout the country increasingly are unable to purchase it. After two years of ground fighting and air bombardment, the economy is in tatters. Families and communities are approaching a breaking point, having sold their assets, spent their savings and exhausted extended networks of support. The situation is most severe for the more than three million internally displaced persons (IDPs) and residents of governorates like Hodeida, who were the poorest before the conflict.

**Climate change: suggestions for the current situation in Yemen**

One of the most recommended solutions to Yemen's water shortages is the development of desalination plants along the

coast. However, it is not a sufficient solution

soon. Firstly, instability in Yemen, which is likely to persist for many years, makes desalination infrastructure projects of the size needed to be built infeasible. Plants would be a likely target for groups trying to disrupt the process, and the necessary investments for such projects would be difficult to come by either from the Yemeni government, or from outside financial institutions. Secondly, desalination projects are costly. Saudi Arabia has expressed a desire to lead the rebuilding of Yemen after the conflict, but because of Saudi Arabia's role in the conflict, there would likely be much domestic opposition to this. The Saudi Development Fund and the Yemeni government had begun the initial negotiations to build a Saudi-funded desalination plant for the city of Taiz before the escalation of the civil war, but the negotiations have stalled due to the conflict. However, this deal does at least show a willingness by Saudi Arabia, a country with considerable desalination experience, to help Yemen overcome its water problems, which could also serve as a trust-building factor between the conflicting parties. Thirdly, Sana'a is not near the coast and would require an extensive pipeline to bring desalinated water into the city. The likely high costs and insecurity of a pipeline to Sana'a could leave the city without a water supply in the future; possibly forcing an abandonment of the city.

**Reform petroleum subsidies:** The Government of Yemen made a first step toward reforming petroleum subsidies by increasing fuel prices in 2010. However, simply phasing out the petroleum subsidy would increase food insecurity because higher fuel prices affect farmers and the urban food insecure most. To stabilize food security during the reform period, the ample budgetary savings from reform should be used to finance a combination of direct transfers and productivity-enhancing investments. Transfer payments alone only

curb the rise in food insecurity in the short run, but the addition of public investments in infrastructure (related to utilities, transport, trade, and construction) fosters food security and sustainable economic growth. The combination of direct transfers and investment is a promising strategy for joining the subsidy reform with the promotion of sustainable development. Transfers, investments, and resulting long-term productivity gains complement each other and lead to reduced food insecurity and poverty.

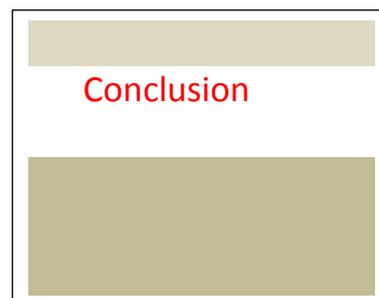
**Reduce Qat production and consumption:** Yemen faces a crisis as its demand for water continues to exceed its renewable supply. Agriculture, which can make an important contribution to rural development and food security, is constrained by the lack of water; water scarcity and contamination threaten the health of many households. And in all of this, Qat emerges as the major culprit, consuming more than 40 percent of Yemen's water supply. Thus, sharply reducing Qat consumption is vital for avoiding drought, achieving non-Qat agricultural growth, and meeting Yemen's food security goals. However, measures to reduce Qat consumption may meet sharp resistance from the Yemeni people. Policy measures will require a communication campaign to provide comprehensive information on their necessity and urgency. The benefits of a Qat tax will outweigh the difficulties of implementation: it is likely to discourage people from excessive consumption, allow Yemen to use its water supply more effectively, and generate additional revenue for the government, all of which make the population more food secure. The tax revenue should be invested in agriculture and water infrastructure and used for the promotion of alternatives to Qat production, such as cereals and coffee production, and processing of agricultural products. If this "Qat reduction for agricultural development"

strategy is implemented properly, farmers will be more than compensated for the loss of Qat revenues, and Yemen's food security will improve.

**Improve food security risk management:** Yemen is very vulnerable to global food price shocks and disasters, so the country must develop appropriate risk management mechanisms. First, the cereal import market must be made more competitive. Currently, the market is dominated by a small number of importers, which increases local cereals prices even in relatively stable economic circumstances. Appropriate laws and regulations that increase competitiveness will make an important contribution to improving food security. Second, the government should hedge against extreme price fluctuations caused by emergency situations such as the 2007–08 global food crisis. This can be achieved through national grain reserves, regional grain reserves, or hedging in international markets. For any type of price risk management, an effective market-price-monitoring system will be critical for effective decision-making. Third, the government should recognize the role of social transfers in building economic resilience among vulnerable communities. Social transfers can include direct transfers, cash-for-work programs, community asset building through public works, assistance in starting microenterprises, and nutrition and health programs. The government should use the political opportunities that arise from food-price crises and disasters to incorporate risk management into the overall economic development planning framework. Strong collaboration among governmental agencies, the private sector, and Yemen's international partners is essential for success.

**Launch high-level awareness campaigns:** The Yemeni government should launch three national campaigns at the highest political level (for example, as “presidential

campaigns”). First, a national family planning program should be implemented. Such a program should be strongly integrated with primary healthcare and should involve religious leaders. Second, a high-level campaign should be launched to address the lack of nutrition and health knowledge among Yemenis. This nutritional education program should cover a wide range of topics, including dietary diversity and micronutrient malnutrition. Third, a campaign should focus on the acceleration of women's empowerment. The evidence clearly shows that gender inequality goes hand in hand with malnutrition. The campaign should focus on improving women's educational attainment, economic participation, health status, and political empowerment.



The world's climate is changing and will continue to change into the coming century at rates

projected to be unprecedented in recent human history. Climate change has made weather less predictable and has increased environmental degradation. Environmental degradation has historically influenced political stability. Variables like rapid population change, water and food scarcity, migration, energy and natural resources consumption are already causing problems and will continue to be impacted by climate change.

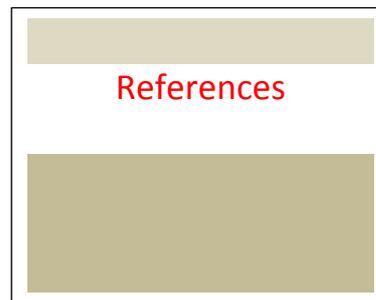
This study focuses on the impact of climate change and ongoing Saudi war on Yemen. Population growth in Yemen is among the highest in the world, with an average annual growth rate of 3% in recent years. Almost one-third of Yemenis or 7.5 million people do not have enough food to satisfy their needs. Results also show that 57.9% of all children

suffer from under nourishment and poor health. Such high prevalence of child malnutrition has a serious consequence for the future development of Yemen's society and economy. In an international context, this puts Yemen among the 10 most food insecure countries in the world.

The civil war in Yemen seems to be politically-motivated competition for power among many actors with varying motives, but underlying all other motives is the ongoing need by all parties to secure access to the diminishing water supply.

Every day we hear about the UN's announcements of sending relief and food items to Yemen, we heard about Billions of dollars are spent on overcoming the humanitarian crisis in Yemen that we have no idea about. In a short run, there is a need for a global and regional action and, rather, by an internal check to monitor the UN actions in Yemen and to help people who are suffering from the famine. There is a need for an effective follow up by the international donors, evidence-based decision making and appropriate monitoring and evaluation in all the actors involved to make Yemen's food security reality.

The international community, particularly the major industrial nations, must stop the negative impact on the global climate through the non-compliance with the international covenants and references such as the Paris Declaration on Climate. They must stop selling the heavy weapons to the untrusted States, which have no respect to the basic human rights. The international community must force all the internal conflicting factions in Yemen and all their regional and international supporters to enter direct negotiations. The political solution is the only solution to resolve the Yemeni crisis and to avoid the worst humanitarian catastrophe of the 21st century in Yemen.



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