Climate Centre

Region-level | Climate fact sheet

Middle East

1. Region overview

The Middle East region is a difficult one to define. As much as possible, this fact sheet will focus on analysis of climate change in Bahrain, Egypt, Iran, Iraq, Israel and the Occupied Territories (ILOT), Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates and Yemen, although we occasionally draw on regional analyses with an expanded definition of the Middle East (such as regional overviews including the Middle East and North Africa). The region is vast and the disparity in wealth and economic stability varies greatly between and within countries. The main economies across the region range from farming (both subsistence and commercial) to hydrocarbon extraction and other extractive industries (Waha *et al.*, 2017). The region is also marked by high levels of urbanization (FES, 2020).

1.1 Climate

For a region as vast as the Middle East, describing the climate of such a large area is somewhat difficult. However, it is possible to look at regional trends and analyses. Typically the region has a hot and dry climate, with an arid and semi-arid environment characterising most territories. These conditions create distinct seasons and seasonal variability, with winds blowing into the interior in summer and blowing towards the sea in winter (UNESCO - EOLSS, n.d.).

Many sections have a Mediterranean climate, featuring hot, dry summers and wet, mild winters. However the mountains of Iran and Iraq have severe winter conditions. Precipitation is generally quite low, with ranges between 350mm to 750 mm annually (UNESCO - EOLSS, n.d.). The area is known for being hot and arid.

Regionally, the Middle East is very impacted by dust storms which often carry over to Europe (Al-Delaimy, 2020). Though they can occur at any time in the year, they are most prevalent between May and September (UNESCO - EOLSS, n.d.).

2021

with support from the ICRC

1.2 Climate change

Historical Climate	Projected climate
Temperature	
▪ Between 1971-2000 temperatures were observed to rise significantly across the region (Karami, 2019). ▪ Observations show that heat extremes have become increasingly frequent in recent decades; this is coupled with a decreasing number of cool days. Since the 1970's warm days and nights have almost doubled in frequency (Lelieveld, 2016). ▪ The Syria and Iraq region saw an increase in approximately 4°C from the 1960's temperature recordings (Cook *et al.*, 2016, Karami, 2019).	▪ Temperatures across the Middle East region are predicted to increase by 3°C by 2050, and could be at as high as 50°C by 2100 (Lelieveld, 2016). ▪ The highest increases in temperature are expected to be in the countries located in the northeastern Mediterranean (latitudes of 36-38° N), in the Balkan Peninsula and Turkey (Lange, 2019).
Precipitation	
▪ Average precipitation amounts were higher in past centuries and millennia than they are today (Karami, 2019). ▪ A recent study revealed that the drought affecting the Eastern Mediterranean has been occurring since 1998 and is possibly the most severe observed in the last 900 years (as measured using scPDSI) (Cook *et al.*, 2016) . ▪ Recently, certain areas of the region (predominantly Syria and Iraq) saw a significant decrease in precipitation, with estimates showing a 10 per cent decrease from previous years between 2006-2009 (Karami, 2019). ▪ Alongside droughts, the region has also seen flooding in areas never seen before; this is a combined effect of urban sprawl changing the normal routes of water, and the increased dryness caused by the drought, making it difficult for flood water to be managed normally by the environment (WEF, 2019).	▪ Precipitation has been predicted to decrease by 20 per cent (UNDP, 2010). ▪ Runoff into the Middle East region will decrease by between 20-30 per cent by the end of the century as a result of drier temperatures and less frequent but more intense rainfall (Karami, 2019;).

1.3 Climate Vulnerability

Analysis shows that the Middle East is already significantly impacted by climate change, both 'present and future' (Waha *et al.*, 2017). Yet the current landscape of climate change barely scratches the surface of what is to come. The Middle East has been labelled as 'global ground zero' for climate change; a 'climate change hotspot;' the area that will 'be the most affected by climate change and global warming (Al-Delaimy, 2020; Lelieveld, 2016). And the evidence that climate change impacts will continue to grow in the region are myriad and growing.

The Middle East is projected to be the first region in the world to run out of water (Al-Delaimy, 2020). Cumulatively, the Middle East region has been identified as the most water-stressed region of the planet, home to just one percent of freshwater resources but five percent of the world's population

with support from the ICRC

(World Resource Institute, 2021). Availability has dropped by 75 per cent in the past 70 years and is expected to decrease an additional 40 per cent by 2030 (Kameel, 2017). At the same time as water availability drops, sea levels will rise by a projected half metre by the end of the century, making it one of the areas most vulnerable to sea level rise (World Economic Forum, 2019).

Temperatures will rise to unprecedented levels, with business as usual approaches leading to regular temperatures beyond 56°C (Zittis *et al.*, 2021). This will create scorching summers that will keep residents bound indoors, as well as render some areas fully uninhabitable by 2100 (Al-Delaimy, 2020; Lelieveld, 2016). By the end of the century, half of the region's citizen's (600 million people) will be annually exposed to 'super and ultra extreme heat waves' (Zittis *et al.*, 2021). The agricultural sector, which large swathes of the population rely on, will decrease in productivity and predictability, eroding livelihoods and increasing poverty and strain on social protection systems (Waha *et al.*, 2017).

Climate shocks will create an added challenge in urban contexts across the Middle East. Urbanization rates are already well above average (65 per cent and growing) (FES, 2020), with 92 per cent of the population living on just 3 percent of the territory (GFDRR, 2019). By 2040, the population in cities is expected to double (GFDRR, 2019). These rapid rates of urbanization and concentration of populations in limited areas is aggravated by climate change. For example, extreme drought has oft been cited as one of the catalysts for the Syrian Civil War, with widespread crop failure driving a sharp increase in rural - urban migration (Kelley et. al, 2015). High rates of urbanization -- which often lack the urban infrastructure and service delivery to match --in turn cause high levels of air pollution and traffic (FES, 2020). It can also contribute to sprawling informal settlements, overcrowding, and higher unemployment, which act as further destabilizing forces on urban areas (Kelley et.al, 2015). In these ways, the intersections between high rates of urbanization and climate change will continue to impact livability and critical urban infrastructure across the Middle East (Salima & Al-Ghamdi, 2020). The risks therein are being increasingly recognized and addressed through a growing focus on enhancing urban resilience and investing in climate resilient infrastructure (GFDRR, 2019).

Further, climate change is predicted to exacerbate the potential for conflict in the area. For example, it will fuel competition over increasingly scarce resources (Atlantic Council, 2019). Migration, a historically important feature in the region, will continue to serve as an adaptive mechanism in the face of conflict and climate change. It is projected that as migrant flows increase, it could further destabilize a region already grappling with high geo-political tensions. These and other transboundary impacts of climate change are predicted to escalate tensions across borders (MEI, 2021). And civil unrest and conflict is anticipated to escalate (IISD, 2009).

Vulnerabilities to climate change in the Middle East will be diverse, far-reaching, complex, and cascading. Though the authors have endeavoured to outline the issues in more detail in the subsequent sections, readers should recognize both that this fact sheet is necessarily non-exhaustive, as well as that these issues are best understood through their intersections rather than in silos.

with support from the ICRC

2.Humanitarian sectors and climate change

2.1 Water and habitat

As a fundamentally important resource that is critical to survival, water is of great importance across the world. In the Middle East region, water access and availability is expected to be a key stressor and conflict amplifier in the coming years.

The Middle East has the largest increase in water deficit, and has been labelled the 'most water scarce' region in the world, with 12 countries experiencing absolute water scarcity (including Jordan, ILOT, and all countries in the Arabian Peninsula) (MEI, 2019; World Bank Group, 2016). Though home to six percent of the global population, the region only has one percent of global freshwater sources (PRB, 2002; World Bank, 2018). It has the highest levels of water stress (as a measure of demand versus total available renewable freshwater sources), that are double that of the global average (MEI, 2019). Seven of the ten countries projected to be most water-stressed globally are in the Middle East, including Oman, Saudi Arabia, Bahrain, Kuwait, UAE, Qatar, and ILOT (Kameel, 2017).

Water access issues are also complicated by and complicate geo-political issues. More than 50 per cent of Middle Eastern countries' water sources are 'located outside of their political boundaries' (MEI, 2016). This is the highest rate of dependence on external water sources in the world, a statistic which compounds the already loaded geo-political context in the area and threatens water security even further. One of the most difficult elements of water resources in relation to climate change is the cross border cooperation which is required in order to effectively manage water resources between countries. An example of this in the Middle East region is in the Euphrates river basin. The river basin extends from Turkey, through Syria and into Iraq (Euphrates) (Feitelson, 2017). The direction of flow of the river has a significant impact on all the countries that rely on the water as part of their domestic supply; Turkey's water policy and decision making has a significant effect on Syria and Iraq, for example (Feitelson, 2017). This means that climate policy, water policy, energy policy, agricultural policy, and general politics in the country will have knock on effects on the countries further downstream. In the drought of 2007-2010, Turkey, which has numerous dams in the upper section of the river, released an increased amount of water to support the populations of Syria and Iraq (Kibaroglu *et al.*, 2013). This dependency on other countries makes places like Syria and Iraq extremely vulnerable to climate change as their water resources are not only dictated by the climatic variations but also by a confluence of geopolitical elements.

The last decades have also shown the ways in which water has played a role in the health, livelihoods, and the larger economy of the region. Regionally, the Middle East exhibits a great disparity in wealth and consists of very differently structured economies; one of the biggest dividing factors being between the countries that have access to water supplies, or can afford to create access to new water supplies, and those that cannot (Sowers, 2010).

The region has a number of oil-exporting states - namely Saudi Arabia and the small city-states of the Gulf region. Oil extraction being an industry heavily reliant on water, these states long ago exceeded their renewable freshwater resources (Lange, 2019). They now rely on desalination and

with support from the ICRC

reused wastewater, and also engage in exploring for fossil groundwater (Sowers, 2010). ILOT is also focusing their efforts on desalination technologies and wastewater reuse programs. Desalination is not only hugely energy intensive, but also expensive. Estimates show that on average, 12 per cent of total sector fuel use across the Gulf countries is spent on desalination, this ranges from 10 per cent in Saudi Arabia to 30 per cent in Qatar (Lange, 2019). This is only possible for these economies because of their economic development and oil reserves and resources. Other countries in the Middle East region would struggle to employ this strategy.

The remaining states are more or less divided into two categories; those who have significant surface water resources, and those who rely on groundwater. There are few countries who have access to both surface and groundwater resources, mainly Syria. Turkey, Egypt, Lebanon, Sudan, Iraq and Iran fall into the category of countries with access to surface freshwater resources. Jordan, Yemen, Tunisia and Algeria are in the groundwater categories (Sower, 2010).

Both storm surges and sea level rise (SLR) projections are particularly worrying for the Red Sea and Mediterranean basins. In the Mediterranean, climate change is projected to worsen storm surges that will cause social and economic damage to infrastructure and coastline communities (Makris et al, 2018). Since 2009, SLR in the Mediterranean was recorded to be 10 cm above the seasonal average (Waha *et al.*, 2017). The Red Sea basin has much less data available for comparison. SLR is worrying for both its direct and indirect effects. In a scenario created by Brown *et al.*, (2009), estimates showed that a 2°C world would mean that the total number of people flooded would be 0.03, 0.26, 1.82 and 1.97 million people in Libya, Tunisia, Morocco and Egypt respectively. This number changes significantly in a 4°C world scenario; 0.13, 0.80, 2.07 and 3.6 million people directly affected by flooding (Waha *et al.*, 2017; Brown, 2009). Indirect effects of SLR point to salination of water resources, and changes in and destruction of ecosystems and habitats for freshwater organisms (Nahry, 2010).

Alexandria, on the Nile Delta of Egypt, has been experiencing the "sinking" of buildings, resulting from less silt deposition (due to reduced flow rates) and thus soil instability. Extraction of water upstream, coupled with decreasing rainfall patterns means the delta is experiencing significant changes in soil composition (World Economic Forum, 2019). This not only has effects on human life, but also ecosystems that rely on the delta for their survival.

Across the region of the Middle East, drought is and will continue to be a key stressor and cause for concern as the climate changes further towards less predictable precipitation and increased temperatures. Already we see that the Levant region has been experiencing the worst drought seen in the last 900 years (NASA, 2016), and 2007-2010 saw the Euphrates River Basin and the Lowe Jordan River Basins (Jordan and ILOT) countries living through an extended drought in a region which is characteristically known for its dryness in general (Feitelson, 2017). Living with a deficit of water is difficult in itself, this is made worse by the unpredictability and increasing frequency with which these events are occuring. The difference between economic development, access to resources, and adaptive capacity can have extreme consequences in terms of drought outcomes. This is evident in the case of drought of 2007-2010 and the differences between Jordan and ILOT. Whereas Jordan and ILOT suffered considerably milder impacts to the drought, ILOT saw huge economic losses and stressors. In ILOT, crop yields fell 35-40 per cent, 200,000 livestock were severely affected and vulnerable communities saw heightened food shortages (Abdo, 2014). Jordan on the other hand came out relatively better with policies put in place to ensure lessened damage. These included limited agricultural water use, the banning of summer water irrigation, and a 45-55 per cent reduction in water quota for farmers. Despite this, no severe economic losses were recorded in Jordan during this time (Feitelson, 2017). These

with support from the ICRC

differences between adaptive capacity are expected to lead to increased inequality and to cause the most vulnerable to climate change to suffer the most. .

2.2 Economic security

Economic security will be impacted in a number of ways across the region as a result of climate change, and economic activity will in some ways amplify the impacts of climate change. Agricultural production and livestock form a significant section of the region's economy, especially for the poorer parts of the population. However, oil extraction and other extractive industries also form a large part of the region's economy.

In terms of agricultural production, climatic changes are projected to have significant impacts on the region. As a result of increased desertification and rising temperatures, projections expect to see a shifting of vegetation and agricultural zones northward (Waha *et al.*, 2017). This will mean that people will be either forced to diversify their livelihoods, or migrate to places where they are able to continue their agricultural practices. With land tensions and ownership issues, this may prove increasingly difficult. In addition to agricultural zones shifting northward, growing periods are expected to shorten, with a decrease of about two weeks projected by mid century (Ferrise *et al.*, 2013). This puts pressure not only on subsistence farmers and their food stocks, but also exporters of items that contribute to the region's revenues, such as olives. Finally, as most agricultural activities take place in semi-arid climate zones, crop yields are expected to decline by 30 per cent in a 1.5-2°C warming world (al-Bakri *et al.*, 2011). This figure is expected to rise to a 60 per cent decrease in yield in a 3-4°C warming world (Waha *et al.*, 2017).

Livestock practices will also be significantly affected by climate change in the region. As with agricultural practices, the changes in length of season will affect livestock farmers. How long animals are able to graze in certain areas and pastures will be affected, leaving herders having to seek out grazing areas further afield or acquire feed to ensure enough food is provided for the animals (Thornton *et al.*, 2009). This will be coupled with the challenges of heat stress and reduced access and availability of drinking water. These changes in turn will be compounded by a projected change in livestock disease and disease vectors (Thornton *et al.*, 2009). All of these impacts are likely to affect those already most vulnerable to climate change and relying upon livestock as part of nomadic and subsistence farming practices. In the years between 2005-2010, Syria saw 85 per cent of livestock lost as a result of persistent drought (Waha *et al.*, 2017). Such large losses are difficult to recover from and significantly affect the communities relying on this as a core part of their livelihoods.

Another significantly important sector of the Middle Eastern economy is the oil industry, coupled with other extractive industries. Global decarbonisation efforts, combined with low-carbon technology developments are already, and expect to continue to cause, a restructuring of this economic sector in the Middle East (Tagliapietra, 2019). Since the Paris Agreement, combined with an increased global awareness of the need to move away from carbon intensive activities, the global market for fossil fuels is projected to significantly shift. Since 2013, oil prices (USD/barrel) have seen a dramatic drop; 109 USD/barrel in 2013 to 54 USD/barrel in 2017 (Tagliapietra, 2019). Simultaneously, technological advancements are increasing the cost-competitiveness of low-carbon technologies such as solar and wind power both in energy generation and storage (Lazard, 2018). This shift in the global energy system poses questions for the Middle East region where in some contexts (such as Saudi Arabia and Kuwait) oil and gas exports account for up to 80 per cent - 90 per cent (respectively) of the country's exports. If no diversification occurs,

with support from the ICRC

hydrocarbon producers potentially stand to face significant losses in revenue (Tagliapietra, 2019). This would significantly impact the populations that rely on these revenues.

It is important to note that the main drivers of economic activity in the region are in and of themselves water intensive, and as such multiply the threats posed by climate change. The oil industry and irrigated agriculture both demand high use of water resources. This dependence on water will likely jeopardize economic security in the context of climate change, as challenges in accessing sufficient water hamper or stall economic growth in the area (World Bank Group, 2016).

2.3 Health

Though there is a recognised deficit in analysis on the impacts of climate change on health in the Middle East region, there is equally a recognition that these impacts will likely be 'overwhelming' for the region, as outlined in the recent publication Health of People, Health of Planet, and Our Responsibility (Al-Delaimy, 2020).

One of the climate changes in the region which will most impact the health sector is the surge in frequency and intensity of heat waves. Modelling projections for 2°C warming show significant increases in the number of 'exceptionally hot days'; the most striking example is Riyadh in Saudi Arabia, which will increase from just 3 to 132 extremely hot days per year by 2071 (Al-Delaimy, 2020). Projections under a 4°C temperature increase are even more stark, with many main capital cities (including Amman, Baghdad, Damascus, and Riyadh) projected to have more than 115 extremely hot days per year each (Al-Delaimy, 2020).

Extreme heat waves are projected to render parts of the Middle East uninhabitable by the end of the century, as well as to limit the potential for people to be outdoors in summer months (Al-Delaimy, 2020). The projected increases in temperature for the regions are significant enough to not only impact human health, agriculture and water availability, but could also cause premature mortality from heat exhaustion and other hot weather extreme related issues, as well as drive increased in heat-related morbidity (Lelieveld, 2016). Though quantifiable projections are difficult to secure because the temperature range that the region will be dealing with (reaching 60 C) are not temperatures which have been reached there previously, researchers are labelling the projections 'devastating' and anticipating the 'highest [heat-related mortality] in history' (Al-Delaimy, 2020). Increases in heat waves are also linked to increases in hospital admissions, thereby adding additional strain to health systems and infrastructure (Waha *et al.*, 2017).

These extreme temperatures are projected to contribute to the conditions for the emergence of new disease strains (GLAWcal, 2021). They are also anticipated to drive increases in existing disease rates.

Floods are projected to increase in frequency and severity as rainfall patterns become more erratic and as urbanization paves over the escape routes of water (Broom, 2019). More floods are leading to more deaths, as well as to increases in waterborne diseases such as cholera.

Waterborne disease outbreaks are also driven by higher temperatures and higher exposure to contaminated water due to desertification, scarcity, and increased demand and competition for decreasing water sources forcing people to access contaminated water (Waha *et al.*, 2017). Vector-borne diseases are also projected to increase. This includes malaria, and dengue fever,

with support from the ICRC

both of which will increase in prevalence and in geographic range as a result of climate change (Waha *et al.*, 2017).

Additional climate-related health challenges will be present in the increase of dust storms in the region. As climate change increases temperatures and decreases precipitation, soil moisture will drop and aridity will increase by up to 50 per cent in coastal areas (under a Business as Usual) scenario (Al-Delaimy, 2020). Dust storms are anticipated to occur more frequently; for example, Iraq had 122 dust storms in 2010 and expected approximately 300 in the year 2020 (Al-Delaimy, 2020). These more frequent dust storms will further impact human health as they consist of fine dust particles which penetrate farther into lungs than larger particles. Importantly, this can in part be attributed to conflict and wars that have taken place in the region, wherein the use of tanks and bombs altered the desert ecosystem (Al-Delaimy, 2020). This once more highlights the intersectional approach necessary to understanding the complex, multi-faceted risks that are threatening the region.

Finally, dust storms are projected to contribute to increases in hospital admissions for asthma and other respiratory ailments, increased injuries and fatalities from traffic accidents caused by low visibility, and expanded range of bacteria and viruses, which can be transported thousands of kilometres by dust storms (Al-Delaimy, 2020). This poses significant challenges for a region which is already grappling with high levels of air pollution (Waha *et al.*, 2017).

A final consideration at the nexus between climate and health is the well-being of the refugees and people who will be displaced by weather and hazard extremes. Migrants have increased exposure to weather extremes and are affected by heat, cold, dust storms, and drying up water sources, and are further jeopardized through structural barriers to access of healthcare (Al-Delaimy, 2020). Beyond physical challenges, researchers have also illuminated that mental health challenges will be a major outcome of climate migration, as refugees and displaced peoples face trauma, Post traumatic stress disorder (PTSD), depression, and more (Al-Delaimy, 2020).

2.4 Protection

Climate change is a major threat to protection in the Middle East.

Though the extent to which the conflict in Syria and/or the Arab Spring uprising are directly attributable to climate change is difficult to ascertain, there is no doubt that a changing climate has added numerous shocks and stressors to an already geo-politically complex and loaded region.

Stephen Cheney, of the US Department of State's Foreign Policy Board and the American Security Project, labels climate change 'an accelerant of instability' in the region (Carrington, 2016). As such, it is advantageous to look at climate change as a threat-multiplier which adds to the conditions under which vulnerable populations might be more receptive to joining uprisings and non-state armed groups (i.e. due to agricultural livelihoods ruined by drought) (Al- Delaimy, 2020). In doing so, however, it is important that practitioners not reduce the complexity of instability and conflict to a single driver. Recent literature has made the case that the links between drought and the Syrian Civil War are less straightforward than previously posited, and that practitioners and policymakers "should exercise far greater caution when drawing such linkages or when securitising climate change" (Selby *et al.*, 2017: p. 232).

with support from the ICRC

Despite the above caveats around attribution science, there is widespread research that highlights the links between climate change and conflict in the region. Included in this is the report Rising Temperatures, Rising Tensions: Climate Change and the Risk of Violent Conflict in the Middle East (IISD, 2009). It breaks down conflict concerns down into six distinct threats: 1) increased competition for scarce resources, 2) increased food insecurity, 3) decreased economic growth leading to increasing poverty and social instability, 4) increased migration flows and displacement, 5) resource scarcity-induced 'militarization of strategic natural resources,' and 6) global inaction on climate change that can jeopardize trust and relations between 'the West' and the Middle East (IISD, 2009). These are explored in more detail below.

Alongside conflict and economic imperatives, climate change will continue to be a contributing factor to historical patterns of displacement and migration in the region. Heat waves, floods, increased conflict, the creation of uninhabitable areas, decreased agricultural productivity, decreased food security, increased sand storms, and all of the accompanying health concerns will contribute to migration and displacement (Al- Delaimy, 2020). For example, disasters are estimated to have caused an additional 341 000 displacements in 2020 (IDMC, 2021), especially through floods in Yemen and wildfires, storms, and earthquakes across the region. Water scarcity has also been identified as a key driver of climate migration and displacement (Waha *et al.*, 2017). This includes mass movement to urban areas as was seen in the lead up to the Syrian conflict (Waha *et al.*, 2017). There, a severe drought caused numerous cascading effects: widespread crop failure, the death of up to 85 per cent of livestock, the decimation of agricultural livelihoods, migration to urban areas in the hundreds of thousands, and extensive food insecurity (Earth Day, 2020).

This projection of increased climate migration and displacement in the region is sobering given that both Jordan and Lebanon already have the highest refugees per capita (Al-Delaimy, 2020). In addition to the additional strain that increased migration will place on a country's infrastructure, mass migration is also a destabilizing phenomena which heightens pre-existing tensions (IISD, 2009). Again, the Syrian case serves as a powerful example of this; widespread migration in turn created the conditions for political unrest and discontent as urban areas became overcrowded and unemployment was rampant.

Then there is food insecurity. Climate-related intensification of food insecurity is a threat not just because of the mass movement that it can induce and/or mobilization for non-state armed actors that it can galvanize (Earth Day, 2020). It also increases competition for access to arable and/or productive land, thereby 'raising the stakes for the return or the retention of occupied land' (IISD, 2009). This is a development that will weigh on the region, which is already suffering political and religious splintering.

Water scarcity has already been linked to the weaponization of water and increase in conflict in the area; a trend which is likely to worsen as climate change escalates. This issue is captured succinctly in the recent analysis Drought is Leading to Instability and Water Weaponization in the MIddle East and North Africa (King & Lehanne, 2021), which explores how water scarcity impacts increased tension between states, between states and non-state armed groups, and can contribute to conditions under which citizens mobilize in mass protest of poor water management and/or situations in which large numbers of people are made ill by contaminated water (King & Lehanne, 2021). For example, ISIS leveraged fears about increased water scarcity to mobilize recruitment efforts and seize control of dams that controlled the little water that remained available (Earth Day, 2020). The term 'hydro-hegemony' has been coined to refer to the leverage that upstream states can exert on downstream states through controlling water (King & Lehanne, 2021).

with support from the ICRC
ICRC

As such, climate change portends a worsening situation for the Middle East, both in terms of water access and a deteriorating security situation. Since the 1950s, per capita water access in the region has already dropped by 85 per cent (MEI, 2019). While many climate models show regional variability and uncertainty in their projections, the fact that the Middle East region will dry up is unequivocally demonstrated in climate projections (NASA, 2016). By 2025, up to 90 million people in the region will experience water stress (Earth Day, 2020). When compounded with demographic change, doubled crop prices, and a projected 58 per cent increase in freshwater demand by 2050 (MEI, 2019), this lays the foundations for increased conflict and/or civil unrest (Earth Day, 2020). Attempts to build regional cooperation in the face of increased competition for water have been limited in their success, patchwork, and deemed 'incomplete or inequitable' (PRB, 2002).

A recent USAID study, The Intersection of Global Fragility and Climate Risks, (Moran *et al.*, 2018) examined the co-occurence of climate risk and fragility to better understand compound risk and the links between climate change and conflict. Numerous Middle Eastern countries were found to be 'highly fragile' to climate risk, whereby high numbers of their citizens live in high exposure areas. These include: 33.2 million people in Egypt, 3.8 million in Iraq, and 1.9 million in Iran. Broken down by percentage of population in high exposure areas, the Middle East again has two countries near the top of the list, including: 39 per cent of the population in Egypt and 12 per cent in Iraq. Egypt, Iraq, and Iran also have significant percentages of their populations that are in very high exposure areas. When examining overall fragility levels based on climate exposure, the Middle East fares as follows: Iraq and Yemen are in 'highest fragility' ranking, and Iran, Syria, and Egypt are listed as 'high fragility' (Moran *et al.*, 2018).

A final consideration that bears highlighting is that of the lower prioritization of climate change on the governance agendas of the region. Already beset with many conflicts and geo-political tensions, the Middle East appears to have less bandwidth to address the simmering 'long-term threat of climate disruption' that will soon explode (Earth Day, 2020). This has resulted in relatively low public awareness and scant media attention paid to what is a fast growing and compounding crisis (Al-Delaimy, 2020).

2.5 Policy

Countries in the Middle East show a genuine and vested interest in addressing climate change issues. It is evident that the region will suffer the effects of climate change and in the best interests of governments to take action. Collaboration is fundamentally important in a region such as the Middle East where the effects and severity of climate change depend on the actions of a multitude of actors. There have been several collaborations formed in the last years with the intention of managing environmental issues holistically. One such example is the League of Arab States (LAS), the organisation comprises 22 Arab States and is an umbrella group formed of specialised agencies. One of the aforementioned agencies is the Council for Arab Ministers Responsible for Environment (CAMRE). CAMRE is a mechanism which aims to facilitate regional strategies on climate change (UNDP, 2018). The organisation produced the Arab Framework Action Plan on Climate Change which has been in place over the last few years, and ended in 2020. This was a regional climate policy framework to strengthen the capacity of each member state to take appropriate measures to address climate change issues.

Alongside the League of Arab States is also the Arab Ministerial Council; they have launched two key policies focusing on water. In 2010, the Arab Water Security Strategy came about with the

scope of working between the years of 2010-2030. This was supported by the Water Strategy Implementation Plan (2016-2035) and together they both address a number of key themes:

- The development and sustainability of water resources
- Efficient and equitable water resource utilisation
- Enhanced water governance and awareness
- Economic efficiency and financial sustainability

With the support of the United Nations, the Arab Centre for Climate Change Policy (ACCCP) was established in 2018 and has five main pillars of work:

- Technical assistance and advisory services
- Capacity building and strengthening of institutions
- Regional platform and policy dialogue
- Integrated responses
- Access to regional knowledge (UN ESCWA, 2020)

All countries have submitted Intended Nationally Determined Contributions (INDC's) and joined the 2015 Paris Accord. Several countries have also now ratified the Paris Agreement and have submitted their Nationally Determined Contributions (NDC's).

A review of the state of INDCs across the Middle East reveal a broad trend of targets which are unambitious in scope, gaps in information provision (especially around emissions baselines), and untimely, unreliable objectives (Rahman & Miah, 2016). Country-specific analysis is found in Climate Action Tracker (CAT) Rankings. For example, CAT has deemed UAE progress to date 'highly insufficient,' pointing out that the scope of the targets is unambitious, that the preliminary steps that UAE had taken towards addressing climate change were waylaid by COVID, and that the current construction of a coal power plant cannot be reconciled with the Paris Agreement's 1.5°C targets (CAT UAE, 2021). In Saudi Arabia, CAT labelled progress to date 'critically insufficient,' the lowest ranking possible. Reasons for this categorization include (among others) alleged censorship of conversation around fossil fuel subsidy removal, unambitious targets, a lack of diversification away from fossil fuels, a lack of climate measures in their COVID-19 recovery plans, and a lack of provision of baseline information around emissions (CAT Saudi Arabia, 2021). Saud Arabia's lack of substantive action to address climate change is significant given that Saudi-Aramco has been identified as the company that has contributed the most global carbon emissions in the past fifty years (Climate Accountability Institute, 2019). Overall, the challenges of implementation, policy ambition, and public awareness pose difficulties in moving forward with planning and executing the next steps forward in the region (Al-Delaimy, 2020).

Though the scope and implementation of INDCs has faced significant bottlenecks in the region, there are also achievements to highlight. Overarching priorities that emerged include mitigation in the energy sector and addressing scarcity in the water sector (Rahman & Miah, 2016). This has been expressed through the submission of updated targets with more ambitious renewable energy goals (CAT Saudi Arabia, 2021). Other highlights include UAE's creation of their first major renewable energy project (a 1.2 GW solar plant) as well as their phasing out of fossil fuel subsidies through deregulating energy prices (CAT UAE, 2021). Further, there have been declining emissions and crude oil exports across the region-- though this appears to be due to COVID-19 and it remains to be seen whether these reductions will hold (CAT Saudi Arabia, 2021).

with support from the ICRC

Bahrain

The Kingdom of Bahrain has drawn upon the Special National Circumstances provision of the Paris Accord, and instead of giving clear targets, has exemplified the ways in which the country will need to take action that will have mitigation co-benefits. These actions revolve around economic diversification, Carbon Capture and Storage technologies, and a focus on renewable energies (The Kingdom of Bahrain, 2015).

Egypt

Egypt's INDC highlights several areas through which they will attempt to increase the resilience of the population. They also outline several pathways to CO2 mitigation, these include (but are not limited to) low carbon technologies and locally appropriate technology transfer. Three main areas are highlighted for Egypt to move forward:

- Stimulate mitigation actions,
- Pursue energy efficiency,
- Develop monitoring, reporting and verification systems (Arab Republic of Egypt, 2015).

Iran

Unconditional mitigation action

- Iran intends to participate by mitigating its GHGs emission in 2030 by 4 per cent compared to the Business As Usual (BAU) scenario.

Conditional mitigation action

- Here they would mitigate additional GHG emissions up to 8 per cent against the BAU scenario (i.e. 12 per cent in total) (Islamic Republic of Iran, 2015)

Iraq

The Government of Iraq announced their INDC targets in 2015, these constituted the following:

- To reduce GHGs emission by around 14 per cent from the Business As Usual (BAU) scenario over the period 2020 until 2035.
- A one percent reduction in economy-wide emissions up to 2035 via national capabilities is made on the condition that peace and security is achieved inside the country to enable the sustainable development in all national sectors.
- A further reduction of emissions by 13 per cent until the year 2035 is proposed if the required technical and financial support can be made available from International funds (ctc-n, 2015).

Israel

The INDC of Israel has proposed the following targets:

Unconditional:

- To achieve an economy-wide unconditional target of reducing its per capita greenhouse gas emissions to 7.7 tCO2e by 2030 which constitutes a reduction of 26 per cent below the level in 2005 of 10.4 tCO2e per capita. An interim target of 8.8 tCO2e per capita is expected by 2025 (The Government of Israel, 2015).

Jordan

The Hashemite Kingdom of Jordan has pledged the following targets:

Unconditional targets:

- To reduce its GHG emissions by a bulk of 14 per cent by 2030. This contribution of GHGs reduction will be unconditionally fulfilled at, maximally, 1.5 per cent by the Country's own means compared to a BAU scenario level.

Conditional target:

- To reduce its GHG emissions by an additional 12.5 per cent by 2030 (The Hashemite Kingdom of Jordan, 2015).

Kuwait

The State of Kuwait has expressed a desire to avoid an increase in greenhouse gas emissions, and move to a low carbon economy. They do not have specific targets indicated in the INDC (The State of Kuwait, 2015).

with support from the ICRC

Lebanon

The Republic of Lebanon has set both unconditional and conditional targets as follows:

Unconditional targets

- A GHG emission reduction of 15 per cent compared to the Business- As-Usual (BAU) scenario in 2030.
- 15 per cent of the power and heat demand in 2030 is generated by renewable energy sources.
- A 3 per cent reduction in power demand through energy-efficiency measures in 2030 compared to the demand under the Business-As-Usual scenario.

Conditional targets

- A GHG emission reduction of 30 per cent compared to the BAU scenario in 2030.
- 20 per cent of the power and heat demand in 2030 is generated by renewable energy sources.
- A 10 per cent reduction in power demand through energy-efficiency in 2030 compared to the demand under the BAU scenario. (The Republic of Lebanon, 2015)

Oman

The INDC for Oman states that Oman will control its expected GHG emissions growth by 2 per cent to be 88714 Gg during the period from 2020 - 2030 (The Sultanate of Oman, 2015).

Occupied Palestinian Territories (OPT)

The conditional targets as set out by the OPT are as follows:

- 24.4 per cent by 2040 relative to Business-as-Usual (conditional to their independence from Israel)
- 12.8 per cent by 2040 relative to Business-as-Usual (in the status quo scenario) (The State of Palestine, 2015)

Qatar

No clear goals or targets were provided by the State of Qatar, instead they share four pillars of work which constitute its 2030 vision. The four pillars are Human, Social, Economic, and Environmental. Their INDC outlines how they will achieve these pillars in more depth (The State of Qatar, 2015).

Saudi Arabia

In 2016 Saudi Arabia ratified the Paris Agreement and the INDC transformed in the NDC which aims to annually abate up to 130 MtCO2e (132 MtCO2e in AR4 GWPs) by 2030 through contributions that have co-benefits in diversifying the economy and mitigating GHG emissions (Kingdom of Saudi Arabia, 2015).

Syria

The Syrian Arab Republic submitted its NDC in 2018 and outlined several ambitions:

- Renewable energy production to reach 10 per cent by 2030
- Development and reshaping of the agricultural sector
- Transforming the transport sector through a number of ways, including inspections and certifications and also decreasing the import of used cars older than three years and encouraging the use of public transport
- Investing in renewable energy sectors
- Improving the solid waste sector
- Considering green architecture in the rebuilding of the housing sector and developing sustainable urban communities (The Syrian Arab Republic, 2018).

United Arab Emirates

Pledged to an increase of clean energy to 24 per cent of the total energy mix by 2021. (Government of the UAE).

Yemen

Submitted INDC in 2015, made up of two targets:

Unconditional target:

- A one percent reduction in GHG emissions by 2030 compared to a business as usual (BAU) scenario.

Conditional targets:

- An additional 13 per cent reduction achievable under certain conditions, which would bring the total GHG reduction to 14 percent below BAU emission levels by 2030 (Government of the Republic of Yemen).

with support from the ICRC

References

Abdo, R. (2014). *Drought Conditions and Management Strategies in Palestine*.

Al-Bakri, J., Suleiman, A., Abdulla, F., & Ayad, J. (2011). Potential impact of climate change on rainfed agriculture of a semi-arid basin in Jordan. *Physics and Chemistry of the Earth, Parts A/B/C*, 36(5–6), 125–134. https://doi.org/10.1016/j.pce.2010.06.001

Al-Delaimy, W. K. (2020). Vulnerable Populations and Regions: Middle East as a Case Study. In *Health of People, Health of Planet and Our Responsibility* (pp. 121–133). Springer International Publishing. https://doi.org/10.1007/978-3-030-31125-4_10

Atlantic Council. (2019). *How climate change could exacerbate conflict in the Middle East* . Retrieved July 8, 2021, from https://www.atlanticcouncil.org/blogs/menasource/how-climate-change-could-exacerbate-conflict-in-the-middle-east/

Broom, D. (2019). *How the Middle East is suffering on the front lines of climate change* | Retrieved July 12, 2021, from https://www.weforum.org/agenda/2019/04/middle-east-front-lines-climate-change-mena/

Brown, S,. Kebede, A, & Nicholls, R, . (2009). *Sea-Level Rise and Impacts in Africa, 2000 to 2100*. Southampton, UK. Retrieved from https://research.fit.edu/media/site-specific/researchfitedu/coast-climate-adaptation-library/africa/regional---africa/Brown-et-al.--2009.--SLR--Impact-in-Africa.pdf

Bucchignani, E., Mercogliano, P., Panitz, H. J., & Montesarchio, M. (2018). Climate change projections for the Middle East–North Africa domain with COSMO-CLM at different spatial resolutions. *Advances in Climate Change Research*, 9(1), 66–80. https://doi.org/10.1016/j.accre.2018.01.004

Carrington, D. (2016). *Climate change will stir "unimaginable" refugee crisis, says military*. Retrieved April 28, 2021, from https://www.theguardian.com/environment/2016/dec/01/climate-change-trigger-unimaginable-refugee-crisis-senior-military

CAT Saudi Arabia. (2021). *Saudi Arabia | Climate Action Tracker.* Retrieved July 12, 2021, from https://climateactiontracker.org/countries/saudi-arabia/

CAT UAE. (2021). *UAE | Climate Action Tracker.* Retrieved July 12, 2021, from https://climateactiontracker.org/countries/uae/

Climate Accountability Institute. (2019). *Carbon Majors*. Retrieved July 12, 2021, from https://climateaccountability.org/carbonmajors.html

Cook, B. I., Anchukaitis, K. J., Touchan, R., Meko, D. M., & Cook, E. R. (2016). Spatiotemporal drought variability in the Mediterranean over the last 900 years. *Journal of Geophysical Research: Atmospheres*, 121(5), 2060–2074. https://doi.org/10.1002/2015JD023929

ctc-n. (2015). *INDC of Iraq.* Retrieved from https://www.ctc-n.org

Earth Day. (2020). Climate change, water woes, and conflict concerns in the Middle East: A toxic mix . Retrieved April 29, 2021, from https://www.earthday.org/climate-change-water-woes-and-conflict-concerns-in-the-middle-east-a-toxic-mix/

El-Nahry, A. H., & Doluschitz, R. (2010). *Climate change and its impacts on the coastal zone of the Nile Delta*, Egypt. Environmental Earth Sciences, 59(7), 1497–1506. https://doi.org/10.1007/s12665-009-0135-0

Feitelson, E., & Tubi, A. (2017). A main driver or an intermediate variable? Climate change, water and security in the Middle East. *Global Environmental Change*, 44, 39–48. https://doi.org/10.1016/j.gloenvcha.2017.03.001

FES. (2020). *Urbanization in the MENA region: A Benefit or a Curse?:* Department for Middle East and North Africa. Retrieved July 9, 2021, from https://mena.fes.de/press/e/urbanization-in-the-mena-region-a-benefit-or-a-curse

GFDRR. (2019). Middle East and North Africa Regional Urban Resilience Conference. Retrieved July 9, 2021, from https://www.gfdrr.org/en/resilient-mena

gLAWcal. (2021). *The Impact of Climate Change on Health in the MENA Region*. Climatic Change (Vol. 137). Springer Netherlands. https://doi.org/10.1007/s10584-016-1665-6

ICRC. (2021). Where we Work. Retrieved June 30, 2021, from https://www.icrc.org/en/where-we-work

with support from the ICRC

IDMC. (2021). Internal Displacement in a Changing Climate . Retrieved July 13, 2021, from https://www.internal-displacement.org/sites/default/files/publications/documents/grid2021_idmc.pdf

IISD. (2009). *Rising Temperatures, Rising Tensions Climate change and the risk of violent conflict in the Middle East Acknowledgements.* Retrieved from https://www.iisd.org/system/files/publications/rising_temps_middle_east.pdf

Kandeel, A. (2017). *Climate Change: The Middle East Faces a Water Crisis*. Retrieved July 12, 2021, from https://www.mei.edu/publications/climate-change-middle-east-faces-water-crisis

Karami, N. (2019). The Modality of Climate Change in the Middle East: Drought or Drying up? *The Journal of Interrupted Studies*, 2(1), 118–140. https://doi.org/10.1163/25430149-00201003

Kelley, C. P., Mohtadi, S., Cane, M. A., Seager, R., & Kushnir, Y. (2015). Climate change in the Fertile Crescent and implications of the recent Syrian drought. *Proceedings of the National Academy of Sciences*, 112(11), 3241–3246. https://doi.org/10.1073/PNAS.1421533112

Kibaroglu, A., & Scheumann, W. (2013). Evolution of transboundary politics in the Euphrates-Tigris river system: New perspectives and political challenges. *Global Governance: A Review of Multilateralism and International Organizations,* 19(2), 279-305.

King, M., & Lehanne, R. (2021). Drought is leading to instability and water weaponization in the Middle East and North Africa . Retrieved July 13, 2021, from https://www.preventionweb.net/news/view/77581

Lange, M. A. (2019). Impacts of Climate Change on the Eastern Mediterranean and the Middle East and North Africa Region and the Water–Energy Nexus. *Atmosphere*, 10(8), 455. https://doi.org/10.3390/atmos10080455

Lazard. (2018). Levelized cost of energy and levelized cost of storage 2018.

Lelieveld, J., Proestos, Y., Hadjinicolaou, P., Tanarhte, M., Tyrlis, E., & Zittis, G. (2016). Strongly increasing heat extremes in the Middle East and North Africa (MENA) in the 21st century. *Climatic Change*, 137(1–2), 245–260. https://doi.org/10.1007/s10584-016-1665-6

Makris, C., Galiatsatou, P., Androulidakis, Y., & Kombiadou, K. (2018). *Climate change impacts on the coastal sea level extremes of the east-central Mediterranean Sea*. Retrieved July 12, 2021, from https://www.researchgate.net/publication/325226261_Climate_change_impacts_on_the_coastal_sea_level_extremes_of_the_east-central_Mediterranean_Sea

MEI. (2021). Key environmental challenges facing the Middle East . Retrieved July 12, 2021, from https://www.mei.edu/publications/key-environmental-challenges-facing-middle-east

MEI. (2019). Freshwater Resources in the MENA Region: Risks and Opportunities | Middle East Institute. Retrieved April 29, 2021, from https://www.mei.edu/publications/freshwater-resources-mena-region-risks-and-opportunities

Moran, A., Busby, J. W., Raleigh, C., Smith, T. G., Kishi, R., Krishnan, N., & Wight, C. (2018). *THE INTERSECTION OF GLOBAL FRAGILITY AND CLIMATE RISKS*. Retrieved from https://pdf.usaid.gov/pdf_docs/PA00TBFH.pdf?mc_cid=9a663aa12f&mc_eid= per cent5BUNIQID per cent5D

NASA. (2016). Drought in Eastern Mediterranean Worst in 900 Years | NASA. Retrieved April 29, 2021, from https://www.nasa.gov/feature/goddard/2016/nasa-finds-drought-in-eastern-mediterranean-worst-of-past-900-years

PRB. (2002). *Finding the Balance: Population and Water Scarcity in the Middle East and North Africa* – Retrieved April 29, 2021, from https://www.prb.org/findingthebalancepopulationandwaterscarcityinthemiddleeastandnorthafrica/

Rahman, S. M., & Miah, M. D. (2016). INTENDED NATIONALLY DETERMINED CONTRIBUTIONS FROM THE MIDDLE EAST AND NORTH AFRICA. *GEOGRAPHY, ENVIRONMENT, SUSTAINABILITY*, 9(4), 92–100. https://doi.org/10.24057/2071-9388-2016-9-4-92-100

RICCAR. (2017). *ARAB CLIMATE CHANGE ASSESSMENT REPORT EXECUTIVE SUMMARY Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region.* Retrieved from http://www.riccar.org/sites/default/files/2018-07/RICCAR-Executive Summary-online_1.pdf

Salimi, M., & Al-Ghamdi, S. G. (2020). Climate change impacts on critical urban infrastructure and urban resiliency strategies for the Middle East. *Sustainable Cities and Society,* 54. https://doi.org/10.1016/J.SCS.2019.101948

Selby, J., Dahi, O. S., Fröhlich, C., & Hulme, M. (2017). Climate change and the Syrian civil war revisited. *Political Geography*, 60, 232–244. https://doi.org/10.1016/J.POLGEO.2017.05.007

with support from the ICRC

Sowers, J., Vengosh, A., & Weinthal, E. (2011). Climate change, water resources, and the politics of adaptation in the Middle East and North Africa. *Climatic Change*, 104(3–4), 599–627. https://doi.org/10.1007/s10584-010-9835-4

Tagliapietra, S. (2019). The impact of the global energy transition on MENA oil and gas producers. *Energy Strategy Reviews,* 26, 100397. https://doi.org/10.1016/j.esr.2019.100397

The Arab Republic of Egypt. (2015). *INDC for The Arab Republic of Egypt*. Retrieved from https://www4.unfccc.int/sites/submissions/indc/Submission Pages/submissions.aspx

The Government of Israel. (2015). I*NDC for Israel*. Retrieved from https://www4.unfccc.int/sites/submissions/indc/Submission Pages/submissions.aspx

The Government of The Republic of Yemen. (2015). *INDC's for the Republic of Yemen.* Retrieved from https://www4.unfccc.int/sites/submissions/indc/Submission Pages/submissions.aspx

The Government of the United Arab Emirates. (2015). *INDCs of the United Arab Emirates.* Retrieved from https://www4.unfccc.int/sites/submissions/indc/Submission Pages/submissions.aspx

The Hashemite Kingdom of Jordan. (2015). *INDC for the Hashemite Kingdom of Jordan.* Retrieved from https://www4.unfccc.int/sites/submissions/indc/Submission Pages/submissions.aspx

The Islamic Republic of Iran. (2015). *INDCs for the Islamic Republic of Iran.* Retrieved from https://www4.unfccc.int/sites/submissions/indc/Submission Pages/submissions.aspx

The Kingdom of Bahrain. (2015). *INDC for the Kingdom of Bahrain.* Retrieved from https://www4.unfccc.int/sites/submissions/indc/Submission Pages/submissions.aspx

The Kingdom of Saudi Arabia. (2015). *NDC for the Kingdom of Saudi Arabia,*. Retrieved from https://www4.unfccc.int/sites/submissions/indc/Submission Pages/submissions.aspx

The Republic of Lebanon. (2015). *INDCs for the Republic of Lebanon.* Retrieved from https://www4.unfccc.int/sites/submissions/indc/Submission Pages/submissions.aspx

The State of Kuwait. (2015). *INDC for the State of Kuwait*. Retrieved from https://www4.unfccc.int/sites/submissions/indc/Submission Pages/submissions.aspx

The State of Qatar. (2015). *INDC for the State of Qatar.* Retrieved from https://www4.unfccc.int/sites/submissions/indc/Submission Pages/submissions.aspx

The Sultanate of Oman. (2015). *INDC for the Sultanate of Oman.* Retrieved from https://www4.unfccc.int/sites/submissions/indc/Submission Pages/submissions.aspx

The Syrian Arab Republic. (2018). *NDC for the Syrian Arab Republic.* Retrieved from https://www4.unfccc.int/sites/submissions/indc/Submission Pages/submissions.aspx

Thornton, P. K., van de Steeg, J., Notenbaert, A., & Herrero, M. (2009). The impacts of climate change on livestock and livestock systems in developing countries: A review of what we know and what we need to know. *Agricultural Systems*, 101(3), 113–127. https://doi.org/10.1016/j.agsy.2009.05.002

UN ESCWA. (2020). *Assessing Climate Change Impacts in the Arab Region*.

UNDP. (2018). Climate Change Adaptation in the Arab States: Best Practices and Lessons Learned. Retrieved from https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwj1g_JTWjaXwAhWOQs0KHbPBBWQQFjABegQIBBAD&url=https per cent3A per cent2F per cent2Fwww.undp.org per cent2Fcontent per cent2Fdam_per cent2Fundp per cent2Flibrary per cent2FClimate per cent2520and per cent2520Disaster per cent2520Resilience per cent2FClimate per cent2520Cha

UNDP. (2010). *Mapping of Climate Change Threats and Human Development Impacts in the Arab Region*. Retrieved from https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjT6JfejaXwAhWEZ80KHc-UAEEQFjABegQIBBAD&url=https per cent3A per cent2F per cent2Fwww.arabstates.undp.org per cent2Fcontent per cent2Frbas per cent2Fen per cent2Fhome per cent2Flibrary per cent2Fhuma_development per cent2Fmapping-of-climate-change

UNESCO-EOLSS. (n.d.). *Middle East Meteorology* . Retrieved April 29, 2021, from http://webcache.googleusercontent.com/search?q=cache:ACZbcl41w5IJ:iprc.soest.hawaii.edu/users/yqwang/Middle-east-meteorology.doc+&cd=13&hl=en&ct=clnk&gl=ca

with support from the ICRC

Waha, K., Krummenauer, L., Adams, S., Aich, V., Florent Baarsch, •, Dim Coumou, •, … Change, R. E. (2017). Climate change impacts in the Middle East and Northern Africa (MENA) region and their implications for vulnerable population groups. *Regional Environmental Change*. https://doi.org/10.1007/s10113-017-1144-2

World Bank. (2018). *World Development Indicators* | DataBank. Retrieved April 29, 2021, from https://databank.worldbank.org/reports.aspx?source=world-development-indicators

World Bank. (2021). *Middle East & North Africa* . Retrieved April 29, 2021, from https://climateknowledgeportal.worldbank.org/region/middle-east-north-africa/climate-data-historical

World Bank Group. (2016). *High and Dry: Climate Change, Water, and the Economy.* Washington: World Bank, Washington, DC. https://doi.org/10.1596/K8517

World Economic Forum. (2019). *How the Middle East is suffering on the front lines of climate change* | World Economic Forum. Retrieved April 29, 2021, from https://www.weforum.org/agenda/2019/04/middle-east-front-lines-climate-change-mena/

World Resource Institute. (2021). *Aqueduct Country Ranking*. Retrieved July 12, 2021, from https://www.wri.org/applications/aqueduct/country-rankings/

Zittis, G., Hadjinicolaou, P., Almazroui, M., Bucchignani, E., Driouech, F., El Rhaz, K., … Lelieveld, J. (2021). Business-as-usual will lead to super and ultra-extreme heatwaves in the Middle East and North Africa. *Npj Climate and Atmospheric Science*, 4(1), 1–9. https://doi.org/10.1038/s41612-021-00178-7

with support from the ICRC