K4D Knowledge, evidence and learning for development

# Climate change risks and opportunities in the Middle East and North Africa

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## Question

*What are some of the climate change risks and opportunities in the Middle East and North Africa, including for mitigation, adaptation and resilience?*

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# 1. Summary

**Climate change is likely to compound existing development challenges in the Middle East and North Africa (MENA), particularly the water crisis and the high dependence on food imports** (Patel et al., 2016). Projected climate change trends include rising temperatures and extreme heat, increasing uncertainty in rainfall and water availability, sea level rises and an increase in extreme events including droughts, floods, storm surges and dust storms.

**The region's agricultural sector, important for both livelihoods and national economies will be negatively affected in a number of ways.** These include reductions in crop yields, shorter growing periods, and negative impacts on livestock such as change in disease vectors. Approximately, 70% of the region's agriculture is rain-fed, making it vulnerable to changes in rainfall and heat.

**Water scarcity is a defining challenge in the region and a driver of the region's reliance on food imports.** Renewable water resources are over-exploited and depleted: per capita availability is below the 1000 $m^3$ (the threshold below which a country is facing water scarcity) in most countries, with the exception of Iraq, Oman, Syria, and Lebanon (Waha et al., 2017). Transboundary water resources play an important role in many of the countries with the potential for tensions over rivers such as the Nile, the Tigris-Euphrates and the Jordan.

**Water stress in the region is not simply a matter of scarcity, but of poor management and governance.** Drivers such as population growth are also increasing water demands. Unmanaged trade-offs in the water-energy-food nexus are also contributing to the over-exploitation of water resources (World Bank, 2018).

**Despite a huge renewable energy potential across the region, there is an extremely high reliance on hydrocarbons for energy.** In 2015, fossil fuel energy consumption represented 97.38% of total energy consumed (Avis, 2020). The region's countries can be roughly split into three groups: oil-producers (e.g. Saudi Arabia), non-oil producers (e.g. Morocco) and conflict-affected countries (e.g. Iraq, Yemen and Syria), some of whom also have oil reserves. As a broad generalisation, the non-oil producing states import fossil fuels for electricity production from the oil-producers. Per capita energy emissions across the region are high due to drivers such as lifestyle and consumption patterns, and population growth.

**The water-energy-food nexus is extremely important in the region.** A high dependence on food imports is a key coping strategy for water scarcity. Approximately 50% of domestic wheat and barley supply, 70% of rice consumption and 60% of corn consumption are met through imports (Waha et al., 2017). Reliance on food imports makes the region vulnerable to price shocks on global markets and the impacts of climate change on agriculture in other regions. Simultaneously, the agriculture sector is the region's biggest water user: 85% of total water withdrawals are for agriculture. Both water and energy are heavily subsidised. Consequently, measure to make resource use more effective may need to be accompanied by targeted social protection measures (Schaar, 2019).

**Climate change may contribute to migration and could act as a threat multiplier in the region.** For example, sea level rises in Alexandria, Egypt, could lead to people having to leave their homes, whilst, migration from rural households may be influenced by climate change impacts on agriculture and the viability of rural livelihoods (Durrell, 2018). Whilst migration is

multi-causal, Durrell (2018) argues that the influence of climate change on migration is already apparent in the region. For example, evidence links drought in Syria between 2007 and 2010 with mass migration to urban centres, exacerbating a number of factors that contributed to unrest (Kelley et al., 2015).

## Mitigation, adaptation and resilience opportunities

**Opportunities for mitigation, adaptation and resilience include:**

- **Strengthen adaptive capacity:** effective institutions are crucial for adaptive capacity. Potential pathways to support institution building include supporting cross-sectoral coordination to implement water-energy-food nexus plans. Support for rural livelihoods can help to strengthen the rural households and communities adaptive capacity. Potential strategies include livelihood diversification, research and development for climate smart agriculture, access to insurance services and microfinance, and, circular economy solutions e.g. water re-use.
- **Regional natural resource management:** potential areas for support include establishing or strengthening transboundary natural resource agreements, and supporting the development of a regional approach to climate change. There is a school of thought within the evidence base around 'blue peace', whereby strengthening water cooperation in the region could also further regional peace.
- **Renewable energy:** developing the region's solar and wind energy potential could decrease the vulnerability of existing energy systems, increase electricity production and meet increasing energy demand. Development of renewable energy could support low-carbon growth in the region, whilst exploring energy trade with Europe could benefit the region through job creation, whilst helping Europe decarbonise its electricity system.
- **Finance:** there is an identified need for adaptation finance and concessional finance in the region. Over 80% of climate finance from international public finance flows supports mitigation, largely in the form of funding for renewable energy (Patel et al., 2016; ECSWA, 2019). However, adaptation is a key priority amongst Arab states (ESCWA, 2019).

## Challenges

**Elements of the region's political economy may pose challenges for realising the above opportunities.** These include the confluence of crises the region is facing: water crisis, climate crisis and a security crisis (Schaar, 2019). The three crises cannot be understood in isolation from each other and the links between the three are complex, diverse and multi-directional (Schaar, 2019). Other key elements include:

- **The role of military and security elites in power structures and the economy:** with the exception of Tunisia, where the military do not play a leading role, across the region military and security elites are heavily involved in both political and economic structures.
- **The region's reliance on hydrocarbons:** oil revenues are falling and climate change mitigation efforts across the globe could lead to a further decline in oil markets. This could be both a risk and an opportunity as a shift away from fossil fuels to renewable energy could threaten elites' political and economic interests. But, there is a potential for this to open up new avenues for dialogue as elites shift to retain their power.

- **Varying civic space:** there is limited civic space across the region to debate climate and environment issues. Whilst some countries have more established civil society and non-governmental organisations who play a role in debates, others have repressed environmental activism and targeted activists.
- **Covid-19:** the impacts of the pandemic pose immediate risks to economic recovery and stability in the region. For example, Jordan's near-term growth prospects have been substantially weakened due to Covid-19.

**Evidence base**

This rapid literature review draws on peer reviewed, practitioner and grey literature. Sources were identified during general searches including 'climate change *MENA *sector' and 'adaptation *MENA'. Some sources were also identified through snowballing. This review found a relatively large evidence base related to the water crisis in MENA and climate change trends in the region, as well as a relatively large evidence base related to the region's political economy. Potential evidence gaps identified by the searches undertaken for this review include: climate finance flows in the region; and, green growth and low carbon growth, aside from renewable energy potential, in the peer reviewed literature. More targeted searches are needed to ascertain whether these are indeed evidence gaps. Nature-based solutions were not considered in this study as the author was aware an independent assessment study has been commissioned.

# 2. Climate change trends

**Climate impact scenarios are generally more serious in MENA, when compared to other regions** (Schaar, 2019; Waha et al., 2017). Climate change trends include (Schaar, 2019; UNDP, 2018; Waha et al., 2017):

- **Rising temperatures and extreme heat:** projected sharp increase in the number of warm days and nights and more days of extreme heat: the warm spell duration index could reach 200 days if global greenhouse gas (GHG) emissions continue at the current level. By 2099, unusual heat extremes will occur in 30-65% of the summer months almost everywhere across the MENA region, and temperatures could reach nearly 50°C. Parts of Algeria and Iraq could be 8°C warmer than they are now. Under a 2°Celsuis (C) of global warming scenario (hereafter 2°C scenario), the number of consecutive hot days is projected to increase in several capital cities in the MENA region: from four days to about two months in Amman, from eight days to about three months in Baghdad and from one day to two months in Damascus. Parts of the region could become uninhabitable for humans and cities will feel an increasing urban heat island effect[1].
- **Increasing uncertainty in rainfall and water availability:** under a 2°C scenario, countries along the Mediterranean, notably Morocco, Algeria and Egypt are projected to receive substantially less rain. There could be up to a 20% reduction in rainfall, which combined with higher rates of evaporation will reduce water availability. There has been

[1] Heat island effect is where metropolitan or urban areas are hotter than the rural areas surrounding them.

an increase in meteorological drought since the 1960s, consistent with the region's overall drying trend.

- **Water availability:** annual water discharge is projected to drop by 15-45% under a 2°C scenario, and up to 75% under a 4°C scenario. Water availability is projected to decrease across the region throughout the 21st century, with the exception of the southernmost areas. Mountain areas in Morocco, Algeria, Lebanon, Syria, Iran, Iraq and Turkey play an important role in the region's water supply as they generate large amounts of run-off. Reductions in snowfall and snow water storage, combined with peak flows of melt water shifting towards earlier months will negatively impact downstream river systems and water availability. Runoff is projected to decrease in the Eastern Anatolian mountains by 25-55% under a 4°C warming scenario.
- **Desertification:** changes in temperature, precipitation and extreme events may contribute to desertification as climate change interacts with local conditions and other drivers.
- **Sea level rise:** projections of sea level rise range from 0.35 metres to an upper bound of 1 metre. Libya, Morocco, Tunisia and Egypt are vulnerable, with Egypt likely to be the most severely affected.
- **Extreme events**: increase in extreme drought conditions across the region, with increases in the number of drought days. One study suggests there could be more than 6 months per year with at least moderate drought conditions on average in 2080-2100 under a 4°C warming scenario. Storm surges are projected to become more intense with up to 50% of the coastal population of Yemen at greater risk of storm surges and potential GDP losses across the region of USD 12.7 billion by 2100 due to storm intensification. Increases in intense rainfall events, particularly in the southern part of the region, Oman and Yemen, could lead to increased flood events with related life and economic losses. Dust and sand storms could also increase.

# 3. Key sectors and climate change risks

## Agriculture

**Climate change may negatively affect agricultural production in a number of ways including shifting vegetation and agricultural zones northwards, shortening growing periods, and reducing crop yields** (Waha et al., 2017). Meta-analysis of peer reviewed studies and scenario modelling suggest a significant correlation between crop yield decreases and temperature increases (Waha et al., 2017). Crop yields are projected to decline by 30% under 1.5-2 °C warming scenario, with legumes and maize crops excepted to be the most affected in both the Maghreb and the Mashrek by mid-century (Waha et al., 2017). Livestock will also be negatively affected in various ways including changes in the length of the grazing season, additional heat stress, and changes in disease and disease vectors: herders in northeast Syria lost almost 85% of their livestock due to drought between 2005 and 2010 (Waha et al., 2017).

**The region's agricultural sector is important for both livelihoods and economies.** The sector employs more than 35% of the region's population and contributes 13.5% to the region's GDP against a global average of 3.2% (Durrell, 2018; Waha et al., 2017). Approximately 70% of agriculture is rain-fed (Waha et al., 2017). The region is vulnerable to temperature and

precipitation changes: most of the region receives less than 300 mm of annual rainfall, whilst the lower limit for rain-fed agriculture is 200-300 mm (Waha et al., 2017). This has associated consequences for food security and livelihoods (Durrell, 2018; Waha et al., 2017). Most agriculture takes place in the semi-arid climate zones close to the coasts or in the highlands (Waha et al., 2017).

## Water

**Water scarcity is a defining challenge in the region.** The World Bank (2018) estimates that 60% of the population live in areas with high or very high surface water stress with reduced available amounts of water for immediate use, e.g. drinking or irrigation. Per capita availability is below 1000 $m^3$ (the threshold below which a country is facing water scarcity) in most countries, with the exception of Iraq, Oman, Syria, and Lebanon (Waha et al., 2017). The World Bank estimate that economic losses from climate related water scarcity could be up to 6% of GDP by 2050 due to impacts on agriculture, health and incomes. Jordan is ranked as the second water-poorest country globally, whilst increasing desertification driving by, amongst others, overgrazing and inefficient irrigation techniques, has reduced land suitable for grazing by 70% in the past three decades (IMCCS, 2020).

**Renewable resources are over-exploited and depleted.** For example, the Nile and Jordan rivers are 'closed rivers': there is no unallocated water. Many aquifers are over-exploited, far beyond natural replenishment rates. Withdrawal-to-availability ratios exceed a critical threshold of 40% in all MENA countries except Lebanon; they exceed 100% in Jordan, the Republic of Yemen, Libya and most of the Arab peninsula countries leading to groundwater resource depletion (IMCCS, 2020).

**Transboundary water resources play an important role in the region's water supplies.** For example, the Tigris and Euphrates rivers account for 98% of Iraqi water supply for drinking, sanitation and irrigation (IMCCS, 2020). As the Mesopotamia Basin receives between 150-300 mm of rainfall annually but experiences 1,500- 2,500 mm of evaporation per year, it is estimated that 92% of Iraq's total surface area is subject to desertification, while 100 $km^2$ of fertile land are lost each year because of salinization (IMCCS, 2020). Transboundary rivers have been sources of regional tension, including downstream riparian countries' concerns over dam development plans by upstream riparian countries.

**Water stress in the region is not simply a matter of scarcity, it is also linked to poor management and governance**. For example, agricultural policies in Syria have encouraged the depletion of groundwater supplies, exacerbating the impacts of climate-induced droughts (Kelley et al., 2015). Per capita water use is high, with some parts of the Gulf Cooperation Council countries having the highest per capita water consumption rates in the world, whilst having some of the biggest gaps between renewable water supplies and demand.

**Increasing consumption, paired with undervalued water, inadequate governance arrangements, and weak enforcement is leading to the depletion of water resources**—especially groundwater—at an unprecedented rate (World Bank, 2018). Competition between different water uses is growing. Unmanaged trade-offs in the water-energy-food nexus are also contributing to an over-exploitation of water resources (World Bank, 2018). Climate change will have negative pressures on water availability and in this context, the World Bank (2018) argues that urgent action is needed to allocate and use water more wisely. However, there is little

predictive data on changes in sectoral uses of water and the literature on water competition between agriculture and other sectors is limited to the use of grey water (Tull, 2020). Wastewater, particularly water pollution due to industrial pollution, is a problem in the region and could be harmful to human health, environmental security and food security (Keulertz, 2019). In 2016, Israel closed its Ashkelon desalination plant for several days due to sewerage from Gaza (Bromberg & Giordano, n.d.).

**Many water utilities and water service providers in the region's conflict-afflicted countries (Syria, Iraq, Yemen and OPTs), as well as Lebanon and Jordan, home to large refugee influxes, have been unable to continuing delivering water.** Diep et al. (2017) outline a number of challenges utilities and service providers in Lebanon, Jordan, Yemen, Syria, Iraq and Palestine face, including lack of revenues, lack of contingency plans and stocks of water chemicals.

## Energy

**The political economy of energy in MENA characterised by** (Avis, 2020):

- the availability of large supplies in conventional oil and gas resources;
- the pivotal role played by hydrocarbon wealth in many MENA oil and gas producers' economic development since the 1960s and 1970s;
- the particular social contract in many MENA countries where energy has, for many decades, been considered a public good to be provided by governments, if not for free, then at prices that have in many cases been merely a fraction of their price in any other international market for most of these countries' modern histories.

**$CO_2$ emissions are high in MENA for a number of reasons including lifestyle and consumption patterns.** For example, per capita emissions in many MENA countries are 60% higher than the average among developing countries (Patel et al., 2016). $CO_2$ emissions reached a historic high in 2018 (Schaar, 2019). The same socioeconomic trends driving GHG emissions are also driving water demand (SEI, 2012). The oil-producing countries of the region have the highest energy consumption per capita, the highest energy subsidies and the lowest level of renewable energy use (Schaar, 2019).

**Whilst there is growing investment in renewables (e.g. solar power in Morocco), the use of fossil fuels remains high.** Estimates suggest that in 1971 fossil fuel energy consumption represented 95.08% of total regional energy consumption; this peaked in 2008 at 98.71%. As of 2015 fossil fuel energy consumption represented 97.38% of total energy consumed, highlighting the limited uptake of alternative fuel sources (Avis, 2020). For a fuller discussion of energy issues in MENA, see Avis' (2020) rapid literature review.

## The water-energy-food nexus

**Food imports, abstraction of groundwater, wastewater reuse and desalination are the key regional coping strategies for water scarcity** (Waha et al., 2017). Water scarcity prevents MENA countries from producing all their food domestically and increases reliance on food imports (Waha et al., 2017). There is a high dependence on food imports across the region: approximately 50% of domestic wheat and barley supply, 70% of rice consumption and 60% of

corn consumption are met through imports (Waha et al., 2017). Imports may intensify with population growth, which makes the region vulnerable to price shocks on global markets and harvest failures in other world regions (Waha et al., 2017). Climate change may also have implications for nutrition as it could reduce the nutrient content of staple foods (Durrell, 2018). For a fuller discussion of food security in the region see Tull (2020).

**The concept of virtual water was developed in relation to the MENA region** (Allan, 2001). Allan (2001) argues that the MENA region ran out of water in the 1970s and ran out of water for self-sufficiency in the 1950s: virtual water, water imported in food, has met MENA food needs and is a potential solution to the water crisis in MENA. However, the viability of depending on virtual water is likely to be affected by political economy factors and also assumes that MENA countries will continue to have the economic resources to pay for growing food imports.

**In many MENA countries, the agriculture sector is the biggest water consumer:** 85% of total water withdrawals are for agriculture and irrigation systems are approximately 46% efficient (IMCCS, 2020). Increasing water efficiency in the sector (e.g. better irrigation) could help to save water, but will need to be placed within an enabling agricultural/irrigation policy framework.

**Desalination is used to meet water needs in a number of countries but it can use large amounts of energy and contribute to GHG emissions.** Over 46% of the world's desalination capacity is in MENA and countries across the region rely on desalinated water to varying extents (World Bank, 2018). There is a need to reduce the environmental cost of water production at desalination plants, including water loss minimisation and efficient energy usage (World Bank, 2012). Solar powered desalination is a potential solution to these problems (World Bank, 2012).

**Water and energy markets are heavily subsided** (Waha et al., 2017). Efforts to make resource use more sustainable (or adapt to falling revenues in the oil-producing countries) by employing price instruments and reducing subsidies, carries the risk of social unrest if they are not accompanied by targeted social protection measures to counter the risk of increased vulnerability (Schaar, 2019).

**High population growth and increasing urbanisation is increasing pressure on water and land, and increasing food, energy and water demands.** Population growth of about 2% annually is predicted to lead the region's population to double by 2070-2080 (IMCCS, 2020; Waha et al., 2017). The region's urban population is expected to double by 2050, to nearly 400 million (IMCCS, 2020). Population growth, migration and urbanisation will increase food and water demands and could increase dependency on food imports and vulnerability to agricultural shocks outside the region (IMCCS, 2020; Waha et al., 2017).

## Health

**Climate change may increase waterborne disease incidence, dengue fever, and morbidity and mortality due to extreme heat and extreme weather events** (Waha et al., 2017). High temperatures can cause heat stress, heat exhaustion, and heat stroke, with the elderly, the young and people with existing medical conditions the most vulnerable (Waha et al., 2017). Ahmadalipour & Moradkhani (2018) project that mortality risk for people aged over 65 years caused by excessive heat stress across the MENA region will increase in the distant future (up to 2100) by 8-20 times higher than that of the historical period (1951-2005) if no mitigation is implemented. This can be limited to 3-7 times higher if global warming is limited to 2 °C

(Ahmadalipour & Moradkhani, 2018). The coastal regions of the Red sea, Persian Gulf, and Mediterranean Sea indicate substantial increase in mortality risk (Ahmadalipour & Moradkhani, 2018). Air pollution, already a significant health burden, could increase due to heat extremes (Waha et al., 2017).

## Coastal zones

**The human population in the MENA region as well as agricultural, industrial and other economic activities tend to be concentrated in coastal zones** (Waha et al., 2017). The population of MENA's coastal cities was approximately 60 million people in 2010, but the number is expected to reach 100 million by 2030 (Waha et al., 2017). Key impacts of climate change in coastal zones include slow-onset sea level rise, floods and damage caused by extreme events such as storms and storm surges, saltwater intrusion into coastal aquifers and increased erosion (Waha et al., 2017). Coastal aquifers in Tunisia, Egypt and Israel are already suffering from saltwater intrusion due to over-extraction and reductions in recharge: sea level rises will aggravate saltwater intrusion, salinization of groundwater, rising water tables and impeded soil drainage (Waha et al., 2017).

**Egypt is particularly vulnerable as the Nile Delta and Mediterranean coast is responsible for at least 30-40% of the country's total agricultural production** (IMCCS, 2020). Moreover, 30% of the labour force works in the agricultural sector, predominately in the Nile Delta (IMCCS, 2020). Up to one-third of Egypt's fish catches take place in the Nile Delta lagoons and would be negatively impacted by salinization (IMCCS, 2020). A 0.5 m rise in sea level in Alexandria, Egypt, could force 1.5 million of the city's population to leave their homes (Durrell, 2018). Across MENA, cities and urban areas are a migration destination, but climate change impacts could lead to urban dwellers migrating.

## Migration

**Histories of mobility and migration in the MENA region include pastoralism and more recently migration to the Gulf Cooperation Council countries and from North Africa to Europe** (Durrell, 2018; Waha et al., 2017)**.** For example, an estimated 36% of international migrants in the MENA region are from other MENA countries with the top countries of origin being the Occupied Palestinian Territories (OPTs), Syria and Egypt (Durrell, 2018). Climate change may disrupt traditional patterns of mobility within the region (Waha et al., 2017).

**Whilst migration is multi-causal and many interconnected factors influence the decision to migrate, studies of the MENA region are beginning to link migration and climate change, particularly due to water scarcity** (Waha et al., 2017; Durrell, 2018). UNDP (2018) argue that displacement could become more likely in some parts of the Arab world due to tensions over shared resources under conditions of scarcity; drought; desertification; and climate change-induced changes to water and land availability. Writing across the MENA region as a whole, Durrell (2018) argues that the influence of climate change of migration flows and displacement is already apparent and it is generally accepted that climate-induced migration will increase as climate change intensifies. One particular pathway linking climate change impacts and migration argues that migration from rural households may increase as impacts are felt on the viability of agriculture, ecosystems and rural livelihoods (Durrell, 2018).

**Resource-sharing should be incorporated into reconciliation and reconstruction arrangements** (Schaar, 2019). The MENA region is home to large internally displaced persons (IDP) and refugee populations, including from Iraq, Syria and Yemen. Schaar (2019) argues that there is the potential for localised resource tensions when IDPs or refugees return home. Currently, the ongoing political process for conflict resolution in Yemen does not include water.

### Stability

**Climate change may act as a threat multiplier in the region, however, establishing a direct causal link is challenging** (Waha et al., 2017). Kelley et al. (2015) argue that the drought in Syria between 2007 and 2010 contributed to the conflict in Syria as widespread crop failures were one driver of mass migration of farming families to urban centres, exacerbating a number of factors that contributed to unrest. However, it is important to note that rural communities' vulnerability to drought was increased by government agricultural policies which led to the overuse of and reduced supplies of groundwater (Kelley et al., 2015). There are a number of other examples from the region linking water and climate impacts with social unrest or tensions. These include the 2008 food crisis in Egypt; local perceptions in Lebanon's Bekka Valley link Syrian refugees with tensions around scarce water resources; and in Egypt in April 2018, farmers in the Nile Delta held demonstrations after the government imposed a sudden ban on water-intensive irrigated rice crops (Schaar, 2019; UNDP, 2018).

**Climate change could in certain contexts and under certain circumstances exacerbate existing tensions and influence other causal factors that increase the risk of conflict** (Schaar, 2019). For example, a potential pathway could be: climate change impacts communities already suffering water stress, increasing competition over water resources, which could add to existing tensions (Schaar, 2019). Climate change acts on many fronts and one event can trigger a cascade of responses, many indirect and hard to predict consequences of climate change may occur (UNDP, 2018). In fragile states, the convergence of conflict and climate change can create new forms of social vulnerability (UNDP, 2018).

## 4. Opportunities: mitigation, adaptation and resilience pathways

### Strengthen adaptive capacity

**Adaptive capacity is the ability of societies to change, reduce risks and protect the population** (Schaar, 2019). It is derived from having the right institutions, knowledge, technology, infrastructure, economic resources, and level of equity (Schaar, 2019). The MENA region is extremely diverse and adaptive capacity varies enormously within the region (Waha et al., 207). In terms of economic resources, GDP per capita ranges from USD 1,400 in Yemen in 2013, to more than USD 20,000 in the oil-rich Gulf states in 2013 (Waha et al., 2017). Potential examples of strong adaptive capacity in the region include Tunisia's move towards a new social contract following the 2011 Arab Spring. Mahmoud & Suilleabhain (2020) argue that effective institutions, including social norms related to tolerance and accommodation, and, the civic and political engagement of a well-organised and vibrant civic society (including women's associations) have helped the country to move towards a new social contract despite a number of potential flashpoints.

**Institutions and governance**

**Well-established and effective institutions are crucial for building higher levels of resilience to climate change impacts and climate change shocks and mobilising adaptive capacity** (Waha et al., 2017; Schaar, 2019). Institutions can help to resolve conflicts linked to resource scarcity and competition (Schaar, 2019). Adaptive capacity can be strengthened through institution-building, providing access to resources and increasing political stability (Schaar, 2019). Governance is also important for adaptive capacity with relevant features including: the quality of governance (e.g. voice and accountability), absence of violence, political stability, government effectiveness, regulatory quality, rule of law and control of corruption (Schaar, 2019).

**Institutions already weakened by conflicts or crisis have less capacity to build resilience to climatic changes and extreme events** (Waha et al., 2017). The depth of changes related to conflict or crisis, such as population displacement, infrastructure destruction and economic damage, may determine if climate-induced stress escalates into a severe crisis (Schaar, 2019).

**Both adaptation and mitigation are urgently needed – and that to be effective, they cannot be undertaken in isolation, but rather must be mainstreamed into countries' development strategies** (SEI, 2012). Cross-sectoral (inter-ministerial) coordination will be important (SEI, 2012). Integrated Ministries of Water and Energy, such as in Lebanon, could have the potential to implement nexus plans and tackle climate change (SEI, 2012). SEI (2012) recommend periodic review of national adaptation plans to incorporate new information and to build integrated, cross-sectoral solutions. Existing strategies need to be implemented through corresponding action and investment plans (SEI, 2012). Mainstreaming climate change adaptation in conjunction with poverty alleviation, development and environment planning will be complicated in countries dealing with instability (SEI, 2012). Drought and flood preparedness plans are also needed.

**Levels of ambition in existing climate policies and Nationally Determined Contributions (NDCs) vary by country grouping** and often reflect the dominant role of hydrocarbons in the region, although Syria, Libya and Yemen do not have NDCs (Schaar, 2019):

- **Oil-producers:** brief NDCs with limited details or quantitative targets. Climate policies are anchored in a framework of diversifying their economies to reduce dependence on volatile oil export revenues. The Gulf Cooperation Council aim to reduce GHG emissions by increasing energy efficiency using available technologies and pricing policies to encourage savings. There are ambitious plans for wind and solar infrastructure, particularly in UAE. [Note: Iraq's NDC is only in Arabic.]
- **Non-oil producers:** Morocco and Tunisia have set a high level of ambition, clarity of strategy and concrete targets for energy efficiency, renewable energy and climate adaptation. These actions will help to tackle challenges related to climate change impacts on water availability and agricultural productivity as well as dependence on fossil fuel imports. The two countries have enacted legislation to anchor their climate policies. In Tunisia this is framed within the new 2014 constitution, and Morocco has established special constitutional provisions. Both countries have created institutions to promote and regulate the expansion of renewable energy, in Morocco's case providing a platform for the ambition to play an international role.

**Rural livelihoods**

**Small farmers play a major role in MENA's food security and supporting viable small farming communities is important from a national perspective to protect food security** (IMCCS, 2020). Smallholders produce a large proportion of the region's domestic supply of staple foods and are extremely vulnerable to the adverse impacts of climate change of rain-fed agriculture (IMCCS, 2020).

**Devastation caused by extreme weather events such as droughts, floods and storms can undermine the long-term adaptive capacity of rural households and communities** as the destruction of productive assets can erode the possibility of long-term recovery and the ability to strengthen resilience against future shocks and the progressive deterioration of environmental conditions (Durrell, 2018). For example, floods in Yemen in 2008 increased the poverty rate and resulted in a 15% rise in the number of hungry people (Durrell, 2018).

Durrell (2018) argues that investments are needed now to strengthen resilience and maintain rural livelihoods, helping communities to prepare for and recover from immediate weather shocks such as drought, and also adapt to shifting climatic conditions over the medium to longer term. Durrell's (2018) resilience strategy paper for CGIAR embraces migration as a form of climate change adaptation, where appropriate, to help reduce pressures in climate-vulnerable areas.

**Strategies to support vulnerable rural populations include livelihood diversification and community-based resilience.** Lessons learned from UNDP's (2018) work in the Maghreb, Mashreq and other Arab states include that providing populations with access to adapted financial services such as Weather Index Insurances (WII) linked with microfinance services can support rural populations to become more resilient to climate induced damage.

**Potential pathways recommended in the literature include climate smart agriculture and working on integrated approaches to the water-energy-food nexus.** Innovations in the region include (IMCCS, 2020):

- **Research and development (R&D) into drought and heat-resistant and salt-tolerant crops**: organisations such as the Dubai-based International Centre for Biosaline Agriculture are developing breeds of grass, date palms and vegetables that can withstand high temperatures.
- **The Sahara Forest project:** located in Jordan's Wadi Araba desert, the project aims to 'roll-back' rapid desertification whilst addressing food and energy shortages. Solar power is used to desalinate seawater to grow crops, with the irrigation run-off used to afforest barren lands.

Some innovative solutions have been piloted in response to Covid-19. For example, in Egypt, UN-Habitat is using riverbank filtration technology to extend affordable safe water access to vulnerable communities at high risk of Covid-19 infection as part of its response in the region (UN-Habitat, 2020).

## Regional natural resource management

**Establishing transboundary natural resource management agreements and navigating the potential obstacles to reaching those agreements would be a way to increase adaptive**

**capacity in the immediate future** (Schaar, 2019). Addressing climate change challenges through regional institutions would recognise the interlinkages between climate-related change and security risks (Schaar, 2019). How these challenges are framed and conceptualised would define what actions could be taken (Schaar, 2019).

**A regional approach to climate change could also tackle a number of other areas.** For example, regional coordination of climate information services and climate impact projection; food security through regional trade, coordination of market information, shared food stocks and dedicated funds; energy security through connecting sub-regional electrical grids; and marine pollution and degradation in the Gulf (SEI, 2012; Schaar, 2019). A regional approach could also open up new finance options and enhanced access to global climate funds (SEI, 2012).

### Regional water cooperation

**Attempts to strengthen water cooperation have been challenging in the past due to water being a politicised and securitised issue** (Schaar, 2019)**.** The water and climate crises are mostly transboundary and require states to act together, but the prioritisation of narrow security interests means states have accorded weak mandates to regional institutions in the past, which has prevented agreement on shared challenges (Schaar, 2019). For example, there is still no Tigris-Euphrates water sharing agreement, despite a number of efforts since the 1920s; the League of Arab States has downgraded its draft framework convention on shared water resources management to a set of guiding principles as the framework has never been concluded and agreed. Without a political process with security-building objectives, it may be difficult to constructively address needs for joint natural resource management (Schaar, 2019).

**However, water could also support furthering regional peace.** Jordan and Israel view their bilateral water cooperation in terms of national security: water security is essential for national stability in Jordan and Jordan's stability is seen as critical for national security in Israel (Bromberg & Giodano, n.d). Ecopeace, an NGO that brings together Israel, Jordan and the OPTs around water security issues, argues that the water-energy nexus can also advance stability, linking Jordan and Israel's renewable energy potential with Israel's desalination capabilities (Israel already sells desalinated water to Jordan at a reduced price to help it meet its own needs and the needs of Syrian refugees to support Jordan's internal stability) (Bromberg & Giordano, n.d.)[2]. The NGO also argues that moving forward on water issues in the Israeli-Palestinian peace negotiations could help to rebuild public trust that peace is possible. Due to desalination, Israel has overcome its water constraints and Ecopeace argues that this means that changing water sharing allocations with the OPTs would not involve reducing Israel's water availability.

## Renewable energy

**Developing the region's solar and wind energy potential could decrease the vulnerability of existing energy systems, increase electricity production and meet increasing energy demand.** Energy demand is estimated to increase by 5% per annum in the region (Avis, 2020) due to drivers including population growth, economic development and the increased need for

[2] For more information see https://ecopeaceme.org/projects/water-the-peace-process/

cooling as temperatures rise. Estimates suggest the region's renewable energy potential could be up to 100 times the electricity demand of MENA and Europe combined**.**

**The World Bank argues there is potential for energy trade between North Africa and Europe[3].** It asserts that the costs of importing clean power from North Africa, particularly Morocco, which has a large solar and wind potential and an existing 1,400 MW transmission link with Spain, are minimal. It could also benefit the region through job creation. Algeria already exports gas to the EU, so there is a history of power trade. Benasla et al.'s (2019) peer reviewed study argues that North Africa's solar resources could play an important role in helping the EU to decarbonise its electricity system and meets its energy targets in a cost-effective way.

**Transition to renewable energy in the region, as well as a global transition away from fossil fuels could create a 'peace dividend'** as geopolitical risks related to contested hydrocarbon reserves in the region diminish (IMCCS, 2020). However, if MENA countries are unprepared for the economic diversification needed to transition from fossil fuel dependence, IMCCS (2020) argue there could be the potential for instability.

**Renewable energy and low carbon growth**

**Morocco aims to reduce energy import dependency by achieving 52% of its installed capacity by 2030** (Kharbach & Chfadi, 2018). Morocco is a net energy importer: in 2013, energy import (oil, gas and coal) accounted for around 90% of national energy consumption (Kharbach & Chfadi, 2018). The country's electricity sector is responsible for the highest share of energy consumption in the country (Kharbach & Chfadi, 2018). Fuel import dependency means that the country is sensitive to increases in international fuel prices and it puts a heavy fiscal burden on the national budget (Kousksou et al., 2015). Kharbach & Chfadi's (2018) modelling suggests hydropower in Morocco could substitute for the electricity produced by coal in the short-term but not in the long run. Morocco has a large solar and wind energy production potential, which could help the country to not only reduce its GHG emissions but also pursue low carbon growth meeting its predicted large rises in energy demand and achieving secure energy supplies whilst reducing the country's energy bill (Kousksou et al., 2015).

**Working across the water-energy nexus**

**In the MENA context, adaptation is essentially about water (including water for food), while mitigation is about energy, and a nexus approach to water and energy planning could lead to smarter, more resilient development solutions** (SEI, 2012). By addressing water and energy together, planners can identify crucial interactions, conflicting demands and potential synergies (SEI, 2012). Water and energy are closely interconnected. For example, desalination technologies can be energy-intensive and increase $CO_2$ emissions, whilst some low-carbon energy solutions require large amounts of energy (SEI, 2012).

**A nexus approach will require a robust scientific framework complemented by tools and consolidated databases to help decision-makers understand how man-made systems**

[3] For more information see: https://blogs.worldbank.org/energy/renewable-energy-export-import-win-win-eu-and-north-africa

**interact with one another and with nature, and how they can be co-managed** (SEI, 2012). The resulting solutions may serve both adaptation and mitigation, such as combining wastewater treatment and reuse with energy production from sludge. Or they may simply avoid negative impacts, as with carbon-neutral solar desalination (SEI, 2012). For example, Lebanon has large untapped renewable energy potential and it could address water and energy needs and climate change simultaneously through technologies such as solar desalination and water storage that co-produces hydropower and irrigation water (SEI, 2012).

## Finance

**It is hard to determine exact climate finance flows into the region but estimates suggests that MENA receives limited flows, with 84% of approved climate finance for the region supporting renewable energy between 2003 and 2016** (Patel et al., 2016; ESCWA, 2019). A 2019 Economic and Social Commission for Western Asia review of climate finance in the Arab region found that Arab states received USD 4.6 billion out of USD 33.3 billion in bilateral, regional and other flows in 2016, with half of this being concessional loans (ESCWA, 2019)[4]. The main recipient countries have been Egypt, Qatar, Morocco, Tunisia and Jordan. The region receives limited flows from the UN Framework Convention on Climate Change financial mechanisms including the Green Climate Fund (GCF), Least Developed Countries Fund (LDCF), the Special Climate Change Fund (SCCF), the Global Environment Facility (GEF) and the Adaptation Fund. In 2018 and 2019, Bahrain and OPT were awarded GCF projects: only 4 countries in the region have received GCF funding (ESCWA, 2019). Between 2003 and 2016, seven MENA countries, including Libya, OPTs and UAE, received no climate finance at all (Patel et al., 2016).

**The largest proportion of public international climate finance flows into the region has come from the Clean Technology Fund (CTF).** The CTF is a multi-donor trust fund channelled through certain multilateral development banks including the World Bank Group. Between 2003 and 2016, the CTF approved support for nine projects: six in Morocco and Egypt and three regional projects to the value of USD 816 million (Patel et al., 2016). The largest project is a concessional loan for the Noor II and III Concentrated Solar Power (CSP) Project in Morocco, approved in 2014 by the CTF (Patel et al., 2016). This project is part of a concerted push by the CTF to scale-up the deployment of CSP technology across the region (Patel et al., 2016). The CTF's MENA Region CSP initiative is supporting the development of 960 MW of new CSP capacity across Egypt, Tunisia, Morocco, Jordan and Libya, with Algeria participating in technical assistance[5]. The CTF argues that CSP can contribute to energy security, climate change mitigation, regional integration and generate employment through technology transfer and local manufacturing.

**The region needs more adaptation and grant finance** (ESCWA, 2019). Between 2003 and 2016, over 83% of climate finance for MENA was for mitigation (Patel et al., 2016). ESCWA (2019) found that loans exceeded grants by 5 to 1, and Arab LDCs received only 2% of flows to the region despite their obvious need; from a sector perspective 74% of flows were for energy,

[4] ESCWA covers Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Mauritania, Oman, State of Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, Tunisia, United Arab Emirates and Yemen

[5] For more information see: https://www.climateinvestmentfunds.org/country/middle-east-and-north-africa-region

transport, and infrastructure and 14% for water and sanitation projects. There is also the suggestion that the quantity and quality of climate finance flows to Arab states is not consistent with nationally determined priorities (ESCWA, 2019). Whilst private climate finance is increasing globally, it will not necessarily be suitable to meet the need for concessional and grant finance, and for adaptation finance in the Arab states (ESCWA, 2019).

**Adaptation is the priority for Arab states** (ESCWA, 2019). MENA countries received USD 822 million in adaptation finance in 2018 through either direct multilateral development bank (MDB) funding or MDB co-financing for projects funded through the multilateral climate funds, compared to USD 3489 million for mitigation (EBRD, 2019). The largest share of adaptation finance went to crop and food production related projects and the largest share of mitigation finance went to renewable energy (EBRD, 2019).

**Arab states face a number of barriers to accessing the UNFCCC's dedicated climate funds.** These include:

- **Complex and lengthy processes**: accreditation for public national entities can take up to 27 months, and it takes 22 months from submitting a proposal to getting approval. Complicated procedures can stop countries with limited institutional abilities from accessing funds.
- **Country cap limit** by the Adaptation Fund: three Arab countries have already reached their cap by implementing only one project.
- **Projects financed by GEF need to be in line with the fund's priority**, fall within the country allocation, and contribute to global environmental goals. GEF gives more importance to the type of projects and the country's capacity to manage the funds rather than to the vulnerability of the country to climate change.

**ESCWA (2019) recommends a number of actions that could help Arab states to negotiate, mobilise and efficiently target climate finance flows.** These include: adopting a needs-based approach to identify and evaluate unmet financing needs; conducting economic costing to identify potential efficiencies and trade-offs of policy options; evaluating targeted opportunities for private sector engagement; identifying national priority climate finance needs that are not well suited to private sector engagement to help ensure efficient allocation of scarce public and international resources to national priorities; and strengthening the integration of climate actions into national and sectoral planning processes. Potential innovative finance mechanisms, such as ecosystem services, green bonds and *sharia*-compliant green sukuk (investments in renewable energy or other environmental assets), results-based financing and debt for climate swaps could help to mobilise additional financial resources (ESCWA, 2019). However, ESCWA (2019) argue these instruments cannot and should not replace public international climate finance flows.

The UN Climate Change Secretariat's Needs-based Finance Initiative is being operationalised in the Arab States through the WEGO-UN Climate Change Regional Collaboration Centre, Dubai[6].

[6] For more information see https://worldgreeneconomy.org/arab-states-climate-finance-mobilization-access-strategy/

It aims to deliver regional clarity in mobilisation and access of climate finance to support identified needs.

# 5. Challenges

## Confluence of crises

**MENA faces a confluence of crises (water, climate change, and security) that need to be addressed together** (Schaar, 2019). Complex conflicts stand in the way of addressing the water and climate crises in MENA (Schaar, 2019). The water crisis is exacerbated by climate change and may fuel conflict, while insecurity is an obstacle to dealing with other pressing issues (Schaar, 2019). The three crises cannot be understood in isolation from each other and the links between the three are complex, diverse and multi-directional (Schaar, 2019).

Internal strife focuses attention on immediate military security threats and the need for protection from violence, away from the water and climate crises, while draining states and societies of their capacity to deal with the new risks (Schaar, 2019). The growing reliance on food imports adds more complexity as the region's internal stability is linked to secure natural resources management and political stability elsewhere, as well as the expectation that growing import costs can be met (Schaar, 2019).

## Role of elites

**Military and security elites play a role in power structures and economies across the region.** Many political orders across the region are authoritarian and security-driven (Schaar, 2019). Tunisia is an exception in the region as the military has never played a leading role and did not attempt to protect the Ben Ali regime during the Arab Spring (Schaar, 2019). In Egypt, the military owns a number of companies that have secured government contracts, and the value of Military Inc. is estimated to be between 5 and 40% of the economy (Schaar, 2019). In Iran, credit institutions under the control of the Islamic Revolutionary Guard represent one quarter of all banking activity (Schaar, 2019). High military spending is also a distinguishing feature of the region (Schaar, 2019).

## Reliance on hydrocarbons

**The exploitation of fossil fuels is central to many economies in the MENA region** (Patel et al., 2016)**.** MENA is home to 57% of the world's proven oil reserves and 41% of its proven natural gas resources, although these are not distributed equally (Patel et al., 2016).

**Declining oil prices and revenue since 2014 has potential implications for the social contract in some MENA states** (Muasher, 2018)**.** It is also reducing the amount of financial support oil-producing countries give to non-oil producing countries (Muasher, 2018). Prior to Covid-19 oil prices were already falling and estimates suggests that as demand contracts due to the pandemic they will not regain pre-pandemic price levels in 2020. Algeria's reliance on hydrocarbon revenues to fund the government and finance large public subsidies has come under increasing pressure since 2014 due to falling oil prices, which have impacted fiscal and export revenues (Cordesman, 2020). Conversely low oil prices may be good for the oil-importing

countries of the region. For example, in Tunisia a sharp reversal of recent oil price dynamics would exacerbate current account and fiscal pressures (Cordesman, 2020).

**Climate change and further decline in oil markets due to a surge in renewable energy investments could undermine the economic interests of the elite and ultimately the political order** (Schaar, 2019). The realisation of the situation by elites could potentially open new avenues for dialogue and policy debate (Schaar, 2019).

## Varying civic space

**There is limited space for citizens to debate climate and environment issues in some MENA countries and governments can interpret environmental activism as a threat which needs to be repressed** (Schaar, 2019). For example, activists have been targeted in both Egypt and Iran, while in UAE public discussion of the sovereign wealth fund that is based on oil revenue is prohibited (Schaar, 2019). In Egypt, dependence on the hydrocarbon sector for government revenue and to fulfil domestic energy demand, shapes the attitudes towards energy and environmentalism amongst both the ruling elite and the wider public (Orrnert, 2020).

**However, it is important to remember that the region is diverse and there is more potential for civil society action in some countries than others**. In Algeria, protests against fracking have been met with some concessions and a counter-narrative by the government (Schaar, 2019). Orrnert's (2020) review of environmental engagement in the MENA, specifically Egypt, Lebanon, Libya, Morocco, Tunisia, Turkey, and the OPTs found that country context and local dynamics shape the barriers and drivers of environmental engagement in the region. For example, in Lebanon, environmentalism can be seen as a way to transcend political divides (Orrnert, 2020).

**Vertical social structures are favoured over horizontal structures or civil society organisations** (Schaar, 2019). Allocative systems for the distribution of resources in oil-producing countries mean that incentives for accountability, such as to taxpayers, are absent (Schaar, 2019).

## Covid-19

**Covid-19 also poses immediate risks to economic recovery and stability in the region,** For example, Jordan's near-term growth prospects have been substantially weakened due to Covid-19 (Cordesman, 2020). Covid-19 is also exacerbating the situation in Iraq, which faces a difficult fiscal crunch due to the collapse in oil prices and persistent political and social turmoil (Cordesman, 2020). Predictions for Iraq include a budget deficit of 19% of GDP by end of 2020, which would lead to a severe financing gap with potential ramifications including postponing infrastructure projects for service delivery sectors, postponing human capital programmes, and reducing the country's ability to respond to post-Covid-19 recovery needs (Cordesman, 2020).

# 6. References


Ahmadalipour A, Moradkhani H. (2018). Escalating heat-stress mortality risk due to global warming in the Middle East and North Africa (MENA). *Environment International, 117, pp. 215-225*. doi:10.1016/j.envint.2018.05.014

Allan, J.A. (2001). *The Middle East Water Question: Hydropolitics and the Global Economy*. London, United Kingdom: I B Tauris.

Avis, W. (2020). The use of fossil fuels in the Middle East and North Africa. K4D Helpdesk Report. Brighton, UK: Institute of Development Studies. https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/15165

Benasla, M., Hess, D., Allaoui, T., Brahami, M., Denaï, M. (2019). The transition towards a sustainable energy system in Europe: What role can North Africa's solar resources play? *Energy Strategy Reviews, 24, pp. 1-13*. https://doi.org/10.1016/j.esr.2019.01.007.

Bromberg, G. & Giordano, G. (no date). *The Water Security Concept- Challenges and Opportunities for Cooperation in the Middle East.* Ecopeace. https://ecopeaceme.org/wp-content/uploads/2017/06/Water_Security_Brief.pdf

Cordesman, A. (2020) *The Greater Middle East: From the 'Arab Spring' to the 'Axis of Failed States'*. Washington DC: Center for Strategic and International Studies. https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/200824_MENA_Axis_Failed_States.pdf

Diep, L., Hayward, T., Walnycki, A., Husseiki, M. & Karlsson, L. (2017). *Water, crises and conflict in MENA: how can water service providers improve their resilience?* IIED working paper. IIED, London. http://pubs.iied.org/10846IIED

Durrell, J. (2018). *Investing in resilience: addressing climate-induced displacement in the MENA region*. Beirut, Lebanon: International Center for Agricultural Research in the Dry Areas (ICARDA). https://repo.mel.cgiar.org/handle/20.500.11766/8760

ESCWA. (2019). *Climate Finance in the Arab Region: Technical Report.* Lebanon: ESCWA. https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/climate_finance_in_the_arab_region_technical_report.pdf

European Bank of Reconstruction and Development (EBRD, 2019). *Joint Report on Multilateral Development Banks' Climate Finance.* https://www.ebrd.com/documents/climate-finance/-2018-joint-report-on-multilateral-development-banks-climate-finance.pdf

International Military Council on Climate and Security (IMCCS). (2020). *The World Climate and Security Report 2020*. Center for Climate and Security, an institute of the Council on Strategic Risks. https://imccs.org/wp-content/uploads/2020/02/World-Climate-Security-Report-2020_2_13.pdf

Kelley, C., Mohtadi, S., Cane, M., 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 of the United States of America, 112. 11, pp. 3241-3246, https://doi.org/10.1073/pnas.1421533112*

Kharbach, M., Chfadi, T. (2018). Oil prices and electricity production in Morocco. *Energy Strategy Reviews, 22, pp. 320-324*. https://doi.org/10.1016/j.esr.2018.10.006.

Kousksou, T., Allouhi, T., Belattar, M., Jamil, A., El Rhafiki, T., & Zeraouli, Y. (2015). Morocco's strategy for energy security and low-carbon growth, *Energy, 84, pp. 98-105*. https://doi.org/10.1016/j.energy.2015.02.048.

Keulertz, M. (2019). *Water and Food Security Strategies in the MENA Region*. MENARA Future Notes, 18. https://www.iai.it/en/pubblicazioni/water-and-food-security-strategiesmena-region

Mahmoud, Y., & Ó Súilleabháin, A. (2020). Improvising Peace: Towards New Social Contracts in Tunisia. *Journal of Intervention and Statebuilding*, *14*(1), 101-118. https://www.tandfonline.com/doi/full/10.1080/17502977.2019.1629377?casa_token=n4g4Xt8qAvYAAAAA:1UICisIrlRU4MRgSEKmUKj1Y2Slkcy7DsR61_WDS6sajpJJkNlav9p-K-32HmP6-1TeSWEHI-qk

Muasher, M., (2018). The next Arab uprising: The collapse of authoritarianism in the Middle East. *Foreign Affairs, 97. 6*. https://carnegieendowment.org/2018/10/16/next-arab-uprising-collapse-of-authoritarianism-in-middle-east-pub-77512

Orrnert, A. (2020). Drivers and barriers to environmental engagement in the MENA region. K4D Helpdesk Report 832. Brighton, UK: Institute of Development Studies. https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/15498

Patel, S., Watson, C & Schalatek, L. (2016). *Climate Finance Regional Briefing: Middle East and North Africa.* Climate Funds Update. London: ODI. https://www.odi.org/sites/odi.org.uk/files/resource-documents/11042.pdf

Schaar, J. (2019). *A Confluence of Crises: On Water, Climate and Security in the Middle East and North Africa.* SIPRI Insights on Peace and Security. https://www.sipri.org/sites/default/files/2019-07/sipriinsight1907_0.pdf

Stockholm Environment Institute (SEI). (2012). *Climate Change, Water and Energy in the MENA Region: Why a 'Nexus' Approach is Crucial for Mitigation and Adaptation*. Discussion Brief. https://www.weadapt.org/sites/weadapt.org/files/legacy-new/placemarks/files/5346a76a180215346569c12093sei-db-2012-mena-climate-nexus.pdf

Tull, K. (2020). The projected impacts of climate change on food security in the Middle East and North Africa. K4D Helpdesk Report 764. Brighton, UK: Institute of Development Studies. https://opendocs.ids.ac.uk/opendocs/bitstream/handle/20.500.12413/15166/764_MENA_food_security.pdf?sequence=1&isAllowed=y

UNDP. (2018). *Climate Change Adaptation in the Arab States: Best practices and lessons learned.* UNDP & GEF. Bangkok: UNDP.

UN-Habitat. (2020). *UN-Habitat Covid-19 Response Plan.* Nairobi, Kenya: UN-Habitat. https://unhabitat.org/sites/default/files/2020/04/final_un-habitat_covid-19_response_plan.pdf

Waha, K., Krummenauer, L., Adams, S. *et al.* (2017). Climate change impacts in the Middle East and Northern Africa (MENA) region and their implications for vulnerable population

groups. *Regional Environmental Change, 17, pp. 1623–1638*. https://doi.org/10.1007/s10113-017-1144-2

World Bank. (2012). *Renewable Energy Desalination: An Emerging Solution to Close the Water Gap in the Middle East and North Africa*. Washington, DC: World Bank. http://documents1.worldbank.org/curated/en/443161468275091537/pdf/730700PUB0EPI001200pub0date09026012.pdf

World Bank. (2018). *Beyond Scarcity: Water Security in the Middle East and North Africa.* Washington, DC: World Bank. https://openknowledge.worldbank.org/bitstream/handle/10986/27659/211144ov.pdf?sequence=3&isAllowed=y

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