



NATO Parliamentary Assembly

SCIENCE AND TECHNOLOGY
COMMITTEE

FOOD AND WATER SECURITY IN
THE MIDDLE EAST AND NORTH AFRICA

SPECIAL REPORT

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* Maria Martens was appointed acting Special Rapporteur after the previous Special Rapporteur Osman Askin Bak was named Minister of Youth and Sports of Turkey at the end of July 2017.

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I. INTRODUCTION

1. The Middle East and North Africa (MENA) has descended into turmoil since 2010/2011 – a period that also coincided with regional drought. At the 2016 Warsaw Summit, NATO made clear that transatlantic security is “deeply affected by the security situation in the Middle East and North Africa” (NATO, 2016). Daesh* and other extremist groups have struck Allied territory with vicious terrorist attacks. Large numbers of refugees and migrants have fled the region for neighbouring countries and Europe. Other threats and challenges loom, including trafficking of small arms and light weapons, the proliferation of weapons of mass destruction and their means of delivery as well as threats against maritime security and energy supplies. Consequently, NATO emphasised “the need to do more to achieve lasting calm and an end to violence”, as “Peace and stability in this region are essential for the Alliance”.
2. The NATO Parliamentary Assembly (NATO PA) continues to follow this security related issue in 2017¹. This report examines the water and food security in the MENA region.
3. For many years, the Science and Technology Committee (STC) has underlined that natural resource constraints should be a concern for the transatlantic community. Food security² and water security³ are factors that can contribute to the stability of the MENA region. The last time the Committee examined these issues comprehensively was in 2011 . Since then, the STC has focused heavily on the security related impacts of climate change, which is likely the most crucial negative factor impacting food and water security over the long term. Climate change is one of the most critical and difficult challenges of the 21st century. In 2015, the NATO PA recognised that climate change-related risks are significant threat multipliers, including through their impact on food production and water resources. This report aims at contributing to the efforts on highlighting climate related security risks.
4. Food and water shortage is a critical issue in the MENA region like in many parts of the world. In fact, for most countries in the region, food and water security are related to national security. This should come as no surprise, given the fact that the region has the lowest per capita availability of water and arable land in the world.
5. The report first examines food and water shortages and their relations with international security. Second, the report presents a snapshot of the status of food and water security globally. Third, it hones in on food and water security in the MENA region. Fourth, it looks at mitigation and adaptation strategies for the region. Last, the report concludes with preliminary thoughts and recommendations on the way forward.

* Arabic acronym of the terrorist organisation “Islamic State in Iraq and Syria”

¹ The Committee on the Civil Dimension of Security has drafted a report on The War in Syria and Iraq: Humanitarian Aspects [157 CDS 17 E] and the Political Committee a report on Tackling the Challenges from the South [171 PCNP 17 E].

² At the 1996 World Food Summit, food security was defined as a situation in which “all people, at all times, have physical and economic access to sufficient, safe and as nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2006).

³ Water security is defined as “the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability” (UN Water 2014b). However, there is no negotiated and internationally accepted legal definition.

II. THE STATE OF GLOBAL FOOD AND WATER SECURITY: A SNAPSHOT

6. Achieving food and water security remain a critical challenge worldwide. Both are therefore rightly at the heart of the United Nations' (UN) new 2030 Agenda for Sustainable Development. When the Agenda was launched in 2015, the international community had made profound progress on reaching the targets set under the previous Millennium Development Goals process. Unfortunately, much work needs to be done to further increase food and water security worldwide.

7. In the 21st century, several macro-scale trends are putting immense pressure on states and societies, including on food and water security: climate change; global warming; desertification and drought; land degradation; environmental degradation; increasing resource demand; population growth; uneven economic development and inequality; urbanisation; and changes in consumer preferences (for example greater consumption of meat and increased water use. To illustrate just one of these pressures, the unprecedented pace of urbanisation, with a projected 66% of the world population living in cities by 2050 (UNDESA, 2014), will have a considerable impact on food and water security. As cities grow, potential cropland is being diverted into urban development; and water, a key resource for agricultural production, is becoming scarcer because of increasing domestic and industrial use (Szabo, 2016).

8. The UN estimates that more than 40% of the global population is already affected by water scarcity and that "by 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two-thirds of the world's population could be living under water stressed conditions" (UN Water, 2014a). Water demand is set to rise significantly. A recent World Bank report estimates that "within the next three decades, the global food system will require between 40 to 50% more water; municipal and industrial water demand will increase by 50 to 70%; [...] the energy sector will see water demand increase by 85%; and the environment, already the residual claimant, may receive even less" (The World Bank Group, 2016). Unless the international community and individual states find workable solutions, demand will exceed today's sustainable water supplies by 40% in 2050 (The World Bank Group, 2016).

9. At the moment, more than 793 million people are undernourished, the Food and Agriculture Organisation (FAO) estimates. The UN Department of Economic and Social Affairs (UNDESA) estimates that world population could reach 9.7 billion by 2050. As the world will need to nourish more than 2 billion additional people by then, food production will come under severe strain. While growth in population and overall consumption levels will slow compared to previous decades, the World Bank estimates that until 2050, "the world needs to produce at least 50% more food" (Alexandratos and Bruinsma, 2012; The World Bank, *Food Security*).

10. However, among macro-scale trends affecting the world today, climate change is perhaps the "ultimate threat multiplier" (Adelphi et al., 2015). It will likely lead to local resource competition; livelihood insecurity and migration; extreme weather events and disasters; volatile food prices; sea-level rise and coastal degradation; and unintended consequences of climate adaptation policies and behaviors. For example, climate change would negatively affect agricultural production, on which the livelihood of 78% of the world's poor depends (The World Bank, 2016a). Crop yields could be cut by 25% (see also Figure 1).

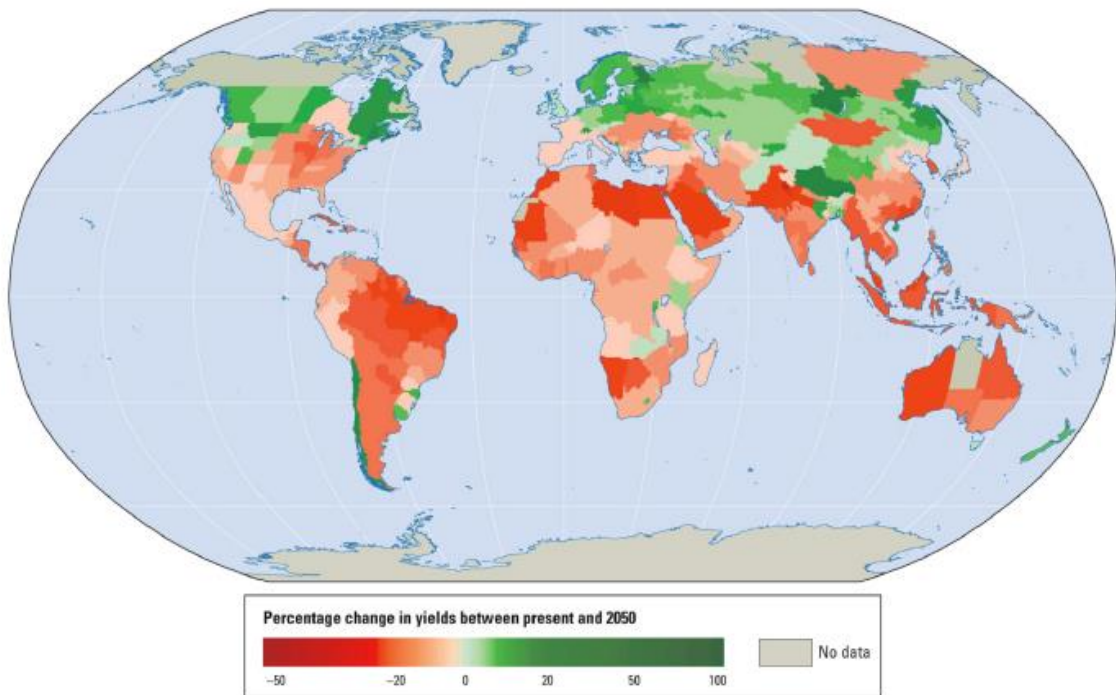
III. FOOD, WATER AND SECURITY

11. No clear academic consensus exists on the precise nature and significance of the interconnections between natural resource scarcity and international security. Food and water shortages may become interconnected with international security in five negative ways. (It should be noted that food and water insecurity can also be a driver for cooperation and institutional and technological innovation.)

12. **Humanitarian crises:** Acute food and water insecurity all too regularly strikes parts of the globe. Such humanitarian crises – often in countries suffering from difficult internal circumstances – require outside help from the international community. In February 2017 for example, a famine was formally declared by the UN in parts of South Sudan – the first since 2011 (UN News Centre, 2017). The country’s civil war and an economy in freefall have left about 100,000 people at risk of starvation. Another million South Sudanese are on the brink of famine. Parts of Nigeria, Somalia and Yemen also remain at risk. The last officially declared famine in Somalia left more than 250,000 people dead (Ford, 2013).

Figure 1: Projected Impacts on Crop Yields in a 3°C Warmer World (World Resources Institute, 2013)

Figure 3.2.1: Projected Impacts on Crop Yields in a 3°C Warmer World

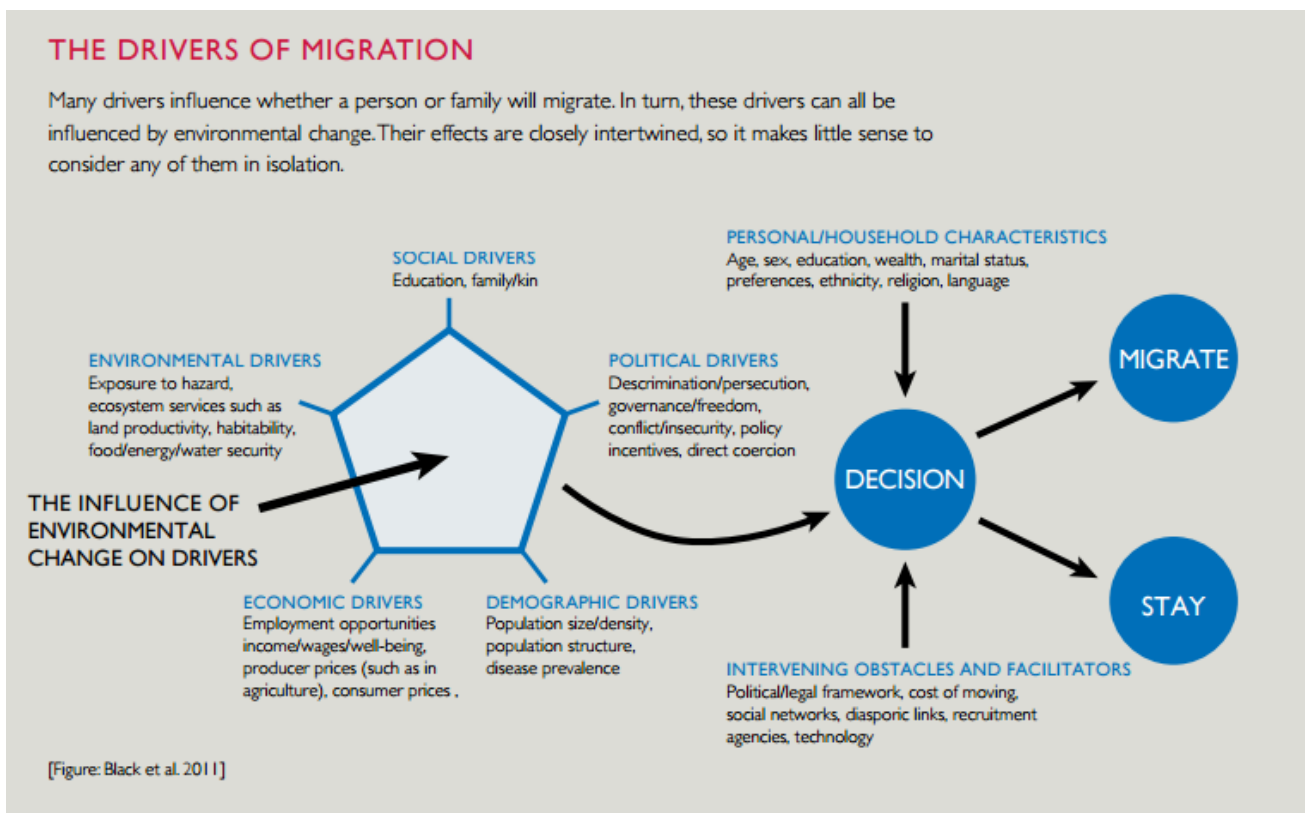


Source: WRI 2013.

Note: -50% change = half as productive in 2050 as in 2015; +100% change = twice as productive in 2050 as in 2015.

13. **Migratory pressures:** Individual decisions to migrate are complex (see Figure 2), but food and water insecurity can be a key factor in such decisions.⁴ The world is currently witnessing the largest migration flows since the Second World War. The UN High Commission for Refugees (UNHCR) estimates that 65.3 million people worldwide were forcibly displaced at the end of 2015 (the last year with complete data), including 21.3 million refugees. While developing countries host about 86% of the world’s refugees, Europe saw a large surge of migrants and refugees in recent years (UNHCR). Between October 2014 and October 2015, more than 875,000 people sought asylum in Europe (The Economist’s Data Team, 2016). In 2016, the number of refugees and migrants arriving in Europe fell to 370,000, but the crisis is far from over. Indeed, Turkey is still host to more than three million refugees and asylum seekers (Batha, 2016).

Figure 2: The Drivers of Migration (US Agency for International Development and Woodrow Wilson Center, 2016)⁵



14. **Intra-state conflict:** Food and water insecurity do not by themselves cause domestic unrest that could lead to the destabilisation of countries. However, deteriorating food and water security can trigger (violent) domestic disputes *in combination* with other factors, such as eroding socio-economic conditions, lack of functioning institutions and political oppression. For example, the domestic upheavals of the Arab Spring had deep roots, including negative economic outlook, social inequalities and political disenfranchisement (Adelphi, *ECC Factbook*).

⁴ It should be noted that migration flows have been part of livelihood strategies throughout history and that rural migration is often temporary or circular, driven not only by socio-economic insecurity but also by individual aspirations. Consequently, population mobility can also provide opportunities, including the reduction of pressure on local labour markets generating higher wages for the rural population remaining in place; investments by the diaspora, including remittances; and skill and technology transfers.

⁵ Based on Black, Richard, Stephen R. G. Bennett, Sandy M. Thomas and John R. Beddington, *Climate Change: Migration as Adaptation*, *Nature* vol. 478, 2011

15. **Inter-state conflict:** While “water wars” have long been prophesied, the evidence remains very limited. However, some experts claim that, as climate change in many ways leads the world into uncharted territory, violent conflicts between states over water resources may occur. If water could be used a “catalyst for cooperation” (which it often is), the competing growing demands between uses and users can encourage cooperation on a regional basis, and will not necessarily lead to water wars. Sustainable, reasonable and equitable utilisation of transboundary water among riparian states will play a key role in this respect: Most of the world’s 286 transboundary river basins and 592 transboundary aquifers are located in regions vulnerable to water insecurity (UNEP DHI; IGRAC, 2015). A large number of agreements exists to regulate relations between states on transboundary water resources. For example, 40% of transboundary rivers are managed in a coordinated or collective fashion (Adelphi, 2017).

16. **Food and water in disputes and conflicts:** Food and water resources and infrastructure can also be targeted or used as coercive tools in times of conflict. A number of provisions in International Human Rights Law and International Environmental Law restrict water resources and infrastructure from being attacked, but regrettably no general prohibition exists. Non-state actors and even states at times pay little heed to the provisions in place. For example, Syria’s largest dam – the Tabqa Dam – has been under the control of Daesh from 2013 until recently and used as a stronghold and potential weapon by the terrorist organisation. If the dam were to rupture, it could flood parts of Iraq and deprive eastern Syria of access to electricity. Similarly, deliberate water cuts have been used as a means of pressure by warring parties during the Syrian civil war. In December 2016, the UN Office for the Coordination of Humanitarian Affairs denounced this practice, after four million people in Damascus were deprived of their main water supply for several weeks (Barrington, 2016).

IV. FOOD AND WATER SECURITY IN THE MENA REGION

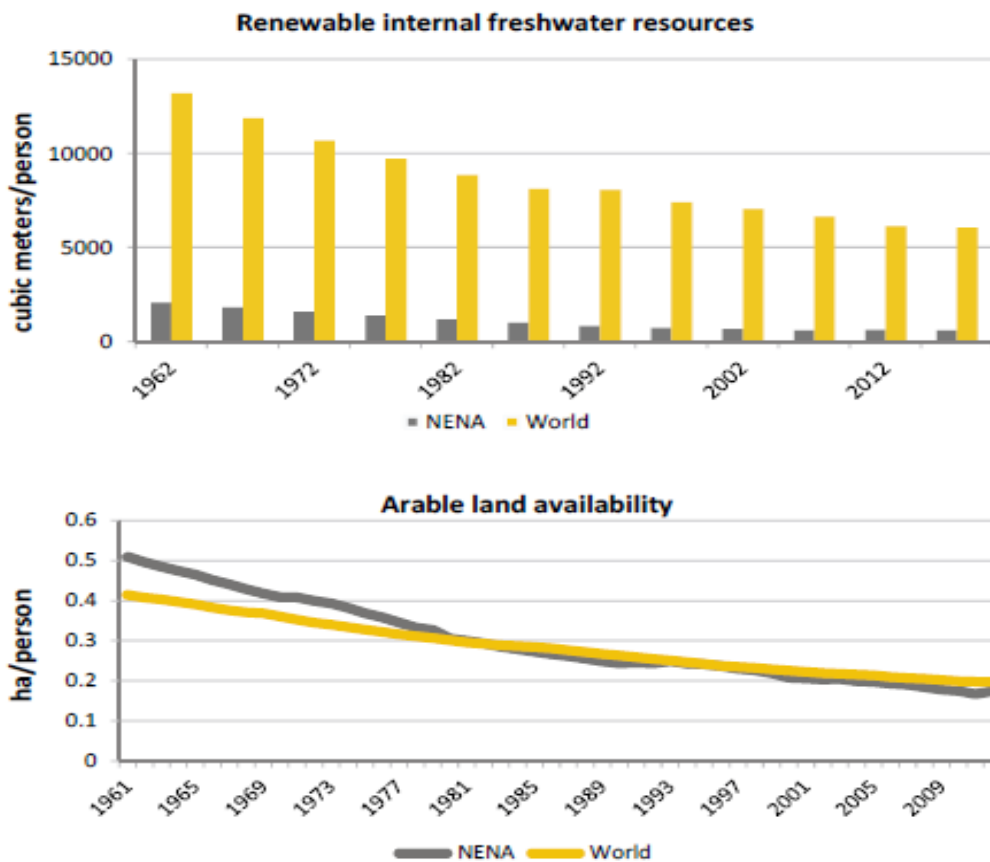
17. Important differences exist between countries in the MENA region, both in terms of their overall food and water security, but also in their ability to cope with their current and future situation. Overall, the long-term prospects for food and water security in the MENA region are dire, however (see Figure 3 and 4). Home to 5% of the global population, the region has access to only 1% of the world’s renewable water supply (Swain and Jägerskog, 2016). This is one reason why total water demand exceeds naturally available water supplies by almost 20% according to the World Bank. During the period from 2000 to 2009, the total unmet demand equalled 42km³, but by 2040-2050, this figure is projected to reach a worrisome 199km³ (The World Bank, 2012a). About half of the MENA population already lives under conditions of water stress (less than 1,700 m³/year) (FAO, 2013). On average, water availability is only 1,200m³/year, compared to the worldwide average of 7,000m³/year (Al-Otaibi, 2015). Perhaps reflecting the substantial water shortage, the MENA region has the highest percentage of total renewable water resources withdrawal in the world. In particular, the FAO singles out the Arabian Peninsula and Northern Africa as regions significantly overexploiting their water resources – by respectively up to 500% and 175% (Aquastat, 2016). The main consequences of such overexploitation of water resources are depletion of renewable groundwater, over-reliance on fossil non-renewable groundwater, and use of non-conventional water such as recycled wastewater or desalinated sea water.

18. When the FAO was reviewing food insecurity in the MENA region in 2015, it noted that it had seen “a serious setback in its fight against hunger” (FAO, 2015a) . As the only region in the world, the MENA region “has seen an increase in the prevalence of hunger and a doubling in the number of hungry people, which now stands at 33 million.” (The crises in Iraq, Syria and Yemen have played a big role in this, of course.) The FAO did note, however, that some countries had achieved substantial progress on hunger and malnutrition, with 15 of the 19 countries achieving the hunger and/or malnutrition targets under the UN Millenium Development Goals. Indeed, many countries in the region now suffer from another form of malnutrition, with a rise in overweight, obesity and

diet-related chronic diseases (Saab and Sadik, 2016). The region is not self-sufficient in food production and relies mainly on food imports to feed its increasingly growing population. MENA countries import around 50% of their wheat and barley, 40% of their rice, and 70% of their maize (The World Bank, 2013). Some Arab countries indeed import all of their cereal calories (The World Bank, 2012b). The reliance on food imports (see also Figure 5 and Figure 6) is expected to increase by 64% between 2010 and 2030 (Swain and Jägerskog, 2016). Such reliance on imports contributes to the exposure to supply and price risks, as seen during the 2007/2008 and 2010/2011 global food crises. Water scarcity is deeply interwoven with food security challenges. In the MENA region, an average of 80% of fresh water withdrawal is used for agriculture (FAO, 2015a).

19. An additional strain on food and water security is exerted by strong population growth. In 2015, the region’s annual population growth rate stood at 1.84% against a global average of 1.1% (The World Bank, 2016b). The population of the region is set to almost double by 2050 – from 357 million residents to 646 million (Schäfer, 2013). With a rising population and further development come rising standards of living, industrial activity and energy demands, as well as higher calorific intake of water-intensive animal products – all of which again will strain food and water security in the region. Further urbanisation is also connected to rising population growth. The Arab world is already highly urbanised (Schäfer, 2013). From 1970 to 2010, the urban population grew fourfold, and by 2050, 68% of the region’s inhabitants will live in cities, which is slightly higher than the expected world average.

Figure 3: Renewable internal freshwater resources (in m³/person) and arable land availability (in ha/person) in the Near East and North Africa and the World (1962-2012) (FAO, 2013)



Source: FAO

20. Climate change will further worsen the region's outlook. The 2014 Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report estimates that the MENA region will face a temperature increase of 0.9 to 4.1°C by the end of the century, accompanied by a decrease in rainfall and an increase in evaporation. The Regional Initiative for the Assessment of the Impact of Climate Change on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR), a collaborative regional initiative between the United Nations and the League of Arab States, has found that the temperature increase by the end of the century could be as high as 5°C.

21. Climate change exacerbates already existing natural climatic variability of precipitation, i.e. the variation in water supply from year to year. This can be devastating in an arid or semi-arid region, especially in rural areas where people's livelihood directly depends on small scale rainfed agriculture. Furthermore, the World Bank estimates the following climate change effects by 2050: under a 2°C scenario, 20-40% of summers might have highly unusual heat extremes (and 90% in a 4°C scenario); rainfall might decline by 20-40% (up to 60% in a 4°C scenario); crop yield might decrease by up to 30% in Jordan, Egypt, and Libya (up to 60% in Syria in a 4°C scenario). Responding to the challenges of the adverse impacts of climate change on water resources requires sustainable adaptation strategies. However, this new era of climate change and water uncertainty calls for the reassessment of the availability of water resources both temporally and spatially. Appropriate adaptation strategies to climate change based on a new vision for water that includes constructing new water infrastructure should be developed in a sustainable way.

Figure 4: Food Security and Water Security in the MENA Region: Select Indicators

	FOOD SECURITY (Global Food Security Index 2016)				WATER SECURITY									
									Water Risk Indicators (2013 data)				Projected Country Water stress for 2040 under Business-as-Usual Scenario	
									Baseline Water Stress		Interannual variability		Score	Ranking
Score	Global Ranking	Regional Ranking (MENA)	Change (2015 to 2016)	Score	Ranking	Score	Ranking	Score	Ranking					
Algeria	54.3	66	13	1.1	3.44	47	2.31	46	4.17	30				
Bahrain	70.1	33	7	-0.5	5.00	1	3.07	17	5.00	1				
Egypt	57.1	57	10	1.0	1.33	102	1.40	93	1.53	89				
Iran	no data				4.78	24	2.32	44	4.91	13				
Iraq	no data				3.48	46	1.59	74	4.66	21				
Israel	78.9	17	1	2.0	4.83	21	2.72	24	5.00	8				
Jordan	56.9	60	11	0.0	4.59	27	2.57	33	4.86	14				
Kuwait	73.5	27	4	0.7	4.96	18	2.70	27	5.00	1				
Lebanon	no data				4.54	28	2.03	55	4.97	11				
Libya	no data				4.84	20	2.66	30	4.77	15				
Morocco	55.5	62	12	0.8	4.24	33	3.12	16	4.68	19				
Oman	73.6	26	3	0.9	4.91	19	3.12	15	4.97	10				
Palestine	no data				4.63	26	2.67	29	5.00	1				
Qatar	77.5	20	2	1.0	5.00	1	2.61	32	5.00	1				
Saudi Arabia	71.1	32	6	0.3	4.99	17	3.54	10	4.99	9				
Syria	36.3	96	14	-1.4	3.85	38	1.83	61	4.44	25				
Tunisia	57.9	53	9	0.6	3.44	48	1.96	57	4.06	33				
United Arab Emirates	71.8	30	5	0.1	5.00	1	3.56	9	5.00	1				
Yemen	34.0	100	15	-4.2	4.67	25	4.94	1	4.74	16				

The Overall Score is the weighted sum of the following category scores:
1) AVAILABILITY
2) AFFORDABILITY
3) QUALITY AND SAFETY

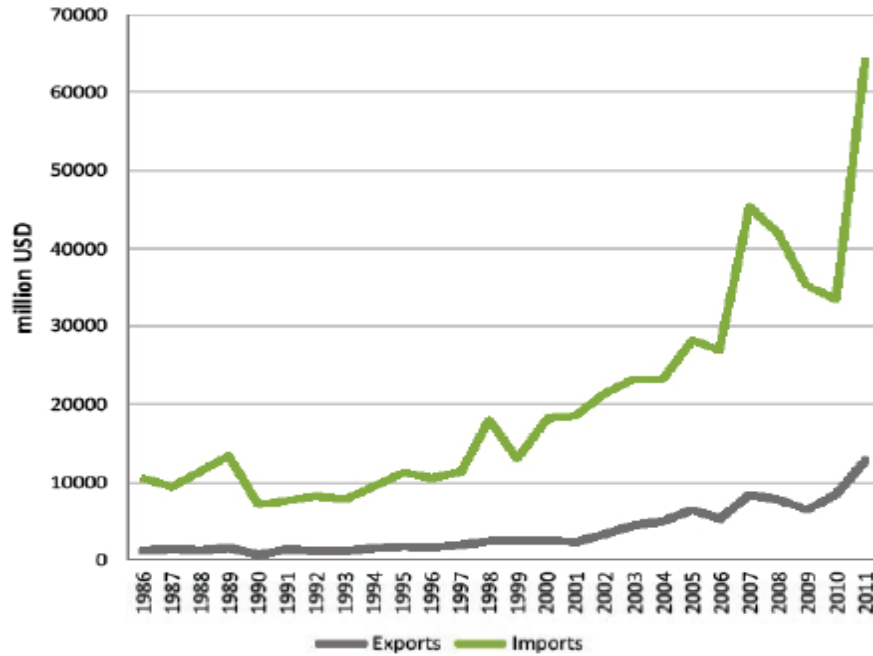
Source: EIU Calculation

Indicators

Baseline Water Stress
withdrawals / available flow
Baseline water
Score Value
[0-1] Low (<10%)
[1-2] Low to medium (10-20%)
[2-3] Medium to high (20-40%)
[3-4] High (40-80%)
[4-5] Extremely high (>80%)

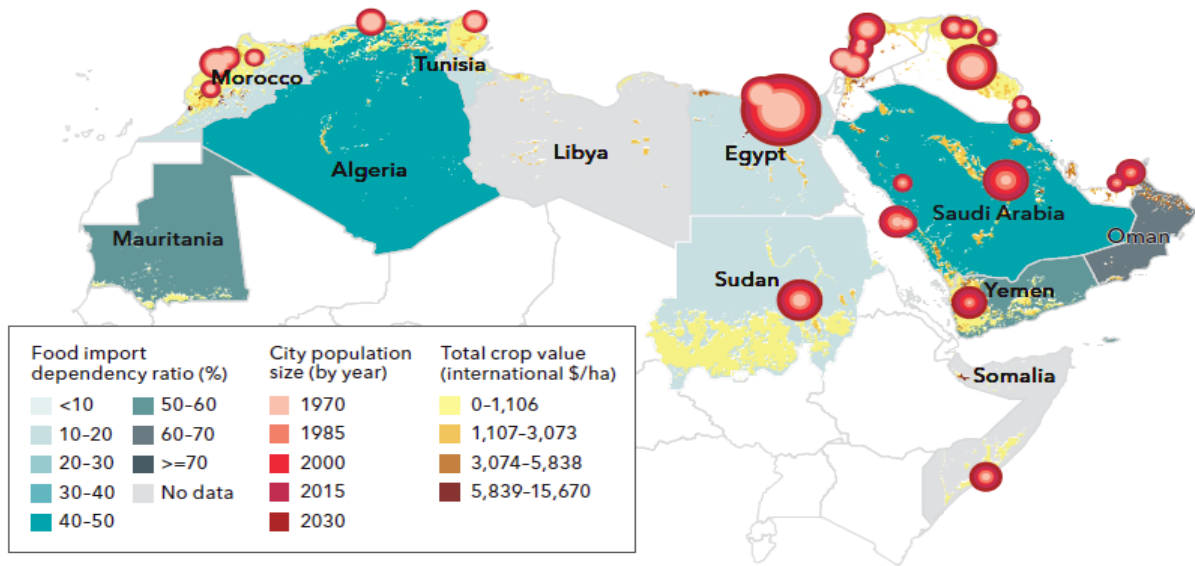
Interannual Variability
standard deviation / mean of total annual supply
Inter-annual
Score Value
[0-1] Low (<0.25)
[1-2] Low to medium (0.25-0.5)
[2-3] Medium to high (0.5-0.75)
[3-4] High (0.75-1.0)
[4-5] Extremely high (>1.0)

Figure 5: Food imports and exports (in million USD) in the Middle East and North Africa (1996-2011) (FAO, 2015)



Source: FAO

Figure 6: Food Import Dependency, Agricultural Value Added and City Growth in MENA (International Food Policy Research Institute, 2017)



Source: Arab Spatial 2016. Prepared by Ecker and Guo (2016) based on data from UN-DESA (United Nations Department of Economic and Social Affairs, Population Division), World Urbanization Prospects: The 2014 Revision (2016), <https://esa.un.org/unpd/wup/CD-ROM/>; FAOSTAT (Food and Agriculture Organization of the United Nations, Statistics Division), Food Balance Sheets, http://faostat3.fao.org/download/FB/*E, both accessed on September 14, 2016; L. You, U. Wood-Sichra, S. Fritz, Z. Guo, L. See, and J. Koo, Spatial Production Allocation Model (SPAM) 2005 v2.0., October 27, 2016, <http://mapspam.info>.

Notes: Cities are defined here as urban agglomerations with more than 1 million inhabitants in 2015. For more information on calculation of the food import dependency ratio, see endnote 13.

22. In addition to long-term structural factors driving food and water insecurity, political factors exert pressure on scarce resources in the MENA region. Countries in the region often engage in inadequate and unsustainable food and water management policies. In most cases, they are an expression of underlying national security concerns (Gürsoy and Jacques, 2014). Water scarcity can be created by a forced promotion of agriculture irrigation aimed at achieving food self-sufficiency and avoiding dependence on the global food market (Swain and Jägerskog, 2016). In addition to human mismanagement, consecutive years of drought can then lead to the collapse of these farmlands.

23. Another key governance challenge highlighted by experts is the need for a proper pricing and regulation mechanism for water, particularly in the oil-rich countries of the Arabian Peninsula. The price of water should meet or exceed its production cost in order to develop a sustainable management system in a region where water is no longer a renewable resource. However, MENA countries widely subsidise its use – spending up to 1.8% of their GDP (IMF, 2015) and financing unsustainable agricultural practices.

V. MITIGATION AND ADAPTATION MEASURES IN THE MENA REGION

24. The combination of climate change with decades of resource mismanagement is a major challenge for the MENA region's food and water security. However, mitigation and adaptation measures are available and have been undertaken by regional governments, mainly in oil-rich countries, to allay the effects of climate change and ensure the sustainability of their regime and its public policies (Center for Strategic Studies, 2016).

A. SUPPLY-ORIENTED SOLUTIONS

25. In order to achieve food security, measures should be adopted quickly and at low cost through promoting water saving efforts by educating farmers on matters such as the planting of suitable crops and sustainable irrigation methods. Since agricultural activities take the lion's share of general water consumption, using modern irrigation techniques, such as sprinklers or trickle irrigation systems, should be used for reducing water wastage. However, conflicts and instability in the region present great impediments in realising such policies aiming at sustainable and efficient utilisation of water. Destruction of water infrastructures also poses great challenges on sustainable water utilisation in the region.

26. To make up for a lack of sufficient freshwater, desalination plants offer one way to generate alternative water. Indeed, the use of desalination is particularly developed in the Middle East. Water desalination capacity in the Middle East represents 70% of worldwide capacity (USGS, 2016). Within the region, the Gulf States and Israel in particular rely heavily on desalination. The high costs associated with building and operating desalination plants and their energy-intensiveness do not make them viable solutions for low-income countries, however. Moreover, desalination produces substantial amounts of high-concentration waste brine which is released into the sea, increasing the temperature and salinity of coastal waters. Support for technical innovation and investment to find economic uses for the "waste" by-products of desalination could offer scope to scale up this technology across the region. Another issue is the location of desalination plants. Unless they are located on the coastline, transportation costs of desalinated water would rapidly become unsustainable, even for oil-rich countries. This deprives landlocked countries, or countries with a short coastline, of access to such a technical solution. Despite these drawbacks, desalination will continue to play an important role in the MENA region. If they can be operated with renewable energy – instead of the fossil fuels used today – the carbon footprint and perhaps costs of desalination plants should go down in the sun-rich MENA region.

27. Recycling and reusing wastewater is another vital strategy in maximising water availability. To illustrate the potential of such technologies, in developing countries, around 90% of wastewater is released untreated into bodies of water; and globally, 60% of water used in irrigation does not reach the roots of the crops (Adelphi, 2017). This technique is particularly developed in Israel, the world leader in this domain, which treats 86% of its domestic wastewater and recycles it for agricultural use – up to 55% of the total water used in agriculture (Kershner, 2015). Experts have however pointed out that the overall low demand for recycled water in the MENA region stems from artificially low prices of the subsidised conventional water supply (and thus the subsequent lack of incentive for water productivity) and negative perceptions regarding the impact of lower quality water on crop yields (Jeuland, 2015). Nevertheless, countries in the region are realising the potential – and indeed imperative – to recycle and reuse. For example, Saudi Arabia, the third largest water reuse market in the world after the United States and China, aims to reuse 100% of urban wastewater by 2025 and over 90% of its total wastewater by 2040. As a result, USD 66 billion in long-term capital investments have been committed for water and sanitation projects until 2025 (Haider, 2015). Jordan's policies are yet another example of a successful mitigation strategy in the face of extreme water scarcity. While precipitation has decreased by 20% over the past eight decades, the share of fresh water used for agriculture was reduced from 80% in the 1970s to around 60% in recent years (Ministry of Water and Irrigation of Jordan, 2016). In 2014, 125m³ of treated wastewater were reused, a figure projected to increase to 240m³ by the year 2025. However, Jordan's carefully planned water strategy was unable not account for the massive influx of refugees, which has increased total water demand by 22% (Nahhas, 2017). As the Committee on the Civil Dimension of Security learned on its 2013 visit to the Zaatari Refugee Camp, water distribution and waste collection still takes place by truck (with a fleet of over 80 huge tanker trucks for water deliveries).

28. Supply-oriented management schemes sometimes focus on major water transfer projects, in order to address a mismatch between spatial distribution of population and water delivery capacity. For example, the Zayandeh Rud River Basin, one of the most important basins in central Iran, has been challenged by water stress for decades. To address water shortage issues, three water transfer tunnels were built, to double the natural flow of the Zayandeh Rud River (Gohari et al., 2013). This short-term solution however backfired when it triggered a population increase due to a perception of water availability. This proves the unsustainability of projects that do not address the underlying causes of the water shortage, including population growth and underpricing water resources (Madani, 2014). Nonetheless, large-scale projects such as the USD 10 billion Red Sea-Dead Sea Conveyor between Israel and Jordan could play an important role in adapting to new water realities going forward, as the Committee learned when visiting Israel and the Palestinian Territories in early 2017.

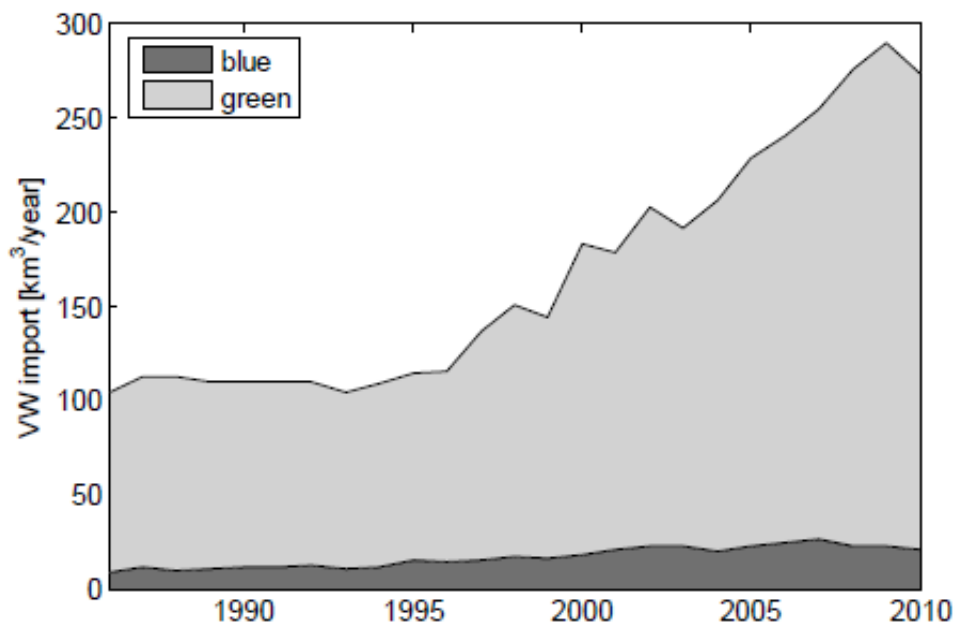
B. MARKET-ORIENTED SOLUTIONS

29. Experts argue that government food and water subsidies – widespread in the MENA region – do not constitute sustainable solutions over the long term. The management of subsidies is inherently political, as under-pricing of water is often used as an instrument to contribute to political stability. However, they produce a high fiscal burden and are relatively ineffective safety nets for the poorest. Thus, reforms should be undertaken to curb subsidies, restore the price of water to their true cost for a more efficient market and potentially specify water efficiency in irrigation systems or land-use planning standards. For example, in 2015 in Saudi Arabia, water was sold at USD 0.08/m³, but cost about USD 1.09/m³ to produce (Jägerskog et al., 2015). Across the Arab region, the average price for water amounts to 35% of the cost of production (10% for desalinated water) (Gelil and Saab, 2015). Important water pricing policy reforms are being implemented, however, in some countries of the MENA region, including in Bahrein, Saudi Arabia and the United Arab Emirates. Saudi Arabia aims to reduce electricity and water subsidies by USD 53 billion by 2020.

30. Another way to increase food and water security in the MENA region is optimising food imports. Through food imports, water-stressed countries can import “virtual water”, (i.e., the water required for the production of the imported agricultural commodities). Put differently, the global food market can be perceived as a marketplace for virtual water. As already noted, countries in the region are major wheat importers – a commodity whose water footprint⁶ was 1,087 billion m³/year in the period from 1996 to 2005 (Mekonnen et al., 2010). Wheat and rice together account for 45% of the global blue water footprint. Increased water scarcity and food insecurity has led to skyrocketing virtual water imports in the past decades, highlighting the high dependency of the Middle East and North Africa on the global food market (see Figure 7). This trend underlines that national policies aimed at ensuring food self-sustainability in the MENA region seem bound to fail, as countries would only add to their high current and future water burdens. The League of Arab States has indeed recognised that a focus on achieving food self-sufficiency leads to damaging agricultural development trends in its Strategy for Sustainable Arab Agriculture Development for the Upcoming Two Decades (2005-2025).

31. Strategic reserves for food (and potentially water) can also constitute an important part of food and water security strategies for MENA countries exposed to the volatility of crop prices on the global and domestic markets. By increasing their wheat stocks, governments could gain leverage on the world market. As of 2010, China, the United States and India, the three main wheat exporters, held more than 50% of the world’s wheat reserves (USDA, 2011), which gives them a strategic advantage over Arab countries whose food security depends on related imports. The willingness of governments in the MENA region to expand their storage capacities to as much as 17 months of consumption is aimed at mitigating the risks of being a net wheat importer, and it gives them leverage on a market vital to their food security (The World Bank, 2012b). This measure, even though it is not a panacea, is a reform aimed at ensuring a more sustainable management of resources.

Figure 7: Temporal evolution of virtual water (green and blue) volumes imported by the Middle East and North Africa in the period 1986-2010 (in km³) (Antonelli and Tamea, 2015)



⁶ The water footprint of a product is the total volume of freshwater that is used to produce the product. The *blue water* footprint refers to the volume of surface and groundwater consumed (evaporated) as a result of the production of a good; the *green water* footprint refers to the rainwater consumed.

32. Since the largest share of societal water consumption is the share required for food production, water-scarce countries unwilling to rely on the global food market and imports for food security have also turned to foreign land acquisitions, purchasing or leasing farmland in countries whose agricultural potential is not fully exploited. For example, companies from Gulf countries have acquired substantial tracts of land in Sudan. The Land Matrix, a global and independent land-monitoring initiative, reports that across the globe 227 million hectares have been acquired between 2001 and 2011, an area of land the size of North-Western Europe (Oxfam, 2011). Such land acquisitions bring about new scales of virtual water trade from water-endowed countries to water-scarce regions. However, such land leases have been criticised for a number of reasons, including for having a negative impact on the developing nations making their land available. For example, these land acquisitions are normally market-oriented and usually conducted by international investors who do little for local development. Indeed, experts argue that some of these land acquisitions, including in the Horn of Africa, have adversely impacted local food and water security. In countries where land control is centralised, there is also a risk of marginalisation of populations at the local level, an issue even more salient in regions with a strong pastoral tradition (Jägerskog et al., 2012). While foreign land acquisitions can play a role in food security strategies, they need to be well managed. Guidelines have thus been developed by international organisations, including by the African Union.

C. INVESTMENT IN THE AGRICULTURAL SECTOR

33. Alternative ways to prevent the decline of water resources must be developed. Water management must become proactive, rather than reactive, in order to address challenges intertwined with food security. The FAO reports that in developing regions, despite the significant share of agriculture in GDP (7.1 % in 2015) and its even greater contribution to rural employment, this sector received only 1.9% of total central government spending. In North Africa, this downward trend is even more egregious, with a drop in the Agriculture Orientation Index (AOI) for government expenditures from 1.05 in 2011 to 0.11 in 2015 (FAO, 2017).⁷ The MENA region accounts for only 6% of the global public spending on agricultural research and development (Sdrlevich et al., 2014).

34. Investing in the modernisation of the agricultural sector is a key factor in increasing food and water security. Key elements include investments in science and technology innovation; climate smart agriculture; and improved agriculture and food value chains to reduce food loss and waste. The European Bank for Reconstruction and Development (EBRD), for example, recently highlighted the role of the private sector in tackling climate change in the food industry and invested heavily in agri-business. It thus supports sustainable climate-friendly agricultural inputs in the region, such as *Éléphant Vert*, a Morocco-based producer of bio-fertilisers, bio-pesticides and bio-stimulants, which received a EUR 24 million loan in 2016 (EBRD, 2016).

D. REGIONAL COOPERATION AND INTERNATIONAL DEVELOPMENT

35. A paradox in addressing food and water insecurity in the Middle East and North Africa is the transboundary character of the challenges faced by governments in one of the least integrated regions in the world. Limited integration has hindered the region's ability to tap into its potential for sustained economic growth and development. A typical MENA country exports less than half, and as little as one quarter, of what it could potentially export (Hoekman, 2016). Despite attempts to institutionalise intra-regional trade through initiatives such as the Pan-Arab Free Trade Agreement, political obstacles have hindered their development. Indeed, intra-regional trade in the Middle East only accounts for 5 to 10% of total trade (Council on Foreign Relations, 2012). Some progress has

⁷ AOI for Government Expenditures is defined as the agriculture share of government expenditures, divided by the agriculture share of GDP, where agriculture refers to the agriculture, forestry, fishing and hunting sector.

however been made in the recent years in the face of the looming security challenges related to water scarcity and food insecurity. FAO, for example, has been promoting a collaborative strategy to address water-food relations in the region launched in 2013 – the *Regional Water Scarcity Initiative* – which puts agriculture at the centre of the water reform agenda.

VI. CONCLUSIONS

36. The report has mostly addressed long-term prospects for food and water security in the MENA region. In this context, it must be noted, however, that the region is already under considerable food and water stress as a result of environmental causes, such as prolonged drought, as well as man-made causes, for example persistent mismanagement or civil wars. To name a few examples:

- In Syria, the 2015/2016 growing season reached a historic low: Only 900,000 hectares of wheat were planted, compared to a pre-civil war level of 1.5 million hectares (States News Service, 2016).
- In Yemen, which already imported 90% of its food before its civil war broke out, 7.1 million people are food insecure and 7 million people severely food insecure (Thai News Service, 2016).
- Lebanon is witnessing severe water stress, as its population has swelled by 30% in the aftermath of the Syrian war (UNHCR).

37. All available and sustainable short-term solutions should be employed to cope with such acute food and water crises. In particular, sustainable safety nets for the region's poorest people must be in place. However, in keeping with the long-term focus of this report, structural development to cope with the pressure on the future of food and water must be the key effort in the MENA region.

38. The good news is that solutions for the MENA region's food and water problems are available. Sufficient water exists to support the Earth's population today and the near future. Thus, "the water crisis is essentially a crisis of governance and societies" (Adelphi, 2017). Equally, the spectre of the "Malthusian Trap" (i.e. that population growth will outpace food production) has not yet materialised, and many argue that the world can escape this trap if it uses all instruments at hand. Many experts agree that the following steps should be taken by MENA countries to tackle their long-term challenges:

- **Food security:**
 - modernise agriculture and food value chains
 - reduce food subsidies and price controls
 - increase public awareness campaigns on the resource implications of food production and food waste
 - build strategic storage capacities
 - increase efficiency of the national and regional food markets to reduce waste
 - enhance the management of food imports
- **Water security:**
 - improve the efficiency of water treatment and (re)use
 - expand water supply and availability in a sustainable manner
 - reduce or eliminate water subsidies
 - increase public awareness campaigns on saving water
 - build water storage systems, dams, hydroelectric power plants and reservoirs
 - utilise transboundary water in an equitable reasonable and sustainable manner

- **Climate change:**
 - design national climate change policies that will address their long-term food and water insecurity

39. Ultimately, ensuring long-term food and water security is the responsibility of national governments, and all of the above recommendations require much stronger political commitment and better governance in the food and water sectors. For this to happen, governments must make trade-offs between short-term benefits and long-term gains. This will not be easy for MENA governments, given the political fragility of many of them. Moreover, this presents complex problems, as food, water and climate are intimately connected with the sectors of economic development, demography, energy, ecosystems and urban planning – to name but a few interrelated sectors. The international community must improve the international food market to increase stability of prices and availability. Last but not least, the Parties who have ratified the 2015 Paris climate agreement must live up to their pledges, including on climate financing for developing countries.

BIBLIOGRAPHY

- Adelphi, *Food Price Volatility and Fragility in the MENA Region*, ECC Factbook, <https://library.ecc-platform.org/conflicts/food-price-volatility-and-fragility-mena-region>
- Adelphi, International Alert, Woodrow Wilson Center International Center for Scholars and European Union Institute for Security Studies, *A New Climate for Peace: Taking Action on Climate and Fragility Risks* (An Independent report commissioned by G7 members), 2015, <https://www.newclimateforpeace.org/#report-top>
- Adelphi, *Water Connects: A Short Guide to Preventive Water Diplomacy*, 2017, <https://www.climate-diplomacy.org/publications/water-connects-short-guide-preventive-water-diplomacy>
- Alexandratos, Nikos and Jelle Bruinsma, *World Agriculture Towards 2030/2050: The 2012 Revision*, FAO, 2012, <http://www.fao.org/docrep/016/ap106e/ap106e.pdf>
- Al-Otaibi, Ghanimah, *By the Numbers: Facts about Water Crisis in the Arab World*, World Bank Blog, 19 March 2015, <http://blogs.worldbank.org/arabvoices/numbers-facts-about-water-crisis-arab-world>
- Antonelli, Marta and Stefania Tamea, "Food-Water Security and Virtual Water Trade in the Middle East and North Africa", *International Journal of Water Resources Development*, vol. 31, no. 3, 2015
- Aquastat, *Did You Know...? Facts and Figures About Water Withdrawal and Pressure on Water Resources*, 2016, <http://www.fao.org/nr/water/aquastat/didyouknow/index2.stm>
- Barrington, Lisa, *Four Million in Damascus Without Mains Water after Springs Targeted: U.N.*, Reuters, 29 December 2016, <http://www.reuters.com/article/us-mideast-crisis-syria-damascus-idUSKBN14I1N5>
- Batha, Emma, *Europe's Refugee and Migrant Crisis in 2016 in numbers*, World Economic Forum, 5 December 2016
- Blumstein, Sabine, Benjamin Pohl, Dennis Tänzler, *Water and Climate Diplomacy: Integrative Approaches for Adaptive Action in Transboundary River Basins*, Adelphi, 2016
- Center for Strategic and International Studies, *The Food Security Solution*, 20 May 2016, <https://www.csis.org/analysis/food-security-solution>
- Council on Foreign Relations, *Regional Cooperation in a New Middle East*, Summary Report, 2012, <http://www.cfr.org/projects/world/regional-cooperation-in-a-new-middle-east/pr1633>
- EBRD (European Bank for Reconstruction and Development), *EBRD Supports Moroccan Producer of Climate-Friendly Bio-Fertilisers*, 21 September 2016, <http://www.ebrd.com/news/2016/climate-friendly-bio-fertilisers.html>
- FAO (Food and Agriculture Organization), *Food Security*, Policy Brief, issue 2, 2006, <http://www.fao.org/forestry/13128-0e6f36f27e0091055bec28ebe830f46b3.pdf>
- FAO, *Government Expenditure on Agriculture*, 2017, <http://www.fao.org/economic/ess/investment/expenditure/en/>
- FAO, *Regional Initiative on Water Scarcity in the Near East Preliminary Regional Review and Gap Analysis - DRAFT FAO RNE*, 2013, http://www.fao.org/nr/water/docs/WSRE_Preliminary-Regional-Review-Gap-Analysis-Draft-Report.pdf
- FAO, *Regional Overview of Food Insecurity, Near East and North Africa*, 2015a, <http://www.fao.org/3/a-i4644e.pdf>
- FAO, *The State of Food Insecurity in the World 2015*, 2015b, <http://www.fao.org/hunger/key-messages/en/>
- Ford, Liz, "Somalia Famine in 2010-12 'Worst in Past 25 years'," *The Guardian*, 2 May 2013, <https://www.theguardian.com/global-development/2013/may/02/somalia-famine-worst-25-years>
- Gelil, Abdel I. and Najib Saab, *Arab Environment: Sustainable Consumption*, Annual Report of Arab Forum for Environment and Development, Beirut: Technical Publications, 2015, <http://www.afedonline.org/Report2015/AFEDreportEng-Ar2015.html>

- Gohari, Alireza, Saeid Eslamian, Ali Mirchi, Jahangir Abedi-Koupaei, Alireza Massah Bavani and Kaveh Madani "Water Transfer as a Solution to Water Shortage: A Fix That Can Backfire", *Journal of Hydrology*, vol. 491, 2013
- Gürsoy, Sezin İba and Peter J.Jacques, , "Water Security in the Middle East and North African Region." *Journal of Environmental Studies and Sciences*, vol.4, no.4, 2014
- Haider, Saeed, "Saudi Arabia Aims at 100% Wastewater Reuse by 2025", *Saudi Gazette*, 19 February 2015, <http://english.alarabiya.net/en/business/technology/2015/02/19/Saudi-Arabia-aims-at-100-percent-wastewater-reuse-by-2025.html>
- Hoekman, Bernard, *Intra-Regional Trade: Potential Catalyst for Growth in the Middle East*, Policy Paper no.1, Middle East Institute, 2016, <http://www.mei.edu/content/intra-regional-trade-potential-catalyst-growth-middle-east>
- IGRAC and UNESCO (International Groundwater Resources Assessment Centre and UNESCO International Hydrological Programme), *Transboundary Aquifers of the World* [map], 2015, <https://www.un-igrac.org/resource/transboundary-aquifers-world-map-2015>
- IGRAC, *Transboundary Groundwaters*, <https://www.un-igrac.org/areas-expertise/transboundary-groundwaters>
- International Food Policy Research Institute, *2017 Global Food Policy Report*, 2017, <http://www.ifpri.org/publication/2017-global-food-policy-report>
- Intergovernmental Panel on Climate Change, *Fifth Assessment Report*, 2014, <https://www.ipcc.ch/report/ar5/>
- International Monetary Fund, "Is the Glass Half Empty or Half Full? Issues in Managing Water Challenges and Policy Instruments", *Staff Discussion Note*, 2015, <https://www.imf.org/external/pubs/ft/sdn/2015/sdn1511.pdf>
- Jägerskog, Anders, Ana Cascão, Mats Hårsmar and Kyungmee Kim, "Land Acquisitions: How will they Impact Transboundary Waters?", Report no. 30, Stockholm International Water Institute, 2012
- Jägerskog, Anders, Torkil Jønch Clausen, Torgny Holmgren and Karin Lexén, *Water for Development – Charting a Water Wise Path*, Report no. 35, Stockholm International Water Institute, 2015
- Jeuland, Marc, "Challenges to Wastewater Reuse in the Middle East and North Africa", *Middle East Development Journal*, vol.7, no.1, 2015
- Kershner, Isabel, "Aided by the Sea, Israel Overcomes an Old Foe: Drought", *The New York Times*, 29 May 2015
- League of Arab States, *Strategy for Sustainable Arab Agriculture Development for the Upcoming Two Decades (2005-2025)*, 2007, <http://www.aoad.org/strategy/straenglish.pdf>
- Madani, Kaveh, "Water Management in Iran: What is Causing the Looming Crisis?", *Journal of Environmental Studies and Sciences*, vol. 4, 2014
- Max Planck Institute, *Climate-Exodus Expected in the Middle East and North Africa*, 2 May 2016, <https://www.mpg.de/10481936/climate-change-middle-east-north-africa>
- Mekonnen, Mesfin M. and Hoekstra, Arjen Y. "The Green, Blue and Grey Water Footprint of Crops and Derived Crop Products", *Value of Water Research Report Series*, no. 47, UNESCO-IHE, 2010
- Ministry of Water and Irrigation of Jordan, "Water Substitution and Reuse Policy", *National Water Strategy 2016 – 2025*, 2016, <http://www.mwi.gov.jo/sites/en-us/Hot%20Issues/Strategic%20Documents%20of%20%20The%20Water%20Sector/Water%20Substitution%20and%20Reuse%20Policy%202025.2.2016.pdf>
- Nahas, Roufan, "Jordan's Water Shortage Made Worse by Refugee Crisis", *The Arab Weekly*, 19 March 2017, <http://www.thearabweekly.com/Environment/8065/Jordan%E2%80%99s-water-shortage-made-worse-by-refugee-crisis>
- NATO, *Warsaw Summit Communiqué*, 2016, http://www.nato.int/cps/en/natohq/official_texts_133169.htm
- NATO PA, Report by the Sub-Committee on Energy and Environmental Security, Science and Technology Committee, Philippe, *Food and Water Security: Implications for Euro-Atlantic Security* by Philippe Vitel, 2011

- Oxfam, "Land and Power: The Growing Scandal Surrounding the New Wave of Investment in Land", *International Briefing Paper no.151*, 2011
- Paletta, Damian, "Islamic State Uses Syria's Biggest Dam as Refuge and Potential Weapon", *The Wall Street Journal*, 20 January 2016
- Saab, Najib and Abdul-Karim Sadik (eds.), *Arab Environment: Sustainable Development In A Changing Arab Climate*, Annual Report of Arab Forum for Environment and Development, Beirut: Technical Publications, 2016, <http://www.afedonline.org/en/inner.aspx?contentID=1238>
- Schäfer, Katja, *Urbanization and Urban Risks in the Arab Region*, Presentation at 1st Arab Region Conference for Disaster Risk Reduction, 19 -21 March 2013, http://www.preventionweb.net/files/31093_habitataqabaurbanresillience.pdf
- Sdravovich, Carlo, Randa Sab, Younes Zouhar and Giorgia Albertin, "Subsidy Reform in the Middle East and North Africa: Recent Progress and Challenges Ahead", *International Monetary Fund*, 2014, <https://www.imf.org/external/pubs/ft/dp/2014/1403mcd.pdf>
- States News Service, *Poor Rains, Supply Bottlenecks Exacerbating Food Security Woes In War-Torn Syria*, *UN Warns*, 15 November 2016
- State of Texas, "Climate Change Further Threatens MENA Water Security", *US Official News*, 6 June 2016
- Strategic Foresight Group, *Cost of Non-Cooperation on Water: Crisis of Survival in the Middle East*, 2016
- Swain, Ashok and Anders Jägerskog , "Water, Migration and How They Are Interlinked", *Working paper 27*, Stockholm International Water Institute, 2016, <http://www.sivi.org/publications/paper-migration/>
- Szabo, Sylvia, "Urbanisation and Food Insecurity Risks: Assessing the Role of Human Development", *Oxford Development Studies*, vol.44, no.1, 2016
- Thai News Service, "Yemen: 'An Entire Generation Could Be Crippled By Hunger' in Yemen - UN Food Relief Agency", 28 October 28 2016
- The Economist's Data Team, *Europe's Migrant Crisis in Numbers: An Interactive Guide to the European Refugee Crisis*, 23 May 2016, <http://www.economist.com/blogs/graphicdetail/2016/03/daily-chart-20>
- United Nations and League of Arab States, *Climate Projections and Extreme Climate Indices for the Arab Region*, 2015, <https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/l1500436.pdf>
- UN News Centre, *Famine Declared in Region of South Sudan – UN*, 20 February 2017, <http://www.un.org/apps/news/story.asp?NewsID=56205#.WL-oLPkrl2w>
- UN Water, *Water Security*, 2014, <http://www.unwater.org/topics/water-security/en/>
- UN Water, *Water Scarcity Already Affects More Than 40% of the People on the Planet*, 07 Oct 2014, <http://www.unwater.org/statistics/statistics-detail/en/c/211807/>
- UNDESA (UN Department of Economic and Social Affairs), *World Population Prospects: The 2015 Revision: Key Findings and Advance Tables*, 2015, https://esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf
- UNDESA, *World Urbanization Prospects: The 2014 Revision*, 2014, <https://esa.un.org/unpd/wup/publications/files/wup2014-highlights.Pdf>
- UNHCR (United Nations High Commissioner for Refugees), *Figures at a Glance*, non-dated, <http://www.unhcr.org/figures-at-a-glance.html>
- USDA (United States Department of Agriculture), *Grains Production, Supply and Distribution*, 2011, <http://www.fas.usda.gov/psdonline/psdDownload.aspx>
- USGS (United States Geological Survey), "Saline Water: Desalination", 2 December 2016, <https://water.usgs.gov/edu/drinkseawater.html>
- NATO PA, Report by the Sub-Committee on Energy and Environmental Security, Science and Technology Committee, Philippe, *Food and Water Security: Implications for Euro-Atlantic Security* by Philippe Vitel, 2011, <http://www.nato-pa.int/default.asp?SHORTCUT=2595>
- The World Bank, *Agriculture*, 2016a, <http://www.worldbank.org/en/topic/agriculture/overview#1>

- The World Bank, *Data, Population growth (annual %)*, 2016b, <http://data.worldbank.org/indicator/SP.POP.GROW>
- UNEP-DHI Centre for Water and Environment and United Nations Environment Programme, *Transboundary River Basins: Status and Trends*, Nairobi: United Nations Environment Programme, 2016, <http://www.geftwap.org/publications/river-basins-spm>
- The World Bank, *Food Security*, non-dated, <http://www.worldbank.org/en/topic/foodsecurity>
- The World Bank, *Renewable Energy Desalination: An Emerging Solution to Close the Water Gap in the Middle East and North Africa*, 2012a, <http://elibrary.worldbank.org/doi/abs/10.1596/978-0-8213-8838-9>
- The World Bank, *The Grain Chain: Food Security and Managing Wheat Imports in Arab Countries*, 2012b, <http://documents.worldbank.org/curated/en/172941468299064537/pdf/680750WP0P11730hainpubENG4013012web.pdf>
- The World Bank, *Turn Down the Heat: Climate Extremes, Regional Impacts, and the Case for Resilience*, 2013, <http://documents.worldbank.org/curated/en/975911468163736818/pdf/784240WP0Full00D0CONF0to0June19090L.pdf>
- The World Bank Group, *High and Dry: Climate Change, Water, and the Economy*, 2016, <http://www.worldbank.org/en/topic/water/publication/high-and-dry-climate-change-water-and-the-economy>
- WRI (World Resources Institute), *World Resources Report 2013–2015: Creating a Sustainable Food Future*, 2013: http://www.wri.org/sites/default/files/wri13_report_4c_wrr_online.pdf
-