



ENVIRONMENTAL CHALLENGES IN THE MENA REGION¹

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This paper summarizes the core environmental challenges in the Middle East-North Africa (MENA) region. It is an adapted and extended version of the Environmental Outlook for the West Asia Region (Abumoghli I. 2019), published following the conference “Environmental challenges in the MENA region: The long road from conflict to cooperation” (SOAS University, London. 2016).

There are multiple understandings concerning which countries constitute the MENA region, with no standardized definition. For this study, it is assumed to include 21 countries located in four sub-groups: the Mashreq region (Egypt, Iraq, Jordan, Lebanon, Palestine, Syria), the Maghreb region (Algeria, Libya, Morocco and Tunisia), the Gulf Cooperation Council Countries (Bahrein, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates), and a fourth cluster including Arab Least Developed Countries (Sudan, Yemen). The countries of Israel, Turkey and Iran generally stand separately, although Israel and Turkey are sometimes included in the Mashreq region (Fig. 1).



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Figure 1 : MENA designation of the study, with the 5 sub-groups of countries (see colour clusters).

Despite their heterogeneous characteristics in geography, natural resources, political and social structures, and income levels, MENA countries share a common context of critical environmental challenges and trans-boundary conflicts that threaten the long-term stability of

the region. Environmental stresses - water and arable land scarcity in particular - have been an important feature of the region's history, but modern times have seen these stresses increasing in relation to development patterns. Some scholars have connected contemporary conflicts to the availability of natural resources in the MENA region. Indeed, not only can conflicts drive environmental damage and prevent concerted efforts to address emergencies, but environmental pressures themselves can become a source of crises over access to natural resources. This interlinkage was highlighted in the sixth *Global Environmental Outlook Regional Assessment* (United Nations Environment Programme [UNEP], 2016), when identifying «Peace, Security and Environment» as the priority theme on human health and well-being for West Asia (GCC and Mashreq countries).

The MENA region already faces a wide array of environmental stresses that include water scarcity, arable land depletion, air pollution, inadequate waste management, loss of biodiversity, declining marine resources and degradation of coastal ecosystems. Future development scenarios are expected to exacerbate these challenges, especially given that MENA is one of the regions that is most vulnerable to the impacts of climate change (IPCC, 2013). Rising temperatures, heightened rainfall variability and rising sea levels (Hungate and Koch 2015), in addition to increasing population and urban growth rates, will amplify environmental stresses. The repercussions of climate risks on food and water security and ensuing conflicts are already well documented by existing case studies (Aw-Hassan A., Rida F., Telleria R., Bruggeman A. 2014, De Châtel F. 2014). In the case of Syria (Hoerling, M. et al. 2012) authors examined the role extreme droughts - possibly caused by climate change - played in the humanitarian crisis between 2007 and 2010.

According to the 2011 *Global Assessment Report on Disaster Risk Reduction* (United Nations ISDR), "since the 2007/2008 agriculture season, nearly 75 % of [Syria's most agriculture-dependent] households suffered total crop failure", leaving an estimated 1 million people insecure and forcing hundreds of thousands of them to move to urban centers. The resulting growth in pressure on urban resources, combined with other contextual factors, contributed to the political uprising in Syria. Moreover, the ensuing refugee crisis expanded beyond Syrian borders, with around 2.6 million people fleeing towards Turkey, Lebanon and Jordan, challenging these fragile ecosystems even more.

Water scarcity

The MENA region is the most water-scarce in the world, with an average renewable internal freshwater resource per capita of 444 cubic meters (calculated for all designated MENA countries, Food and Agriculture Organization [FAO], 2018), well below the UN water scarcity limit of 1,000 cubic meters per person per year (UN-Water, FAO, 2007). The semi-arid and arid countries are characterized by highly variable rainfalls. Most of the blue water resources (surface water and groundwater) are shared between several countries located along the Euphrates, Tigris and Nile rivers. Renewable water resources vary between MENA countries: Gulf Cooperation Council (GCC) countries are highly dependent on non-conventional water resources such as desalination of seawater, producing 60 % of the world's desalinated water.

Due to population growth rates, rapid urbanization, improved standards of living and increased frequency of droughts in recent decades, water demand has been increasing rapidly, surpassing the region's supply capacity. Indeed, in addition to overexploiting groundwater resources, the growing demand for water has resulted in degrading water quality, through seawater intrusion, salination of aquifers and inefficient waste and drainage water management systems. Considering that 86 % of MENA's annual freshwater withdrawals are allocated to the agriculture sector (calculated for all designated MENA countries, FAO, 2016), the lack of water available for irrigation poses a serious threat to the region's food security. Moreover, the *Global Environmental Outlook* (GEO)-6 (2016) reports that climate change

projections on temperatures, precipitation patterns and sea levels predict a further decrease of water availability in the region, combined with growing demand for water.

Land resources

Recent trends such as climate change, political conflicts and changes in land-use patterns and practices resulting from rapid urbanization, underlie the desertification and land degradation that the MENA region has been experiencing over the past decades. Climate change manifestations – including reduced precipitation rates and higher surface temperatures - accelerate desertification through soil erosion, salinization and increased dust storms.

In the West Asian countries specifically, long-lasting wars are another strong driver of environmental damage, from the burning of 15 million barrels of oil and overgrazing in Iraq, to heavy deforestation rates and forest fires in Syria. Mismanagement of these natural resources further exacerbates the impacts of climate change and hinders mitigation strategies: forest fires release carbon emissions, the depletion of trees prevents carbon absorption, while the conversion of rangelands to drylands makes them more vulnerable to soil erosion and high evaporation rates in the face of dust storms and increased temperatures.

Land degradation leads to the deterioration of biodiversity and ecosystems, reduced productivity, the exacerbation of water scarcity, and shrinking arable lands (only 5 % of the MENA total area excluding Turkey and Israel, FAO-Organisation for Economic Co-operation and Development [OECD], 2018). Already, 40 % of arable land requires irrigation to be suitable for cultivation. Due to ongoing desertification processes, Iraq is estimated to lose around 250 square kilometers of arable land annually, while overgrazing in Jordan is assumed to have depleted the supportive capacity of rangelands, which cover 80 % of the country's total area. This phenomenon further jeopardizes the food security of MENA countries, hence further undermining their socio-political stability.

An example of overcoming the aforementioned land resource challenges, is Israel through its leading agricultural research and use of technology. Despite only 13.6 % of its land being naturally arable (FAO 2016), highly developed technologies, such as high-yield crops and varieties, drip irrigation systems and the use of fertilizers, allow the country to satisfy most of its own food demand and to export more than 2 billion dollars' worth of agricultural products annually (Export.gov 2019).

Air quality

The MENA region faces a serious issue of air pollution: the concentration of particulate matter (PM₁₀) is considered very high, far exceeding WHO guidelines (2006) and even legal standards (20 µg/m³ annual mean). This causes detrimental effects to human health, livelihoods and ecosystems. In 2016, Riyadh (Saudi Arabia) reported an annual mean PM₁₀ of 251 µg/m³, while Greater Cairo (Egypt) reached 284 µg/m³ in 2015 (World Health Organisation [WHO] 2018). Air pollution is estimated to be responsible for 176,000 premature deaths in 2013 in the region, and for the loss of more than 2 % of the regional GDP (calculated for all designated MENA countries except Syria, World Bank, 2016). Air pollutants have natural sources too: the MENA region is part of the "dust belt" where most dust storms originate (Furman, H. K. H. 2003). They carry fine sand and dust over long distances, paralyzing many activities - flights, road traffic, supply chains, crop cultures - and exacerbating respiratory diseases. Although naturally driven, their frequency and intensity have escalated in the last 30 years due to land degradation, desertification, drought and climate change, especially in the most vulnerable countries, such as Iraq.

Anthropogenic factors also drive the concentration of atmospheric pollutants: industrial emissions are the most important human-induced source of air pollution (UNEP 2017), with the presence of many petroleum refineries and fossil fuel-powered power plants in the region. Furthermore, the region's current growth rate and urbanization trend results in the intensification of fossil use for low-standard transportation, construction activities and household power generation. Most of the region's countries still practice open burning of agricultural and/or municipal waste, which is another source of air pollution. Regulatory progress can however be noticed through the international banning of leaded petrol, adopted by most of the countries.

MENA countries have considerable renewable energy potential, benefitting from some of the world's highest solar insolation levels (as part of the SunBelt), favorable wind conditions, as well as hydro and geothermal sources in certain specific locations. However, this potential is still underutilized: in 2015, renewable power production (including hydro) accounted for just 7 % of MENA countries generation capacity (calculated for all designated MENA countries except the Palestinian Authority, Ritchie H. and Roser M. 2020), contrasted by the high reliance on fossil fuels.

Waste management

The GEO-6 on West Asia (2016), supporting the report of Arab Forum on Environment and Development ([AFED] 2008), identifies waste management as a rising environmental concern in the MENA region. GEO-6 indicates a 3 % median annual increase in municipal solid waste in the GCC and Mashriq countries, that further disrupts waste management systems. Urbanization, improved living standards (consumption and production rates), conflicts and human displacements influence the solid waste generation and composition. In the case of Lebanon, 15.7 % of the country's total municipal solid waste generation is due to refugees. Despite efforts from some Arab MENA countries (GCC members, Egypt, Jordan) to develop legal frameworks and national strategies for integrative waste management, the lack of financial and technical resources to support appropriate infrastructure, monitoring information and designated entities impede their implementation. Consequently, the waste process of collection-segregation-treatment-disposal is not functional and there is no significant waste-to-energy sector. A significant portion of solid waste is not collected daily (35 % in Egypt, 26 % in Syria and 95 % in rural Yemen) and segregating waste for reuse and recycling is mainly carried out by the informal sector. Finally, about 90 % of the total solid waste in GCC and Mashreq countries is disposed into dumpsites and unlined landfills, resulting in air, land and groundwater pollution from hazardous chemicals, high GHGs emissions (up to 12 % of the national emissions, such as in Jordan) and particulates produced from burning waste. The interlinkage between peace, security and environment was especially demonstrated when long-lasting governmental waste mismanagement in Lebanon, in the backdrop of religious cleavages, spawned the 2015 protests.

As an exception, Israel has introduced substantive changes in its waste policies since the 1990s, establishing an integrated waste management system similar to those of other OECD countries. Despite the absence of official valid figures documenting the level of target achievements, regulations have been issued to close uncontrolled dumpsites, set up sanitary landfills, reduce the amount of waste produced, increase recycling rates, and discourage packaging waste through polluter-pay measures (Bösiger R. 2019).

Coastal and marine ecosystems

The MENA region comprises 3 marine sub-regions: the south-eastern part of the Mediterranean Sea, the Red Sea and Gulf of Aden, and the ROPME Sea Area. They host some of the world's most unique coastal and marine environments, with high levels of species endemism in the isolated Mediterranean (8 % of the world's marine species, International

Union for Conservation of Nature, 2017) and Red Sea, as well as remarkable habitats such as mangroves, seagrass beds, coral reefs and mudflats.

These ecosystems provide a number of goods and services: rich fisheries ensure a historical source of food and income to coastal communities, seawater resources are converted into fresh water through desalination and the growing tourism industry generates economic benefits (20 % of Lebanon's Global Domestic Product (GDP), UN-Habitat 2011). However, many pressures are exerted on these resources, threatening their future availability. Unregulated coastal development associated with urbanization and population growth has led to the modification of 40 % of the GCC coast, while the coastal regions of the Maghreb (Algeria, Libya, Morocco, Tunisia) are the most highly urbanized (AFED 2008).

Aside from physically degrading natural habitats, critical for the feeding and nursery of marine species, human activities disrupt and pollute these ecosystems. Desalination plant discharge, waste, agricultural drainage run-offs (40 % of sewage effluents in the Gaza Strip are discharged to the sea without treatment), and oil spills (5 000 estimated tons in the Red Sea) all contribute to introducing nutrients, hydrocarbons and heavy metals into marine environments. Other pressing environmental issues include bycatch, overfishing - as shown with the GCC countries doubling their catches over the two past decades - and sea level rise, induced by climate change.

Indeed, most of the MENA capitals, including several of the fast-growing cities (Abu Dhabi, Doha, Dubai), are located on coastal zones, making them highly vulnerable to the predicted sea-level rise in the next century. The latest IPCC report (2013) projects a potential global mean sea level rise of about 1 meter by 2100 (in the high emissions scenario). Such an increase would directly impact considerable surfaces of coastal areas, reducing agricultural land and destroying economic and population centers. The low-lying countries, small island states and river delta areas (Tunisia, Qatar, Libya, UAE, Kuwait, and Egypt) are particularly at risk of flooding and salination. Coastal environment degradation will further compound these damages, with the loss of mangroves and coral reefs increasing coastline exposure to waves.

Biodiversity

Terrestrial, coastal and marine ecosystems of the MENA region host a wealthy biodiversity. In the Jordan Valley, marshlands and wetlands provide essential support to 500 million migratory birds every season. The diverse habitats of GCC and Mashreq countries (mountain upland plateaus, inland, riverine and coastal plains, sand deserts and wetlands, Fig.2) host 5,500 endemic plant species, and many wild progenitors or relatives of essential crops, cereals, pulses, oil- and fibre-yielding plants, vegetables and fruits. The research on these species' specific adaptations to their harsh environment, such as drought tolerance, offers very interesting perspectives. However, their situation is alarming: in Yemen and Oman, 220 of the endemic species assessed by the International Union for the Conservation of Nature (IUCN) Red List are threatened with extinction.

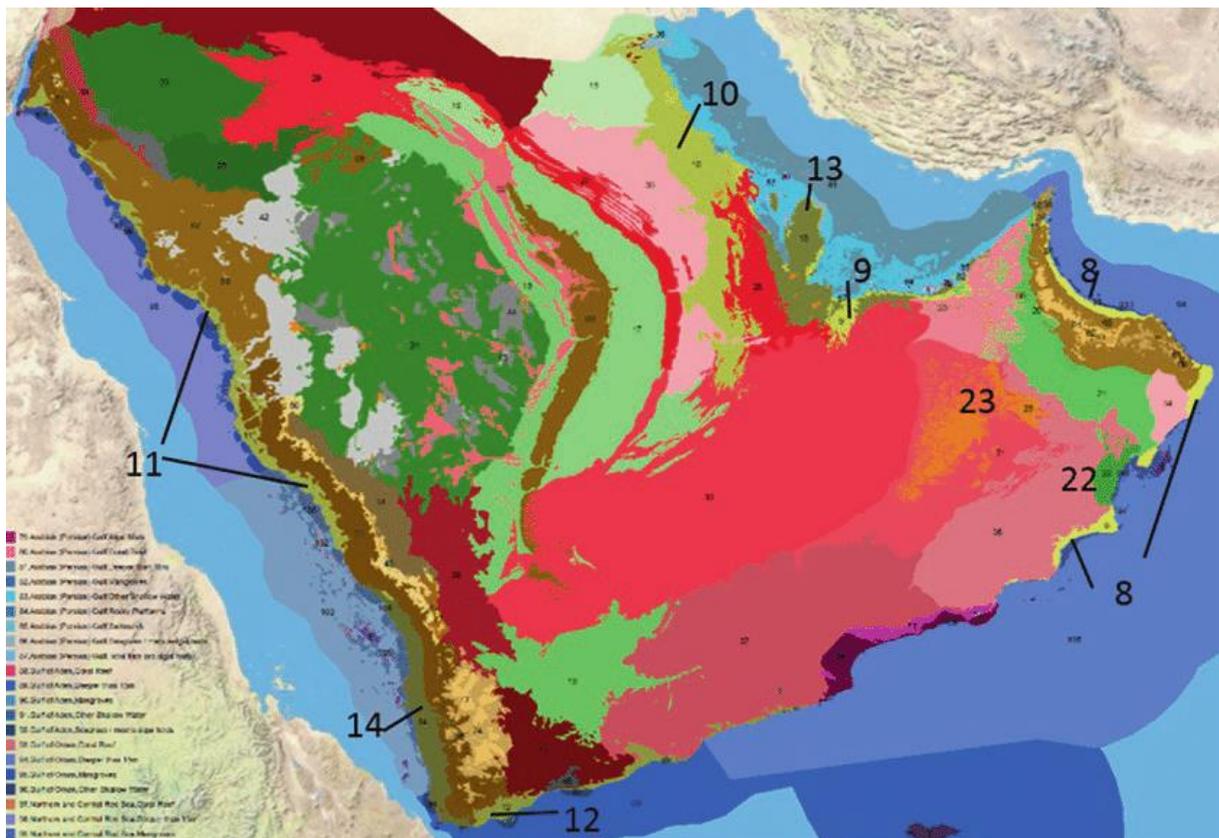


Figure 2: Plants of Sabkha Ecosystems of the Arabian Peninsula (Ghazanfar S. et al. 2019)

Remarkable marine ecosystems face the same status. Mangroves, seagrass beds and coral reefs are critically endangered in the Arabian Gulf, while they sustain rich communities, including the world's second largest population of dugongs and the endangered green turtle. Species loss and habitat decline are mainly driven by development, climate change (sea temperatures warming cause coral bleaching), conflict and inadequate policies such as insufficient protected areas coverage or conservation and restoration programs.

Transition towards sustainability

Concerted efforts towards greater sustainability are now taking place throughout the region. In the energy sector, for example, most of the MENA countries are committed to scaling-up their installed renewable energy capacity, and some countries have particularly ambitious plans: Morocco announced it intends to have a national renewable energy target of 52 % by 2030, Algeria set it at 27 %, while the UAE has a 24 % target by 2021. Morocco ranks first in total renewable generation capacity (excluding hydropower), with the largest solar photovoltaic program (AFED 2008), while Egypt occupies the leading position in wind energy. Nonetheless, almost all other countries have distributed and utility-scale PV installations. "Over 3,000 MW of new renewable power capacity is now under construction in the region." according to the International Renewable Energy Agency (IRENA). In the case of Turkey, a study from the SHURA Energy Transition Centre (2018) even demonstrated that the share of renewable power (10 % in 2017, excluding hydro) has the potential to double by 2026 through its existent transmission grid.

Regarding water resources, the FAO reports progress in water governance although the perverse effects of past policies persist (2018). Governments in the MENA region are seeking to change incentive frameworks for use of water in agriculture, to establish licensing and regulation systems for groundwater management, and sometimes to decentralize water

resources management to the local level while increasing responsibility for water efficiency to communities. Such approaches have proven to be successful in Jordan and Egypt. Israel is recognized as a leading country in water recycling, with more than 87 % of the country's wastewater treated and reused for agriculture (Marin, P. et al. 2017). The institutional, regulatory and technical measures underlying this achievement compose an inspirational best-practice for other MENA countries.

Conclusion

The MENA region's mostly semi-arid and arid environment makes it one of the historically most vulnerable to natural stresses, and currently to climate change. Over the past two decades, major changes such as population growth, economic development, accelerated urbanization - especially in the coastal areas - and geo-political conflicts in some countries, have further exacerbated the most pressing environmental challenges shared throughout the region: water scarcity, arable land depletion, ecosystems degradation, biodiversity loss, waste management and air pollution. These issues are intertwined and inseparable from their socio-economic implications, as pointed out by the GEO-6 (2016) when identifying Peace, Security and Environment and the Food, Energy and Water nexuses as the 2 priority themes in West Asia.

There is progress in the region's stride to achieve the Sustainable Development Goals, as evidenced by the ambitious national targets of Morocco, Egypt and Algeria in transitioning to renewable energy (Goals 7 and 13). New water-related technologies also have a key role to play in the sustainable development of the MENA region, as demonstrated by the pioneering achievements of Israel in water desalination, recycling and reuse. However, although some case studies reflect growing attention by MENA governments concerning environmental issues, experts warn that efforts are still far from sufficient to adequately address them (OECD 2010). Policy developments face difficulties when it comes to coherent implementation and enforcement. According to experts, the re-organisation broadly needed to achieve integrated environmental management in the MENA countries would require institutional and regulatory reforms, long-term investment, efficient governance, regional cooperation for concerted efforts and the involvement of all stakeholders.

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