MENA's Common and Differentiated Environmental Challenges

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Introduction to the MENA Region

MENA – the Middle East and Northern Africa is sometimes called "the Arab World" or the "Greater Middle East". The region is generally considered to be comprised of twenty-one countries, covering an area of some fourteen million square kilometers and home to 571.6 million people, as of 2018.[1] This constitutes some 8% of the world's population--roughly comparable to the percentage of Europeans. A little more than half of MENA residents live in cities. Five countries – Egypt, Turkey, Iran, Algeria, and Sudan make up 60% of MENA's population.[2]

While MENA countries include a very broad range of landscapes and climatic realities, the region can be divided into four basic geographic regions. These include:

- *The Al-Mashreq countries*, (Iraq, Syria, Turkey, Iran, Lebanon, Jordan, Israel and Palestine) which for the most part, enjoy reasonable surface and groundwater resources;
- *The Al-Maghreb countries* of Northern Africa (Libya, Tunisia, Algeria, and Morocco) whose people crowd the Southern Mediterranean coasts, away from the desert hinterlands and whose cultures continue to reflect French colonial influence;
- Egypt and Sudan make up the *Nile Basin countries*, whose vast population straddle the world's longest river.
- *The Arabian Peninsula countries* include Saudi Arabia, Kuwait, the United Arab Emirates, Qatar, Oman, Bahrain and Yemen. These lands are typically hyper-arid and frequently are imbued with prodigious petroleum resources, making it home to the most powerful economies in the region.[3]

Despite the vast differences in history, prosperity, climate and topography, the MENA countries and their people, share many common characteristics. Religion is one: More than a quarter of the world's Muslims reside in the MENA region. But then, it is also the only part of the world where the vast majority of the population is Muslim, with Arabic serving as the predominant lingua franca. Recent census data suggest that the region's populations of 13 million Christians and 7 million Jews (largely living in Israel) are growing, but they remain a trivial fraction of the region's people.[4] Relative to many parts of the world, religion has a powerful role, not only as factor in conflicts, but also as a source of spiritual enlightenment and inspiring cultural heritage.

While there are varying levels of precipitation and access to hydrological resources, almost the entire MENA region can be characterized as *drylands* and its reputation for water scarcity is well deserved. For instance, all of the MENA countries are defined by the United Nations as being

[1] The World Bank, Data Bank. https://databank.worldbank.org. Last visited on January 22, 2020.
[2] The World Bank, Data Bank. https://databank.worldbank.org. Last visited on January 22, 2020.
[3] Kandeel, A., 2019, *Freshwater Resources in the MENA Region: Risks and Opportunities,* Washington, D.C., Middle East Institute, https://www.mei.edu/publications/freshwater-resources-mena-region-risks-and-opportunities.
[4] Pew Research Center, 2015, "Middle East-North Africa", *The Future of the World Religions, Population Growth Projections, 2010-2050,* https://www.pewforum.org/2015/04/02/middle-east-north-africa/#fn-22818-63.

affected by desertification.[5] A recent report by the World Bank calls the Middle East and North Africa "the most water scarce region in the world", with 60 percent of the populating living with *high* or *very high* surface water stress. [6]

The pervasive water shortages contribute to the general ecological and economic fragility—over seventy percent of the gross domestic product is produced in areas that face chronic hydrological shortfalls. Access to water remains a particularly troublesome challenge because, notwithstanding the prodigious income generated by the region's oil sales, agriculture still provides a livelihood for some 35% of MENA residents, contributing to 13% of the regional GDP. This is far higher than the global 3.2% average. It also means that issues such as climate change and desertification constitute existential threats to the livelihoods and lifestyles of tens of millions of MENA residents.[7]

Manifestations of this vulnerability are already conspicuous. In 2019, the MENA economic growth rate is projected to be extremely subdued—with the 3.3 trillion dollar aggregate GDP only expected to increase, 0.6% less than half the rate of demographic growth.[8] Climate change actually threatens to be doubly damaging to the region's economy. Beyond projected drops in water for irrigation and household usage, the anticipated increase in renewable energy investment worldwide will almost certainly mean a reduction in oil production revenues.

This summary seeks to assess MENA's common ecological challenges and evaluate some of the primary social, physical and economic drivers behind environmental degradation and reasons why some MENA countries enjoy better conditions than others. Urbanization is increasingly defining local residential patterns, bringing with it, prodigious air pollution problems. Water resources have always been scarce in the region, but despite the promise of desalination, water shortages remain an enduring—and in some MENA countries an increasingly severe—problem. These are exacerbated by climate change, which is going to play an increasing role in the economic and recreational reality of the region. Finally, population pressures are a dominant driver in many MENA countries' environmental pathologies. But demographic dynamics in the region are not uniform, so that places like Lebanon, Morocco and Tunisia have fertility levels that are either near or below replacement levels.

The analysis posits that in an area characterized by considerable political turbulence and violence, regional environmental challenges provide an excellent basis for cooperation and for confidence building. Moreover, due to the powerful religious traditions, faith leaders have an important role to play in supporting such political ecological collaboration. If the region can continue to expand its renewable energy capacity, implement efficient water management technologies and strategies, while moving beyond its traditional agrarian economic livelihoods, it has the potential to build a new, shared culture of sustainability.

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[5] United Nations Convention to Combat Desertification, Action Programmes, last visited, December 2, 2019, https://www.unccd.int/convention/action-programmes.

[6] World Bank. 2018. *Beyond Scarcity: Water Security in the Middle East and North Africa. MENA Development Report*, Washington, DC: World Bank. https://openknowledge.worldbank.org/handle/10986/27659 License: CC BY 3.0 IGO.

[7] EcoPeace Middle East, 2019, *Climate Change, Water Security, and National Security for Jordan, Palestine, and Israel*, Amman, Jordan; Tel Aviv, Israel; Ramallah, Palestine: Carry, Inga (Ed.).

[8]World Bank, 2019, *MENA Economic Update: Reaching New Heights: Promoting Fair Competition in the Middle East and North Africa*, Washington D.C., World Bank, https://www.worldbank.org/en/region/mena/publication/mena-economic-update-october-2019-reaching-new-heights.

Air Pollution in an Increasing Urbanized Region

During the past decades, a steady "rural – urban" migration has changed the face of most MENA countries. As this phenomenon continues, paralleling trends in Europe and other continents, over half of MENA residents already live in cities and urbanization rates only increase. The World Bank projects that by 2050, the number of residents in the region's cities will double. If present trends continue, they will face a range of acute environmental problems.

With a population of over 20 million people, Cairo is easily the largest city in the MENA region. It is also the most polluted. Indeed, it is in a recent study that aggregated several environmental indicators, such as ambient air quality, noise and light pollution, Cairo ranked as the most polluted city in the world. Statistically, Cairo has more than a 10% higher aggregate pollution level than New Delhi. It is 25% more polluted than the "bronze medal" pollution champion, Beijing.[9] The sources of the atmospheric contamination can roughly be divided equally between the tremendous automotive fleet and stationary industrial sources. The fact that over half of the country's polluting, industrial infrastructure are located in the metropolitan area plays a large role in the city's pollution nightmare.

The surfeit of emissions poses meaningful health insults, especially due to the high concentrations of fine particulate concentrate in Cairo's air. One 2015 study by the *Egypt Scientific Society* attributed 2,400 premature deaths, 329,000 cases of respiratory disease and 8 million asthma attacks annually to the chronic contamination of urban air.[10] In a country with imperfect health insurance coverage, the 1.3 billion dollar price tag associated with *direct* medical expenses is largely born by the air pollution victims.

When one compares these risk estimates to other countries with far lower pollution concentrations, they almost certainly constitute an understatement. An earlier, peer-reviewed study reported 15,000 excess annual deaths due to air pollution—twice the air pollution related mortality rates found in hyper-pollution havens such as Mexico City and Mumbai.[11] According to the World Bank, at 71, life-expectancy in Egypt is among the lowest in MENA countries, a full decade lower than places like Israel and Lebanon. Only in Syria, Iraq and Yemen do people live fewer years on average.[12]

Cairo's situation may be extreme, but it is hardly anomalous. The World Health Organization reports that the seven million residents of Riyadh also face extremely high air pollution exposure. Of particular concern is the egregious air pollutant, *pm 2.5* (fine particles that penetrate the lungs) whose concentrations are fifteen times higher than recommended health standards.[13] With over 3 million people, Casablanca is by far the largest city in Morocco. Not surprisingly, it is also a world leader in air pollution. In 2016, Marrakesh hosted the United Nations Climate Change Convention. Prior to the meeting, environmental commentators wondered whether this was appropriate seeing that

[9] Whittaker, F., 2018, the Most Polluted Cities in the World, *The Eco Experts,* https://www.theecoexperts.co.uk/blog/most-polluted-cities.
[10] McLoughlin, P., 2015, Cairo's Deadly Environment,, *The New Arab,* July 19, 2015 https://www.alaraby.co.uk/english/indepth/2019/11/30/syria-weekly-banking-on-lebanon-is-not-paying-off.
[11] Gurjar, B.R., Jain , A., Sharma , A., Agarwala, A., Gupta , P., Nagpure , A.S., Lelieveld, J. 2010, Human health risks in megacities due to air pollution, *Atmospheric Environment* 44 4606-4613.
[12] World Bank, 2017.
[13] Ramsey, L., 2016, About 80% of all cities have worse air quality than what's considered healthy — here are the 15 with the worst air pollution. *Business Insider,* https://www.businessinsider.com/the-cities-with-the-worlds-worst-air-pollution-who-2016-5.

Casablanca at the time was ranked the sixth most polluted city in the world[14] with air quality in Marrakesh not much better. As a result of modest improvements in the country's air quality standards since that time, other cities around the world have surpassed Morocco's metropoles. Today Casablanca and Marrakesh are now only among the world's top 50 polluted cities, with air pollution in Tunis measured at similar levels.

With 15 million people, Istanbul is the second largest city in the MENA region. Air pollution in the city has reached crisis levels, primarily due to mobile source emissions and the revived utilization of wood and coal for household heating, in the light of increases in natural gas prices. In 2015, Istanbul gained the dubious honor of being the world's most congested city, which has only grown worse with massive new development projects on the European side of the city.[15] But air quality remains a problem throughout the country, with only six of Turkey's 81 provinces meeting the country's basic air standards. The extent of the air pollution problem is not well characterized as only two of the major "criteria air pollutants" (sulfur dioxide and particulate matter) are monitored regularly, with more serious contaminants, such as air toxics, nanoparticles or even pm 2.5, not even measured in most cities.[16]

In most areas including drinking water quality, litter, noise pollution and accessibility to parks, Tehran has reasonable environmental rankings. The exception is air pollution levels, which are very high.[17] In 2019 there were an exceptional number of air pollution episodes across the country, culminating in a late December when 14,000 people were hospitalized with air pollution related ailments—about sixty five percent involving pulmonary problems and the remainder with respiratory symptoms. Roughly half of those hospitalized live in Tehran, where schools and universities were closed for five days. Some 4,000 to 5,000 premature mortalities due to air pollution were reported among the city's 7 million residents.[18]

Mobile, rather than stationary sources are behind recent increases in MENA's air pollution concentrations. The number of cars in metropolitan areas around the region is rapidly rising. For instance, in a single decade, between 2004 and 2014, the number of automobiles in Morocco almost doubled. The consistent violations of air quality standards for suspended particulates in Baghdad are also attributed to growing traffic density.[19]

Unfortunately, the increase in automotive traffic in these countries was not accompanied by meaningful improvements in the quality of gasoline sold at the pumps. Nor did the steady influx of new vehicles mean the retirement or decommissioning of older cars. Indeed, a significant contributing factor to today's air pollution crisis is the aging of MENA's transport fleet. Until recently, an average

[14] Staff Reporter, 2016, Casablanca, Sixth Most Polluted City in the World, *Morocco World News,* September 7, 2016. https://www.moroccoworldnews.com/2016/09/196299/casablanca-sixth-polluted-city-world/.

[15] Staff, Istanbul air may be a health hazard, *Ahval, January 30, 2019,* https://ahvalnews.com/turkey-environment/istanbul-air-may-be-health-hazard.

[16] Air pollution rising dramatically in Turkey's Istanbul, *SOL International,* January 30, 2019, https://news.sol.org.tr/air-pollution-rising-dramatically-turkeys-istanbul-175644.

[17] Numbeo, *Cost of Living, Tehran,* website last visited January 12, 2020, https://www.numbeo.com/pollution/in/Tehran.

[18] Tehran Times Staff, 2019, Air pollution choking Iranian cities, some 14,000 hospitalized, *Tehran Times,* December 25, 2019, https://www.tehrantimes.com/news/443416/Air-pollution-choking-Iranian-cities-some-14-000-hospitalized.

[19] Rabee, A.M., 2015, Estimating the health risks associated with air pollution in Baghdad City, Iraq. *Environmental Monitoring Assessment,* 187 (1) 4203.

Egyptian taxi had been on the road for 32 years. Older vehicles, invariably, are more polluting than new cars, with many automobiles operating entirely without catalytic converters.[20]

The combination of poor fuel quality, old 'super polluting vehicles' and inadequate, clean public transport options in MENA cities takes its toll on the health of residents. A recent survey conducted by scientists at University of Hassan II Casablanca, reported a range of health impacts from Morocco's pollution emissions associated with the growing vehicle fleet.[21] The direct costs to Moroccan society has been measured at over one billion dollars—over one percent of total GNP.[22]

There are some environmental experts who might categorize these adverse environmental conditions as an inevitable stage in MENA countries' economic evolution. The well-known 'Kuznets Curve' posits that as countries move from developing to developed economic status, pollution levels initially increase until reaching a peak and then dropping steadily as new prosperity allows for societies to address environmental challenges. According to this view, it is only a matter of time until a dramatic improvement in urban environmental quality will be observed in MENA's emerging economies. Unfortunately, the economic data do not support such a supposition. For instance, Egypt's annual per capita GDP has actually dropped during the past decade, falling to 2800 dollars/ year—while air pollution mounted. [23]

The most immediate road to improved air quality involves a transition from fossil fuel and coal-based electricity to renewable energy. Given the prodigious access to sunshine and the extraordinary drop in solar panel prices, the region needs to prioritize a cleaner, solar-based energy system. This is slowly starting to happen. Too slowly. The *Middle East Solar Industry Association* recently reported that some 15 billion dollars of solar projects will begin operation in the MENA region during the next five years. It identifies the top five markets in the MENA as the UAE (58%), Egypt (23%), Jordan (10%), and Morocco (6%).[24] Many countries, however, for now, appear to be left behind. Even Israel, internationally recognized for its technological prowess and start-up entrepreneurial culture, has a meager 5% of its electricity produced by renewables.[25]

Water Crisis

Since time immemorial, water has constituted a critical resource for people living in the MENA region. In a 2018 report, the World Bank posited that of "all the challenges the Middle East and North Africa region faces, it is least prepared for water crises."[26] Objectively, the region is recognized

[20] World Bank, 2015, Scrapping and Recycling Old Vehicles in Egypt, https://www.worldbank.org/en/results/2015/08/12/scrapping-recycling-old-vehicles-egypt.
[21] Inchaough, M., Tahiri, M., 2017, Air pollution due to road transportation in *Morocco: evolution and impacts,* Journal of Multidisciplinary Engineering Science and Technology. 4 (6) 7547-7552.
[22] Croitoru, L. and Sarraf, M. 2017, Estimating the Health Cost of Air Pollution: The Case of Morocco. *Journal of Environmental Protection,* 8, 1087-1099.
[23] Macrotrends, 2019, Egypt GNP,1967-2019, https://www.macrotrends.net/countries/EGY/egypt/gnp-gross-national-product
https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=EG
World Bank, GDP per capita (current US$) - Egypt, Arab Rep.
[24]Proctor, D. 2019, Solar Projects Show Rapid Growth in Middle East, *Power,* January 11, 2019, https://www.powermag.com/solar-projects-show-rapid-growth-in-middle-east/.
[25] Tal, A. 2019, Israel Can Do Better: A 70-Year Report Card of Environmental Underachievement, *Tel Aviv Review of Books,* Winter, 2020..
[26] World Bank. 2018. *Beyond Scarcity: Water Security in the Middle East and North Afric*a. MENA Development Series. Washington D.C., World Bank.

as the most water scarce region in the world—with most communities confronting chronic water stress. The problem is that the combined effect of massive population growth and climate change have exacerbated hydrological conditions, making new, sustainable water policies and technological advancements imperative. And things are surely going to get worse. Climate models suggest that in parts of the MENA region where population density is highest and agricultural production most significant, average precipitation has already begun to drop.

For some time, the Hashemite Kingdom of Jordan has found itself in the midst of a severe water crisis. Already ranked as the second most water poor nation in the world, per capita availability is about 88 percent below the international water poverty line of 1,000 cubic meters (one million liters) per person. Jordan's population has grown some 2000 percent since it became independent some 70 years ago, stretching existing water resources to the max. And now, the influx of over one million refugees from Syria has contributed to an additional 40% increase in water demand in some regions.

Jordanian Minister of Water and Irrigation, Raed Abdul Saud, recently announced a new water provision formula according to which citizens would only receive water once a week, for a maximum of eight hours.[27] Already, mounting discontent over chronic shortages boiled over into full-fledged riots in Jordan, with some communities literally ripping out water meters in protest of irregular and low quality water supply.[28] Increasingly, water shortages are recognized as a source of social and international tensions across MENA.[29]

The Euphrates River offers another case in point. In the first half of the twentieth century, hydrometric stations on the Syrian-Turkish border measured the natural flow as reaching 1200 cubic meters per second.[30] By 2010, the mean annual discharge was as low as 500 cubic meters per second. Part of the drop can be attributed to diversions that filled reservoirs and provided irrigation but climate change's contribution is increasingly cited as a factor.[31] Many experts argue that the consecutive droughts and the rise in average temperatures were the reason for the agricultural collapse that precipitated the destabilizing events that preceded Syria's civil war.[32] [33] Other experts believe that the proximate cause was the disruption of Euphrates water supply by Turkey.[34] But all agree, that drought conditions have changed the historic agronomic calculus of the region and constitute a destabilizing force in a very volatile region.

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[27] JT, 2018, Water woes come to fore at Jordan, NATO meeting, *Jordan Times,* November 19, 2019, https://www.jordantimes.com/news/local/water-woes-come-fore-jordan-nato-meeting.

[28] Schwartzstein, P. 2019, How Jordan's Climate and Water Crisis Threatens its Fragile Peace, The Center for Climate and Security, https://www.preventionweb.net/news/view/67594.

[29] Givetash, L. 2018, Water scarcity fuels tensions across the Middle East, *NBC News,* November 1, 2018**,** https://www.nbcnews.com/news/world/water-scarcity-fuels-tensions-across-middle-east-n924736.

[30] UN-ESCWA.2013, *BGR Inventory of Shared Water Resources in Western Asia*; Chapte 1: Euphrates River Basin; UN ESCWA: Beirut, Lebanon,. 47–78.

[31] Bilgen, A. 2018, The southeastern anatolia project (gap) revisited: The evolution of gap over forty years. *New Perspect. Turkey*, *58*, 125–154.

[32] Kelley, C.P.; Mohtadi, S.; Cane, M.A.; Seager, R.; Kushnir, Y., 2015, Climate change in the fertile crescent and implications of the recent Syrian drought, *Proceedings of the National Academy of Science,* 112, 3241–3246.

[33] Gleick, P.H. 2014, Water, drought, climate change, and conflict in syria. *Weather Climate and Society*. 6, 331–340.

[34] Karnielli, A., Shtein, A., Panov, N., Weisbrod, N., and Tal, A., 2019, Was Drought Really the Trigger Behind the Syrian Civil War in 2011? *Water* 11(8) 1564-1575.

The environmental devastation found in the Jordan River offers an even more extreme example.[35] With tributaries beginning in Lebanon and Syria, this spiritually iconic waterway was once a powerful geographic and strategic landmark—so formidable that Moses chose not to cross it. Some estimates reckon that the historic annual currents of the southern segments contained 1,600 million cubic meters of rushing waters a year.[36] But those days are long gone and will probably never return; due to past diversions in Syria and Israel and reduced precipitation, present measurements show an average annual flow of 23 million cubic meters, only 1.4% of the original current.[37]

For many years, the drop in available water across MENA was primarily attributed to rising consumption and population growth—factors that drove aggregate demand. Experts, however, increasingly recognize that *supply* is also a problem, as the role of climate change as a factor that water managers can no longer ignore. In November 2018, after five years of drought, the Sea of Galilee reached its lowest point in recorded history, even though its waters had hardly been tapped during the previous years.[38]

Such profound disparities in hydrological, economic and social realities could easily become a source of enmity and ultimately conflict. But they also could provide a unique opportunity for innovation and cooperation. A combination of drip irrigation and wastewater reuse have enabled Israel to increase its agricultural production while reducing the utilization of fresh water resources.[39] Seawater desalination first came of age as a municipal water supply solution in the Arabian Gulf. Today the cost-effectiveness and energy efficiency of the original thermal, distillation processes utilized in Saudi Arabia facilities are increasingly questioned.[40]

The alternative desalination technology, reverse osmosis process, is less expensive, but the environmental impact of the brine produced after it is discharged back into the sea remains an open question. According to a recent United Nations report, Saudi Arabia, UAE, Kuwait and Qatar account for 55% of the total global share of brine discharged from energy-intensive desalination plants.[41] Israel municipal water supply today also relies almost entirely on treated seawater. The local plants produce the least expensive, desalinated water in the world, but the associated carbon footprint is considerable.[42]

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[35] Gafny, S. Talozi, S., Al Sheikh, B., and Ya'ari, E.. 2010. *Towards a Living Jordan River: an Environmental Flows Report on the Rehabilitation of the Lower Jordan River*. EcoPeace/Friends of the Earth Middle East, Amman, Bethlehem, Tel Aviv.

[36] Rumman, N., 2010 Managing the Jordan River – A Palestinian Perspective, in *Water Wisdom, A New Menu for Palestinian and Israeli Cooperation in Water Management*, ed. A. Tal and A. Abed-Rabbo New Brunswick, NJ: Rutgers University Press, 238–45.

[37]Chen, A., Weisbrod, N., 2016, Assessment of Anthropogenic Impact on the Environmental Flows of Semi-arid Watersheds: The Case Study of the Lower Jordan River, *Integrated Water Resources Management: Concept, Research and Implementation* D. Borchardt et al. (eds.), Springer, Switzerland, DOI 10.1007/978-3-319-25071-7_12, 14:1303–1314, 59-82.

[38] Tal, A. 2019, The implications of climate change driven depletion of Lake Kinneret water levels: the compelling case for climate change-triggered precipitation impact on Lake Kinneret's low water levels, *The Science of the Total Environment*, 664, 1045-1061.

[39] Tal, A. 2016, Rethinking the Sustainability of Israel's Irrigation Practices in the Drylands, *Water Research* 90, 387-394.

[40] Fountain, H., 2019, The World Can Make More Water From the Sea, but at What Cost? *The New York Times,* October 22, 2019, https://www.nytimes.com/2019/10/22/climate/desalination-water-climate-change.html.

[41] Jones, E., Qadir, M., van Vliet, MTH, Smakhtin, V.Kang, S.M., 2019, The State of Desalination and Brine Production, A Global Outlook *Science of the Total Environment*, 657, 1343-1356.

[42] Tal, A., 2018, Addressing Desalination's Carbon Footprint: The Israeli Experience, *Water,* 10, 197-210.

The World Bank's recent report about looming water scarcity in the MENA region calls for much more conscientious and "out of the box" thinking in order to overcome what is already crisis levels of shortages: *"Now and in the future, a broader range of tools, technologies, and policies will need to be considered, debated, and implemented. Investments in water infrastructure, information systems, institutions, and technologies will be needed. Societies will need to move beyond the traditional approach to managing scarcity by augmenting supplies, and consider controversial solutions… Social inclusion must be central to the delivery of water services and protection of poor and marginalized populations from water-related risks."*[43]

The Challenge of Climate Change

No environmental issue reflects both the common environmental destiny of people across the Middle East and North Africa—as well as the profound disparities among MENA countries—like climate change and greenhouse gas emissions. Combined greenhouse gas emissions from within the region contribute some 8% of the global total, only slightly more than its proportion of the world population. Average individual emissions when calculated are slightly more than 6 tons per person, roughly analogous to the international average.[44] Yet such figures hide the vast contrast existing between the region's wealthier and poorer countries.

Some of the highest per capita greenhouse gas emission rates can be found in the Arabian Peninsula: Oman, Qatar, Saudi Arabia and the United Arab Emirates easily accede 30 tons of per capita CO2 equivalents, with Kuwait having the highest per capita footprint in the world—nine times the global average. At the same time countries like Sudan, Yemen and Palestine are among the world's lowest emitters, with per capita averages below 1.5, only a quarter of the global average.

While contributions to the climate crisis may vary dramatically across the region, consistent with the arguments of climate justice advocates, *everyone* living in the region is going to feel the profound changes in the weather which global warming will bring. Indeed, MENA is a "climate change hot spot", with the negative impacts of the new climatic reality disproportionately felt across the region. For instance, while the UN climate convention seeks to contain global temperature rise to 1.5 degree Celsius, one climate model projects that temperatures in July and August in the MENA region could increase by as much as 4% by the end of the century.[45] Another predicts a 7-degree increase in maximum temperatures across MENA by the end of century.[46] Precipitation may drop by as much as 25% and the intermittent heat waves are certain to lengthen.[47] Nevertheless, statistics can be numbing and do not fully express the severity of the risk posed by global warming to the region. The Middle East and North Africa are stereotyped as hot desert lands for a reason. And the region is already getting much hotter. In the United Arab Emirates, summer temperatures now routinely exceed 50 degrees Celsius (122 degrees Fahrenheit).[48] In Iraq, recent temperatures of over 53

[43] World Bank. 2018. *Beyond Scarcity: Water Security in the Middle East and North Afric*a. MENA Development Series. Washington D.C., World Bank.
[44] Rabinowitz, D., 2019, *Parched Future? The Middle East in the Post Normal Climate Era*, Draft Manuscript, Accepted for Publicatioon, Stanford University Press.
[45] Evans, J. 2009, 21st century climate change in the Middle East. *Climatic Change 92*:417–432.
[46] Lelieveld, J., Proestos, Y., Hadjinicolaou, P. Tanarhte, M., Tyrlis, E. Zittis, G. Strongly Increasing Het Extremes in the Middle East and North Africa (MENA) in the 21st Century, *Climatic Change,* 137 (1-2) 245-260.
[47] Bocchignani, E., Mercogliano, P., Panitz, H.J., Montesarchio, M., 2018, Climate change projections for the Middle East–North Africa domain with COSMO-CLM at different spatial resolutions, *Advances in Climate Change Research,* 9 (1) 66-80.
[48] Maximum, Temperature Touches 51° C in UAE, , July 11, 2018, https://www.khaleejtimes.com/news/weather/weather-maximum-temperature-crosses-51c-in-uae.

degrees (127.4 degrees Fahrenheit) were amongst the highest ever recorded on the planet.[49] When the human body begins to heat up to ambient levels of 40 degrees Celsius (104 degrees Fahrenheit) and exceed its normal physiological range of 37 to 38 degrees Celsius (98.6 to 100.4 Fahrenheit) we experience fever. Once the 40 degree barrier is broken, critical cellular machinery begins to break down. In other words, it is extremely dangerous to be outdoors for an extended period of time in heat that is significantly higher than these thresholds, even assuming that physical activity is at a minimum.[50]

When thermometers registered 40 degrees, causing some 1500 deaths in Paris during the 2003 heat wave—it was a wakeup call for Europe and the West about the risks associated with increasingly hot summers. People living throughout the MENA region, however, have been living and adapting to such "relatively moderate" summer temperatures from time immemorial. Nonetheless, the recent spikes in temperature significantly exceed previous levels and have already caused innumerable public health disasters: In 2015, some 61 people died with hundreds of hospitalizations after heat waves engulfed Egypt.[51]

High temperatures also serve to exacerbate social tensions. In the Cairo, summer conditions became so extreme that helpless elderly people, trapped in sweltering buildings, literally baked to death and riots subsequently broke out in the streets.[52] Access to air conditioning in Iraq has come to mean the different between life and death, which further highlights existing gaps between "haves and have nots".[53] Those of course constitute the immediate "acute impact". Of greater concern may be the "chain reactions" that could produce a litany of impacts involving desertification, food scarcity, forced migration, and political instability.[54]
The irony of course is that just as there are great asymmetries in greenhouse gas emissions, the ability to adapt to climate change across the region reflect the vast income disparities. Already countries like the United Arab Emirates, Saudi Arabia and Israel have begun to prepare sophisticated adaptation strategies.

Indeed, Jordan stands to benefit from Israel's climate adaptation measures, with the Israeli government openly describing the strategic significance of increasing water transfers to its eastern neighbor.[55] Israel has begun to build desalination plants and a water distribution infrastructure that will literally reverse 70 years of water policy that delivered water from the relatively rainy Galilee to

[49] Samenow, J., 2016, Two Middle Eat Locations Hit 129 Degrees, Hottest ever in Eastern Hemisphere, Maybe the World, *Washington post,* July 22, 2016, https://www.washingtonpost.com/news/capital-weather-gang/wp/2016/07/22/two-middle-east-locations-hit-129-degrees-hottest-ever-in-eastern-hemisphere-maybe-the-world/.
[50] Leahy, S., 2019. 'Off-the-charts' heat to affect millions in U.S. in coming decades, *National Geographic,* July 16, 2019, https://www.nationalgeographic.com/environment/2019/07/extreme-heat-to-affect-millions-of-americans/.
[51] Egypt heatwave leaves 61 people dead, *BBC News,* August 12, 2015, https://www.bbc.com/news/world-middle-east-33886557.
[52] Valentine, K. 2015, Extreme Heat Leads To Deaths, Protests In The Middle East, *Think Progress,* August 10, 2015, https://thinkprogress.org/extreme-heat-leads-to-deaths-protests-in-the-middle-east-cfdb5faf7cef/.
[53] Hall, R. 2019, In the Future Only the Rich Will be Able to Escape the Unbearable from Climate change. In Iraq, it's already happening, *Independent,* (August 19, 2019) https://www.independent.co.uk/news/world/middle-east/climate-change-apartheid-poor-iraq-effects-heatwave-a9049206.html.
[54] Tal, A., 2013, Shifting Sands, Land and Water Management in the Middle East, *Harvard International Review,* 35(2) 37-41.
[55] Tal, A., 2017, Will Demography Defeat River Restoration? The Case of the Jordan River, *The Journal of Water Research.* 111, 404-419.

its southern drylands. Today, after prolonged years of droughts, pipes are being laid and pumping stations built to draw seawater from the Mediterranean, desalinize it and discharge it into the Kinneret Lake—to the northern Sea of Galilee. With the annual addition of a few billion liters of desalinated water, the lake will once again serve as a national reservoir and even deliver substantial quantities of additional water across the border to ameliorate Jordan's acute shortages.[56]

Population Pressures

Population densities vary dramatically among countries in the MEA region. Some, like Palestine, with 827 people per square kilometer, are extremely crowded, while others, such as Algeria with 18 people per square kilometer, have vast areas of open spaces. Notwithstanding great disparities in fertility levels across the MENA countries, the World Bank reports that over the past decades, annual population growth in the region has been steady around 2 percent and that the region should double in size by 2050.[57] The associated challenges to environmental management are enormous. Like a proverbial runner on a treadmill, countries must meet close enormous socio-economic and infrastructure gaps while taking on the innumerable new environmental challenges.[58]

For many years, cultural sensitivities prevented MENA governments and experts from raising the issue of demography and population pressures.[59] Eventually, the laws of basic division became too powerful to deny; in dividing up natural resources, when the numerator increases, there is less available per capita resources remaining. Every additional person born brings with them an environmental footprint, which includes energy and transportation needs, water consumption as well as solid waste production.

Faced with unprecedented densities, many countries began to promote family planning. Egypt is a case in point; 2019 estimates count 101,213,975 residents,[60] almost a forty percent increase since the 2006 census of 72.7 million. Its present two percent annual population growth means that every year it must create 2 million more jobs, provide housing for 2 million more people and find the natural resources to support them. It is little wonder that Cairo suffers from housing[61] and unemployment crises.[62] A campaign to reduce the birth rates was launched, which included 12,000 newly trained family planning advocates focusing on the rural sector where birth rates are highest. They presumably will go to work at the 6,000 family planning clinics where check-ups are free and birth control is highly subsidized (e.g. condoms can be purchased for less than 1 US cent and

[56] Lidman, M., 2019, Plan to Pump Desalinated Water to Sea of Galilee May Open Diplomatic Floodgates, *The Times of Israel,* June 27, 2019, https://www.timesofisrael.com/plan-to-pump-desalinated-water-to-sea-of-galilee-may-open-diplomatic-floodgates/.
[57] World Bank, 2019, *Reaching New Heights: Promoting Fair Competition in the Middle East and North Africa,* October, 2019, Washington, World Bank Group, http://pubdocs.worldbank.org/en/660811570642119982/EN-MEM-ReachingNewHeights-OCT-19.pdf/.
[58] Tal, A. "2013, Overpopulation is Still the Problem, *The Huffington Post,* September 27,2013.
[59] Mitsch, A., 1990, Purdah and Overpopulation in the Middle East, *World Watch 3 (6)* 10-34.
[60]World Population Review, http://worldpopulationreview.com/countries/egypt-population/, last visited December 2, 2019.
[61] Masri, L., Abdelaty, A. 2018, Egyptian housing crisis exacerbated by government policies, *Christian Science Monitor,* Novembver 27, 2018, https://www.csmonitor.com/World/Middle-East/2018/1127/Egyptian-housing-crisis-exacerbated-by-government-policies.
[62] England, A. 2018, Middle East Jobs Crisis Risks Fueling Unrest, IMF Warns, *Financial Times,* July 12, 2018, https://www.ft.com/content/3daf3d5a-8525-11e8-a29d-73e3d454535d.

intrauterine devices for 12 cents.)[63] However, it seems, thus far, to have been a largely fruitless effort. Fertility rates have actually gone up by almost 20% over the past decade—and now are back to 3.5 children per woman.[64]

A very different dynamic can be found in the Al-Maghreb with Algeria, Tunisia and Morocco all showing dramatic drops in total fertility during the past fifty years. In 1970, the average number of children born to women in all three countries exceeded 6.5. Today, they are all below 2.7 with Tunisia and Morocco reaching optimal "replacement levels" of 2.1. Lebanon offers the most extreme example of the profound "demographic transition" occurring in many MENA countries, with 1.72 total fertility level, its population profile looks increasingly "European". [65]

It should not be surprising to find an inverse association between environmental performance and fertility levels. Yale University publishes a ranking of environmental performance on a semi-annual basis. The rankings are based on objective indicators involving parameters such as air quality; water and sanitation; heavy metals; biodiversity and habitat; forests; fisheries; climate; and energy and water resources. Not surprisingly, at the top of its 2018 rankings list are northern European countries, such as Switzerland, France and Denmark—with the Democratic Republic of Congo, Bangladesh and Burundi at the very bottom.

The pronounced differences across the MENA region to some extent can be explained by demographic factors. Among the best environmentally performing countries are Morocco and Israel—32 and 19 respectively in the world. Notwithstanding the political turbulence (or perhaps as a result of it) Iraq still has extremely high fertility levels (4.0 children per woman) and a rapid annual population growth rate of 2.5%. Environmentally, it is ranked 152 out of the 180 countries evaluated. Libya is a similar, but somewhat different story. Because of its past baby boom, the country's population continues to grow at an annual rate of 1.45%. But like its North African neighbors, today's mothers in Libya only average 2 children per family. Environmentally, Libya ranks a low 123 worldwide. Presumably, as its population begins to stabilize, it will be able to better address its environmental challenges.

Religion and Regional Environmental Cooperation

While the Middle East is stereotyped as a region overrun by religious fanaticism, factionalism and violence, reality on the ground is somewhat different. Objectively, there is nothing in the Abrahamic religions that make them a force for destabilization and hostility. [66] On the contrary, increasingly religious tolerance and understanding is emerging as the central voice in the region. This was

[63] Awadalla, N. 2017, Egypt Promotes Birth Control to Fight Rapid Population Growth, *Reuters*, August 30, 2017, https://www.reuters.com/article/us-egypt-population/egypt-promotes-birth-control-to-fight-rapid-population-growth-idUSKCN1BA153.

[64]Radovich, E., el-Shitany, A., Shokamy, H. and Benova, L**.**, 2018, Rising up: Fertility trends in Egypt before and after the revolution, *PLoS One,*13 (1)): xe0190148, 10.1371/journal.pone.0190148.

[65] CIA, *The World Factbook,* (last visited, December 15, 2019). https://www.cia.gov/library/publications/the-world-factbook/fields/345.html.

[66] Schiffman, L.H., 2016, Peace and Reconciliation in the Abrahamic Religions: Sources, History and Future Prospects, Keynote Speech at the 2016 *Annual International Conference on Ethnic and Religious Conflict Resolution and Peacebuilding*, https://www.icermediation.org/news-media/meeting-coverage/peace-and-reconciliation-in-the-abrahamic-religions-sources-history-and-future-prospects/.

recently highlighted in the United Arab Emirates where in February 2019 Pope Francis was invited to convene a mass and help issue in The Year of Tolerance.[67]

The same is true with regards to Abrahamic religions' attitudes towards protecting the environment. If there is one theological principal, which is common to mainstream Islamic, Christian and Jewish leaders and institutions it would be a profound commitment to preserving the Creation.[68] In considering today's climate crisis, religious leaders appear to speak in one voice.[69]

MENA's present environmental challenges constitute something of a paradox. On the one hand, they can increasingly be characterized as problems, which require public participation. Progress will come from reducing fertility, meat consumption, motorization and a range of other environmentally deleterious activities that involve billions of individual decisions. In a region that remains largely traditional and faith-based, clearly, the roads chosen by MENA's diverse peoples will be informed by their religious convictions.

At the same time, many of the most critical challenges involve regional or global resources, whose management requires transboundary cooperation. Watershed protection, biodiversity preservation and even air pollution control cannot be solved by unilateral national actions. In many cases, scaling up renewable energy and desalination require regional solutions.[70] As today's environmental hazards increasingly become existential threats, local citizens and their leaders may come to realize that the threat of environmental disaster dwarfs historic political and religious conflicts. Inspired by a theology of conservation, sustainability and commitment to future generations, the peoples of the MENA region, regardless of their religious persuasion, should be increasingly willing to collaborate to resolve their ecological problems. Religious leadership has a critical role to play in supporting and encouraging such blessed collaboration.

[67] Debusman, B., 2019, Visit by Pope Francis puts UAE's promotion of tolerance on the world stage, 2019, *Arabian Business,* February 8, 2019, https://www.arabianbusiness.com/culture-society/412826-visit-by-pope-francis-puts-uaes-promotion-of-tolerance-on-the-world-stage.

[68]Schaefer, J., Özdemir, I., Benstein, J., Khalid, F. and N. Ammar, N. Judaic, Christian, and Islamic Perspectives on Shared Moral Principles, paper commissioned at the *Abrahamic Traditions and Environmental Change Workshop*, Rhodes, Greece, 23-26 June 2019, sponsored by the Abrahamic Programs for Academic Collaboration in the MENA Region. August, 2019, https://abrahamicprograms.uconn.edu/abrahamic_traditions_and_environmental_change/2019-workshop-proceedings-papers.

[69] Schaefer, J. 2016, Motivated for Action and Collaboration: The Abrahamic Religions and Climate Change, *Geosciences,* 6, 1-19, file:///Users/alontal/Downloads/geosciences-06-00031-v2.pdf.

[70] EcoPeace Middle East / Konrad-Adenauer-Stiftung, 2017, *Water Energy Nexus. A Pre- feasibility Study for Mid-East Water-Renewable Energy Exchanges,* Amman, Jordan: Katz, David and Shafran, Arkady (Eds.).