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Water Scarcity in Jordan

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Introduction

Nearly eight hundred million people worldwide do not have access to potable drinking water.[1] Due to the fact that freshwater is unevenly distributed throughout the globe, some nations have water security, yet others experience water scarcity. Further, in the modern era, a growing number of nations are facing water scarcity, at least in some region of their country. Water scarcity is no longer a problem faced solely by impoverished nations, but is developing into a global issue. Water shortages do not always stem from lack of water in general, but rather from a lack of water suitable for drinking and domestic use. In addition, these nations often face an economic scarcity of water, when finding a source is too expensive or time consuming. For countries that rely on water for their daily and economic needs, this places a major stress on the nation. Throughout the globe, the lack of clean water in poor nations, attributed to a myriad of reasons, forces its people to use diseased water, which can have adverse health effects, and thereby continue the cycle of poverty. An example of this issue can be seen in the Middle Eastern country of Jordan, where a country lacks the water resources to meet its individual and national needs, resulting in a struggle to share resources with neighboring countries and develop alternatives.

Water Use and Consumption

Water is essential for everyday life. While it may appear that water is abundant, the vast majority of Earth's water is saltwater; unsuitable for nearly all uses. Less than three percent of the planet's water is freshwater.[2] Further, this water is unevenly distributed with nearly seventy percent of freshwater frozen in glaciers and iceberg unavailable for human use.[3] Generally, it is estimated that the average human would be able to survive a maximum of one week without water. In the United States, many individuals do not recognize just how dependent they are on water for tasks deemed to be daily necessities. In a nation where at times it may seem as if water is plenty, one must recognize one's use of the resource in drinking, cooking and sanitation. As Table 1 states, the average American household devotes almost 160 gallons of water daily to these uses. This is well above the United Nations recommended minimum standard of 13.2 gallons, and the average household uses of any other geographic area. That being said, an individual's water use is not always in the direct form. The food an individual consumes in an

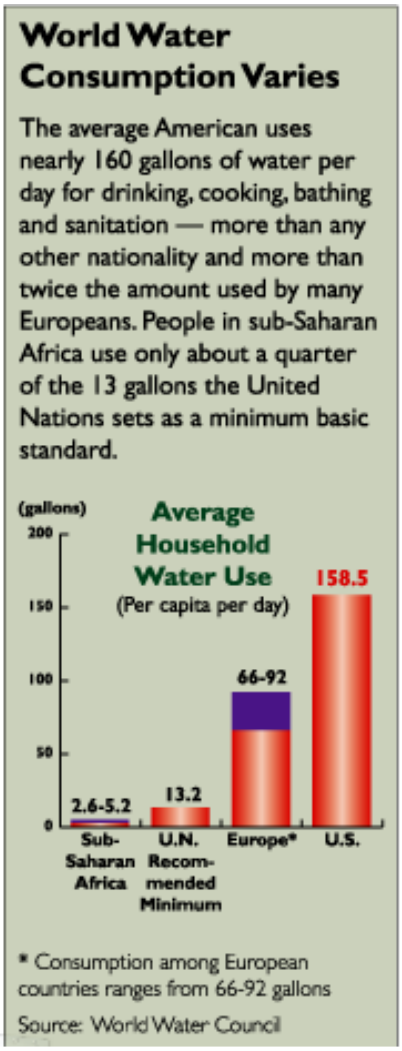


Table 1
Source: CQ Global Researcher - Entire Report[4]

[1] United Nations, "United Nations: Global Issues," n.d., http://www.un.org/en/globalissues/water/
[2] P. Behr, *Looming Water Crisis* (CQ Press, 2008),
[3] United Nations, "Water Scarcity in the Arab World" (New York: United Nations, 2003)
[4] http://library.cqpress.com/globalresearcher/document.php?id=cqrglobal2008020000&type=hitlist&num=0

average day requires between 800 and 900 gallons to grow.[5] For example, one pound of beef requires 1,799 gallons of water, and one pound of chicken calls for 468 gallons of water.[6] Similarly, one apple and one pound of wheat use eighteen gallons and 132 gallons of water, respectively, for growth. Outside of food products, 500 sheets of paper take 1,321 gallons of water to be produced.[7] Water's role in many undeveloped and developing countries is also vital. These nations feel the effects of water scarcity and drought especially hard, and often find it difficult to sustain their needs and compete in a global economy.

Efforts of the United Nations

From the late 1970s to the early 1990s, the United Nations held several conferences focused on addressing the global crisis caused by lack of water to meet basic human needs and continued growing demands. In an effort to combat water scarcity and its spread, United Nations General Assembly declared 2003 the International Year of Freshwater.[8] During the same year, the Chief Executives Board established UN Water as an inter-agency coordination group for all freshwater and sanitation related issues. With continued efforts to raise public awareness and action, the General Assembly declared the period from 2005 to 2015 as the International Decade for Action, "Water for Life."[9] Notably, the United Nations established eight Millenium Development Goals, or MDGs in 2000 with the aimed year of achievement being 2015.[10] The seventh goal was to ensure environmental sustainability. Within this goal, the United Nations established Target 7.C: to halve the proportion of the population without sustainable access to safe drinking water and basic sanitation.[11]

Causes of Water Scarcity and Future Predictions

As of 2008, the volume of water used by humans since 1950 has tripled. Additionally, the amount of irrigated cropland has doubled.[12] By the end of the twenty-first century, drought is expected to extend across half of the Earth's land surface due to climate change, resulting in hunger and increased food prices. Further, extreme drought is expected to affect one-third of the planet, making traditional agriculture essentially impossible. The United Nations estimated that it would cost at least $10 billion annually to provide clean water and sanitation for all persons worldwide.[13] Currently, only about $4 billion is devoted to this purpose. Drought affects both rich and poor nations, threatening water supplies and food production, primary in regions with arid, dry climates. Marq de Villiers, author of *Water: The Fate of Our Most Precious Resource*, and Frank Rijsberman, a known water expert, claim that there is in fact enough land and water to provide food and drinking water for everyone, but that humans are not using the resource efficiently enough.[14] As of 2008, irrigation used seventy percent of total water withdrawals,

[5] Behr, *Looming Water Crisis*
[6] National Geographic, "The Hidden Water We Use: How Much H2O is Embedded in Everyday Life?," Environment.NationalGeogrphic.com, nd., http://environment.nationalgeographic.com/environment/freshwater/embedded-water
[7] Ibid.
[8] United Nations, "United Nations: Global Issues."
[9] Behr, *Looming Water Crisis*
[10] United Nations, "Goal 7: Ensure Environmental Sustainability," UN.org, accessed April 18, 2013 from United Nations Millennium Development Goals, http://www.un.org/millenniumgoals/environ.shtml
[11] Ibid.
[12] Behr, *Looming Water Crisis*
[13] Ibid.
[14] Ibid.

industry claimed twenty-two percent, and the remainder was consumed by homes, personal and municipal uses.[15]

Marq de Villers finds the problem to be associated with the allocation, supply, management and demand of water. Civilizations have altered many of the world's rivers to suit their needs through the deepening or building of dams.[16] Dams have been vital to the rapid expansion of irrigated farming and economic growth, with the number of dams higher than fifty feet increasing sevenfold between 1950 and 2000.[17] However, they also lead to population expansion which places a strain on the resources. Further, pollution also poses a major problem to the world's supply of potable water. This is only worsened by the depletion and despoiling of the world's reservoirs, river and watersheds. The loss of wetlands increases water runoff, which aggravates flooding, in turn reducing the replenishment of aquifers and leaving rivers and lakes more vulnerable to pollution.[18] Aquifers are the greatest and fastest growing source of irrigation water. Experts assert the water would take eons to replenish, but is being used in less than a century.[19] Depleting aquifers will have ruinous and potentially irreversible effects on the forty percent of the world's agricultural output that depends on irrigation from groundwater. As Table 2 shows, the amount of irrigated land in developing countries has greatly surpassed that of developed countries. However, both rates are slowing due to declining water resources.

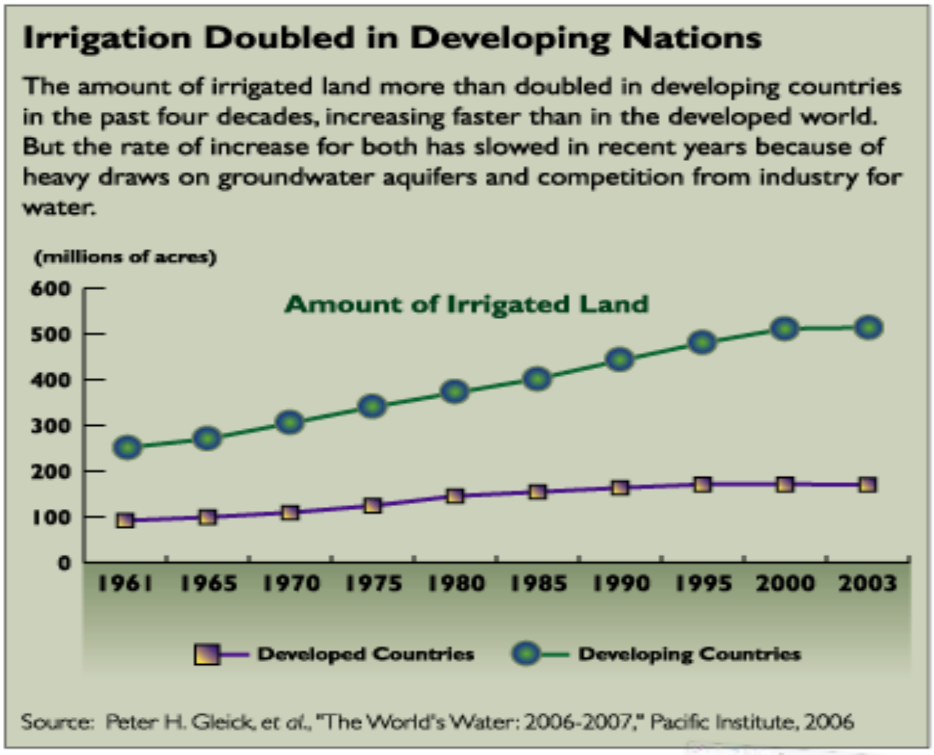


Table 2
Source: CQ Global Researcher - Entire Report[20]

Analysts warn that increasing stress placed on water supplies, along with the impact of climate change will create dangerous and even irreparable effects. Climate change is forecasted to extend and intensify drought, primarily in Earth's driest regions, and disrupt normal water flows from mountain snowcaps.[21] Snowpacks have already been shrinking, thereby upsetting

[15] Ibid.
[16] Ibid.
[17] Ibid.
[18] Ibid.
[19] Ibid.
[20] http://library.cqpress.com/globalresearcher/document.php?id=cqrglobal2008020000&type=hitlist&num=0
[21] Behr, *Looming Water Crisis*

vital seasonal water flows. Scientists are divided over whether climate change can be blamed for the current drought. However, global warming is likely to fuel more extreme weather, including droughts, violent storms and flooding.[22] The impact of climate change is predicted to be especially critical in the Middle East. Frank Rijsberman predicts of the average price of water used in agriculture globally could increase by two to three times in future decades, which in turn would transfer to food prices. The awareness of climate impacts on water supplies will hopefully increase the urgency of governments to respond.

Types of Water Scarcity

A 2006 study by the International Water Management Institute addressed the two types of evidence water scarcity; physical and economic. Physical water scarcity refers to insufficient supplies for the demands of all, and is present in landscapes home to about 1.2 billion people. On the other hand, 1 billion people experience economic scarcity, in which "human capacity of financial resources" cannot provide adequate water.[23] A United Nations task force projected that by 2025, 3 billion people globally will be confronted with "water stress conditions".[24] Access to safe, fresh water separates the well-off from the world's poorest. Each year, 1.8 million children – five thousand per day – die from waterborne illnesses such as diarrhea, according to the United Nations.[25] The consequences of water scarcity are, and will continue to be most dire for the planet's poorest inhabitants. Such a situation can be seen in the nation of Jordan.

Case Study: Jordan

The Middle East consists of three of the world's earliest river valley civilizations along the Nile, Jordan and Tigris and Euphrates. The agriculturally-based societies led to some of the globe's first cities and empires.[26] This agricultural tradition largely continues in many countries today. The Middle East is also characterized as the birthplace of the three major world religions of Christianity, Judaism and Islam.[27] Economists typically divide Middle Eastern states into production and allocation states. Allocation states derive their primary revenues by directly selling key resources to the rest of the world, and include the majority of the major oil-producing states.[28] On the other hand, production states, such as Jordan, obtain most of their revenues from citizens' labor in agriculture, herding, manufacturing or trade, as well as collecting taxes.

Jordan is located in the Middle East between Israel and Iraq.[29] Its terrain mainly consists of desert plateaus, and it has an arid climate with a rainy season from November to April, its peak during the winter months.[30] Jordan has had a complicated past with its neighbors, losing the West Bank to Israel in 1967, but then signing a significant peace treaty in 1994. It is believed that if the internal conflicts within the Middle East can be beaten, the projections for economic

[22] Ibid.
[23] Ibid.
[24] Ibid.
[25] Ibid.
[26] S. Anderson et al., *International Studies: an interdisciplinary approach to global issues*, (Boulder: Westview Press, 2013),
[27] H. R. Kerbo *World Poverty: Global Inequality and the Modern World System* (New York: McGraw Hill 2006)
[28]S. Anderson et al., *International Studies: an interdisciplinary approach to global issues*,
[29] CIA, "CIA World Factbook: Jordan" CIA.gov, last modified March 18, 2013, https://www.cia.gov/library/publications/the-world-factbook/geos/jo.html
[30] H.A. Amery, and A.T. Wolf (Eds.), *Water in the Middle East: a geography of peace* (Austin: University of Texas Press, 2000),

development and poverty reduction are positive.[31] Jordan consented to the World Trade Organization in 2000, and began to participate in the European Free Trade Association in 2001.[32] In 2007, the country held municipal elections under a system in which twenty percent of the seats in all municipal councils were reserved for women, demonstrating a move toward gender equality. Citizens also staged uprisings in early 2011 during Arab Spring, demonstrating for political reform. However, these protests were suppressed by the government. [33]

The current population of Jordan is nearly 6.5 million.[34] According to the United Nations, its fertility rate has dropped by almost 0.5 children born per woman since the early 2000s to an overall rate of 3.32. As a whole, the Arab region has gone through rapid population increase due to a decline in mortality, notably since the second half of the 20th century. This can largely be attributed to the introduction of modern medical services. Jordan's population is expected to continue its growth and predictions estimate a population of over nine million people by 2030.[35] The most prominent issue Jordan faces is the impact such population growth will have on the demand of a limited water supply.[36] However, population growth has generally been surpassed by the high rate of urbanization which has grown massively since 2000.[37] In 2000, the percentage of urban population exceeded seventy-five percent of its total population.[38] This creates major issues for urban developers and planners who are struggling to provide adequate services for urban residents, such as safe water and sanitation. The rural population is also expected to increase due to higher fertility rates in such areas.

As a country that is geographically slightly smaller than Indiana, Jordan's economy is one of the smallest in the Middle East.[39] Jordan not only has insufficient supplies of water, but also lacks a profitable supply of oil. It is the fourth poorest country in terms of water resources.[40] The Middle East and North Africa, or MENA, region is the driest region of the world, with six percent of the world's population having access to a mere one percent of the world's freshwater resources. Two-thirds of Middle Eastern inhabitants depend on water sources outside of their borders.[41] Like Egypt, Jordan has a mixed economy in which oil does not play a dominant role.[42] Therefore, the government is heavily dependent on foreign aid.[43] Figures for the average Gross Domestic Product are misleading.[44] The estimated GDP per capita in 2012 in Jordan was $6,000.[45] However, the typical Jordanian does not earn such an amount per year. In fact, over fourteen percent of Jordan's population is below the poverty line.[46] Economic disparities such as

[31] Kerbo, *World Poverty: Global Inequality and the Modern World System*,
[32] CIA, "CIA World Factbook: Jordan."
[33] Anderson, S., et al., *International Studies: an interdisciplinary approach to global issues*,
[34] CIA, "CIA World Factbook: Jordan."
[35] United Nations, "Water Scarcity in the Arab World"
[36] Amery and Wolf (Eds.), *Water in the Middle East: a geography of peace*,
[37] Ibid.
[38] United Nations, "Water Scarcity in the Arab World"
[39] CIA, "CIA World Factbook: Jordan."
[40] M. Qadir, et al., "Wastewater production, treatment, and irrigation in Middle East and North Africa," *Springer Science and Business Media B.V.*, (2009): 37-51, doi:10.1007/s10795-009-9081-y
[41] Behr, *Looming Water Crisis*
[42] S. Anderson et al., *International Studies: an interdisciplinary approach to global issues*,
[43] CIA, "CIA World Factbook: Jordan."
[44] S. Anderson et al., *International Studies: an interdisciplinary approach to global issues*,
[45] CIA, "CIA World Factbook: Jordan."
[46] Ibid.

this are intensified by population growth.[47] Such population growth also plays a major role in water supplies. As of 2003, Jordan had 0.9 km^3 of renewable freshwater/year, compared to its 555 m^3/year in 1970. Its projected per capita renewable freshwater for 2030 was 96 m^3/year, almost half of the current amount.[48] As seen in Table[49] 3, Jordan's annual renewable water resources are drastically low compared to most other Middle Eastern regions. Some experts claim that Jordan had run out of water to sustain its current rate of use during the 1950s and 1960s.[50] Jordan also faces other environmental issues such as deforestation, overgrazing, soil erosion and desertification.[51]

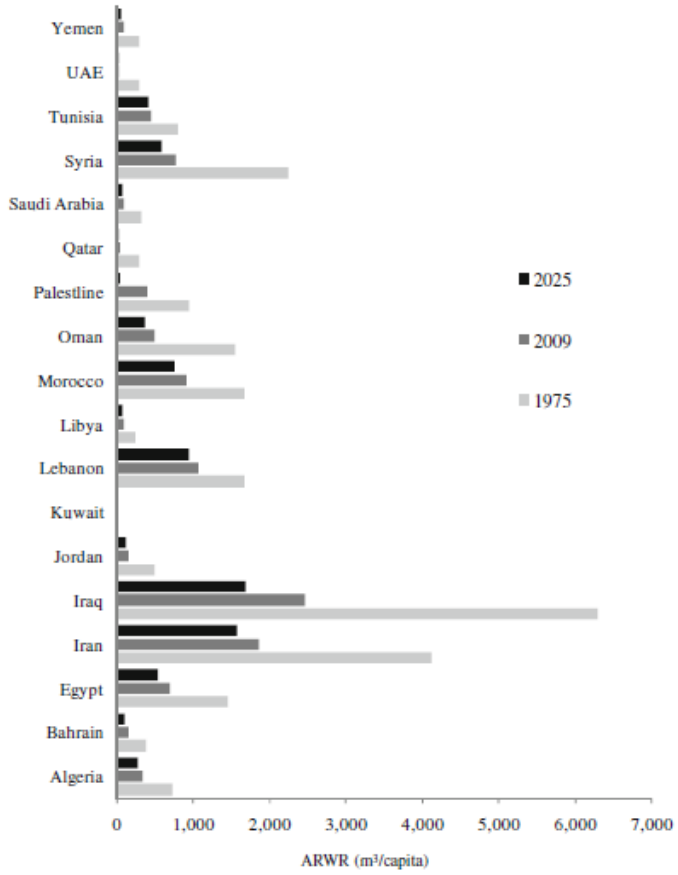


Fig. 1 Annual renewable water resources (ARWR) in the MENA region countries (Based on water resources data from FAO available at http://www.fao.org/nr/water/aquastat/main/index.stm and population data from WRI available at http://earthtrends.wri.org/text/population-health/country-profiles.html)

Table 3
Source: Wastewater production, treatment and irrigation in the Middle East and North Africa

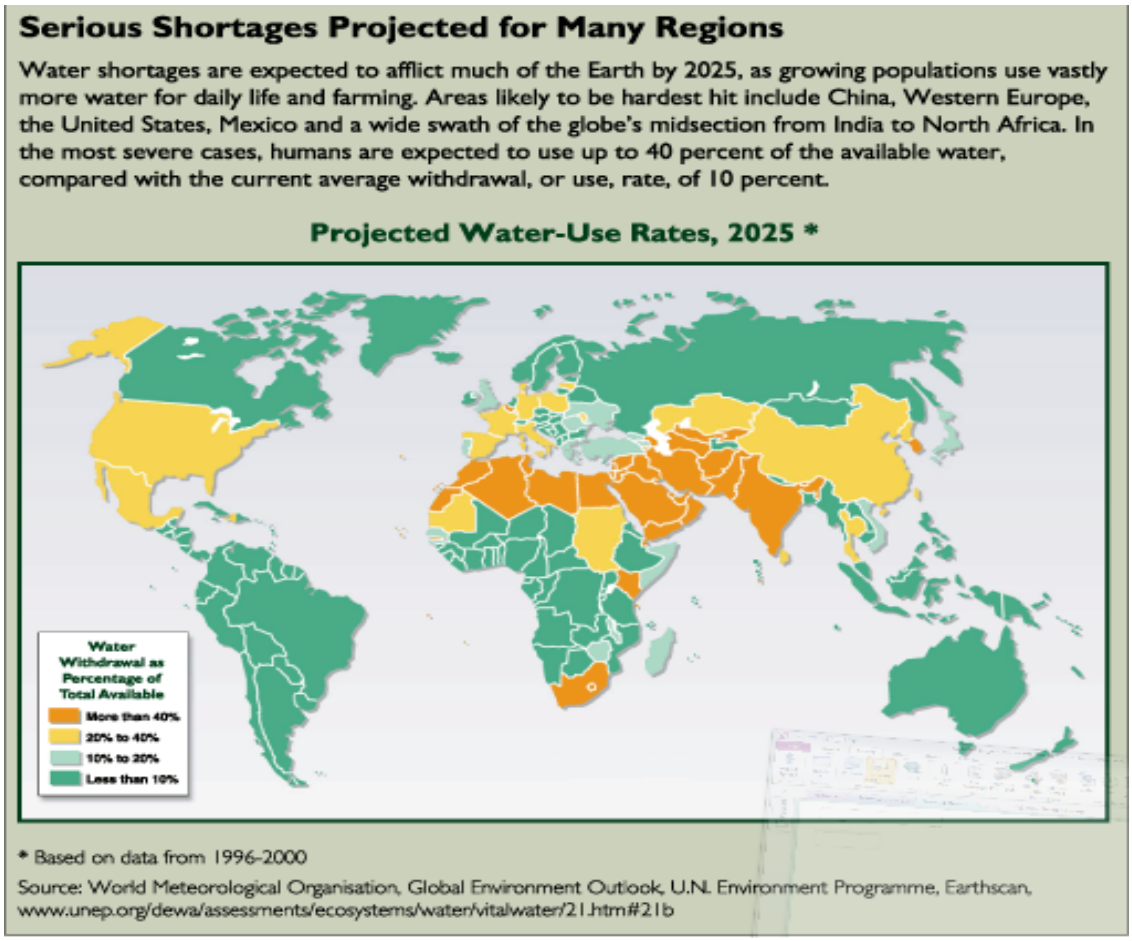
[47] S. Anderson et al., *International Studies: an interdisciplinary approach to global issues*,
[48] United Nations, "Water Scarcity in the Arab World"
[49] M. Qadir, et al., "Wastewater production, treatment and irrigation in Middle East and North Africa", Springer Science and Business Media B.V., 40
[50] Amery and Wolf (Eds.), *Water in the Middle East: a geography of peace*,
[51] CIA, "CIA World Factbook: Jordan."

The Jordan River is one of the local sources of water for Jordan. However, this river also runs through several other nations including Lebanon, Syria, Israel and Palestine. The Jordan River, although well known, is small in a global context with an area of 18,300 km^2.[52] Eighty-three percent of Jordan's total population lives in the Lower Jordan River Basin, and it is home to most of the nation's industry and irrigated agriculture.[53] Historically, the Jordan River flowed from the Lake of Tiberias to the Dead Sea. However, today it is characterized more as a small stream of sewage.[54] This is largely attributed to the fact that the beginning of the Lower Jordan River has been dammed since 1964. In addition, most of the rain that falls in the basin is evaporated or evapotransiprated by irrigation and rainfed crops.[55] The Yarmouk River, which flows into the Lower Jordan River, originates in Syria and Jordan. However, numerous diversions and dams have greatly affected the flow and quality of the water. Urban expansion and agricultural development has greatly reduced the Yarmouk's inflows into the Lower Jordan River.[56] The water of the Lower Jordan River is extremely poor quality, particularly in terms of nitrates and salinity.[57] Despite its physical presence, the river is no longer considered a major potential source for drinking water. The Jordan River itself flows into the Dead Sea, but such a stream has been severely reduced over the past few decades. Currently, the Dead Sea is extremely brackish and is 400 meters below sea level. The Dead Sea itself is shrinking at a rate of one meter of shoreline per year.[58] By the mid-2020s, inflows to the Dead Sea are expected to be reduced to 170 Mm^3/year, likely resulting in salinization.[59] As a result, other resources, such as groundwater, must be explored.

Groundwater resources can be divided into two categories: those being replenished under present-day conditions, and those which were put into storage during previous, wetter conditions. Those in storage are basically "fossil" in nature, meaning once they are removed, they cannot be replaced.[60] In addition, they tend to be located in the eastern and southern parts of Jordan where it is drier. Jordan has three main aquifer complexes; the Upper Cretaceous, the Disi Group Aquifer System and Zerqa Group Aquifer System. These groundwater resources have been increasingly used for irrigation. Jordan has 788.6 km^2 of irrigated land, which requires a massive amount of water.[61] In the early 2000s, the overpumping of the aforementioned aquifers was already occurring.[62] Most of this overpumping was associated with fossil water in deeper aquifers because it is difficult to efficiently utilize many of the surface water flows of smaller perennial rivers.[63] As seen in Map1, Jordan along with other MENA countries is expected to use

[52] Amery and Wolf (Eds.), *Water in the Middle East: a geography of peace*,
[53] C. Chartres and S. Varma, *Out of Water: From Abundance to Scarcity and How to Solve the World's Water Problems* (Upper Saddle River: FT Press 2011),
[54] M. Zeitoun, *Power and Water in the Middle East The Hidden Politics of the Palestinian-Israeli Water Conflict* (New York: Palgrave Macmillan, 2008)
[55] C. Chartres and S. Varma *Out of Water: From Abundance to Scarcity and How to Solve the World's Water Problems*,
[56] Ibid.
[57] M. Zeitoun, *Power and Water in the Middle East The Hidden Politics of the Palestinian-Israeli Water Conflict*
[58] Ibid.
[59] C. Chartres and S. Varma *Out of Water: From Abundance to Scarcity and How to Solve the World's Water Problems*,
[60] Amery and Wolf (Eds.), *Water in the Middle East: a geography of peace*,
[61] CIA, "CIA World Factbook: Jordan."
[62] Amery and Wolf (Eds.), *Water in the Middle East: a geography of peace*,
[63] Ibid.

forty percent of its available water for daily life and agriculture by 2025, while the current average is only ten percent worldwide.[64]



Map 1
Source: CO Global Researcher - Entire Report[63]

Potential of Future Conflict

Despite water's vital attributes, the significance of water can serve as a foundation for conflict in locations with a dwindling quantity. One of the major concerns revolving around this lack of freshwater in Jordan is the potential for wars or future conflict over the resource. MENA countries have long been forced to divide water sources between their nations while disregarding each nation's borders, thereby creating much tension.[65] Inequalities of geography, resources, economy and military capacity among states that live along riverbanks have made cooperation a difficult process. Typically, states located upstream have advantages over the lower stream states. Downstream states are more widely affected by developments that occur outside of their borders, since they rely on the quantity of water that flows into their lands.[66] For example, the building of a dam or irrigation diversion upstream could greatly decrease the amount of water

[64] http://library.cqpress.com/globalresearcher/document.php?id=cqrglobal2008020000&type=hitlist&num=0
[65] G. Park, "Crystal unclear: the challenges of water politics in the Middle East," *Harvard International Review*, (Winter 2008): 36-39,
[66] Ibid.

that reaches a lower stream country. Therefore, this could also result in one state gaining influence over the water policies and usages in the region. Available water resources may also create advantages for a particular nation. In 1985, Israel obtained forty percent of its annual water need from the West Bank aquifer.[67] However, Jordan had no other watershed to depend on outside of the Jordan River. Therefore, Jordan must rely on other methods such as rain catchment or underground sources to meet over half of their water needs. This creates an uneven system in the water dispute.

Economic inequalities also play a major role in regional development. Jordan, often referred to as the "poor cousin" by neighboring countries, suffers from a weak economy.[68] Due to its lack of natural resources, Jordan faces deflation, external debts and other economic problems. This only further limits its possibilities of development. Differing military capacities also result in an imbalance of power. Israel has a much larger and stronger army than Jordan. This can induce fear in smaller nations, and increase the potential for conflict over peaceful collaboration.[69] Many politicians have addressed the likelihood of conflict over water in the future. With so many countries sharing water resources, albeit unevenly, a war would seem inevitable.[70] In 1979, after signing a peace treaty with Israel, President Anwar Sadat of Egypt claimed that 'the only matter that could take Egypt to war again is water'.[71] In addition, during the mid-1980s, American intelligence agencies estimated at least ten places where war could occur over shared water resources, the majority of these locations in the Middle East.[72] Many writers point to the Six Day War between Israel and Arabs in 1967 as a previous example of water scarcity causing war.[73] Although whether water scarcity was the primary cause of war, there is a general consensus that water played at least a minor role in the war.

At the same time, several scholars argue against the idea of future "water wars." Many of the countries located along major rivers are members of international organizations including the United Nations and the World Bank. It is believed that their involvement in these associations would encourage compromise, potentially by offering incentives, or establishing a nonpartisan regional organization focused on water politics.[74] Further, it is argued that water scarcity would create a common situation among states, leading them to look for mutually beneficial solutions to such a problem. Some find that water is too valuable to fight over, and countries will be more inclined to promote coexistence and cooperation.[75] Some also find power asymmetry to account for the lack of water wars. The tension and conflict exists, but weaker states will 'know their place' and recognize that the opportunity costs of an attack are too high.[76] Some point to the 1994 treaty between Jordan and Israel, which included several components addressing water allocation as a sign of agreements on water sharing.[77] While wars are not a viable option, nations must look to develop other alternatives to fulfill their water needs.

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[67] Ibid.
[68] Ibid.
[69] Ibid.
[70] Zeitoun, *Power and Water in the Middle East The Hidden Politics of the Palestinian-Israeli Water Conflict*
[71] M Doltyar and T.S. Gray *Environmental Politics*, vol. 9, no. 3*The Politics of Water Scarcity in the Middle East* (London: Frank Cass 2000)
[72] Ibid.
[73] Park, "Crystal unclear: the challenges of water politics in the Middle East,".
[74] Ibid.
[75] M Doltyar and T.S. Gray *Environmental Politics* vol. 9, no. 3
[76] Zeitoun, *Power and Water in the Middle East The Hidden Politics of the Palestinian-Israeli Water Conflict*
[77] Park, "Crystal unclear: the challenges of water politics in the Middle East,".

Other Strategies

Urban wastewater, also known as "brown water" can be treated and used as a source for irrigation. In fact, treated wastewater has become a valuable source of water in the MENA region since it is essentially independent of seasonal fluctuations.[78] About forty-three percent of wastewater generated in the MENA region is treated.[79] This water can be used for farming purposes, as agriculture is the primary user of water; consisting of eighty-six percent of water use in the MENA region. Jordan uses sixty-five percent of its water for agriculture.[80] In fact, the volume of wastewater itself are increasing due to growth in population and urbanization, and economic development. Jordan has a relevant wastewater policy structure in existence. In 1998, their wastewater policy consisted of three bases; reclaimed water would be considered part of the water budget, water reuse would be planned on a basin scale, and fees for wastewater treatment could be collected from the water uses.[81] Jordan's primary water treatment plant is known as Khirbet es Samra. While the plant is successful, it also faces overloading; when too much water is treated at once.[82] Due to this reason, the desired quality of reclaimed water is not consistently achieved.[83] To combat these issues, Jordan has implemented a strengthened campaign to rehabilitate and improve wastewater treatment plants. They have also introduced standards to protect the health of both the fieldworkers and the consumers of products grown using wastewater.[84] With the increased use of wastewater, Jordan must also conduct further research on the health impacts of using wastewater as well as the financial feasibility of continuing to invest in this resource. Regardless, water reuse has a great potential if combined with resource planning, environmental management and financing arrangements.

Water can also be treated or reused through desalination and use of greywater. Wealthy nations and cities that face severe water stress have looked to invest in desalination of ocean water to fufill their water needs. The Arab region has more than half of the global desalination capacity, with Kuwait paving the way since the 1950s.[85] However, desalination plants currently have the capability to provide one three one-thousandths of daily worldwide freshwater consumption.[86] In addition, desalinated water is extremely costly, and governments typically subsidize upwards of a third of the consumer cost. Desalination also uses great amounts of heat energy and has negative environmental impacts.[87] With regards to Jordan, desalination may not be a viable option financially. However, the country has pioneered the way in treating greywater at the domestic level. Greywater has less chemical and biological contaminants, but cannot be consdiered freshwater.[88] There have also been efforts to collect rainwater for some household uses.[89] In poor communities, greywater projects have great potential, leading to increased

[78] United Nations, "Water Scarcity in the Arab World"
[79] M. Qadir, et al., "Wastewater production, treatment, and irrigation in Middle East and North Africa,"
[80] Ibid.
[81] Ibid.
[82] Amery and Wolf (Eds.), *Water in the Middle East: a geography of peace*,
[83] M. Qadir, et al., "Wastewater production, treatment, and irrigation in Middle East and North Africa,"
[84] Ibid.
[85] United Nations, "Water Scarcity in the Arab World"
[86] Behr, *Looming Water Crisis*
[87] United Nations, "Water Scarcity in the Arab World"
[88] M. Qadir, et al., "Wastewater production, treatment, and irrigation in Middle East and North Africa,"
[89] United Nations, "Water Scarcity in the Arab World"

community participation. Further, greywater reuse had increasing yields of valuable crops and economic returns at a low cost.[90]

There are numerous other strategies for improving water efficiency. However, they are not without their drawbacks. Jordan could pursue plans to increase the rate of their groundwater mining. However, eventually the water quality would decline, and briny water would be pumped.[91] Another proposition is that of the Red-Dead sea canal. The canal could help prevent further shrinking of the Dead Sea, and supply the main cities with water, although it would not be freshwater. The costs of the canal and desalinzation are massie and likely would exceed $5 billion, but plans still have received major consideration.[92] In addition, better farming techniques are being researched and in some cases, implemented. Many countries have looked to increase their production per unit of land by using fertilizers are improving seed varieties.[93] Other technologies such as drip irrigation systems and fertigation are also being used at an increasing rate.[94] Policymakers are trying various ways to solve the global water challenge, including contracting with private firms to operate urban water and sanitary systems, adopting new conservation technologies, enacting multi-nation pacts to manage region watershed and increasing funds for water projects in the world's poorest regions.[95]

In the modern era, water is seen as the new oil. So far, there is no consensus on how to make adequate clean water globally available to all people in affordable, environmentally sustainable ways. Alternative energy poses a potential solution to part of the problem. Solar power consumes approximately one-quarter of a gallon of water per kilowatt hour, whereas wind power consumes none.[96] However, such alternative energy plans have yet to be fully implemented. Nonetheless, great steps are being made in the right direction, and many are optimistic that not all hope for efficient water use is lost. In 2012, the United Nations met its Target 7.C to halve the proportion of people without access to improved drinking water sources, three years ahead of schedule.[97] Further since 1990, more than two billion people have gained access to clean drinking water, with the greatest progress in Eastern and Southern Asia. Within Jordan ninety-eight percent of their urban population has obtained an improved drinking water source, compared to ninety-two percent of their rural population. Overall, this accounts for improvements among ninety-seven percent of their population.[98] While the issue of water scarcity on a global scale will not be fixed easily or quickly, the majority of scientists agree that a solution can and will be developed.

[90] M. Qadir, et al., "Wastewater production, treatment, and irrigation in Middle East and North Africa,"
[91] Amery and Wolf (Eds.), *Water in the Middle East: a geography of peace*,
[92] C. Chartres and S. Varma *Out of Water: From Abundance to Scarcity and How to Solve the World's Water Problems*,
[93] United Nations, "Water Scarcity in the Arab World"
[94] Ibid.
[95] Behr, *Looming Water Crisis*
[96] National Geographic, "The Hidden Water We Use: How Much H2O is Embedded in Everyday Life?,"
[97] United Nations, "Goal 7: Ensure Environmental Sustainability."
[98] CIA, "CIA World Factbook: Jordan."