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WATER IN THE MIDDLE EAST, A POSSIBLE SOURCE OF INSTABILITY AND CONFLICT

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Abstract.

The Middle East with its abundant amount of oil has a limited amount of water. This water scarcity is due to its location and due to its climate in the first place. With 1% of the world fresh water shared between its people which is 5% of the world population and the need for economical growth, the importance of the water becomes high. In spite of the water shortage in the Middle East and the strategic importance of the water, now war erupted in the Middle East for the cause to control the scarce element. No war in the past dose not rules out the possibility of future war. Are we today witnessing an immanent war in the Middle East for the control of the water? Or dose the situation is different as being portrayed of the water conflict?

Introduction

Water is a vital resource in all economies. In those societies which have to be managed in arid environments where indigenous water is limited, the challenges are particularly significant. In the middle of the last decade of the century Middle Eastern countries needed twice as much water as is currently available. By 2025 it is possible that they will

need four times as much as is available in indigenous natural resources.[1] Water is used in all economic and in many municipal and domestic activities. The production of food is the most water intensive economic use, requiring about 1000 cubic metres per year per person. Domestic and municipal uses can be met with about 100 cubic metres per person per year. Drinking requirements run at about one cubic metre per person per year.[2] Only Turkey and Lebanon amongst Middle Eastern countries have the water resources to meet current and all future water demand including those of agriculture. All other countries, including Egypt and Israel, need more than twice as much water as currently available to them in surface flows and renewable groundwater.[3]

Population pressure, irrigation demands and growing resource needs throughout the Middle East are increasing competition for fresh water. The problem has become especially urgent in recent years because of the growing demands for water, the irregularity of rainfall, the limited options for improving overall supply and management, and the intense political conflicts in the region. At the same time, the need to jointly manage the shared water resources of the region may provide an exceptional opportunity to move toward an era of cooperation and peace.[4]

It is widely recognized that the Middle East region is by far the driest and most water scarce region in the world and that is increasingly affecting the economic and social development of most countries of the region. The Middle East has only 1% of the world

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[1] J.A. Allan and Chibli Mallat, "Water in the Middle East: Legal, Political and Commercial Implications," Centre of Islamic and Middle Eastern Law; available from http://www.soas.ac.uk/Centres/IslamicLaw/WaterIntro.html;Internet; Accessed 4 February 2007.

[2] Ibid.

[3] Ibid.

[4] Ibid.

fresh water shared between 5% of the world's population.[5]

Today, average per capita water availability in the region is about 1200 cubic meters per year (world average is close to 7000). The annual water availability in the region ranges from a high of about 1800 cubic meters per person in Iran to less than 200 cubic meters per person in Jordan, West Bank/Gaza, and Yemen. By 2025, the regional average water availability is projected to be just over 500 cubic meters/person/year.[6]

Annual per-capita availability of water in some Middle Eastern countries is already low. Yemen for example it is 46,800 gallons, which is 15% of US annual water availability levels. 30% is coming from underground water resources, which in turns destroys aquifers. In Gaza, aquifers are declining at a rate of more than double annual rainwater recharges.[7]

Water management in Meddle East and North Africa is a serious problem. 87% of freshwater resources are used in mostly low-value agriculture. Industrial and municipal uses are 13%, which is low if compared with 69% and 31% worldwide. This shortage in industrial use is a constraint for economic growth in many MENA countries. Inefficient (or mismanagement) use of water is not confined to agriculture; half of all municipal water in MENA is lost due to leakage in delivery network, or due to inaccurate metering

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[5] Ben Sutherland "Water shortage 'foster terrorism'," *BBC news*, March 2003; available from htt://news.bbc.co.uk/1/hi/sci/tech/2859937.stm;Internet; accessed 15 February 2997.

[6] The World Bank Group. "Water Resource Management," http://lnweb18.worldbank.org/mna/mena.nsf/; Internet; accessed 3 May 2007

[7] World bank, "From scarcity to security: Averting a water crisis in the Middle East and North Africa,"1996. http://web.worldbank.org; Internet; accessed 7 February 2007

or due to theft. Meanwhile, 45 million people in the region do not have safe water and 80 million lack safe sanitation.[8]

This paper will examine the water shortage and scarcity situation in the Middle East, the cause of water shortage and scarcity and the possibility of instability and conflict in some parts of this region. The paper will conclude that even though there is a water problem and there is a possibility of conflict, thatt in general the situation in term of conflict is not as so serious as portrayed.

Geographical and Historical Background

The Middle East is a geographical area comprising the lands around the southern and eastern parts of the Mediterranean Sea, a territory that extends from the eastern Mediterranean Sea to the Arabian Gulf (Persian Gulf), Annex (A). The Middle East is a sub-region of African-Eurasia, or more specifically Asia, and sometimes Africa. The three main cultures of the middle-east are Arabic, Turkish and Persian. These cultural spheres have three generically different languages and ethnicities i.e. Arabic, Turkish and Persian.[9]

The term Middle East defines a general area, so it does not have precise borders. It is generally taken to include: Bahrain, Egypt, Iran, Turkey, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, the United Arab Emirates, Yemen and the

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[8] Ibid.

[9] The McFLY Encyclopedia, McFly, "Middle East," http://www.mcfly.org/en/Middle_East; Internet; accessed 31 January 2007.

Palestinian Territories of the West Bank and the Gaza Strip. The countries of the Maghhreb (Algeria, Libya, Morocco and Tunisia) are frequently linked to the Middle East due to their strong historical and cultural associations, as is Sudan. The African countries Mauritania and Somalia also have links to the region. Turkey and Cyprus, although geographically inside or close to the Middle East, consider themselves to be part of Europe, Annex (B).[10]

The total land area of the Middle East is 7.3 million sq km (2.8 million sq mi). Much of the region consists of flat plains or plateaus. Extensive desert areas stretch across the southern reaches, including the Libyan Desert and Arabian Desert in Egypt, the Rub‘ al Khali in southern Saudi Arabia, and the Syrian Desert at the junction of Saudi Arabia, Jordan, Syria, and Iraq. Northern mountainous areas include the Taurus Mountains in Turkey, the Elburz Mountains and Zagros Mountains in north western and western Iran respectively, and the mountains of northern Iraq. Syria, Lebanon, Jordan, and Israel contain the northernmost extension of the Great Rift Valley, a depression that extends from the Middle East to south-eastern Africa. The Mediterranean Sea is the largest sea in the region. The area is particularly susceptible to earthquakes, which have caused massive devastation in the second half of the 20th century, especially in Iran and Turkey.[11]

Rainfall and temperature vary considerably across the Middle East and even within countries. For example, the Caspian Sea coast of northern Iran receives up to 2000 mm (80 in) of rain a year, while the desert regions of Iran may receive no rain at all for

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[10] Ibid.

[11] Encarta Encyclopedia, “Middle East,” http://encarta.msn.com/encyclopedia_761579298/Middle_East.html#p3; Internet; accessed 2 February 2007.

several years. Temperatures also vary by region. Ankara in the central plateau region of Turkey averages 0°C (32°F) in January and 23°C (73°F) in July. In contrast, low-lying coastal regions of the Arabian Peninsula (the large peninsula south of Jordan and Iraq) and those bordering the Mediterranean Sea experience much more moderate winter temperatures: Jiddah in western Saudi Arabia averages 24°C (75°F) in January and 31°C (89°F) in July. Lowland desert areas in the interior regions of the Arabian Peninsula, Iran, Iraq, and Egypt experience periods of extreme heat in the summer, with temperatures often reaching 45°C (113°F) or higher.[12]

Since the middle of the 20th century, the Middle East has been at the centre of world affairs. It is probably the modern world's most strategically, economically, politically and culturally sensitive area. It possesses huge stocks of crude oil. And it is the birthplace and spiritual centre of Judaism, Christianity and Islam. Throughout the 20th and into the 21st century, the region has experienced both periods of relative peace and tolerance and periods of conflict and war. Current issues include the Iraq War, The Israeli-Palestinian conflict, and the Iranian nuclear program.[13]

Hydrological Background

There are four main sources of water in the Middle East, Annex (C) : (1) Precipitation, (2) Rivers, (3) Underground water (aquifers) and (4) Desalinized seawater. The well known rivers and seas in the Middle East are the Arabian Gulf (Persian Gulf), the Red

[12] Ibid.

[13] Wikipedia, the free encyclopedia, "Middle East," http://en.wikipedia.org/wiki/Middle-eastern; Internet; accessed 30 January 2007.

Sea, the Gulf of Aden, the Mediterranean Sea, the Sea of Galilee, the Caspian Sea, the Dead Sea, the Gulf of Aqaba, the Tigris (Dijlah) River, the Euphrates (Al Furat) River, the Jordan River and the Nile River. The Litani river is a wholly Lebanese river. Apart from the Nile River, which provides much of the water supply and irrigation systems of Egypt, and the Tigris and Euphrates Rivers, which supply Iraq, Syria, and Turkey, and the Jordan River, which supplies Jordan, Israel and Palestine, there are no major rivers or passable waterways. With such a limited water supply, access to water for drinking, irrigation, and hydroelectricity has become increasingly crucial in many parts of the Middle East.

Environmental factors can affect water supply. From the late 1980s to the 1990s droughts in Ethiopia reduced the flow of the Nile, Egypt's only source of water. Rapid growth in Egypt's population over the same period compounded the water shortage. The Aswan high Dam in southern Egypt, opened in 1971, has decreased annual flooding of the delta region at the Nile's outlet to the Mediterranean Sea, resulting in coastal erosion and increased salt content of the soil.

Reasons Beyond Water Crisis in the Middle East.

The water struggle in the Middle East arises from a confluence of variables, including water scarcity, rapid population growth, economic expansion, technological advances, poor water management, ill-defined water laws, and previously existing tensions. None of

these variables exists in a vacuum. Each affects the others in some way, adding to the complexity of any comprehensive water solution in the Middle East.[14] The crisis over water in the Middle East is escalating. Despite existing agreements, dwindling resources increasingly affected by pollution, agricultural and industrial initiatives and population growth, have elevated the strategic importance of water in the region.[15]

For Middle Eastern nations, according to IIan Berman and Paul Michael Wihbey in their paper titled " The new water politics of the Middle East published in *Strategic Review*, summer 1999, "water is becoming a catalyst for confrontation, an issue of national security and foreign policy as well as domestic stability."[16]

Freshwater resources are finite, unevenly distributed worldwide, and often shared by more than one country. Thus, fresh water can be a trigger for conflict, but can also become a reason for cooperation, as parties in water scarce regions join together to manage this crucial shared resource. Nonetheless, the disparities between countries are wide and some are already faced with constraints in meeting domestic water demand owing to physical, socio-economic and political factors. As a result, water and water-supply systems may become instruments of political confrontation and objectives of military operations as the population expands.[17]

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[14] Stephen, D Kiser. *Water: The Hydraulic Parameter of Conflict in the Middle East and North Africa* (Colorado: Institute for National Security Studies, U.S Air Force Academy, 2000), 6-22.

[15] Ibid.

[16] Paul Michael Wihbey and Iian Berman, "Geopolitics of Water," *JINSA*, available from http://www.jinsa.org/articles/articles.html/; Internet; accessed 2 February 2007.

[17] Bertrand Charrier, Shlomi Dinar, and Mike Hiniker. "Water, conflict resolution and environmental sustainability in the Middle East," *The Uniresity of Arizona*; available from http://ag.arizona.edu ; Internet; accessed 15 February 2007

It is expected that the crisis of water will increase as the population in the Middle East increases. The scarcity of water resources to cope with this increase of population and the improper usage of water resources by Middle Eastern countries will certainly exacerbate this crisis and might pull the area in military confrontation.[18]

Central to these problems is the assertion that resource scarcity and certain forms of environmental degradation are major factors in political instability or violent conflict at local, regional and interstate levels. In short, there is a growing perception that local, regional, and global environmental deficiencies or resource scarcities may increasingly lead to conflict.[19] It can be said that the following are the main factors for the water crisis in the Middle East:

- The increase in population in the Middle East has worsened the water crisis. The population in the Tigris and Euphrates basin (Dijlah and Alfurat basin) reached 114 million in 2001, 69 million in Turkey, 18 million in Syria and 27 million the in Iraq. In 1990, the population in the said basin was 85 millions, which yields an increase of almost 30 million. The population in the year 2000 of the Nile basin was 173 million, of whom 69 million were in Egypt, 33 in Sudan and 71 million in Ethiopia, while the population in 1990 was 130 million, making an increase of 43 million. As a result of this increase in population, a water deficiency resulted. In Syria, this deficiency was 3 billion cubic meters, in Jordan around 250 million

[18] Ghazi Ismaeal Rababah, *The problem of the water in the Middle East. The original title in Arabic is: " Mozelat almeyah fy Alsharq Alawsat"* (Abudhabi: The Emirates Center for Strategic Studies and Research, 2002), 6-11

[19] Bertrand Charrier, Shlomi Dinar, and Mike Hiniker. "Water, conflict resolution and environmental sustainability in the Middle East," *The Uniresity of Arizona*; available from http://ag.arizona.edu ; Internet; accessed 15 February 2007.

cubic meters, in Egypt almost 17 billion cubic meters and in Israel 1 billion cubic meters.[20] The director of the global environmental program of the Pacific Institute for Studies in Development, Environmental and Security, Peter Gleick argues that there will be a great pressure on water demand, due to population growth.[21] In some of the most water-short parts of the Middle East, most notably the Jordan and Euphrates river basins, populations are expected to grow extremely rapidly (see Table 1). At the same time, new demands for water are putting pressure on existing supplies. In Israel and Jordan, projected population growth could require the severe restriction or complete elimination of irrigated agriculture over the next several decades just to free up sufficient water to provide a reasonable minimum amount to their populations. For example, the United Nations' medium projections show the population of Israel and the Gaza Strip reaching 10 million by 2025, not including the Palestinians presently included by the United Nations in Jordan's population.[22] In some Middle Eastern countries, the rate of natural population growth is so high that there will be twice as many people to care for in twenty years' time. In Israel and Jordan, particular circumstances have led to sudden increases in population through immigration.[23] Simply supplying this population with a minimum annual water requirement of 150 cubic meters per person for drinking, sanitation, and all commercial and

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[20] Ghazi Ismaeal Rababah, The problem of the water in the Middle East. The original title in Arabic is: " Mozelat almeyah fy Alsharq Alawsat" (Abudhabi: The Emirates Center for Strategic Studies and Research, 2002), 6-11

[21] Peter H. Gleick, "water, war & peace in the Middle East," *Pacific Institute for Studies in Development, Environmental and Security*; available from http://web.ebscohost.com; Internet; accessed 8 February 2007

[22] Ibid.

[23] Greg Shapland, *Rivers of Discord, International Water Disputes in the Middle East* (New York: ST. Martin's Pess, 1997), 1-4, 154-157.

industrial activities would require 1,500 million cubic meter per year, which is approximately equal to Israel's entire long-term reliable supply. This level of use would leave only recycled wastewater for the agricultural sector and so would almost completely eliminate irrigated agriculture. Table 2 shows how the per-capita availability of water in the countries of the Middle East and parts of the Arabian Gulf (Persian Gulf) is likely to decrease given the expected population growth between now and 2025[24]. Most hydrologists believe that having less than 500 cubic meters available per person per year significantly limits the options available to a society. Many countries in the region already fall into this category, and more will in the future as populations grow."[25]

Table 1. Middle East population estimates and projections

country	1990 (millions)	2000 (millions)	2025 (millions)	Annual percentage rate of increase in 1990
West bank	0.90	1.12	2.37	3.40
Gaza Strip	0.62	0.76	1.23	1.98
Israel	4.66	6.34	8.15	1.67
Jordan	3.10	4.00	8.50	3.41

[24] Peter H. Gleick, "water, war & peace in the Middle East," *Pacific Institute for Studies in Development, Environmental and Security*; available from http://web.ebscohost.com; Internet; accessed 8 February 2007.

[25] Ibid.

Lebanon	2.74	3.31	4.48	2.00
Syria	12.36	17.55	35.25	3.58
Saudia Arabia	14.87	20.67	40.43	3.28
Turkey	55.99	68.17	92.88	2.05
Iraq	18.08	24.78	46.26	3.21
Iran	58.27	77.93	144.68	2.71

Source: Pacific institute for studies in development, environmental and security. http://web.ebscohost.com; Internet; accessed 8 February 2007. water, war & peace in the Middle East, by: Peter H. Gleick

Table2. per-capita water availability in 1990 and 2025

country	**1990 Cubic meter per person per year**	**2025 Cubic meter per person per year**
Kuwait	75	57
Saudi Arabia	306	113
United Arab Emirates	308	176
Jordan	327	121

Yemen	445	152
Israel	461	264
Qatar	1,171	684
Oman	1,266	410
Lebanon	1,818	1,113
Iran	2,025	816
Syria	2,914	1,021
Iraq	5,531	2,162

Source: Pacific institute for studies in development, environmental and security. http://web.ebscohost.com; Internet; accessed 8 February 2007. water, war & peace in the Middle East, by: Peter H. Gleick

Jan Selby writes in his book *water, power and politics in the Middle East*, " water crisis is fundamentally a product of overpopulation relative to the available resources: as populations grow, so the finite resource base becomes more and more stretched, and so crisis ensues. 'Unfortunately, water resources are finite; future increases in population therefore imply increased water competition.' This happens within particular regions, locales and states, but also, so some claim, on a global scale. Thus globally, world population growth is 'outrunning water supply', while the Middle East as a whole 'is 'close to the ceiling' in term of its very high number of people per flow unit of water'. Across the Middle East, individual states are hitting a 'water barrier'. And this is largely because of imbalances in the population-natural resource

equation.[26] Dr. Ghazi Ismael Rababah in his book *The problem of the water in the Middle East* attributes the crisis of the water in the Middle East not only to the natural growth of the population, but also due to Jewish immigrants to Israel from the former Soviet Union. This rapid increase of Israel population will impose a heavy burden on Israel to fulfill the water need of those immigrants.[27] According to the Jerusalem Centre for Public Affairs and under an article written by Amikam Nachmani " *A commodity in scarcity: The politics of water in the Middle East* ", " immigration into Israel is increasing the stress on that country's already taxed water sources ".[28]Israel may appropriate Arab water, which will lead to the increase of tension or conflict in an area that is already unstable.

- Water scarcity & climate change. Water scarcity is an obvious root cause of the water crisis in the Middle East.[29] The Middle East is one of the most arid areas in the world. There are three natural sources of water for the subject countries to exploit, river water, ground water and rainfall. None of these sources is abundant, and what few sources do exist are all currently either fully exploited or their use is prevented due to conflict. Other sources of water, which include recycled and desalinated water and the import of water from outside, are too expensive and only rich countries like the Gulf Cooperation Council (GCC) countries are able to

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[26] Jan Selby, Water, Power and Politics in the Middle East. The other Israeli-Palestinian Conflict (London. NewYork: I.B. Tauris, 2003), 19-26

[27] Ghazi Ismaeal Rababah, The problem of the water in the Middle East. The original title in Arabic is: " Mozelat almeyah fy Alsharq Alawsat" (Abudhabi: The Emirates Center for Strategic Studies and Research, 2002), 6-11

[28] Amikam Nachmani , "A commodity in scarcity: The politics of water in the Middle East," *Jerusalem Centre for Public Affair*; available from http://www.jcpa.org/jl/hit02.htm; Internet; accessed 3 February 2007.

[29] Stephen, D Kiser. *Water: The Hydraulic Parameter of Conflict in the Middle East and North Africa* (Colorado: Institute for National Security Studies, U.S Air Force Academy, 2000), 6-22.

afford them.[30] As regarding the climate change, Peter Gleick argues in his report " *water, war & peace in the Middle East*" "that all debates about regional water supplies assume that natural water availability in the future will not change and that flows will be subject only to natural variations. In fact, this assumption may no longer be true because of possible changes in the global climate. Global climate change could affect water availability in many ways, though the precise nature of such changes is still obscure. Climate change could either increase or decrease overall water availability in different times and in different places".[31] Hydrologists expect higher temperatures to lead to substantial increases in evaporation in the region, which would decrease overall water supply and increase demand. The increase of demand will in turn place severe political strains on the region.[32]

Dr. Fakhri Albazaz, in chapter 9 of a book titled "*Water in the Arab World: Perspectives and Prognoses* "asserts that climate change will not affect the rain falling only, but will also affect the flow of the rivers and might increase the flooding or increase drought. Climate change might increase the night temperature, which in turn will not allow the formation of the dew used by desert vegetations to grow and to survive. The problem of desertification will increase.[33]

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[30] Ibid.

[31] Peter H. Gleick, "water, war & peace in the Middle East," *Pacific Institute for Studies in Development, Environmental and Security*; available from http://web.ebscohost.com; Internet; accessed 8 February 2007.

[32] Ibid.

[33] Fakhri Albazaz, *Water in the Arab World: Perspectives and Prognoses*, *Chapter 9*. ed. Peter Rogers and Peter Lydon. (Abudhabi: The Emirates Center for Strategic Studies & Research, 1997), 371-385.

- The water crisis in the Middle East can be attributed to rapid economic development, over the last 25 years. Stephen D. Kiser in his book "Water: The Hydraulic Parameter of Conflict in the Middle East and North Africa ", says that the economic development has taken place largely in the industrial sector rather than an agriculture. Such increases in industrial growth have created increasing competition for water.[34] Indeed, industrial use of water is projected to continually increase in the Middle East; while it constituted eight percent of total water use from 1986 to 1993, it is projected to be as high as 14 percent by 2000 and 37 percent by 2025.[35] This increase in industrial use of water creates a problem. While industrial uses of water contribute much more to a nation's gross domestic product than do agricultural uses of water, industrial run-off is much more difficult to treat and often ends up polluting other sources of water, such as aquifers and streams.[36] The industries requiring the most water are petroleum, food processing, metals, chemical processing, and pulp and paper. The industrial use of water creates toxic and hazardous pollutants that render waste water unfit for subsequent human consumption or use in the agricultural sector; these conditions can also permanently pollute aquifers. The expansion of industry to the developing world, in addition to local human contamination of fresh water supplies, is making it more difficult to maintain water quality.[37] The tendency of the world population is to move to urban areas looking for better living. The

[34] Stephen, D Kiser. *Water: The Hydraulic Parameter of Conflict in the Middle East and North Africa* (Colorado: Institute for National Security Studies, U.S Air Force Academy, 2000), 6-22.

[35] Ibid.

[36] Ibid.

[37] Earth. The state of the world on a single page. http://www.theglobaleducationproject.org/earth/fresh-water.php.

situation is the same in the Middle East. Increases in economic growth also typically lead to greater urbanization; over half the Middle East now lives in urban areas where people consume 10-12 times as much water per capita as village dwellers. For example, in 1960, approximately 35 percent of Jordan's population lived in or around the capital Amman; in 1991, that figure reached 55 percent, and it was about 60 percent by 2000. In 1996, the entire Jordan basin's population was 63.4 percent urban, with that number likely to increase significantly in the current decade. Thus, economic development created and will continue to drive greater per capita demands for water. Hence, population increase and economical growth will create water demand.[38]

- The conflicts over water in the Middle East are not only about limited water availability; they also arise over the control of existing resources. In the Jordan basin, control over shared groundwater resources underlying the West Bank and the Gaza Strip are at the heart of the tension between Israelis and Palestinians. In 1967, Israel issued Military Order 92, which prohibits the drilling of new wells without permission from the military authorities, fixes quotas for pumping from existing wells, and expropriates wells in all occupied lands.[39] The Palestinians claim that these restrictions have, effectively, frozen Palestinian use of water in the occupied territories, resulted in insufficient water for Palestinian urban and industrial use, and stopped new agricultural development. At the same time, Israel has allowed the development of water wells for Jewish settlements in the

[38] Stephen, D Kiser. *Water: The Hydraulic Parameter of Conflict in the Middle East and North Africa* (Colorado: Institute for National Security Studies, U.S Air Force Academy, 2000), 6-22.

[39] Peter H. Gleick, "water, war & peace in the Middle East," *Pacific Institute for Studies in Development, Environmental and Security*; available from http://web.ebscohost.com; Internet; accessed 8 February 2007.

occupied areas. One outcome of this situation is a gross discrepancy in per-capita water use by Israelis and Palestinians in the occupied territories. The perception that much of the Israeli water goes to nonessential uses, such as irrigation of lawns and the filling of swimming pools, has not helped the problem.[40] Water rights and allocation is, and always has been, a great source of contention. From the very beginning of Israel statehood, securing as much water as possible for one's own state or territory was synonymous with survival, and denying the enemy water was a way of undermining his strength. Under present water distribution schemes, a very visible disparity in water consumption exists that favors Israel. This is a source of tension both at the international level and between Israel and the Palestinians in the West Bank.[41] Dwindling water resources increasingly affected by pollution, agricultural and industrial use and population growth, have elevated the strategic importance of water in the region. The water issue is at the root of the struggle over territory. Israel is made up of 5.3 million Jews and 1.4 million Arabs. The West Bank, Gaza and East Jerusalem are inhabited by 2.5 million Palestinians. The Palestinian National Authority (PNA) complains that Israel controls the sources of water and one third of West Bank inhabitants have only intermittent water supplies. Israel has complete control over water resources in the West Bank and uses 82 percent of the underground water, the PNA says. Palestinians in the West Bank are charged three times as much per unit of water as Israeli settlers.[42] According to environmental news, quoting

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[40] Ibid.

[41] Stephen, D Kiser. *Water: The Hydraulic Parameter of Conflict in the Middle East and North Africa* (Colorado: Institute for National Security Studies, U.S Air Force Academy, 2000), 6-22.

[42] Environmental News Service, "Water is the Root of Israeli-Palestinian Evil," http://www.ens-newswire.com/ ens/mar2002/2002-03-29-02.asp; Internet; accessed 8 February 2007.

Israeli news paper “Ha’aretz” “ more than half a million of the Palestinian inhabitants in the West Bank have not consistently received water for more than two months ”. The yearly Israeli consumption of water is 12 million cubic meters. The Palestinian National Authority says " this 12 million cubic meters is the percentage of deficiency that cities in Gaza lack." The Palestinian daily consumption of water is 35 to 50 liters per capita, while the daily consumption of the Jewish settlers is 280 to 350 liters per capita”.[43] Both sides rely for water on the West Bank Mountain Aquifer, which straddles the demarcating border of the disputed West Bank territory. It currently provides a third of Israel’s water supply and 80 percent of Palestinian consumption.” The Israeli human rights group B'Tselem said 215,000 Palestinians in more than 150 villages are not connected to running water and that Israel has discriminatory allocation. “At a time when the Israeli public debates whether to water the lawn or wash their car, Palestinians suffer from a shortage of water to meet their most basic needs,” B'Tselem said in a statement.[44]

- Allocation of the right budget came late in many Middle Eastern countries. The result was many water projects were not carried out in the right time. By not allocating the right budget for the water in the Middle East countries, fewer dams were built to collect rain water, fewer irrigation canals, water sewage networks were not modernized and extra swage treatment plants were not built.[45] Serious repercussions came out, among them, waste of domestic water. For example in

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[43] Ibid.

[44] U.N Observer. www.unobserver.com; Internet; accessed 21 February 2007.

[45] Ghazi Ismaeal Rababah, The problem of the water in the Middle East. The original title in Arabic is: “ Mozelat almeyah fy Alsharq Alawsat” (Abudhabi: The Emirates Center for Strategic Studies and Research, 2002), 6-11.

1990 the domestic water waste was between 13 to 30 percent out of a total 260 million cubic meters. Egypt, during the seventies wasted about 15 billion cubic meters of water, which is equivalent to 1.5 billion cubic meters each year. About 400 million cubic meters of Litani river water out of 700 million cubic meters goes to the sea without any exploitation, and out of 10 billion cubic meter of surface and rain water, 8 billion cubic meters evaporate without exploitation.[46] Today many governments and policy makers in the MENA are tackling the water problem as the water scarcity became apparent. Algeria, Egypt and Morocco, for instance, spend between 20 and 30 percent of their budget on water according to the World Bank report released 2007. The report also estimates water-related environmental problems cost many countries between 0.5 and 2.5 percent of GDP a year.[47]

- International law is not clear. It is a muddling issue in respect of accepted agreement between the nations, including the Middle East countries. International water law and institutions have important roles to play despite the fact that no satisfactory water law has been developed that is acceptable to all nations. Developing such agreements is difficult because of the many intricacies of international politics, national practices, and other complicating political and social factors.[48] For nations sharing river basins, factors affecting the successful negotiation and implementation of international agreements include whether a

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[46] Ibid.

[47] The World Bank Group, "Coping with scarce water in the Middle East and North Africa,March 11, 2007" http://web.worldbank.org/ WBSITE/EXTERNAL/NEWS/0,,contentMDK:21253203; Internet; accessed 2 April 2007.

[48] Peter H. Gleick, "water, war & peace in the Middle East," *Pacific Institute for Studies in Development, Environmental and Security*; available from http://web.ebscohost.com; Internet; accessed 8 February 2007.

nation is upstream, downstream, or sharing a river as a border; the relative military and economic strength of the nation; and the availability of other sources of water supply. Despite general principle and new concepts governing shared freshwater resources, and in spite of the drafting and provisional adoption of 32 articles on the law of the Non-Navigational Uses of international watercourses in 1991 by International Law Commission and even though there are principles set forth of equitable utilization and the obligation not to cause harm to other riparian (the countries on the rivers) nations, some of the Middle Eastern countries used the unclear international law to build a massive reservoir behind the dams, like what Turkey did in 1989.[49]

Despite earlier guarantees of a constant flow of water, Turkish President Turgut Ozal rattled Syria and Iraq by deciding to hold back the flow of the Euphrates for a month.[50] In September 2000 the BBC reported that Turkey would limit the flow of the water to Syria. It said "Turkey has warned that, because of a serious drought, it cannot provide Syria with the supplies of water it wants from the rivers the two countries share". It continued to say "that Turks say the volume of future supplies will depend on the level of winter rainfall". Even though the two countries had an agreement on water supplies, but in that month the average flow to Syria has been less than one-third of the normal amount. Syria and Iraq said Turkey was ignoring international regulations on the use of shared waterways, and have blamed Turkey's huge network of dams on the Tigris and Euphrates for causing

[49] Ibid.

[50] Stephen, D Kiser. *Water: The Hydraulic Parameter of Conflict in the Middle East and North Africa* (Colorado: Institute for National Security Studies, U.S Air Force Academy, 2000), 6-22.

shortages, something Ankara denied. The BBC correspondent in Turkey said "the current row has once again pushed the issue of water to the top of the regional agenda ".[51]

- There are issues that may exacerbate the water crisis in the Middle East, among them is the growing of agricultural products that require a big quantity of water, such as cotton, rice, citric and some vegetables.[52] These products require large quantities of water, and without the good irrigation system (like dipping system) and the usage of traditional irrigation they put a burden on the water.

- Another factor that may increase the water crisis in the Middle East is the political situation in the Middle East. The Middle East, and in spite of peace agreements between the parties involved in the previous wars (Egypt, Jordan, Israel and the Palestinians) is a situation of no war and no trusted peace. There are no bilateral agreements regarding the sharing of the water. The non-existence of such agreements encourages each state to control as much water as it can, without considering the interests of other states.

Water Resources in the Middle East

In the Middle East, water resources are nearly dramatic. Of all the regions in the world, Middle East and North Africa (MENA) faces the most severe water shortage. With about 5 percent of the world's population, it has less than 1 percent of all renewable freshwater.

[51] http://news.bbc.co.uk/2/hi/europe/943006.stm; Internet; accessed 4 March 2007

[52] Ghazi Ismaeal Rababah, The problem of the water in the Middle East. The original title in Arabic is: " Mozelat almeyah fy Alsharq Alawsat" (Abudhabi: The Emirates Center for Strategic Studies and Research, 2002), 6-11.

Per-capita availability in the region dropped to 1,250 cubic meters a year in 1996 from 3,300 cubic meters in 1960, by far the lowest in the world. Overexploitation of groundwater resources, which destroys aquifers, accounts for some of the shortages. Yemen, for instance, withdraws 30 percent more from aquifers than is currently being replenished. In Gaza, aquifers are mined at a rate of more than double annual rainwater recharges. In addition, about 87 percent of all freshwater resources in the region are used in low-value agriculture and only 13 percent go to industrial and municipal uses. Meanwhile, 45 million people in the region do not have safe water and 80 million lack safe sanitation. Despite conservation measures, regional demand will soon outpace supply in some countries.[53] Despite the great size of the Middle East, there are only three rivers that can be classified as large by world standards-the Nile, the Euphrates, and the Tigris. The watersheds of both the Euphrates and the Tigris are situated within the Middle East, predominantly in the countries of Turkey, Syria, and Iraq. The fourth largest perennial river in the Middle East is the Jordan River. Sea water desalination and ground water are another source of water in the Middle East. The following are the main water resources in the Middle East:

The Tigris and Euphrates Rivers: The Euphrates, which is the longest inter-state river in western Asia, has been exploited since 4000 B.C. Several ancient civilizations in Mesopotamia were supported by basin irrigation from the Tigris and Euphrates Rivers. Owing to the extremely arid climate, however, the farm lands on the Mesopotamian alluvia have suffered from salt accumulation and water logging problems since 2400

[53] The World Bank Group. "Water Resource Management," http://lnweb18.worldbank.org/mna/mena.nsf/; Internet; accessed 3 May 2007.

B.C., during the Sumerian age. This ancient civilization disappeared with the abandonment of irrigation-canal systems.[54]

Before Turkey began building large dams on the Euphrates, the river's average annual flow at the Turkish-Syrian border was about 30 x 10^9 m³. To this, a further 1.8 x 10^9 m³ is added in Syria from the Khabour River, a major tributary. On several occasions in recent years, low water levels in the Lake Assad reservoir, behind the Tabqa dam, have restricted the hydro-power output (with installed capacity of 800 MW) and irrigation development. In the longer term, a reduction in Euphrates water entering the country could be a major constraint on Syrian power generation and agriculture. Iraq used to receive 33 x 10^9 m³ of river water per year at Hit, 200 km downstream from the Syrian border before the 1970s, when both Turkey and Syria built a series of large dams on the Euphrates River. By the end of the 1980s, the discharge decreased to as little as 8 x 10^9 m³ per year at Hit. By 1989, 80% of the natural run-off of the Euphrates River had been exploited by adding a third large dam, the Ataturk, which is the largest dam in Turkey, with a gross reservoir storage volume of 48.7 x 10^9 m³ (effective volume, 19.3 x 10^9 m³).[55]The exploitation of the Euphrates, which has problems of both quantity and quality, such as the increasing salinity in the internal delta downstream, is examined to distinguish the complexities, commonalities, and conflicts over riparian issues which put the peace of the world at risk.

[54] Masahiro Murakami, "Managing Water for Peace in the Middle East : Alternative Strategies, "*United Nations University Press*. 1995; available from http:// www.unu.edu/unupbooks/80858e/80858E00.htm; Internet; accessed 21March 2007.

[55] Ibid.

Historically, development was limited to the semi-arid and arid zones of the lower reaches of the Tigris and Euphrates. The valleys of the two rivers encompass the northern portion of the famous "Fertile Crescent," the birthplace of the Mesopotamian civilizations. Owing to salt accumulation, water logging, and poor management of the canal system, the irrigated lands were progressively abandoned and the old civilizations declined.[56]

The water resources of the Euphrates River have been almost fully exploited since the 1970s by construction of the large dams at Keban, Karakaya, Karababa/Ataturk, and Tabqa on the upper and middle reaches of the main stream. Eighty per cent was reached by adding the Ataturk dam in 1989.[57] See annex (D).

The Nile River: The Nile, which is the world's longest river, receives most of its discharge from precipitation falling well outside the Middle East on the upland plateau of East Africa and the highlands of Ethiopia. The Nile is the whole life of Egypt. The country owes its existence to the river, which provides water for agriculture, industry, and domestic use. Cultivation is dependent on irrigation from the river.

The proposal to build a single large dam at Aswan for multiple objectives including flood control, year-to-year water storage, and hydro-power generation was put forward by Adrein Danionson in 1949 as an alternative to a "century storage" scheme. Construction of the high dam started in 1960 and was completed in 1970. Before the dam was built and went into operation, the Nile floods brought silt containing potassium and phosphorous

[56] Ibid.
[57] Ibid.

but also could leach away any accumulated salts. The fine-grained alluvial soils of the Nile valley do not drain easily and need artificial drainage. Due to the hot, arid climate, irrigation water evaporates quickly, leaving behind its salt, causing salinization.[58]

The water levels in the Nile have been falling for nine years since the early 1980s. In 1985-86 there was a three-metre drop in the level of Lake Nasser, the reservoir behind the Aswan dam, and in 1986-87 it fell from 195.6 m to 184.7 m (WPDC 1988). Egypt has been attempting to avert a national crisis through three strategies: rationalization, river development, and groundwater development. The reservoir storage has been recovered by steps with intensive rainfall and inflow in the early 1990s. This long-term fluctuation depends on the large-scale basin hydrology in the humid through the arid zones.[59] See Annex (E).

The Jordan River: Owing to the general aridity of the region, a very large portion of the total area consists of endoergic or inland drainage. The Jordan River, the fourth largest perennial river in the Middle East, receives most of its discharge from precipitation on the southern part of the Anti-Lebanon Range. The Jordan River originates in the mountains of eastern Lebanon. As the Jordan flows south through the entrance to the Great Syrian Rift Valley, it is fed from underground sources and small streams at various points in Jordan, Israel, Syria, and Lebanon. The Jordan's main sources are the Hasbani River, which flows from Lebanon to Israel, the Banyas River, which flows from Syria to Israel, the Dan River, which begins and flows inside Israel, and the Yarmouk River, which begins near the Golan Heights and flows to the Jordan River. Following its flow into 'Lake of Galilee', the Jordan River continues southward into the centre of the Jordan

[58] Ibid.
[59] Ibid.

Valley, forming the border between the western edge of Jordan and eastern side of Israel including part of the Palestinian Autonomy. The Jordan continues flowing into the Dead Sea, and then through a smaller stream it flows eventually into the Red Sea.[60] The Jordan is a multinational river, flowing southwards for a total length of 228 km through Lebanon, Syria, Israel, and Jordan. It is already overdeveloped except for a winter flow in its largest tributary the Yarmouk River, which forms the present boundary between Syria and Jordan for 40 km before becoming the border between Israel and Jordan.

In the absence of irrigation extraction, the Jordan system delivers an average annual flow of 1.85×10^9 m³ to the Dead Sea, equivalent to 2% of the annual flow of the Nile and 7% of the annual flow of the Euphrates. Twenty-three per cent of this discharge originates in pre 1967 Israel.

The discharge that feeds into the upper part of the Jordan River is derived principally from groundwater flow through a group of karstic (containing large deposits of limestone) springs on the western and southern slopes of Mount Hermon (Jabel esh-Sheikh). There are three rivers in the headwaters of the north fork of the Jordan River: the Dan River, the Hasbani River, and the Banias River, of which the quality of water is excellent, with salinity less than 15-20 mg of chlorine per litre.

The flow in the lower reaches of the system is supplemented by springs, but much of their contribution is so saline that they degrade the quality of the river flow, to the extent

[60] American University, "The Inentory of Conflict & Environment (ICE)," http://www.american.edu/ ted/ice/Jordan.htm; Internet; accessed 21 March 2007.

of several thousand parts per million of total dissolved solids at the Allenby Bridge near Jericho.[61] See annex (F).

Sea water desalination: Owing to the rapid increase in demand for water in the Arabian Gulf countries, Saudi Arabia, Kuwait, the United Arab Emirates, Qatar, Bahrain, and Oman where conventional water resources such as fresh surface water and renewable groundwater are extremely limited, other alternatives such as wastewater reclamation and desalination have been adopted since the 1960s. Countries such as Saudi Arabia, Kuwait, Qatar, and Bahrain all use non-renewable groundwater resources in large quantity, causing depletion of these valuable resources and deterioration in the quality of water. Although conventional water resources such as renewable groundwater and surface runoff are available in countries like Oman, the United Arab Emirates, and Saudi Arabia, these resources still need to be properly developed in an integrated water-resources planning context. In some of the more arid parts of the Middle East, in particular the Gulf states, where good quality water is not available or is extremely limited, desalination of seawater has been commonly used to solve the problems of water supply for municipal and industrial uses.[62]

Kuwait was the first state to adopt seawater desalination, linking electricity generation to desalination. The co-generation station, as it is called, re-uses low pressure steam from the generator to provide energy for the desalination process. As a result, both energy and costs are minimized. Kuwait began desalinated water production in 1957, when 3.1

[61] Masahiro Murakami, "Managing Water for Peace in the Middle East : Alternative Strategies, "*United Nations University Press*. 1995; available from http:// www.unu.edu/unupbooks/80858e/80858E00.htm; Internet; accessed 21March 2007.

[62] Ibid.

million m³ were produced per year. By 1987 this figure had risen to 184 million m³ per year.[63]

In Qatar, too, an intensive programme of desalinated water production has been started, which supplied about 150 million m³ of water per year by the year 2000. This is believed to be about three quarters of the total water demand, with the rest to be supplied from groundwater sources, which are mostly brackish. About half of the country's demand will be generated in the urban/industrial centres.[64]

Saudi Arabia entered the desalinated water field much later than Kuwait. The first plant was commissioned in 1970. It has, however, gone in for an ambitious programme of desalination plant construction on both the Red Sea and Gulf coasts. The Saline Water Conversion Corporation had installed 30 desalination plant projects by the end of the 1980s. The total production of desalinated water is estimated to be 2.16 million m³ (572 million [US] gal.) per day including a facility at Al-Jubail producing 1 million m³ per day, which is currently the world's largest distillation plant.[65]

In spite of the high cost of seawater desalination, with unit water costs five to ten times as much as those of conventional water-resources development, a vast quantity has been produced to meet the increasing demand for domestic water in the Arabian Gulf countries. As in Kuwait, however, there is increasing government concern about the production cost of desalinated water, and every effort is being made to ensure that water use is as efficient as possible. There are about 1,483 desalination units operating in the Arabian Gulf countries, which account for 57.9% of the worldwide desalting plant capacity. The dominant plant type is multi-stage flash (MSF) which accounts for 86.7% of the desalting capacity, while the reverse osmosis accounts for only 10.7%. The

[63] Ibid.
[64] Ibid.
[65] Ibid.

installed capacity of desalination plants in the Arabian Gulf countries is estimated at 5.76 million m³ per day in total, including 2.98 million m³ in Saudi Arabia, which is approximately half of the total desalination capacity of the Gulf countries. The installed capacity with shares of each process is shown in annex G. MSF desalting has proved to be the simplest, most reliable, and most commonly used seawater system in large capacities. It has reached maturity with very little further improvement in sight. This maturity is expressed in reliable designs of large units up to 38,000 m³ (10 million gal.) per day, long operation experience with high on-line stream factors (up to 95%), confidence in material selection, and very satisfactory water pre-treatment. However, there has been a recent trend towards the use of reverse osmosis in seawater desalination, both for new plants and in connection with the present MSF plants, taking into account the possible reduction in energy requirements and the lower operation and maintenance cost for RO.[66]

Possible Areas of tensions or conflicts over water resources in the Middle East

Many analysts believe that the water crisis in the Middle East is on the edge of conflict. The dwindling resources of water have elevated the strategic importance of water to an issue of national security and foreign policy as well as domestic stability. Given water's growing ability to redefine interstate relations, the success of future efforts to address water sharing and distribution will hinge upon political and strategic approaches to this

[66] Ibid.

diminishing natural resource. The following are the possible conflict areas in the Middle East over the water:

- **Turkey - Syria** . Along the Tigris and Euphrates Rivers, Turkey and Syria are currently approaching a massive confrontation over water resources. Relations between the two countries, strained at best, have been exacerbated since the 1980s by growing tensions over water, which have brought them to the brink of war several times. Despite the signing of a protocol ensuring Syrian access to Euphrates water in 1987, Turkish development efforts have increasingly threatened to marginalize and even eliminate Syrian access to water. Most notably, the Southeast Anatolia (GAP) Project has provided Turkey, situated at the headwaters of the Tigris and Euphrates River system, extensive control over the flow of Euphrates water. Turkish disruption of the flow of the Euphrates in January 1990 to fill water reservoirs in front of the Attaturk dam highlighted Syrian vulnerability to Turkish control over upstream water resources. Further complicating the issue is Syria's continued support for the extremist PKK (Kurdish Workers' Party) in its insurgency against Turkey, a move that has prompted Turkey to threaten a blockade of water. In the future, Turkish-Syrian disputes over water could escalate into regional conflict. Both Syria and Iraq, situated downstream from Ankara, have become increasingly threatened by Turkey's large-scale consolidation efforts. Once fully operational, the GAP Project may reduce Euphrates water to Syria by 40% and Iraq by up to 80%.Such activity, critical for Syria, will also be significant enough to substantially affect Iraq, currently somewhat autonomous because of its access to Tigris River water. In addition, aggressive Turkish acquisition efforts, currently concentrated on the

GAP Project, are anticipated in the future to focus upon Tigris River water as well. Though currently divided in their opposition to Turkish efforts, such activity could nudge Syria and Iraq, despite their differences, and despite the situation in Iraq into a strategic alliance, possibly destabilizing the region and precipitating a regional conflict.[67]

- **Iraq – Syria.** The relations between the two countries on water issues go back to times when Turkey was not in the heart of the problems. As an upstream riparian (the countries on the rivers) to Iraq, Syria began to develop its irrigation programs during the late 1960s and early 1970s, when Iraq was trying to become a major power in the region. The hostilities between the two nations reached its peak during Syria's filling of Lake Assad, which reduced the flow of the river to a trickle. In 1974, relations continued to deteriorate, and an ill fated agreement was reached. The following year, Iraq accused Syria on holding back water and asked the Arab League to intervene. Syria, a dissatisfied party to the negotiation process, pulled out of the Arab League Committee on the issue. By the end of May 1975, relations between Iraq and Syria threatened to turn violent. Syria closed its borders and airspace to Iraq and both countries began to mass troops on their mutual borders. A Saudi Arabian brokered deal was reached, and although it was not made public, unofficially Syria agreed to keep 40 % of the water from the Euphrates river and let 60 % flow into Iraq.[68]

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[67] IIan berman and Paul Michael Wihbey, " The new water politics of the Middle East," *The Institute for Advanced Strategic & Political Studies; available from* www.iasps.org; Internet; accessed 19 February 2007.

[68] Ibid.

- **Iraq – Turkey.** At the opposite ends of the Twin Rivers, the two countries had a relatively stabile relation over this issue. Only after the completion of the Ataturk Dam, the Iraqi government voiced its concerns about the waters of the Euphrates river. They continued to complain about the new developments in the GAP, especially regarding the projects on the waters of the lower Euphrates and Tigris rivers.[69]
- **Jordan – Israel.** The Jordan River Basin has also emerged as a flashpoint for conflict over water. Resources in the area, suffering serious overuse as a result of pollution and population growth, have increasingly impacted interstate relations. Between Jordan and Israel, water resource issues are reaching a fever pitch (a state of extreme excitement). Despite the 1994 Israeli-Jordanian Treaty, which established comprehensive guidelines regulating the distribution, preservation and availability of water from the Jordan and Yarmouk Rivers, conflicts over water have risen to the forefront of relations between the two countries. Jordan, fed only by underground sources and the Jordan River, has experienced an escalating water deficit, one that is expected to reach 250 million cubic meters (nearly 1/3rd of current annual consumption) by 2010. At the same time, Israel, currently utilizing almost all available water from its National Water System (consisting of the West Bank Mountain Aquifer, the Coastal Aquifer and the Lake Kinneret Basin), has been forced to resort to overexploitation of available resources for expanding agricultural and industrial ventures. As a result, water has become a critical bone of contention between the two countries, a tension exacerbated by the recent

[69] Trade and Environment Database, "Tigris-Euphrates Rivers Dispute," www.american.edu; Internet; accessed 8 March 2007.

effects of the region's harsh climate. Facing a looming deficit in water availability brought about by lingering drought conditions, Israel halved its annual allocation of 2 billion cubic feet of water to Jordan in March 1999. Jordan, hit hard and lacking adequate desalinization capabilities, has in turn found itself unable to sustain current levels of consumption, declaring drought conditions and mandating water rationing in May 1999. A breakdown of relations between Jordan and Israel could lead to water seizure by either side.[70]

- **Israel – The Palestinian Authority.** The historically troubled relations between Israel and the Palestinians have also been magnified by water. Mutual reliance on the West Bank Mountain Aquifer, which rests atop the demarcating border of the disputed West Bank territory (and currently provides 1/3rd of Israel's water supply and 80% of Palestinian consumption), has created friction between the State of Israel and the Palestinian Authority. Efforts at cooperation between Israel and the Palestinians have so far proven markedly ineffective. Despite the passage of the 1995 Interim Agreement on the West Bank and Gaza Strip, which included a Water Annex dealing specifically with water resource distribution, Israeli-Palestinian relations have continued to be plagued by conflicts over water.[71] The Palestinian Authority, in spite of the "equitable distribution" formula constructed under the Water Annex, has claimed to be suffering from uneven water allocation under Israeli guidelines maintaining water distribution proportions at 1967 levels. Even the Multilateral Water Resources Group, created in 1992 as part of the peace

[70] IIan berman and Paul Michael Wihbey, " The new water politics of the Middle East," *The Institute for Advanced Strategic & Political Studies; available from* www.iasps.org; Internet; accessed 19 February 2007.

[71] Ibid.

process negotiations, has failed to affect movement toward agreement on water sharing between the parties.[72]

- **Israel – Syria.** As the Jordan flows south through the entrance to the Great Syrian Rift Valley, it is fed from underground sources and small streams at various points in Jordan, Israel, Syria, and Lebanon. The Jordan's main sources are the Hasbani River, which flows from Lebanon to Israel, the Banyas River, which flows from Syria to Israel, the Dan River, which begins and flows inside Israel, and the Yarmouk River, which begins near the Golan Heights and flows to the Jordan River. The Jordan is a multinational river, flowing southwards for a total length of 228 km through Lebanon, Syria, Israel, and Jordan. The Yarmouk River is the largest tributary to the Jordan river. The Yarmouk River forms the present boundary between Syria and Jordan for 40 km before becoming the border between Israel and Jordan. Israel is occupying the Syrian Golan heights where the Lake Kinneret located, which for the time being is the one main water source for Israel. The two country are technically at war since there is no peace agreement between them.

- **Egypt – Sudan – Ethiopia.** The beginnings of a crisis have materialized along the Nile as well. Ethiopia, making movements toward state building for the first time in a generation following the overthrow of the communist Mengistu regime in 1991, has focused upon water distribution as an issue of paramount concern. The North African country, currently ravaged by conflict with Eritrea, possesses neither the economic stability nor the investor confidence to facilitate desalination

[72] Ibid.

efforts. Consequently, Ethiopia has increasingly objected to the water use of Egypt, claiming present allocation, regulated by a 1959 agreement over Nile water, to be extremely inequitable. Asserting the 1959 agreement to be preferential to Egypt and Sudan, Ethiopia has hinted it may resort to a unilateral exercise of sovereignty or a military confrontation with Egypt. Egypt, for its part, has long asserted aggressive control over Nile water. Situated downstream from a long line of countries with access to the Nile, water occupies a central plank of Egypt's foreign policy and national security stance. Concerns regarding water dependency spurred the efforts aimed at creating the capacity to trap and store water (including the construction of the Aswan High Dam) during the 1950s.

Despite these efforts, however, Egypt has become increasingly vulnerable on the water issue. Affected by environmental factors, water availability flowing to Egypt along the Nile has been significantly reduced, making Egypt increasingly dependent upon, and influenced by, the political climate and interstate dynamics of the region.[73] This growing vulnerability is likely to become a major source of political tension in the near future. Since Egypt has retained an aggressive military stance with respect to water, domestic Ethiopian development efforts (such as growing attempts to dam the Blue Nile) are likely to result in increasing regional tensions. In addition, Sudan has become an increasingly unstable factor in the Middle Eastern water calculus. Ravaged by civil war, Sudan has manifested expansionist desires over Nile water, threatening to withdraw from the 1959 Agreement. These movements have increasingly jeopardized the stability of

[73] Ibid.

neighbouring nations, endangering Ethiopian and Egyptian access to water. As a result, tensions along the Middle East/North Africa boundary are on the rise.[74]

Security concerns and the environmental scarcity in The Middle East

Security concerns are linked fundamentally to what academic researchers term "environmental scarcity". The scarcity of renewable resources such as arable land, forests and fresh water. Many academic researchers like "Ulrich Kuffner" believe that conflicts over water "have occurred between many countries in all climatic regions, but between countries in arid regions they appear to be unavoidable. Claims over water have led to serious tensions, to threats and counter threats, to hostilities, border clashes, and invasions". Even though the Middle East can generally be characterized as an arid climate, two great river systems, the Nile and the Tigris/Euphrates, serve to anchor the major population centers in the region. Conflict over the water of the Nile may someday come to pass between Egypt, Sudan, and Ethiopia; while Turkey, Syria, and Iraq all are located along the Tigris/Euphrates watershed and compete for its resources. Further conflict over water may embroil Israel, Syria, and the Palestinians over the Jordan River and the aquifer water. Numerous scholars in recent years have conceptualized water in security terms as a key strategic resource in many regions of the world.[75] Thomas Naff maintains that water scarcity holds significant potential for conflict in large part because it is fundamentally essential to life. Naff identifies six basic characteristics that distinguish water as a vital and potentially contentious resource. (1) Water is necessary

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[74] Ibid.

[75] Jason J. Morrissette and Douglas A. Borer, " Where Oil And Water Do Mix: Environmental Scarcity And Future Conflict In The Middle East And North Africa," *U.S Army War College; available from* http://carlisle-www.army.mil/usawc; Internet; accessed 3 March 2007.

for sustaining life and has no substitute for human or animal use. (2) Both in terms of domestic and international policy, water issues are typically addressed by policymakers in a piecemeal fashion rather than comprehensively. (3) Since countries typically feel compelled by security concerns to control the ground on of under which water flows, by its nature, water is also a terrain security issue. (4) Water issues are frequently perceived as zero-sum, as actors compete for the same limited water resources. (5) As a result of the competition for these limited resources, water presents a constant potential for conflict. (6) International law concerning water resources remains relatively "rudimentary" and "ineffectual". As these factors suggest, water is a particularly volatile strategic issue, especially when it is in severe shortage.[76]

Despite increasing demand, water has not been the primary cause of war in the Middle East in the last 25 years. Nevertheless some leaders in the Middle East including those considered to be among the most moderate, such as King Hussein of Jordan and former UN Secretary General, Boutros Boutros-Ghali of Egypt, have warned explicitly that water is the issue most likely to become the cause of a future Israeli-Arab war.[77]

Conclusion & Recommendations.

The region of the Middle East and North Africa (MENA) accounts for about 5% of the world's population, but only 1% of the freshwater. Per-capita water availability in the (MENA) region has fallen by 62% since 1960 and is expected to fall by another 50% in the next 30 years. Eighty-seven percent of all freshwater resources in the region are used in mainly low value agriculture; water losses in municipal distribution systems often

[76] Ibid.
[77] Ibid.

exceed 50% of the water supplied for urban use.[78] The highly tapped Jordan River basin provides critical water supplies to Israel, Jordan, Syria, the Palestinian territories and Lebanon and has been a source of frequent conflict in the region. In the Jordan basin, the situation is exacerbated by politics: while some of the riparian are at peace with one another, others are still at war or in the process of slow reconciliation. In North Africa, nine sovereign states share the Nile basin's water, key to development and revival in the region. Egypt, Sudan, and Ethiopia are most vocal about problems in the basin, and the Nile's water is becoming increasingly subject to demands by riparian which previously did not necessarily insist on their share. Throughout the Middle East and North Africa region, water quantity is the most serious issue, followed by water quality. Central to these problems is the assertion that resource scarcity and certain forms of environmental degradation are major factors in political instability or violent conflict at local, regional and interstate levels. In short, there is a growing perception that local, regional, and global environmental deficiencies or resource scarcities may increasingly lead to conflict. In both the Middle East and North Africa, increasing poverty in certain countries, population pressures, unsustainable water withdrawals, continuing territorial dispute, trans boundary rivers and growing nationalism, environmental degradation and water scarcity are factors that may increase regional tension. Furthermore, Middle Eastern leaders, both past and present, have stated that water is the factor most likely to lead to war.

[78] Bertrand Charrier, Shlomi Dinar, and Mike Hiniker. "Water, conflict resolution and environmental sustainability in the Middle East," *The Uniresity of Arizona*; available from http://ag.arizona.edu ; Internet; accessed 15 February 2007.

The opposite of tension is action towards cooperation among the states in arenas of water and the environment. Water stands to become a vehicle which can enhance peaceful relations between the parties and the countries in the Middle East, since water is vital for the survival of the entire regional citizenry, parties and states may find it necessary to cooperate. Governments, both national and local, hold the key responsibility. However, the private sector, non-governmental organizations, international agencies and national agencies can play a major role both as investors and as managers of utilities. In fact, it is the common responsibility of all actors of society: businesses, governments, scholars, researchers and individuals, to contribute to the elaboration of numerous solutions. In addition to learning from their efforts and efforts in other regions, interested parties must promote a new water and environmental ethic, educate the masses and facilitate discourse.

The following are some recommendations points that might help in ameliorating the water scarcity and reduce the water tension in the Middle East and North Africa:

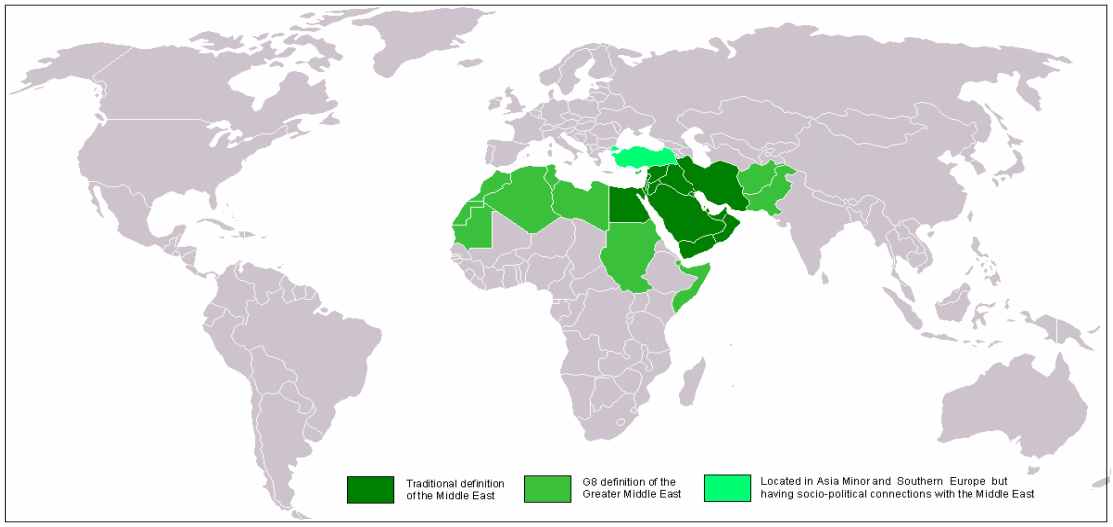
- Improvement of communication among those who determine water policy within and across watersheds.
- Develop new ways for irrigation (dipping method for example) and decrease agricultural consumption by developing more efficient crops.
- Sustainable use and management of surface and ground water.
- Promotion of education stressing that water shortages are a common problem requiring cooperative solutions.
- Promotion of greater water use efficiency.

- Import food like wheat which require a large quantity of water (about 1000 tonnes of water are required to produce a tone of wheat).[79] Consideration of decision-making at a regional level encompassing multiple watersheds.
- Establishment of a regional commission to manage water jointly, and.
- Greater use of strategic scenarios as management and education tools.[80]

[79] Tony Allan, " Avoiding war over natural resources*," Global Policy Forum*; available from http://globalpolicy.org; Internet; accessed; 18 March 2007.

[80] Bertrand Charrier, Shlomi Dinar, and Mike Hiniker. "Water, conflict resolution and environmental sustainability in the Middle East," *The Uniresity of Arizona*; available from http://ag.arizona.edu ; Internet; accessed 15 February 2007.

Annex (A)



The traditional Middle East and the G8's Greater Middle East. Source is Wikipedia, the free encyclopedia http://en.wikipedia.org/wiki/Middle-eastern

Annex (B)

Political & transportation map of the traditional Middle East today. Source is Wikipedia, the free encyclopedia http://en.wikipedia.org/wiki/Middle-

Annex (C)

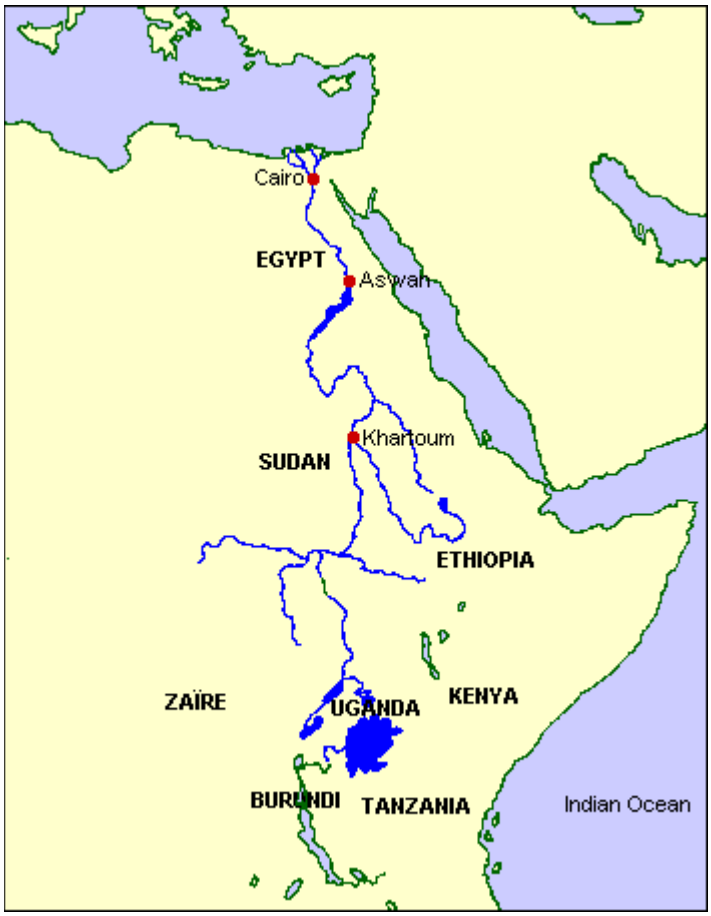
Middle East Natural Resources

Annex (D). Euphrates and Tigris Rivers

Source: Le Monde diplomatique, Paris, 1994, updated in 2001.

Source: United Nations Environmental Program/ Grid-Arendal. Maps and Graphics. http://maps.grida.no

Annex (E) The Nile river



Source: http://www.american.edu

Annex (F) The Jordan River.

Source: World Atlas. http://encarta.msn.com

Annex (G)

Installed capacity of desalting plants and share by process type
in the Arabian Gulf countries

	No. of units	Capacity (1,000 m^3/day)	Share by process type **(%)**				
			MSF	**RO**	**ED**	**VC**	**MED**
Saudi Arabia	874	2,980	80.7	16.2	2.6	0.5	
Kuwait	279	1,090	95.5	1.8	0.55	1.6	0.25
U.A.E.	99	1,020	98.3	0.9	0.5	-	-
Qatar	47	310	9 7.9	-	-	0.7	0.9
Bahrain	143	260	56.7	37.2	4.9	0.8	0.4
Oman	41	100	91.1	1.9	0.9	1.7	
TOTAL	1,483	5,760	86.7	10.7	1.8	0.65	0.15

MSF = **MULTI-STAGE FLASH**.
RO = **REVERSE OSMOSIS.**
ED = **ELECTRODIALYSIS.**
VC = **VAPOUR COMPRESSION.**
MED = **MULTI-EFFECT DISTILLATION.**

Source: Masahiro Murakami. ”Water for peace in the Middle East : alternative strategies.”. United nations university press. 1995. www.unu.edu

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