

**WATER: THE HYDRAULIC
PARAMETER OF CONFLICT IN
THE MIDDLE EAST AND NORTH
AFRICA**

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FOREWORD

We are pleased to publish this thirtieth-fifth volume in the *Occasional Paper* series of the US Air Force Institute for National Security Studies (INSS). Steve Kiser has produced a significant study behind today's headlines, explaining in detail how environmental factors underlie many real and potential conflicts. Environmental security is one of several "new" dimensions of the contemporary international scene, and it is one that requires much greater examination. This paper deepens our understanding of its dynamic interplay with more traditional security factors in two important cases.

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JAMES M. SMITH
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EXECUTIVE SUMMARY

Water is a primary concern of most governments in the Middle East and North Africa. A myriad of synergistic variables are exponentially increasing demands for water, while simultaneously decreasing the region's ability to supply it. These variables include a rapidly increasing population, a large per capita increase in water demand, increasing water pollution, rapid economic growth, persistent regional drought, and irrecoverable water overexploitation. Compounding the issue are regional tensions (such as those between Israel and the Palestinian Authority and Egypt and Sudan), vague international water laws, and a history of regional conflict.

A gloomy prediction emerges if one extrapolates the trends in each of these variables. Especially in the Middle East, water supplies are so tight that even the most optimistic forecast suggests the water issue will be "super-critical" within a decade. Indeed, water issues surround the current peace process, and may actually be worsened should a successful treaty be negotiated between Israel and the Palestinian Authority.

This paper examines these variables in depth, and then forecasts a series of possible events that could be the catalyst for a water-based conflict in the Middle East. These events include mass Palestinian migration to a newly declared Palestinian state, transferring control of the West Bank aquifer to the Palestinian Authority, loss of Israeli control of the Jordan River headwaters (which would necessarily result from returning the Golan Heights to Syria), continued or exacerbated drought, and an Israeli return to a more hawkish government.

While currently water should only be considered a proximately source of conflict in the region, in the future, water could very well become the primary reason governments decide to go to war.

Water: The Hydraulic Parameter of Conflict in the Middle East and North Africa

INTRODUCTION

“Unless properly managed, water scarcity can be a major source of strife, as well as a roadblock to economic and social progress.”¹ These words, spoken by US Secretary of State Madeleine Albright, illustrate the expanding notion of security. Instead of viewing it through the narrow lens of traditional national security, the less discriminating notion of human security is gaining a broader acceptance in the international community. In a world full of conflict, identification of the causes of fighting is as important as the identification of who is fighting, and the conventional premises of national security are no longer sufficient. Environmental security is one key component of human security, and access to water is one of the components of environmental security—one that is increasingly acting as a catalyst for different groups to initiate hostilities, or at least as a hindrance to achieving peace and stability.

The Middle East and North Africa highlight this trend well. In the Middle East, despite the present chaos that seemingly makes peace a remote prospect, most major parties involved at least appear to want peace. In a region of the world where ten years ago simply admitting your enemy even had the right to exist was a major concession, this desire for peace represents a sea change in attitude. Therefore, the prospects for the peace process to move forward are incontestable, albeit at a frustratingly inconsistent gait. The formal parties to the peace process must deal with the same familiar points—the status of the Golan Heights, Jerusalem, Palestinian refugees, and West Bank settlements. All are thorny issues that will test even the most patient and skilled negotiator. However, the less visible and often unmentioned hurdle is water; this issue historically is the most difficult to solve, and there is little hope the current peace negotiations will be any different. Water and other natural resources are constant underlying sources of conflict in North Africa

as well. The possibility of conflict occurring between Egypt and the Sudan over water exists, and will only be exacerbated by Egypt's ambitious plans for increased use of the Nile. Moreover, Sudan's civil war has clear roots in water issues. These examples fortify many analysts' suggestions that water has eclipsed oil, the source of many previous conflicts, in importance. Ironically, the most oil-rich region of the world is a most likely candidate to host a war, not over the once all-important crude, but over water.

This paper will specifically address these two case studies where water will either catalyze conflict or at least complicate peace. The first study details the significant water interests which Israel, Jordan, the Palestinians, and Syria must address before a permanent, structured peace can be negotiated in the Jordan river basin. It also models how the current peace proposals would affect water rights, and how those new water allocations and parameters could create the potential for future water conflict. The second study examines potential conflict over the waters of the Nile River, specifically Egypt, Sudan and Ethiopia's water security plans/issues, and how they could precipitate conflict. The water issue in both regions is a complicated tapestry of interconnected interests and needs; while Israel, Jordan and the Palestinians obviously are all competing for the same water resources, Israel's water concerns with Syria are complicated by the fact that Syria's water shortages are being exacerbated by Turkey's decision to dam the Euphrates River. Egypt could potentially alleviate some of the water shortages in Israel, Jordan and the Gaza strip by diverting water from the Nile, but that would significantly increase tensions with the Sudan and Ethiopia. Indeed, creating a properly managed water program in the Middle East that is agreeable to all parties involved will be a very complicated and delicate exercise in negotiations and statesmanship.

THE JORDAN RIVER BASIN

This section of the paper examines water issues in the in the Jordan River basin. This region includes several states and non-state entities: Lebanon,

Syria, Israel, Jordan and the West Bank, as the Jordan (or its tributaries) flows through each of these countries/territories. Water shortages are a common theme in the history of this particular region of the world, often acting as a source of conflict. Today access to fresh water in the Middle East, and in the Jordan River basin particularly, is critical for survival—water is a life-sustaining resource that is being exploited well beyond the rate it can be replenished. Current meteorological, demographic, economic, and political trends all suggest the water situation in the Jordan drainage area will worsen, at least in the near term. This increasingly tense situation tempers any euphoria born from the reinvigorated peace process; indeed, water will be one of the most difficult negotiating points in the peace process and very well may prove too difficult to completely solve. Hence, it is critically important to explore the dynamic between water and the Middle East peace process.

To fully address this question, I will provide a brief summary of the recent political, economic and military events related to the water issue. Next, I will list the numerous variables affecting the water shortage: hydrology, geology, population growth, economics and a host of other factors that make water an especially contentious issue. I will then present a brief review of the principal elements of the current peace process, illustrating how water and conflict in the area are inextricably linked. Finally, I will forecast potential events that will highlight how water could derail even the best efforts of well-intended peacemakers and become a proximate cause of conflict in the future.

Recent History

To better understand how water can be a source of conflict in the Jordan basin, a summary of recent “water history” is necessary. Such a brief historical review will illustrate how contested the water issue has been in the region.

Development of water sources in the Jordan basin has been contentious since Biblical times, but became especially acrimonious since the Balfour Declaration of 1917, the British document in which Jews were promised a “National Home” in Palestine. The water issue was sparked then

because the British declared that if the water resources of the area could be fully developed, at least 4-5 million Jewish immigrants could move to the area without displacing any of its current Arab occupants. Hence, studies on water distribution began to either corroborate or disprove the Balfour numbers.

Several water studies were conducted resulting in multiple comprehensive water plans and recommendations for the entire region. In 1922, the British published the Mavromatis Plan, which was followed by the Henriques Report in 1928; the World Zionist Organization advocated the Palestine Land Development Company Plan, authored by American J.B. Hayes, in 1935; M.G. Ionides, an engineer and advisor to the Transjordanian government, published an irrigation plan in 1939. This was followed by the U.S.-sponsored Lowdermilk Plan of 1944 and the Anglo-American Committee of Inquiry's Survey of Palestine Plan in 1946. This was the last major plan before the state of Israel formally came into existence in 1947, followed immediately by the outbreak of war.² While these plans did have scientific methodologies, their results and recommendations, unfortunately, were more affected by political ideology than by the data collected. If the author or sponsor of the study was pro-Arab, the study illustrated why the land could not absorb Jewish immigrants. If the sponsor was Zionist, the study invariably constructed a more optimistic scenario.

After Israel won its war of independence, it unilaterally began developing water resources. This included draining the swamps of Lake Huleh in northern Israel and construction of the National Water Carrier, both of which enabled Israel to begin exploitation of the Jordan River headwaters. Arabs, outraged at the diversion of water out of the Jordan basin and into the Negev Desert, attempted to divert water from the Jordan River to Lebanon, Syria and Jordan, before it reached Israeli territory (their projects failed for a variety of technical and political reasons).³ Several minor clashes, specifically over water diversion attempts, occurred between Jordanian, Lebanese, Syrian and Israeli forces. Indeed, destruction of the other camp's water projects was

the main goal in many of these small raids: Syrians ambushed soldiers protecting workers digging trenches to drain the Huleh Swamp in April, 1951; Israelis unilaterally began exploiting water sources in demilitarized zones, under heavy (and often used) military escort. Other minor skirmishes with Jordan and Lebanon occurred frequently as well. Several years later, the skirmishes over water escalated to include the use of artillery, mortars, and aircraft. In February 1964, Israel shelled a joint Syrian-Jordanian water works project designed to exploit water from Lake Tiberias (also known as the Sea of Galilee). Israel launched armed raids into southern Lebanon and destroyed three water reservoirs in a border town on October 26, 1965.⁴

Partly because of the increase in tensions over water in the early 1950s, the United States sent a special ambassador to the region. Eric Johnston was the head of the International Council of the Authority for Technical Assistance. He was tasked with creating a comprehensive water scheme for the entire region. He did so, with mixed results. All countries involved generally agreed upon what came to be known as the Johnston Plan. The plan was not signed, however, as Jordan feared such an agreement would necessarily entail a peace treaty with Israel. When tensions between Israel and Egypt increased, leading to the 1956 Sinai Campaign, the Johnston plan was set aside. However, it became the de facto agreement that Arab powers in the region generally attempted to follow.⁵ In the meantime, during the period 1948-1964, no fewer than 13 water development schemes in the region were proposed by various organizations. Since none were fully agreed to, Israel finished construction of its National Water Carrier, a large water carrier which takes water from Lake Tiberias and the headwaters of the Jordan River, and pumps it to the Mediterranean littoral and the northern Negev Desert.

Hence, although the Johnston Plan remained the de facto blueprint for the region for a number of years, as of 1984 Israel exploited approximately 55 percent of the available water in the Jordan basin (the Johnston Plan

allocated far less to the Israelis). This left only 45 percent for Jordan, Lebanon and Syria.⁶

Today, no comprehensive water plan currently exists, although Arab nations generally still refer to the Johnston Plan when discussing water rights. Only two ratified bilateral water arrangements exist, one between Israel and Jordan, and one between Syria and Jordan. I will discuss these later in the paper. In the absence of an agreed-upon framework, the current water situation is only marginally more structured today than it was in the previous decades.

WATER AND CONFLICT—THE VARIABLES

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.

Water Scarcity—An Examination of the Water Sources in the Region

It is obvious that the very root of the water problem in the Middle East is a shortage of water. It is one of the most arid areas in the world. There are three natural sources of water for the subject countries to exploit: river waters, ground waters, and rainfall. None of these sources is abundant in the Jordan River basin, and what few sources do exist are all currently either fully (or over) 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 the Jordan basin, are too expensive, too technically challenging, or politically unfeasible, and therefore will not notably affect the peace process, at least in the near term. An examination of each of the three primary water sources follows.

River Waters of the Region: There are two major river systems involved in the Arab-Israeli water conflict: the Jordan watershed, comprising

the Jordan and Yarmuk Rivers, and the Litani watershed. (Although the Litani is not part of the Jordan basin, it is included in this discussion due to its close proximity to the Jordan and the political considerations surrounding it.) Both Jews and Arabs have claims to these river systems, many of which are irreconcilable and mutually exclusive. The Jordan watershed is especially problematic, as the majority of its headwaters originate in Lebanon, Syria and Jordan but are largely exploited by Israel. The Litani poses its own problems, despite the fact it completely originates in and flows only through Lebanon. Its close proximity to Israel has created ambition south of the border and paranoia to the north.

The Jordan headwaters are comprised of the Hasbani and the Baniyas rivers, which originate in Lebanon and Syria respectively. These two rivers converge north of Lake Hula in the northern Galilee region of Israel. The Dan River, which rises in Israel, joins the Jordan at Lake Hula. From that point of confluence, the Jordan River flows south through Israeli territory and Lake Tiberias. Just south of Tiberias, the Jordan is fed by the Yarmuk River, which originates in southern Syria, and then forms the international boundary between Jordan and Syria before emptying into the Jordan. The southern half of the Jordan, between Lake Tiberias and the Dead Sea, forms the international boundary between Israel and Jordan. Hence, water for the Jordan originates in all four nations, and partially forms an international boundary for three of them. This hydrology complicates political and economic considerations among these riparians. According to a study conducted by the Tennessee Valley Authority in 1953 under the auspices of the United Nations, the total estimated annual flow of the Jordan amounts to 1880 million cubic meters of water per year (mcm/y), 77 percent of which originates in the three Arab countries, 23 percent of which originates in Israel.⁷

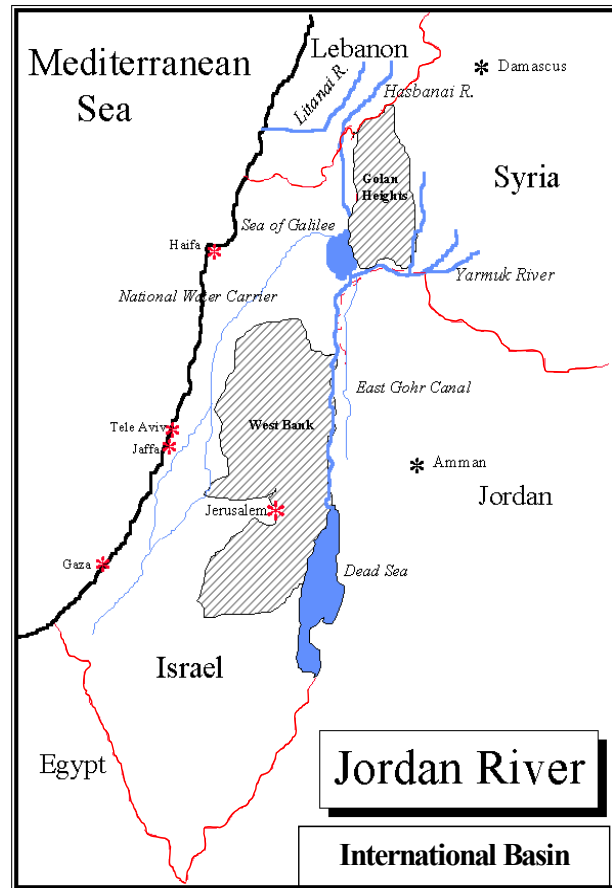
This mixture of water origins, river flows and international boundaries creates a witch's brew of problems. Over 90 percent of Syria's

water is shared with Turkey, Iraq, Israel, Lebanon and Jordan. Approximately 36 percent of Jordan's water sources are shared with Syria, the West Bank and Israel. More than half of Israel's water is shared with Syria, Lebanon, Jordan and the West Bank. With such a complicated hydrological river system, the situation can be volatile. Indeed, the Jordan basin has been described as "having witnessed more severe international conflicts over water than any other river system in the Middle East...and...remains by far the most likely flashpoint for the future."⁸

The Litani river watershed is, geographically speaking, much simpler. It rises in central Lebanon, flows in a southwestern route completely through Lebanon, and empties into the Mediterranean Sea several miles north of Tyre. Hence, the boundaries of this watershed are completely contained within the political boundaries of Lebanon. However, this has not prevented its waters from being a source of contention in the region. Part of this problem is that the Litani has never been fully exploited by Lebanon; the extra water flowing unused into the Mediterranean is desperately needed by Syria, Jordan and Israel. Many speculate part of the reason Israel invaded Lebanon in the early 1980s was to secure, and then partially divert, the Litani. The estimated annual flow from the Litani totals 410 mcm/y.⁹

Ground Waters of the Region: Syria, Lebanon and Israel all have indigenous underground aquifers within their political boundaries—hence, these particular aquifers are not directly contributing to the Arab-Israeli struggle for water at the sovereign state level. However, a large aquifer located under the West Bank symbolizes the struggle between Palestinian and Jew for access to water.

Diagram 1. Jordan River Basin



Modified from: A.H. Miller, "The Jordan River—Too Little for Too Many"¹⁰

Table 1. Jordan Flows and Originations

	Source Country	Gain (mcm/y)	Loss	Total
Dan River	Israel	245		
Hasbani R.	Lebanon	138		
Banias River	Syria	121		
Jordan (in Hula Valley)	Israel			504
Hula Valley	Israel		100	
Local runoff In Hula	Israel & Syria	140		
Flow into Lake Tiberias	Israel			544
Runoff/rainfall Into Tiberias	Israel/ Syria	200		
Evaporation From Tiberias	Israel		270	
Outflow to Lower Jordan	Israel/ Jordan			474
Yarmuk	Syria/ Jordan	492		966
Wadis/Springs In Ghor Valley	Jordan/ Israel	505		1471

Source: Thomas Naff and R.S. Matson, *Water in the Middle East*.
Boulder, CO Westview Press, 1984.¹¹

Ground water makes an enormous contribution to Israel's total water supply—indeed, Israel uses approximately 850 mcm of ground water each year, accounting for just under 45 percent of its total water use.¹² However, about 400 mcm/y of this water comes from the Mountain Aquifer (see diagram 2, which divides this into three sections: the Western, Eastern, and

Northeastern Aquifers), which lies under the West Bank and was captured from Jordan in the 1967 War. It flows to the Israeli littoral or into the Jordan. The primary way to access this water from the West Bank is to sink wells, as there are few natural springs directly above the aquifer. Tensions between the Palestinians and Jews arise primarily because Israel refuses to allow Palestinians to sink their own wells in the West Bank, instead insisting the Palestinian villages hook into the Israeli National Water Carrier (NWC). However, Jewish settlers in the West Bank can sink their own wells if they are not yet supplied by the NWC. Hence, Jews can exploit this water, but Arabs are not allowed to do so, creating tensions between the various occupants of the West Bank. This situation will be discussed further later in the paper.

Rainfall in the Region: Rainfall is especially scarce in the Jordan basin, particularly in the exceptionally arid southern Negev desert in Israel. While northern Israel and the extreme northwest corner of Jordan receive approximately 110 cm of rainfall annually, for both nations rainfall accounts for very little of the region's water, and therefore, does not supply any meaningful amount of water that can be reliably exploited. Unfortunately, the rain for an entire year in Israel and Jordan usually comes in one or two major showers. Syria and Lebanon, on the other hand, receive rainfall in enough amounts to aid in agriculture and some recharging of underground aquifers.

To better put the scarcity issue in perspective, Jordan and Israel are the fifth and seventh driest nations on the planet respectively, both in total water availability and in a per capita measurement. Only Kuwait, Libya, Oman and Singapore are drier.¹³

Rapid Population Growth—Higher Demand for an Increasingly Scarce Resource

The second greatest factor underlying water tensions in the Middle East is the explosive population growth in the area over the last 50 years. According to the Population Reference Bureau, a Washington, D.C.-based organization that tracks global population trends, the population of the Middle East quintupled

from 60 million in 1950 to 286 million in 1996. If the current rate of population growth continues, the population of the region will double yet again in the next 30 years.¹⁵

Diagram 2. Aquifers/Ground water in the Jordan

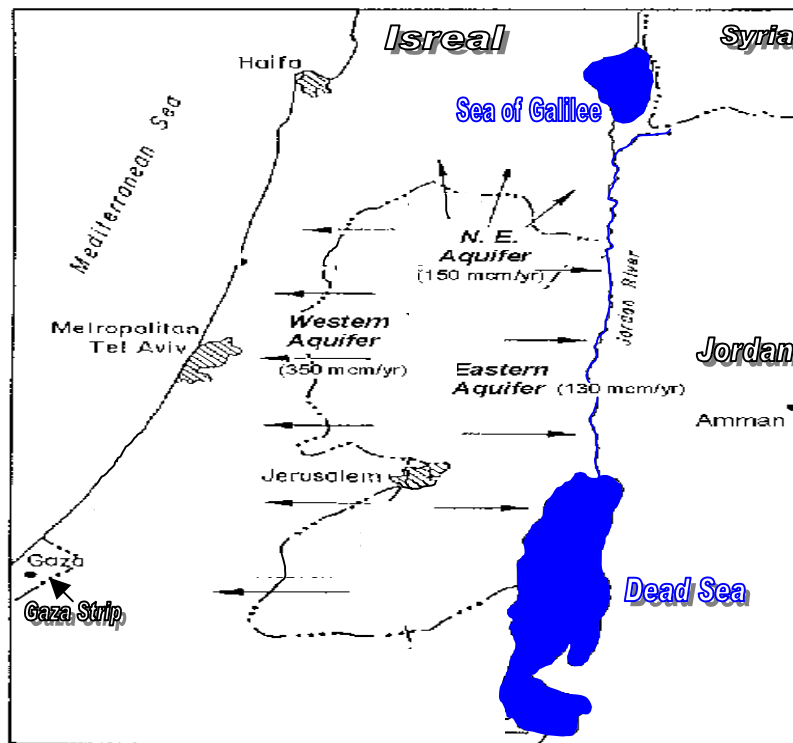


Table 2. Total Usable Water Availability in the Region, by Source

	River (Surface) Flow (mcm/y)	Groundwater (mcm/y)	Rainfall (mcm/y)
Israel	600	850.0	
Jordan		1.0	
Lebanon	33.0	38.0	120.0
Syria	55.0	70.0	70.0
West Bank	3.0	3.0	

Source: World Resources Institute¹⁴

Specifically within the Jordan basin, population grew at a faster rate than in the Middle East overall, mostly due to large influxes of immigrants. Syria and Jordan's natural population growth rate is estimated at 3.7 and 3.4 percent, respectively. While Israel's natural population growth is only estimated at 1.5 percent, the continuing influx of Jewish immigrants, especially those from Russia, caused the real annual population growth to be closer to 10 percent since 1987.¹⁶ Additionally, hundreds of thousands of Palestinians moved to Jordan from Kuwait after the Gulf War, further increasing the population of one of the most water-scarce nations in the world.

As populations increase, the per capita water availability decreases. Population growth in the Middle East is on a trajectory to reduce per capita water availability approximately 50 percent by the year 2025.¹⁷ Indeed, a World Bank Report in 1993 stated, "within one's lifetime, annual average per capita renewable [water] supplies—excluding so-called 'fossil' aquifers in the Arab region—will have fallen by about 80 percent."¹⁸ The outcomes of this increasing gap between supply and demand lead to land and water degradation, disruptions in the hydrological cycle, an increase in water-born illnesses, and other maladies—all of which will increase insecurity and the likelihood of conflict.

**Table 3. Population/per capita water availability
(population in thousands, water in cm/year)**

	Israel	Jordan	Lebanon	Syria
1955	1,748/ 1,230	1,447/ 905	1,613/ 3,087	3,967/ 6,501
1990	4,821/ 461	4,259/ 308	2,555/ 1,949	12,348/ 2,089
2025	8366/ 247-303	9369/ 104-114	5621/ 1,021-1,248	27,165/ 713-835
2050	12,549/ 192-300	11,500/ 68-90	8431/ 768-1,218	40747/ 454-667

Sources: Falkinmark, World Resource Institute¹⁹

Swedish hydrologist and Population Reference Bureau scientist Malin Falkinmark developed an index to measure the adequacy of water

supplies. Her guidelines, which can be compared to the chart above, are: Stress: 1,000-1,700 cm/y, Scarcity: 500-1000 cm/y, and Absolute Scarcity: below 500 cm/y. By these standards, the table suggests Israel and Jordan were in the lowest “absolute scarcity” category as early as 1990 in per capita water availability, with projections suggesting that even that meager supply could be almost halved in the next 25 years. To put this in better perspective, as of 1995, the annual per capita water availability in the United States was 9,413 cubic meters—30 times that of Jordan and 25 times that of Israel.²⁰

Rapid Economic Development—Increasing Pressures of Water Usage

Despite recurring war and perpetual tension, Middle East economies have enjoyed significant development in the last 25 years. While the benefits of such development are unquestionable, the new pressures placed on scarce water resources are significant.

It is important to note the majority of this growth occurred in the industrial sector of these economies; such industrial growth creates increasing competition for water, which is already being used for domestic or agricultural purposes. Although increasing populations require more food, little growth in the agricultural sectors of these economies (with the exception of Syria) occurred, especially in the last decade. In fact, agriculture constituted 18 percent of Jordan’s GNP in 1965, but only 6 percent by 1993.²¹ This is mostly because all the water sources available in the region were already fully exploited, preventing any further irrigation of arid lands. Moreover, all lands that do not need irrigation are already fully planted. Hence, growth in these economies is naturally in the non-agricultural sectors: in Israel, high-tech industries are springing up in the Haifa region. 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 2025.²²

This increasing industrial use of water creates problems. 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. This is especially true of areas where water infrastructure is not well developed, as in the Middle East. Hence, pollution of water sources will be increasingly problematic.

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.²³ For example, in 1960, approximately 35 percent of Jordan's population lived in or around the capital of Amman; in 1991, that figure reached 55 percent, and it is projected to be nearly 60 percent by 2000.²⁴ In 1996, the entire Jordan basin's population was 63.4 percent urban, with that number likely to increase significantly in the coming decade. Thus, economic development created and will continue to drive greater per capita demands for water. Hence, these last two variables (increasing population and a growing economy) create a synergistic spike in water demand.

Table 4. Water Use as a Percentage of Total Use

	Domestic	Industrial	Agricultural
Israel	29	7	64
Jordan	29	6	65
Lebanon	11	4	85
Syria	7	10	83
West Bank	22	0	78
Gaza Strip	15	0	85

Sources: World Resources Institute, 1992; Central Bureau of Statistics, 1998²⁵

Technology Enables Greater Water Exploitation

Modern technology gives humans the ability to alter their natural environment, which is now happening at an unprecedented level and in unprecedented ways. Specifically with water exploitation, technology allows the construction of irrigation canals, dams and deeper wells. As with economic development, this

has both good and bad outcomes. Certainly, the increasing capability to develop previously unusable water with dams and aquifer construction allowed the population of the Middle East to expand, increased regional crop yields, improved sanitation, and enhanced other quality of life factors.

However, this technology is a two-edged sword. Dams create large reservoirs, creating higher water loss due to increased evaporation. Large irrigation projects waste water through inefficient watering. Deeper wells extract larger amounts of groundwater, lowering water tables. Lowered water tables allow saltwater seepage, in turn causing increased salinization of the water table, permanently rendering it unusable.

All these scenarios exist in the Jordan basin. Indeed, water exploitation in the Gaza Strip has caused the salinity of the water table there to reach almost unusable levels. Each year 140 mcm are pumped out, while the natural annual return is approximately 60 mcm.²⁶ Water projects, to include Israel's National Water Carrier and Jordan's East Ghor Canal, are typical of large water projects which increase evaporation rates. Water usage has so altered the Jordan and Yarmuk Rivers that the Dead Sea (the final basin where the Jordan flows) has dropped by approximately 50 feet in the last 80 years, and its total surface area has shrunk by nearly 40 percent.²⁷ The Jordan is little more than a rivulet by the time it drains into this ever-shrinking body of water. Hence, technology has enabled the population of the region to exploit water beyond the point of sustainability.

Unequal Distribution of Water

Water rights and allocation is, and always has been, a great source of contention. From the very beginning of Israeli 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.

The construction of the National Water Carrier allows Israel to pump approximately 500 million cubic meters per year of high-quality sweet water out of the headwaters of the Jordan and Lake Tiberias.²⁸ Indeed, this represents the lion's share of the irrigation-quality water in the Jordan. This water, which represents roughly one quarter of Israeli total consumption each year, is completely removed from the Jordan watershed, and pumped to consumers in the Mediterranean littoral and the northern Negev.

This water diversion represents a double blow against Arab water interests in the area. First, by removing water from the headwaters of the Jordan, the flow of high-quality water into Lake Tiberias is lowered. This reduces the quality of water in the lake, from which both Jordan and Israel pump additional water. There are salt water belts under and around Lake Tiberias, which, when the level of the lake got below a critical level in the 1980s, began discharging into the lake itself, further reducing the quality of the lake's water. Israel responded to this by tapping the salt springs and then pumping the saline drainage water downstream to dump it back into the Jordan, where it enters Jordanian territory. Again, since the flow out of Lake Tiberias is reduced, already increasing the salinity of the Jordan below it, the addition of this saline drainage into the Jordan significantly reduces the quality of water Jordan can exploit out of that section of the river. Thus the injury is two-fold: Jordan receives much less water from the Jordan River than does Israel, and the water it does receive is so high in salt content it is only marginally useful, even for irrigation.²⁹

Ironically, Israel makes water claims on the Yarmuk (Jordan's primary river water source) as well, since the Yarmuk is the primary tributary to the Jordan. This further reduces Jordan's water claim. Indeed, with the severe drought in the region over the past two years, Israel is attempting to reduce the amount of water Jordan can claim from the Yarmuk from 55 mcm/y to 27 mcm/y.³⁰

Within Israel and the occupied territories, the uneven distribution of water is obvious as well. In the 1980s, water consumption among Israeli settlers in the West Bank was seven times that of the Arab inhabitants.³¹ Recently, Mustafa Natsheh, the mayor of Hebron, indicated the disparity was eight times as much.³² Western sources suggest a smaller, but still enormous, four-fold difference: Israeli settlers consume between 90-120 cubic meters per capita per year, while Palestinians consume 25-35 cubic meters per year.³³ Furthermore, Israel forbids Arabs living in the West Bank from drilling their own wells or developing any other water resources in an attempt to rectify the consumption imbalance.³⁴ Indeed, while this ban is in place, Israeli settlers, using the latest technology to drill deep into the aquifer, are exploiting the West Bank aquifer at a rapid rate. Should a political settlement giving the Palestinians control of the West Bank ever be agreed upon, the Mountain Aquifer in the West Bank will be already over exploited, which will make it difficult for the Palestinian Authority (which currently does not have access to the same drilling technology Israel has) to supply adequate water for the remaining residents of the Territories.

Additionally, Palestinians pay up to twice as much for water as Israeli settlers—when water is made available to the Palestinians. Some camps in the West Bank have not had water for months. One 7000-member refugee camp depends on a water supply provided by the United Nations, which has run for just two hours a day since April. Hebron has to truck in water for its 100,000 residents.³⁵ This creates bitterness and tension between Jews and Arabs, especially when water supply is tight, as it has been in the last two years.

Poor and Difficult Water Management

Water management in the Jordan basin is problematic for two main reasons. The first is the difficulty in exploiting the only outside water that enters the region naturally—rain. Although rains in the area are seasonal, they are very unpredictable. The majority of the rain typically comes in the winter months, leaving the hot summer months with little to no precipitation. Moreover, the

rains are often irregular and localized, making their capture and exploitation nearly impossible. Thus, while Jordan and the West Bank receives on average 20 mcm/y of rainfall a year, only 3 mcm/y of that amount can be captured and utilized, because it comes in only one or two rainfalls. Furthermore, due to the extreme arid nature of the region, high evaporation and transpiration rates diminish the amount of rain that can be used.

On a strategic level, none of the countries under discussion use their water efficiently. Israel, Syria and Jordan all insist, as a matter of national policy, that they need to be self-sufficient in food production. Thus, to paraphrase the first Israeli Prime Minister Ben Gurion, they try to make the desert bloom, despite the extraordinarily heavy water burden this creates.

Israel uses 1180 mcm (62 percent of total supply) and Jordan uses 67 mcm (74 percent of total supply) for agriculture. Because the agricultural lobby is so strong in both governments, each heavily subsidizes water. While both nations have done much to increase the efficiency of their irrigation methods (indeed, Israel was a pioneer in the development of drip irrigation technology, and boasts only a 12 percent loss during irrigation³⁶), the contribution of each nation's agricultural sector to GNP have steadily declined over the years. In 1993, only 2.6 percent of Israel's and only 6 percent of Jordan's GNP was generated by agriculture.³⁷ These figures suggests that while both Israel and Jordan are improving their water efficiency within their agricultural economic sectors, a more appropriate overall water strategy would be to import more food and transfer the newly available water to efficient industrial and domestic uses. This would not only boost GNP (a ton of water used in industry typically generates \$14,000, while a ton of water in agriculture typically generates \$1,000³⁸), but would also leave additional water for inevitable future population growth in the region. Interestingly, due to the perceived vulnerabilities both nations argue would exist due to the resulting food dependence, such a change in strategic water management is highly

unlikely. The political clout of the agricultural sector in each nation also prevents any significant reduction in subsidies.

International Law—Muddling the Issue

Existing international law regarding water sources shared among multiple sovereign states is vague and does not apply well to developing areas. The majority of international water law was developed in Europe and is concerned mostly with navigation rights and water purity, rather than water availability.³⁹ Hence, international law provides little concrete guidance to the Jordan basin riparians.

Two conflicting legal principles exist concerning international fresh water laws: sovereignty and integrity. Absolute sovereignty is advantageous to the upstream riparians as it regards water as an integral part of a state's national territory. This doctrine states "Territorial sovereignty is the sovereignty applied to a specific country or basin, the right to make decisions with regard to his country or basin without having to consult other countries and their citizens."⁴⁰ Downstream riparians who may object to the way the upstream riparians are developing common water sources are considered to be meddling in the internal affairs of the sovereign nation where the water originates. This is the principle Turkey used to create the massive reservoir behind the Attaturk Dam in 1989. 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. Indeed, in November 1998, Syria threatened to bomb several of the smaller dams that make up Turkey's Grand Anatolia Project (GAP), a massive hydrology project that reduced the Euphrates' flow by approximately 60 percent. The Turks responded that the water originating within their national borders was as much theirs as oil within the boundaries of Arabic nations belongs to the Arabs. If Arabs, despite having used the waters of the Euphrates for centuries, wanted to make a water claim against Turkey for the GAP, then Turkey would have the right to make oil claims against downstream Arab riparians.

The second legal principle is that of absolute integrity, which focuses on the integrity of the body of water rather than the sovereignty of the state where the body of water originates. This legal doctrine states “A river which flows through the territory of several states or nations is their common property.... Neither nation can do any act which will deprive the other of the benefits of those rights and advantages. The inherent right of a nation to protect itself and its territory would justify the one lower down the stream in *preventing by force* the one further up from turning the river out of its course, or in consuming so much water for purposes of its own as to deprive the former of its benefits” (italics added).⁴¹ This principle obviously favors the downstream riparians.

When these two principles come into conflict, they do not permit a reconciliation of interests—indeed, they are mutually exclusive. Historically, the outcome of such a conflict of legal principles is dependant on a single factor—which state advocating a particular doctrine is stronger.

The Jordan basin is very complex legally speaking and would be so even if well-developed water laws existed. As mentioned earlier, the lion’s share of the Jordan River’s water rises outside of Israel, in Lebanon or Syria. Israel, through military action, subversion, and negotiation, has been very successful in preventing any attempted diversion of these waters before they enter Israeli territory. This allows Israel’s National Water Carrier to extract almost 70 percent of the Jordan River after it enters Israel, but before it reaches a point where the Palestinians in the West Bank can exploit it. Indeed, in 1967, Israel shelled a joint Syrian/Jordanian dam on the Yarmuk River, as it viewed the dam as a threat to its water supply. Both situations illustrate Israeli reliance on the absolute integrity principle—despite the water originating outside its political borders, Israel makes a claim to the water. However, when addressing Palestinian complaints of not leaving enough water in the West Bank aquifer or Jordanian complaints of needing more water flowing out of Lake Tiberias, Israel follows the principle of absolute sovereignty. Hence,

Israel is implementing both (albeit contradictory) legal principles to maintain its share of water.

The matter is even more complicated than this. Of the approximately 1,950 mcm/y of water Israel uses annually,⁴² roughly 950 mcm/y, or 48 percent, comes from territory Israel captured during the 1967 war: 400 mcm/y from ground water in the West Bank and 450 mcm/y from the upper Jordan. Depending on the legal status of the Occupied Territories and the Golan Heights, the legal status of water ownership becomes even murkier. As later discussion will point out, the current possibilities of returning the Golan to Syria and granting greater autonomy to the Palestinians in the West Bank will greatly increase the contention of which population can legally exploit those 950 mcm/y of water.

As noted, only two international water agreements exist in the region: the Jordanian-Syrian Agreement on the Utilization of the Waters of the Yarmuk River (signed in September 1987) and the water provisions in the Peace Treaty between Israel and Jordan (signed in October 1994). Lebanon has no water treaties with any of its neighbors, and the two most bitter enemies in the region, Syria and Israel, have no bilateral water agreements. Because of the complicated nature of the water system in the Jordan basin, creating more than bilateral agreements is difficult. Also due to the complicated nature of the water system, a comprehensive water agreement among all four nations is necessary to achieve a lasting solution to the water crisis in the area.

Previously Existing Tensions

Water use is simply one of many tensions between the peoples of the Jordan River basin. It has been the primary source of conflict in the past, as both Arab and Jew have attacked the other's water infrastructures based on perceived threats. It has also been the proximate source of conflict, as many Arab analysts claim one of the overriding reasons for Israel to go to war in 1967 was to capture additional water sources.⁴³ But even if there were

adequate water sources in the Middle East, there would still be plenty of reasons for conflict to exist. As Israeli hydrology professor Uri Shamir stated for *National Geographic*, “If there is political will for peace, water will not be a hindrance. If you want reasons to fight, water will give you ample opportunities.”⁴⁴

The loss of water sources to Israel seems to be a national shame to Palestinians, Jordanians and Syrians. Priit Vesilind, a reporter for *National Geographic*, conducted a series of interviews in 1993 throughout the Middle East to gauge sentiment on the water issue. A Syrian border official in the Golan Heights stated in 1993, as he pointed to an Israeli flag flying across the demilitarized zone, “See that flag? Those blue stripes represent the Nile and Euphrates. The Israelis think this is where their land should extend, all the way from Egypt to Turkey. And they are working to get this area.” Abdullah Toukan, the science advisor to the late King Hussein of Jordan suggested, “In this arid region water is life. Money may bring desalination plants, but the real solution remains the restoration of Jordan’s rightful share of water.” Palestinian elder Shaher Khufash, living in the village of Marda in the West Bank, once stated, “Israel has stolen our water, and we are thirsty.” Despite the fact Israel built National Water Carrier infrastructure to the village, the village elders refused to hook up to Mekorot, Israel’s national water supplier. “Doing so means accepting them and their confiscations. Also, they say we have to pay for the water then. The people refuse.”⁴⁵ It seems from these limited statements that at least some believe the solution to current water shortages isn’t to make sure everyone has enough water; rather, it’s to make sure your enemy doesn’t have any water.

Until recently, Israel maintained a security zone in southern Lebanon. Katyusha rockets, fired by Hizbollah extremists, slammed into northern Israel regularly until the Israeli pullout in June 2000. Israeli tanks still practice maneuvers in the Golan Heights, anticipating a Syrian attack. Syria will not even discuss peace with Israel unless Israel comes to the negotiating table

willing to return the Golan Heights. A peace treaty between Israel and Jordan was signed only 5 years ago; water rights were the last issue to be agreed upon, and are among the main issues threatening to undermine the otherwise workable pact. And although the Camp David Accords sealed a peace treaty between Israel and Egypt decades ago, the peace is an uneasy one. In this environment of mutual distrust, terrorist organizations, occupation zones, demilitarized zones, occupied territories and a history of a major war every decade since 1947, there is little wonder progress on such things as cooperation in water use hasn't received more attention.

THE CURRENT PEACE PROCESS AND WATER

While the Knesset frequently debates the necessity of a regional water solution, Israeli policy makers have generally chosen to “go it alone” in terms of water management. Without a formal regional peace agreement, a formal regional water solution would be exceptionally difficult, despite the numerous and varied attempts. With Israeli economic and military might unchallenged in the area, the unilateral water policy Israel pursued could not be challenged by the Arabs. However, the current peace process, if successful, will change that—Israel's “imposed” water solution to the region cannot survive.

While the details of the current peace plans between Israel, the Palestinians and Syria are not fully available, the most important issues are. Israel is willing to return land for peace. Prime Minister Barak of Israel appears willing to negotiate the return of the Golan Heights to Syria, and to give greater autonomy (and possibly allow the Palestinians to declare statehood) in the West Bank. These actions will have significant ramifications for the balance of water in the region. A discussion of each follows.

Return of the Golan Heights

By returning the Golan Heights to Syria, Israel will relinquish its nearly exclusive control over the headwaters of the Jordan River. This is a major sacrifice, one that Israel, after reviewing its implications on the water situation, may not be willing to make. According to Thomas Stauffer, a

former professor at both Harvard and Georgetown Universities, Israel's control of the Golan is significant to its water supply for three reasons:⁴⁶

First, control of the Golan prevents Syria, Lebanon and Jordan from developing the headwaters of the Dan, Banias, and Hasbani Rivers. In the 1960s, these three nations developed their own unified water plan that essentially would divert water from these rivers before it ever entered Israeli territory. As mentioned earlier, Israel bombed these areas to prevent such a plan from ever reaching fruition. Relinquishing the Golan Heights now would at least strategically allow these three nations to pursue development of those headwaters. Should the Levant Arabs choose to do so, a significant reduction in water to the upper Jordan, and consequently to Israel, would result.

Secondly, Israel has expressed an interest in including the Litani River in southern Lebanon in any regional water plan. Indeed, some articles suggest Israel's invasion of Lebanon in the 1980s was to secure the Litani for itself; the 15-year maintenance of the security zone only fed those fears. Control of the Golan protects Israel's flank should she ever decide to divert Litani waters to the Hasbani River, thus increasing the flow of water into the headwaters of the Jordan. While this is highly unlikely under Prime Minister Barak (it would require re-occupation of southern Lebanon in order to regain access to the Litani), a more hawkish Israeli government might, in the future, seriously consider such a plan. By giving up the Golan now, any such action by the Israelis becomes much more difficult.

A third factor in giving up the Golan is the protection of the inlets of the National Water Carrier and the pumping stations from possible bombardment of Syrian artillery. Again, this scenario is unlikely in the current political climate, but there is no guarantee this climate will continue. Should Syria place military forces on the Golan; the entire Hula Valley and Lake Tiberias would be in range of Syrian artillery.

In short, giving up the Golan will make Israel vulnerable to Arab designs on Jordan River water, complicate any future Israeli water designs on

the Litani, and expose Israel's northern tip once again to Syrian military forces. No doubt, this will be a major point in the negotiations between Israel and Syria. Indeed, the most contentious (and last) issue to be agreed upon in the peace talks between Israel and Jordan in 1994 was the creation of a Joint Water Committee to develop additional water resources on the Yarmuk River. The Yarmuk is much less significant to Israel than are the feeder rivers to the headwaters of the Jordan, which will likely make this aspect of any peace agreement especially difficult.

Increased Palestinian Autonomy in the West Bank

Israeli hegemony in the West Bank is crucial to Israel's water supply. As previously mentioned, approximately 400 mcm/y of water from the West Bank aquifers feed into Israel's National Water Carrier. Additionally, Israelis have, and must continue to preempt local use of the Mountain Aquifer so that the water continues to flow to Israeli surface water sources along the coast, rather than be siphoned off by residents of the West Bank drilling wells. Should Palestinian wells be sunk in the West Bank, the aquifer could quickly be exploited to the point Israeli springs in the Mediterranean littoral would go dry, or at least experience significantly decreased flows.

Additionally, there is the concern of water pollution. Palestinian water projects are primitive compared to Israeli standards. What little agriculture they do have uses inefficient irrigation techniques, and the black market wells that do exist add to the pollution of the aquifer. Indeed, some sewers in the West Bank simply empty straight into the aquifer. Should the Palestinian Authority (in whatever form, be it an autonomous controlling authority or the national government of the state of Palestine) take more control of the water sources in the West Bank, the Israeli springs and wells fed by the West Bank aquifers will almost certainly become more polluted.

Immigration would also pose a significant impact on the water situation if Palestinians assume control in the West Bank and their people are allowed to return home. Approximately 2 million Palestinians live around the

world—a de facto Palestinian diaspora. Should a Palestinian State become reality, these 2 million people would have a politically recognized homeland based on their ethnicity. Just as Israel encouraged millions of Jews to immigrate after declaration of statehood (in not too dissimilar circumstances) in the last five decades, hundreds of thousands of Palestinians, both in the refugee camps in Jordan and in the Palestinian diaspora, may decide to move to the West Bank. Such an influx of new residents would create an incredible strain on an already marginal water supply. Assuming Kliot's assessment (previously quoted) that each Palestinian consumes approximately 25-35 cubic meters of water per year, 1 million Palestinian immigrants to the West Bank would create an immediate additional need of 25-35 million cubic meters of water per year—a demand for which there is currently no supply.

Israeli Withdrawal from the Security Zone

Israel's withdrawal from the Security Zone in Lebanon now makes it extraordinarily difficult for Israel to make any claims on the Litani River in the future. Indeed, increasing populations in both Israel and the West Bank may make this an eventual necessity; however, without Israeli hegemony (if it ever really existed) in southern Lebanon, such exploitation of the Litani would most likely need to come about through negotiations rather than force.

Peace, the 1967 War and Conquered Water

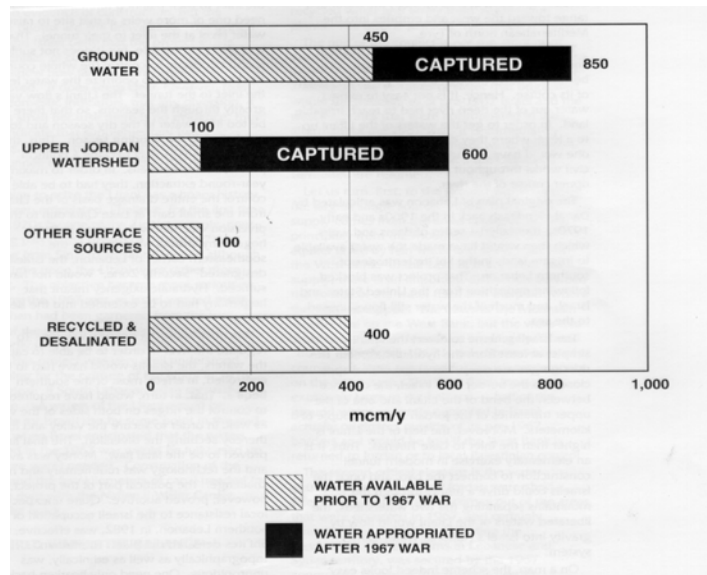
The 1967 War vastly increased Israel's supply of water. The possible loss of this water due to territorial concessions would create a crisis in Israel—a crisis that would be exceptionally difficult to solve. There is no new water in the Jordan basin area that is waiting to be developed. As early as 1981, Israel was exploiting 99 percent of its available water. Drought, like in the early 1980s and since 1997, has forced Israel to critically examine the value of the water it does use. War in 1967 made up the water deficit Israel needed in order to continue to expand economically and agriculturally, as well as to continue absorbing Jewish immigrants. The peace process strongly suggests Israel will

now have to share that water it once conquered. Israel has no means to acquire new water to replace what it gives up in the peace process.

This factor alone will be one of the most contentious issues on the negotiating table. Any peace with the Palestinians must address increased water rights for West Bank Palestinians. A sovereign West Bank would complicate further exploitation of the Jordan. The waters of the Golan Heights, while not important to Syria prior to the 1967 War, are now increasingly significant due to Turkish exploitation of the Euphrates River. Hence, Syria will be very reluctant to share any water originating from the Golan with Israel should a peace treaty be signed. Negotiating these water issues will be extraordinarily problematic.

In sum, Israel's imposed water solution to the Jordan basin cannot survive the peace process unless Israel is ready to abandon its agricultural sector. Only by thinking in terms of a regional water solution will Israel be able to meet current water demands and effect peace in the region.

Table 5. Significance of Water Captured by Israel in 1967 War



Source: Stauffer, Center for Policy Analysis on Palestine, 1996⁴⁷

Table 6 dramatically depicts the water challenge Israel would face by returning territories occupied in the 1967 War. It is important to note that this is *available* water, currently used and exploited. The following chart shows how much *total* water Israel would lose control of, should the Golan and the West Bank be returned.

FUTURE WATER CONFLICTS

Conflict over water in the Jordan basin remains possible, despite the current prospects for regional stability. As demand shows no sign of slowing and new supply is not available, in the near-term, the water situation can only become more critical. Indeed, the return of the Golan and loss of the West Bank aquifer would have profound effects on the geohydro-political structure of the Jordan basin.

Theoretical Framework to Analyze Potential for Conflict

The Middle East Research Institute has directed an on-going international study of water in the Middle East since 1984. The 13-volume set includes a theoretical framework from which one can roughly predict the potential for conflict. To simplify the data, the authors constructed a matrix that predicted the relative power and conflict potential in the Jordan basin. This matrix was constructed on three factors: perceived water need, power, and riparian position. These factors were then added to get a total that tentatively reflects the relative strength of the individual riparian (see Table 7).

According to the model, the greatest potential for conflict exists when a lower riparian is a more powerful actor than the upper water controlling riparian and perceives its water needs to be deliberately frustrated. Additionally, the model suggests that a significant geohydro-political inhibitor to conflict is when the uppermost riparian is the most powerful actor in an international river basin.

The peace process will create the first condition and remove the second condition, setting up the most likely scenario for conflict in an international river basin. Israel, having withdrawn from the security zone in

Lebanon, and if it gives up much of the headwaters to the Jordan by returning the Golan to Syria, would essentially become a lower riparian state on the Jordan River. The power differential between these three nations is enormous, thus satisfying the requirements for the most unstable river basin arrangement: that of a lower riparian being more powerful than the upper riparians who control the water source. Hence, the peace process, at least according to this theoretical construct, will structure the Jordan River basin in such a way as to maximize the likelihood of conflict in the future.

Table 6. Jordan Flows/Originations, Post Peace Process

	Source Country Pre/Post Peace	Gain (mcm/y)	Loss	Total	Israeli Loss
Dan River	Israel to Syria	245			245
Hasbani R.	Lebanon	138			138*
Banias River	Syria	121			121*
Jordan River (in Hula Valley)	Israel			504	
Evaporation in Hula Valley	Israel		100		
Local runoff In Hula	Israel/Syria to primarily Syria	140			Approx. 100
Flow into Lake Tiberias	Israel/ Syria			544	
Runoff/rainfall Into Tiberias	Israel/ Syria	200			
Evaporation From Tiberias	Israel		270		
Outflow to Lower Jordan	West Bank/ Jordan			474	
Yarmuk	Israel/Syria/ Jordan	492		966	
Wadis/Springs In Ghor Valley	Jordan/Israel to Jordan only	505		1471	505**
TOTAL ISRAELI LOSS OF WATER CONTROL				1109	1109

Source: Naff and Matson, 1984. Modified by author, 2000⁴⁸

Notes: * Although the Hasbani and Banias originate in Lebanon and Syria respectively, Israel's control of the Golan allows Israel to exploit them. Both these rivers run almost exclusively through the Golan before they flow into the Jordan. Hence, the loss of the Golan would prevent Israeli exploitation and (geographically, at least) enable Lebanon and Syria to begin exploitation of these headwaters prior to their flow into Israel.

** From the loss of the West Bank.

Table 7. Relative Power as a Measure of Conflict Potential

	Perceived Need	Military Power	Riparian Position	Total
Israel	5	9	5	19
Jordan	5	2	2	9
Syria	3	3	2	8
Lebanon	1	0.5	2	3.5

Source: Frey, 1992⁴⁹

Specific Indicators of Potential Conflict Over Water

While a theoretical framework is certainly helpful in assessing the potential for conflict in a given region, it does little to actually help predict when that conflict will occur. Given the hydro-political situation in the Jordan basin, and knowing what specific factors contribute to the current water crisis, it is possible to forecast some specific indicators of impending water conflict. At least three specific developments could occur which would, once again, create conditions ripe for interstate conflict over water.

High level of Palestinian Autonomy/Sovereign State in West Bank

Any increase in Palestinian authority in the West Bank will proportionally increase tensions with Israeli settlers. The greater the authority and autonomy, the more likely clashes will occur between Palestinians and Jews. While the rise in Palestinian authority will be the prime reason tensions and the possibility of conflict will increase, water would be a very convenient and likely proximate cause of any outbreak of violence. Indeed, as many Israeli settlers in some way depend on local water infrastructure instead of exclusively on the National Water Carrier, any attempt by Palestinian authorities to directly curtail the West Bank Israelis consumption of water—or increase their own consumption to the detriment of the settlers—is likely to synergize a conflict.

This is a very likely outcome of the peace process. Skirmishes between Palestinians and Israeli settlers in the West Bank are likely to be local and contained should the Palestinians simply increase their authority over water. Again, water would not be the primary source of conflict—rather, any

perceived control or superiority by Palestinians over Israelis would be the primary source. Water is simply a likely catalyst that would ignite nationalistic passions.

However, full-blown Palestinian statehood may cause much more widespread violence. Declaration of a Palestinian state will, without a doubt, cause a great deal of consternation among many Israelis, especially those who may have to move out of the West Bank, either by choice or coercion. Any remaining Israeli settlers would be subject to a sovereign Palestinian government, which at the very best would treat the Israelis and Palestinian citizens equally. There is no reason to believe this equality would not include water allocations. Hence, Israeli consumption of water would be cut by at least 75 percent (assuming Western sources are the most accurate concerning the distribution of water in the West Bank), possibly by as much as 88 percent (assuming Arab sources are the most accurate). However, if Israelis are not treated equally with Palestinians, their water supply may very well be cut completely. In either case, conflict throughout the West Bank between Israeli settlers and Palestinians should be assumed.

Massive Immigration from the Palestinian Diaspora to a New Palestinian State: As previously mentioned, the creation of a sovereign Palestinian state may result in massive immigration to the West Bank. If only half of the Palestinian diaspora moves to the West Bank, an immediate additional need of 25-35 mcm of water would exist. This would quickly deplete the already damaged West Bank aquifer and the Jordan River, in turn creating a need for new water resources outside the region within a few years. Additionally, the underground flow of the West Bank aquifer to springs in the Israeli littoral would be significantly reduced, further curtailing Israeli water supplies. The remaining flow of the Jordan would also need to be shared between the Palestinians and Jordan. In essence, the artificially introduced and very sudden increase in population would put a tremendous strain on already faltering water resources.

Such a strain on these resources probably would not result in large-scale conflict between Israel and the newly created Palestinian state. However, general tensions in the region would rise. An independent Palestinian State would be dependent on Syria, Jordan and Israel to ensure adequate flows from the Yarmuk and Jordan rivers to get their necessary water supplies from the Jordan River. Jordan and Palestine would need to come up with a water sharing agreement for the Jordan River, an agreement that would almost by definition reduce Amman's already meager supply of water. A nascent Palestinian state would have no military power, only traces of economic influence, and very little economic clout. Syria and Jordan, not just Israel, may not see it in their best interest to be generous with such a scarce resource. Hence, the tension would not be just between Arab and Jew, but between Arabs as well. Immigration would thus only add to the difficulties of the region and despite the added manpower, leave the Palestinians less able to fight for their share of water.

Government Elected in Israel that is not Pro-Peace. Prime Minister Barak, should he return the Golan to Syria and in some way reduce Israel's

access to West Bank water, will be making Israel vulnerable in a variety of ways, to include creating a significant need to find new sources of water. Should the variety of options for bringing additional water to the Jordan basin prove unfruitful (such as massive desalination projects, bringing water from Turkey and/or Egypt, building a canal from the Sinai to the Negev, etc.), water will likely come to the forefront of Israeli politics. The Israeli agricultural community, long very powerful in Israeli politics, will withdraw support from the Barak government, as agricultural subsidies would most likely be one of the first casualties of water shortages. A candidate and political party who vows to recapture the water that a pro-peace Labor coalition “gave away” to the Arabs could very well replace the Barak government. Such developments would strongly suggest state-level conflict is much more likely.

This scenario is largely conjecture and requires a series of specific events to occur, but is still certainly within the realm of possibility, especially considering the Knesset’s (Israeli Parliament’s) several attempts to pass a vote of no-confidence against Barak following his participation in the unsuccessful Camp David II Accords. While this is the most unlikely of the possible roads to conflict, it is also the most dangerous, as it would include the conscious decision of the Israeli government to enter into conflict with other sovereign Arab states to regain water lost to the peace process.

SUMMARY OF MIDDLE EAST WATER CONFLICT

Water has always been a source of contention in the Middle East, and the current peace process will not change that. Indeed, all of the contributing factors that caused the water situation in the region to reach critical proportions are becoming worse, not better. While the Barak government certainly has good intentions in creating a lasting peace in the region, overcoming the water question may be the most contentious issue faced by both Arab and Jewish negotiators. Even if a peace agreement is reached in the next year, continuing (and worsening) water shortages may cause the

negotiated peace to fail; indeed, demographic changes directly resulting from the peace process may serve to increase water tensions in the region.

Israeli courage in considering the return of occupied territories is remarkable. By giving back these territories, Israel will create a tremendous water burden, as well as make itself more vulnerable to Arab water exploitation at Israel's expense. All these factors highlight the urgent need to develop a regional water strategy that is accepted by all parties in the Middle East. Whether these strategies include the introduction of outside water to the Jordan basin, technological advances (such as extensive desalination, large increases of water reuse from domestic and industrial waste, etc.) or a decrease in agricultural use in water, cooperation among all the actors in the Jordan basin is absolutely critical. The peace process, as difficult as it may be, is the first step towards that cooperation.

NORTHEASTERN AFRICA

The Nile River shares some of the same conflict-inducing characteristics as the Jordan. It, too, is an international river basin, as it runs through 10 different sovereign nations. Just like the Jordan Basin, a large and growing population depends on its waters—40 percent of Africa's population lives in the Nile Basin. The Nile River is the only significant source of water in one of the driest regions in the world. Furthermore, the population and water distribution in the Nile basin is such that Egypt consumes the vast majority of the flow, but contributes no water to the river. Indeed, according to the Strategic Studies Institute, 86 percent of the Nile waters originate in Ethiopia, while Egypt uses a remarkable 99 percent of the water supply.⁵⁰ These factors, along with others, create a variety of possibilities that could lead to conflict.

Two different types of conflict could erupt over Nile waters—internal, civil conflict, and state against state conflict. Internally, water continues to fuel the civil war in Sudan, and indeed appears to be bringing other parties into the civil war. Water could precipitate traditional state-

versus-state conflict in the region as well. The governments of Ethiopia, Sudan, and Egypt all could be brought to the point of conflict over Nile redistribution issues.

INTERNAL CONFLICT OVER NILE WATERS

Few wars are ever fought in the name of their real causes: instead they are fought under old banners and old slogans, based on memories of past conflict. Because these memories fade so slowly, they obscure from the valiant warriors the possibility that they might be fighting for reasons no longer relevant or valid and even, on occasion, against their own interests. Recent strife in the Nile Basin is a case study of such misdirection.

There are a variety of internal issues among the various Nile Basin states that can and have caused war: ethnic strife, hunger, religious differences, and the effects of post-colonial political structures have all contributed to violence in the region. However, upon closer examination of many of these internal conflicts, environmental degradation is not far below the surface. While access to resources (which are becoming increasingly scarce due to environmental damage caused largely by a perennial state of conflict in Africa) is not yet the obvious or stated source of many of these conflicts, it certainly is a contributing cause. Indeed, many of the conflicts occurring now may be fought in the name of identity (race, religion, etc.), but the underlying issue is resource scarcity.

Internal conflicts in Rwanda, Ethiopia, Uganda, and other Nile basin riparians can in some way be traced to resource shortages. However, the ongoing civil war in Sudan best illustrates how water is a definite source of conflict in the basin.

Civil War and Conflict in Sudan

Such stated versus real cause misdirection is at least partly responsible for Sudan's current civil war. Most fighters on both sides remain convinced that the war is all about ethnicity, cultural identity and religion; however, access to key resources, primarily water, is a primary source of the

war. Sudan is such a vast country that for long periods most Sudanese tribes were able to live in their homelands in relative isolation from each other, free to develop their own cultural values and norms. Only when forced to move from their traditional habitats by reason of ecological degradation or political coercion did they have to confront alien cultures and peoples. These points of contact between strong ethnic identities, whether Arab or African, created friction and raised the potential for low or high intensity conflict.

The ecological division in Sudan is between North and South. The North, densely populated with Arab Muslims, is arid. While the Nile River

Diagram 3: Map of Sudan



Source: CIA World Factbook, 2000

flows through the North, it is largely beyond the drainage basins of the feeder streams and rivers that consolidate themselves into the White and Blue Niles further to the south, and which converge in Khartoum, the capital. The South,

lightly populated, is much wetter, receiving adequate rainfall as well as enjoying many feeder streams and springs scattered throughout the area. Hence, the Arabs are “water have-nots,” while their fellow “citizens” to the south are African “water haves.”

While the civil war is a continuing if sporadic feature in Sudan, the current conflict is being exacerbated by water and land. Due to a significantly changed environment (persistent drought and desertification) and the need to increase food output (to feed a burgeoning population and increase grain exports as part of an International Monetary Fund package), the northern Arabs began looking south. Indeed, mechanized farming, which is still very foreign to southern villagers, began replacing huge swaths of savannah and forest in areas where Southerners once subsisted. Furthermore, Egypt is continually pressing Sudan for more water from the Nile to feed its own exploding population. Hence, the current civil war in Sudan is fueled by the need to take land and water from the Southern Sudanese—a political decision that transcends any cultural, ethnic or religious difference.

Many of the fighters in the South, primarily organized under the Sudan People’s Liberation Army (SPLA), have attacked a variety of Northern-introduced projects in the last 30 years, most notably the canal digging equipment at the Jonglei Canal project and the large mechanized farming schemes. Both the canal and the farming projects must be examined, as they go to the heart of the current conflict—the need for more water.

The Jonglei Canal project was started primarily for two reasons—drain the Sudd Swamps to create more farmland, and conserve the approximately 4000 mcm/y that is assessed to be lost through evaporation in the swamps. The project, first envisioned at the turn of the century, was actually started in 1978 as a joint Sudanese-Egyptian project, working with a French company. For northern Sudan, since the adoption of mechanized farming and heavy irrigation in the mid-1970s, water has become the limiting factor for agricultural expansion. Additionally, draining the swamps would

theoretically create a “breadbasket” of fertile land for farming. Finally, Egypt desperately wanted the additional water represented by its half share in Jonglei.

The Jonglei was one of the most researched and debated hydroprojects in Africa. Averaging 210 feet in width and 16 feet in depth, it is large enough to be seen from space. Conspicuous through its absence, however, was any serious discussion of how draining the Sudd wetlands would affect the local residents—the approximately 1.7 million tribespeople that depend on the swamps for their existence. The fear of loss of water during the dry seasons, loss of fish in the swamps, introduction of foreign peoples to the area, and rumors that Egyptian farmers would settle in the canal area sparked riots in the southern city of Juba in November 1974. They voiced their opinions loudly through violence, as many southerners flocked to the SPLA. Despite the protests, the Sudanese government decided to go through with the project, sparking many violent attacks on the construction sites by the SPLA’s swollen ranks. The Canal project was forcibly suspended in 1984 due to continual SPLA attacks, having completed 250 km of the 360 km length of the canal.⁵²

Water became an issue in the violence aimed at the spread of mechanized farming in the South as well. The fertile savannah plains of acacia trees and tall grass were also where the Arab-dominated Sudanese government envisioned Sudan’s new “bread-basket.” More predictable rains make these plains suitable for a variety of crops; however, the traditional Sudanese crops, such as sorghum, millet, maize, sesame, groundnuts and cotton, require vast swaths of land. The huge expansion of large-scale mechanized farming, which constantly devoured new land, spread into southern Kordofan and the northern parts of the Upper Nile provinces. The owners of the mechanized farms, having exhausted vast tracts of the north, pushed inexorably southwards into the area inhabited by the Nilotic tribes, who ran the major cattle economies of the South. Having seen how the locals

were squeezed off their land when mechanized farming arrived, Southerners were hostile to this incursion, and their response was violent.⁵³

Another conflict between the Sudanese government and its people rises from the decision by the Sudanese government to build the Kajbar Dam on the Nile. The resulting reservoir would require the relocation of the last core concentration of Nubian tribes in the Sudan. This decision has created a flurry of protests, threats, and low-intensity conflict, as the Nubians see the necessary relocation resulting in a diffusion and eventual extinguishing of their unique culture and language. Members of the Nubian Alliance (representing communities in Sudan's Northern State) are threatening mass suicide to protest the taking of their lands. These peoples were adversely affected four times this century by dams, most notably Egypt's construction of the Aswan. This project flooded much of the Nubian homeland along the Egyptian and Sudanese border, causing many of the indigenous peoples to relocate to other areas. Despite the current protests, threats and petitions, Sudan's government seems determined to proceed with the project and it has announced that it would compensate and resettle those affected by the dam; however, the Nubian people have refused the offer.⁵⁴ A mass suicide would undoubtedly be marked by violent protests, by both the Nubian "diaspora" in Khartoum and by those Nubians who would wish to strike a blow against what they see as an oppressive government.

EXTERNAL (STATE AGAINST STATE) VIOLENCE

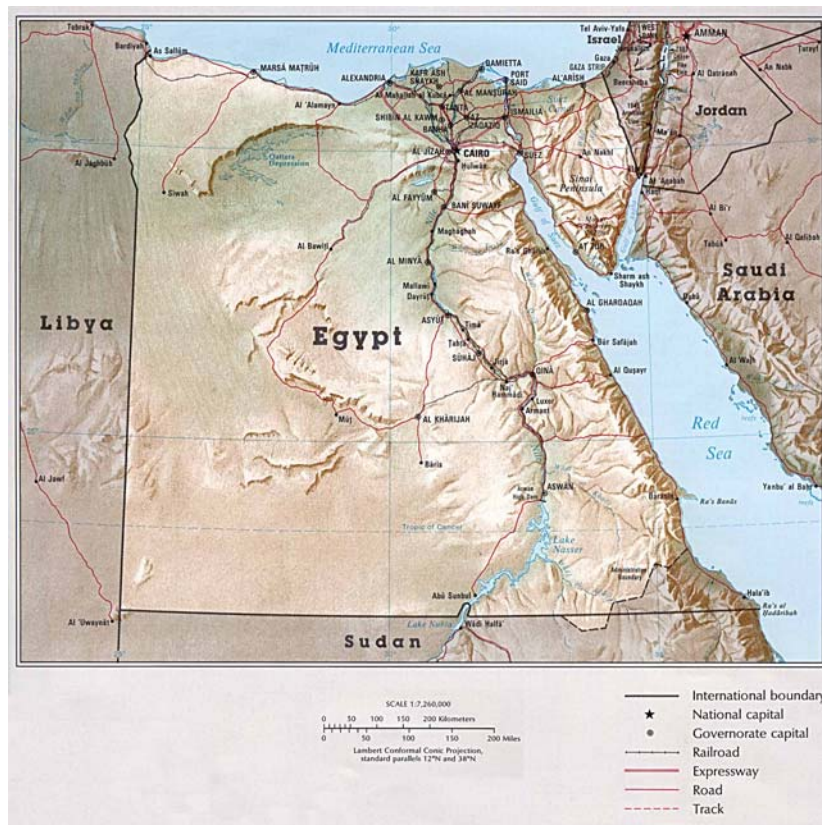
As mentioned earlier, Egypt is the mega-consumer of all Nile River water, despite contributing no measurable water to the river. Historically, culturally, and politically the Nile is synonymous with Egypt. However, upstream riparians are now beginning to compete with Egypt for the precious waters.

Egypt and Sudan have long had contentious relations over water. The low point this century between these two nations is arguably in the 1950s, when Egypt began building the Aswan High dam. This project flooded areas

near Wadi Halfa, displacing some Sudanese residents, to include the Nubian population previously mentioned.

The resulting consternation over which nation got a greater share of the Nile, who would pay for reparations for the displaced Sudanese citizens, who would pay for hydroprojects, and a variety of other concerns helped midwife the Nile Waters Agreement of 1959.

Diagram 4. Egypt



Source: CIA, *Atlas of the Middle East*, 1993

This agreement is the benchmark for division of the river between Egypt and the Sudan. In it, Egypt's annual allotment is 1.9 trillion cubic feet of water annually, while Sudan is allocated 648 million cubic feet. The

remaining 8 riparians did not get any allocations, as they refused to recognize the agreement.⁵⁵

However, the Nile Waters Agreement is quickly becoming overcome by events, with both Egypt and Sudan indicating they need greater amounts of water to continue economic development and to feed their ever-increasing populations. As will be discussed later, Ethiopia will also become a significant country in Nile water use in the coming decade.

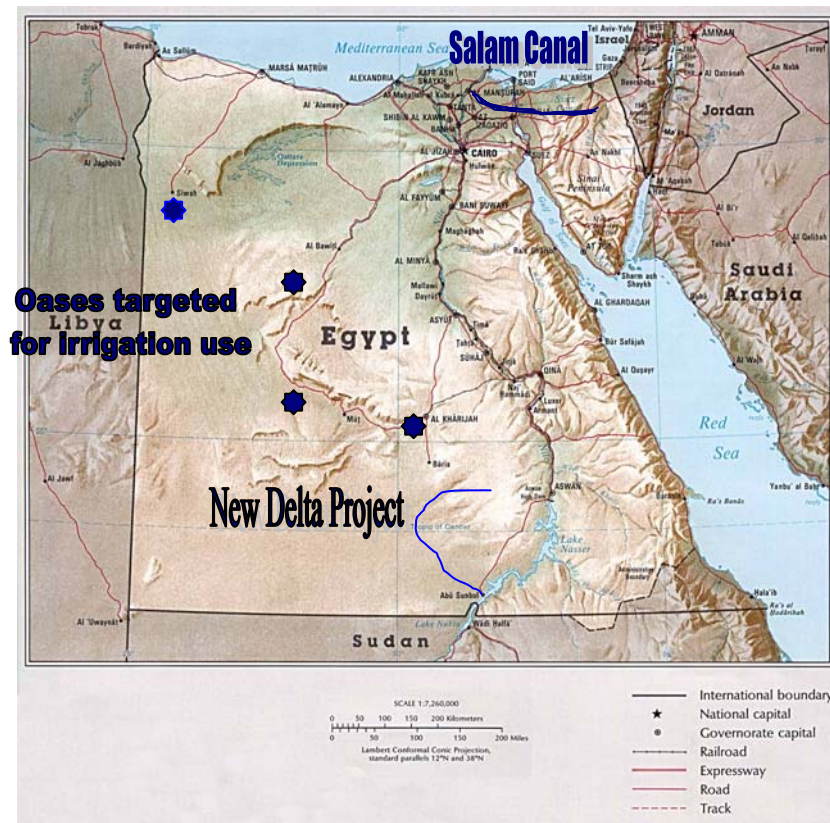
Egypt in particular has begun a massive project just south of the Aswan. Currently, the Nile covers just 4 percent of Egypt's landmass, but hosts 95 percent of Egypt's population of some 65 million people. With that population growing at 1 million residents every eight months,⁵⁶ overcrowding is one of President Mubarak's major domestic challenges. To solve this problem, he has looked to the desert and ordered construction of the New Delta Project in southern Egypt and a "peace pipeline," named the Salaam Canal, in the Sinai Peninsula. Smaller projects include digging a series of wells and irrigation ditches along an old caravan route, and developing oases in western Egypt. The Associated Press graphic (see diagram 6) illustrates these ambitious plans.⁵⁷

While these hydro-projects will enable Egypt to disperse its population and increase its ability to grow greater amounts of food, it does so by increasing its allotment of water from the Nile River. Indeed, Egypt's ambitious plans are running headlong into future projects Sudan and Ethiopia have for the Nile River.

As previously mentioned, Sudan plans to build the Kajbar Dam on the Nile north of the capital, Karthoum, where the Blue Nile and the White Nile converge before flowing into Egypt.⁵⁸ This promises to reduce the flow of the Nile into Egypt by a still undetermined amount. Additionally, Khartoum plans to build a second dam, the Merowe dam, on the Nile south of the Kajbar dam, in addition to adding 10-foot embankment on the Roseires Dam, located 300 miles southeast of Khartoum on the Blue Nile. According

to Sudan's Irrigation and Water Minister, Sharif al-Tahami, the two new dams and modified Roseires Dam would only give Sudan "complete storage of its share of the Nile,"⁵⁹ and not exceed its allotment. Despite Tahami's assessment, Sudan's and Egypt's projects will result in both states likely exceeding their water allocations from the 1959 agreement. It is still unclear how this issue will be resolved.

Diagram 5. Irrigation Plans for Egypt



SOURCE: CIA, *Atlas of the Middle East*, 1975. Modified by author.

However, the more important, longer-term concern is Ethiopia's plans for the Nile. Ethiopia recently emerged from a long period of civil war and famine and entered into a period of accelerated growth and economic development. While the wasteful war with Eritrea stunted that development temporarily, Ethiopia's need for additional water to fuel her population and

economy will continue to grow. The government has overseen the construction of more than 200 small dams that will use nearly 500 million cubic meters of the Nile's flow annually.⁶⁰ Additional dams are being planned to increase the country's irrigation and hydropower capacity. Though Ethiopia's current development plans will require only a small portion of the Nile's water, its potential demands could significantly reduce the river's flow into Egypt. Ethiopia has an estimated 3.7 million hectares of land, an area larger than Belgium, which could be irrigated.⁶¹ With a population nearly the size of Egypt's and a faster annual rate of population growth—3.2 percent annually for Ethiopia versus 2 percent for Egypt—Ethiopia will need to develop a large portion of this land for agricultural use.⁶² Irrigating only half this land area with water from the Nile could reduce the river's flow to Sudan and Egypt by 15 percent. Hydrologists doubt the basin produces enough renewable fresh water to satisfy the irrigation plans of both Ethiopia and Egypt.

The Egyptian government has long recognized upstream development of the Nile's waters as a potential national security threat and has stated its willingness to go to war to preserve its access to fresh water. Indeed, former United Nations Secretary General Boutros Boutros Ghali, then acting as the Egyptian Foreign Minister, stated “The next war in our region will be over the waters of the Nile, not politics.”⁶³ Indeed, the Egyptian High Military Command has prepared contingency plans for armed intervention in each of the countries around the Nile basin in case of a direct threat to the flow of the river.⁶⁴

Applying the Middle East Research Institute's (MERI) theoretical framework for measuring the potential for state-on-state violence in an international river basin, the Nile basin provides yet another example of the future likelihood of war. While the feeder streams and rivers originate in a total of 10 countries, for the purposes of this study, only 3 countries are

currently projected to exercise enough influence over the Nile Basin in the next 20 years to be significant: Egypt, Sudan, and Ethiopia.

Table 8. Relative Power as a Measure of Conflict Potential, Current

	Perceived Need	Military Power	Riparian Position	Total
Egypt	9	7	9	25
Sudan	3	4	5	11
Ethiopia	2	2	1	5

Table 8 is the author's assessment of how these states fit the MERI framework. Currently, Sudan's military spends approximately \$550 million annually on their military, compared to Ethiopia's \$138 million; nearly a four-fold difference. However, Sudan's military is largely equipped with outdated Soviet weaponry, lacks professionalism, and is continuously beaten down by a better-equipped, better-trained, and more motivated SPLA. Sudan's population of 59 million is growing at a 2.7% annual rate, compared to Ethiopia's 61 million growing at a 3.2% rate. Finally, Sudan's gross domestic product, as measured in purchasing power parity, is \$31.2 billion, compared to Ethiopia's \$32.9 billion.⁶⁵ Hence, Sudan can roughly be considered twice as powerful, based mostly on the much larger military outlays; economic and population figures are currently close enough to not significantly affect the military power comparisons. Egypt, with both Soviet and US weapons, a \$3.28 billion annual military budget, regular training with US military forces, and a population of 67.2 million, is clearly stronger than either Sudan or Ethiopia.⁶⁶

If Egypt were to execute offensive measures to ensure its current flow of what most would consider its more than "fair share" of Nile water, neither Sudan (embroiled in a civil war) nor Ethiopia (just exiting from a civil war, a prolonged drought, a war with Eritrea, and geographically distant from Egypt) would have the military capability or the political will to defend themselves from Egypt. Both countries are much more likely to appeal to the

international community for aid in food, power, and other sources of aid, as any military action against Egypt with the current power dyads would be futile. Hence, the likelihood of armed state versus state conflict in the short term between any of these riparians is low.

Table 9. Relative Power as a Measure of Conflict Potential, 2010

	Perceived Need	Military Power	Riparian Position	Total
Egypt	9	7	9	25
Sudan	6	2	5	13
Ethiopia	6	4	1	11

However, once all three countries finish their ambitious water projects along the Nile, a different hydro-political situation emerges (see Table 9, above for the author's projection of relative power by 2010). Egypt will continue to be significantly stronger, both militarily and economically, than either Sudan or Ethiopia. However, the situation between Sudan and Ethiopia becomes problematic. Should peace between Ethiopia and Eritrea hold, Ethiopia will likely surpass Sudan in military power for a variety of reasons. The civil war in Sudan shows absolutely no sign of resolution, which will continually sap Khartoum of military resources. Indeed, some analysts are suggesting the SPLA is gaining the upper hand, which will ensure a steady erosion of military readiness of the Sudanese military.⁶⁷ Additionally, Sudan will continue to be on the U.S. State Department's list of nations who support terrorism in the near future, thus earning it economic sanctions and weapons purchasing difficulties. Juxtaposed is Ethiopia with hard cash to pay for modern weapons. Indeed, from January to July of 2000, Ethiopia spent over \$300 million on weapons—over twice its normal annual amount in half the time. Addis Ababa reportedly bought up to 210 T-55 tanks from Bulgaria, field guns and multiple rocket launchers from China, Mi-8 transport helicopters, Mi-24 attack helicopters, and Su-27 fighter-bombers from Russia. Additionally, an ammunition factory apparently was built in the capital to fuel

the improvident war against Eritrea.⁶⁸ Sudan has no such military luxuries, has no patron states to provide them free of charge, and has little chance of reversing its economic fortunes in the next decade. Hence, Sudan's military power will continue to erode, while Ethiopia's will improve. Despite the changes in the power dyads of these three riparians, Egypt will remain dominant—threatened neither by a weakened Sudan nor a strengthened Ethiopia.

The potential for conflict in the Nile River thus becomes one between Ethiopia and Sudan. A variety of scenarios could develop. Recalling that 86 percent of the Nile originates in Ethiopia, Addis Ababa could significantly affect the flow of water into Sudan. A reconstituted Ethiopia, recovered from the war with Eritrea and with a continually growing economy, could feel safe enough from Egypt simply through geographic distance, and strong enough to rebuff Sudanese efforts, politically, economically, or militarily, to stem the flow of the Blue Nile. It is important to note Ethiopia is not a party to the 1959 Water Agreement, and is therefore not obligated by treaties to allow certain amounts of water to flow out of her borders. Should Ethiopia adopt the absolute sovereignty paradigm of international water law, as has Turkey, Addis Ababa would be justified (at least according to the government's internal analysis) to retain as much water as technically possible. Hence, feeling relatively safe and immune from external pressures and without legal bindings from treaty or law, and with a burgeoning population and growing economy both in acute need of more water, Ethiopia could consider herself free to act as she thought appropriate.

Ethiopia would probably be correct in feeling safe through her geographic separation from Egypt. While Egypt is unquestionably the most powerful state of the three, Cairo cannot project her military might beyond states along her borders, especially to deter a drought-prone Ethiopia from exploiting more of the abundant river water running off its western mountains. Egypt is much more likely to resort to political and economic pressure than

military might. However, in an area of Africa that is rife with guerilla and proxy conflict, the border between Sudan and Ethiopia is highly suitable for surrogate warfare. Sudan could easily train and equip a rebel-like group, whose ranks are filled from a spectrum of possible fighters, from disaffected Ethiopian tribes to Sudanese regular soldiers. These groups could, with little difficulty, infiltrate the unguardable border, and conduct missions ranging from destroying the small dams along the Blue Nile (thus freeing additional water for Khartoum) to destabilizing the Ethiopian government, or at least act as leverage against Addis Ababa in water negotiations. Given Khartoum's history of supporting guerilla groups in other countries to push its political causes, historical support of terrorism, and a weakened military, it is unlikely for Sudan to use conventional forces to initiate an openly state-versus-state conflict.

However the scenario unfolds, the wildcard in future conflict in the Nile Basin is, at least according to this theoretical framework, Ethiopia. She is the unquestionable upstream riparian, is projected to have an unspecified but significantly expanding need for water, and will increase and probably surpass Sudan in economic and military strength in the coming decade. If the immediate downstream riparian, the Sudan, perceives its water needs being frustrated by an emboldened Ethiopia, conflict could result.

However, with populations rapidly growing in the area, another specter looms—internal dissent in all three nations, as citizens increasingly question the ability of their governments to meet a basic need—providing enough water.

Unfortunately, while numerous studies exist regarding the Nile in Egypt and Sudan, the level of study and amount of data outside these two countries is insufficient to make sound policy suggestions. Unlike the Jordan River basin, which has been the subject of numerous comprehensive hydrological studies since the beginning of the 20th Century, studies concerning the Nile Basin headwaters remain relatively scarce. It is in the

headwater regions that data is most needed. Regrettably, data is unlikely to be available in the near future; persistent violence in those areas prevents any long-term, in-depth studies to determine the sources and amounts of flow that originate in each of the headwater states.

SUMMARY OF NORTHEAST AFRICA WATER CONFLICT

Various groups have already fought one another over access to water in the Nile River basin. Thus far, the violence has been confined to internal strife between various ethnic groups or an ethnic group against the government. No significant state-versus-state fighting has occurred between the 10 riparian states of the Nile basin over water rights. However, that is largely because the resources of the Nile have never been stretched to the point of breaking, but this point is now quickly approaching.

The likelihood for continued civil conflict over water, especially in Sudan, is high. However, it is quite unlikely that the United States or the United Nations would become involved in Sudanese internal matters. Moreover, the states with the greatest potential for conflict, Sudan and Ethiopia, do not have the means or will to do so at present. Still, that could change in the coming decade. Hence, the United States and the United Nations are not likely to be called upon to resolve a Nile conflict in the near term, but may be called upon to enter the Nile basin, perhaps in a peacekeeping or enforcing role, in latter part of the decade.

POLICY IMPLICATIONS

The international community is taking human security, and thus environmental security, more seriously each year. Most notably Canada, Australia, New Zealand, and Norway are leading the way in arguing for these new notions of security, focusing on the security of the individual that ignores international boundaries, rather than the traditional state-centric focus on security issues. It is no coincidence that the latter three states mentioned suffer from environmental problems: ozone depletion in Australia and New

Zealand, and radioactive fallout from Chernobyl in Norway. It is only a matter of time until more states, to include the United States and Canada, are more significantly affected by global environmental matters. While the U.S. is slowly moving away from a state-centric notion of national security (as evidenced by the 1999 White House National Security Strategy document, which indicated disease and a degraded environment are US security concerns⁶⁹), it needs to do so more quickly and become more fully engaged in human security efforts around the world.

The theoretical framework used in this paper, developed by the Middle East Research Institute, is a valuable (although simplistic) first step in developing predictive tools where the environment could contribute to conflict. By measuring riparian position, perceived need, and military strength, a security analyst can quickly approximate how a government may assess its abilities to use force against another state over water issues. A stable situation exists where the most powerful state is also the state that controls the headwaters of an international river basin. The most unstable situation exists where the strongest state controls none of the headwaters, but feels its water needs are being aggravated by a weaker (and thus easily defeated) upstream riparian.

Whether or not this model is completely accurate is secondary to the fact that the theory it represents highlights the importance of water issues in an international river basin. Water is an international issue and thus, water programs should not be developed unilaterally. With water demand on the rise and water supply waning, water programs need to be developed on a basin-by-basin level at a minimum.

In the Jordan river basin, water is a traditional source of conflict, and promises to be even more contentious in the future. Currently, Israel is the undisputed power in the region and controls most of the headwaters of the Jordan. However, Israel has already withdrawn from its security zone in Lebanon. If it also returns the Golan Heights to Syria, Jerusalem will no

longer control the majority of the Jordan headwaters. To exacerbate the situation, any Palestinian state in the West Bank would challenge Israel's exploitation of the aquifer below. The peace process would thus take the Jordan Basin from the most stable to the least stable situation according to the theory.

The Nile Basin is similar in many ways, with each likeness adding to the central problem: a rapidly increasing water demand coupled with a decreasing water supply. Egypt is the undeniable power in the basin—so powerful, currently no nation can or will challenge Egypt's claim to Nile waters. However, with Ethiopia's increasing population, expanding economy, and growing military capability, Addis Ababa may feel it necessary and possible to start keeping more of the Blue Nile for herself, which would likely trigger a conflict with her western and immediate-downstream neighbor, Sudan.

While the water issues described above are certainly not global in nature, they are international. Decisions made by the Turkish government concerning the flow of the Euphrates will affect Egypt's decisions on water uses for the Nile. As such, a truly comprehensive water plan, including the waters of the Tigris, Euphrates, Litani, Jordan and Nile Rivers must be negotiated by all 15 states involved. Until an international agreement and cooperation on these disputed waters is in place, the potential for conflict and violence will remain high. As such, it is imperative that international organizations such as the United Nations have a role in such agreements. Since the U.S. is already playing a key mediation role in the Middle East peace processes in addition to having Israel, Egypt and Turkey as strategic allies, Washington should necessarily be involved in any international water agreement in the region.

Such a cosmopolitan approach to water management is appropriate. Like air, water is truly a global, common resource—actions of one nation concerning a river (be they benevolent or harmful) will necessarily influence

the actions of neighboring states. Currently, the United Nations, various aid organizations and environmental interest groups follow water issues. Applicable UN issue areas include Sustainable Development, Human Settlements, Social Development, Humanitarian Affairs and Environmental Programs, although there is no single international body for water governance. The creation of such a body would aid development of international water law, mediation of international water disputes, and provide a forum for educating underdeveloped regions on ways to conserve water as well as tackle the other issues presented in this paper. It might also moderate the dozens of other potential water conflicts around the world.

It is important for any organization involved in promoting peace and stability in this region of the world to understand the growing significance of water. With a fixed supply and a skyrocketing demand, access to this fundamental resource will become increasingly important to governments and populations. Developing expertise in water management is the first step in cultivating the skills to negotiate conflicts where water is an issue, and it will be the cornerstone of any attempt to create a comprehensive water plan. The scientific, economic, geographic, sociologic and political communities need to focus increasing attention on developing data, models, theories and histories of water use and needs. The United States and United Nations ought to encourage such efforts.

The United States should also take a leading role in promoting the spread of water-saving technology. For example, because Egypt continues to rely on traditional ditch irrigation, it uses far more water than is necessary to grow its food. Should Egypt adopt Israeli-developed drip irrigation, the agricultural demand for water would decrease by orders of magnitude. This would free up tremendous amounts of Nile water for other uses and for other states, thus reducing tensions. Furthermore, the U.S. should encourage both U.S. and foreign firms to develop desalinization technology and promote its use around the world. While Saudi Arabia leads the world in desalinized

water use, it is still economically unviable for most regions. Israel is developing new techniques to desalinate water that is less costly, but it is still not cheap enough for widespread use. Finally, the U.S. should encourage the sharing of energy-saving technology in order to reduce the need to build dams for hydroelectric power. By allowing lesser-developed states to “leapfrog” to more efficient energy infrastructures, the need to alter rivers and water usage for energy-related purposes could be avoided.

Peace depends on satisfied states and populations, generally free of external coercion or threat. Adequate food, shelter, clothing, medical care and education are key components to keeping populations healthy and satisfied. These are the basic components of human security. At the very core of each is the need for water. The more contentious this basic component for life becomes, the more likely populations will fight over it. And it is becoming very contentious indeed.

ENDNOTES

1. Albright, Madeleine. Remarks at Event Sponsored by the World Resources Institute and National Defense University in Recognition of Earth Day, Fort Lesley J. McNair. April 10, 2000, Washington, D.C.
<http://secretary.state.gov/www/statements/2000/000410.html> (as of 10 August 2000)
2. Kally, Elisha. *Water and Peace: Water Resources and the Arab-Israeli Peace Process* (Westport, CT: Praeger, 1993), 5-13.
3. Drake, Christine. “Water Resource Conflicts in the Middle East.” *Journal of Geography*. (Jan/Feb 1997), 4-11.
4. Paul, David. “Water Issues in the Arab-Israeli Conflict.”
<http://www.salam.org/palestine/water.html>. (as of 10 August 2000)
5. Kally, 16-19.
6. Hassan Bin Talal, Crown Prince of Jordan. Address to International Arab/Israeli Water Symposium, Amman, Jordan, 25-26 February, 1994.
7. Main, Charles T. “The Unified Development of the Water Resources of the Jordan Valley Region.” Prepared at the request of the United Nations under the direction of the Tennessee Valley Authority, Boston, 1953.
8. Anderson, E. “Water: The Next Strategic Resource.” *The Politics of Scarcity: Water in The Middle East* (Boulder, CO: Westview Press. 1988), 3.

9. Halawani, Salah. "Lebanese Development Projects and Israel's Pursuit of the Litani and Hasbani Waters." *Israel and Arab Waters: An International Symposium*. (London: The Arab Research Center, 1984), 53.
10. Miller, A.H. "The Jordan River—Too Little for Too Many." Global Seminar, on-line. http://www.seagrant.wisc.edu/Advisory/Water_Seminar/Jordan_River/jordan_r.htm#Watershed. (as of June 1999)
11. Naff, Thomas and R.S. Matson. *Water in the Middle East* (Boulder, CO: Westview Press, 1984).
12. Stauffer, Thomas. "Water and War in the Middle East: The Hydraulic parameters of Conflict." (Washington, D.C: The Center for Policy Analysis on Palestine, 1996), 9
13. World Resource Institute, *Annual Global Environmental Data on CD*, 1992.
14. Ibid.
15. Population Reference Bureau, 1996 World Population data sheet, Washington, D.C.: Population Reference Bureau, Inc, 1996
16. Hoch, Gary. "The Politics of Water in the Middle East," *Middle East Insight*, Volume IX, No. 3, (March-April 1993), 20.
17. Sadik, Abdul-Karim, and Shawki Barghouti. "The Water Problems of the Arab World: Management of Scarce Resources," *Water in the Arab World—Perspectives and Prognosis* (Boston: Harvard University Press, 1994), 2.
18. World Bank, *Water Resources Management: A Policy Paper*, Washington, D.C.: The World Bank. 1993. World Bank. World Development Report 1992: Development and the Environment. (New York: Oxford University Press, 1992).
19. Falkenmark, M. and C. Widstrand, *Population and Water Resources: A Delicate Balance* (Washington, D.C. Population Reference Bureau, 1992).
20. World Resource Institute, World Resources 1996-97 Database. Washington, D.C.
21. Dombrowsky, Ines. "The Jordan River Basin: Prospects for Cooperation Within the Middle East Peace Process?" *Water in the Middle East: Potential for Conflicts and Prospects for Cooperation* (Berlin: Springer, 1998), 96.
22. Sadik and Barghouti, 5.
23. Drake, 5.

24. Rogers, Peter. "The Agenda for the Next 30 Years." *Water in the Arab World—Perspectives and Prognosis* (Boston: Harvard University Press, 1994), 293.
25. Central Bureau of Statistics, Government of Israel. Statistical Abstract of Israel. <http://geography.miningco.com/gi/dynamic/offsite.htm?site=http://www.cbs.gov.il/engindex.htm>. 1998.
26. Kally, 52.
27. Andersson, Hilary. "Dead Sea in Danger." BBC Online Network, Aug 29, 1999. <http://news2.thls.bbc.co.uk/hi/english/world/middle%5Feast/newsid%5F392000/39242.stm>
28. Stauffer, 4.
29. Stauffer, 7.
30. Harman, Danna. "Jordan: Israeli Decision to Cut Water Supply Casts Suspicion on Peace Process." *Jerusalem Post*. March 18, 1999.
31. Hassan Bin Talal, 1984.
32. Adams, Paul. "West Bank Water Row." BBC Online Network, Aug 26, 1999. <http://news2thls.bbc.co.uk/hi/english/world/middle%5Feast/newsid%5F158000/158955.stm> (as of Oct 1999)
33. Klot, Nurit. *Water Resources and Conflict in the Middle East* (London: Routledge, 1994).
34. Drake, 11.
35. Adams, Ibid.
36. Hoch, 21.
37. Dombrowsky, 96.
38. Brown, Lester R. and Brian Halweil. "China's Water Shortage Could Shake World Food Security." *The Worldwatch Institute*, Vol. 11, No. 4 (1998), 10-11.
39. Barandat, Jorg, and Aytul Kaplan. "International Water Law: Regulations for Cooperation and Discussion of the International Water Convention." *Water in the Middle East: Potential for Conflicts and Prospects for Cooperation*, (Berlin: Springer, 1998), 14.
40. Berber, F.J. *Die Rechtsquellen des Internationalen Wassernutzungsrechts*, Muenchen, 1955, 13.
41. Ibid.
42. Stauffer, 9

43. Schimda, Leslie. "Israeli Water Projects and their Repercussions on the Arab-Israeli Conflict." *Israel and Arab Water* (New York: Ithica, 1984), 28.
44. Vesilind, Priit J. "Middle East Water—Critical Resource." *National Geographic*, Volume 138, No. 5. (May 1993), 48.
45. Ibid, p. 60-62.
46. Stauffer, 8.
47. Ibid, 12. Used with permission.
48. Naff, Thomas and Frederick Frey. "Water: An emerging Issue in the Middle East?" *Annals. American Association of Political Science.* Vol. 431. Special issue, November 1985.
49. Frey, Frederick. "The Political Context of Conflict and Cooperation Over International River Basins." Conference on Middle East Water Crisis. May 7-9, 1992. Waterloo, Ontario.
50. Strategic Studies Institute. Conference Brief: "Natural Resources and National Security Policy: Sources of Conflict and U.S. Interest." 8 May 2000. Washington, D.C., 2.
51. NASA Space Shuttle Earth Observatory Database, as illustrated in the Southwestern Bell WorldRoom webpage. <http://worldroom.tamu.edu/mideast/photos/51g-46-001.html>(as of 10 August 2000)
52. Abi-Aad, Naji and Grenon, Michel. *Instability and Conflict in the Middle East* (New York: Saint Martin's Press, 1997).
53. Ibid.
54. Environmental Defense Fund. Online. <http://www.edf.org/programs/international/dams/africa/c%5Fkajbar.html>. 7 Oct 99
55. Markus, Amy Docker. "Water Fight." *Wall Street Journal*, 22 August 1997.
56. World Population Prospects Database. Washington, D.C. 1996.
57. CNN. Online <http://cnn.com/WORLD/africa/9910/30/sudan.peace/>(as of 10 August 2000)
58. Markus, Amy Docker. "Water Fight." *Wall Street Journal*, 22 August 1997.
59. "Power Short Sudan Seeks Finance for New Dams." *Rueter News Service*, June 4, 1998.
60. Ibid.

61. Postel, Sandra. *Dividing the Waters: Food Security, Ecosystem Health and the New Politics of Scarcity*. Washington, DC: Worldwatch Institute, 1996.
62. World Population Prospects Database. Washington, D.C. 1996.
63. Sunday Nation, 10 Jan 1988.
64. Abi-Aad and Grennon, 144.
65. CIA's World Factbook, on-line. <http://www.cia.gov/cia/publications/factbook/country.html#e>(as of 10 August 2000)
66. Ibid.
67. "Confluence of Crisis Hits Sudan." Stratfor online, July 12, 2000. <http://www.stratfor.com/MEAF/commentary/0007122202.htm>(as of 10 August 2000)
68. "The Ethiopian Offensive: Where does it End" Stratfor online, February 9, 2000. <http://www.stratfor.com/services/giu/020999.asp> (as of 10 August 2000)
69. A National Security Strategy for a New Century. The White House. 3. December, 1999.

WORKS REFERENCED

- Assaf Karen, and Nader al Khatib, Elisha Kally, Hillel Shuval. *A Proposal for the Development of a Regional Water Master Plan*. Jerusalem: IPCRI, 1993.
- Nimrod, Y. *Angry Waters: The Controversy Over the Jordan River*. Givat Haviva: Center for Arabic and Afro-Asian Studies, 1966.
- World Resource Institute. World Resources 1993-94 Database. Washington, D .C.

