WATER CONFLICTS & INTERNATIONAL WATER MARKETS

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Food security is connected to water security and both pose national security challenges. Countries that suffer from water deficits invariably have food deficits and these conditions contribute to tensions between themselves and neighboring countries that can erupt into violent confrontation. This chain of security problems derives from the usage of water for food production. Of all the uses of water, food and agricultural production are the most extensive and intensive. Per unit of outcome, their per unit input dwarfs any other use of water. It follows, therefore, that food security is particularly problematic in arid and semi-arid regions and countries where the most intractable conflicts over water occur.

Oil is the commodity that has dominated 20th century security conflicts. In the 21st century that commodity will be freshwater. Unlike oil, however, freshwater has no substitutes.[1] Economic development, population growth, and urbanization — coupled with universal policies of subsidization and under-pricing — have resulted in an over-exploitation of increasingly scarce water resources with accompanying environmental degradation. Water for domestic agriculture and industrial uses is becoming so scarce in some regions that imminent security conflicts are upon us. In others there are conflicts over a dam in one country that alters the flow of a river across borders.

The common denominator of water is that it courses through several countries, each trying to confine it for its purposes, whether withdrawal or power generation. Aquifers, for example, often extend beyond a single country, so that ground water use in one country

[1]Coal, for example, can be used in place of oil in powering turbines for electricity. With freshwater, however, substitutes are limited only to so-called "grey water" – partially salinated or treated re-cycled water – for household sanitation, industrial cooling, or a few agricultural products.

degrades and diminishes its availability in another. Water is an exemplar of a globalization that does not recognize borders and fits into a 21st century class of new security challenges. The same river or aquifer transects many countries, creates environmental problems in one that spill over to another, and produces conflicts over uses and the environment. While these problems have always existed, they have now reached such a peak of importance that emerging water-induced national security challenges confront conventional analyses of national security threats.

Some Water and Agricultural Facts

There is currently a widespread discussion of water as a human right which intersects with discussions of food security and minimal guaranteed food as a basic human right. Some advocates go so far as to campaign for free or nearly free water unlimited in scope. This is easily dismissed, because of resource constraints, uneven allocation of water resources across regions and countries, and the basic economic law that a low or no price for a commodity will encourage waste, over-consumption, and inefficiencies, all of which threaten the environment and do not conserve a natural resource. In a balanced assessment of these campaigns, Peter H. Gleick – one of the most authoritative analysts of water – concludes that 50 liters per person per day of fresh water is a minimal requirement, broken down among five liters per day for drinking, 20 for sanitation, 15 for bathing, and 10 for food preparation. This does not include the heavy use of water for food production, which he estimates at 2,700 liters (per day), ranging from current usage of about 5,700 liters in North America to 1,800 in Sub-Saharan Africa. (Gleick, 2000, pp. 10-11) These variations reflect water scarcities and diet adaptations. The 50 liter per day per person minimal requirement can be provided at a price that is subsidized. Above that level the true long term conservation price can be used, thereby satisfying the dual objectives of delivering a minimum freshwater requirement to everyone at an affordable price and introducing a long term conservation price that will yield preservation of a scarce natural resource.

Freshwater for individual consumption and agricultural production derive from two sources: renewable and non-renewable. Non-renewable freshwater comes from underground aquifers whose water is either harvested or mined. *Harvested* aquifer water replenishes

itself but only slowly and at a pace that is not equal to its withdrawal. Like minerals that form under the earth's surface, these underground rivers come from seepage into the soil and accumulate over hundreds if not thousands of years. Once withdrawn they do not reappear unless there is natural or artificial re-charge. In virtually every instance of harvested aquifers, the rate of withdrawal vastly exceeds the rate of re-charge. In addition, this resource becomes unusable long before the water is depleted because salination typically sets in once the aquifer has been drawn down and before it is physically depleted. Then it can no longer be used for freshwater. Aquifers that have no source of replenishment are *mined*; once withdrawn there is no replacement, much like oil or coal.

Renewable freshwater derives from precipitation during the process of a hydrologic cycle in which energy from the sun evaporates fresh water from the earth's supply in rivers, lakes and on land surfaces and redistributes it around the world in an unequal transfer across time and space, depending upon atmospheric conditions throughout the globe. How much freshwater there is cannot be easily determined because much runs off into oceans that could be trapped into reservoirs. Some water deficit countries simply do not have enough renewable freshwater sources, typically those in arid and semi-arid regions. Others are rich in potential freshwater but do not capture it. Various soft and hard technologies can go far in alleviating water deficits in what are otherwise countries that are potentially rich in freshwater.

The existing data on aggregate water resources are approximations, therefore. The best estimates are that of all water on earth 96% is salt water found in oceans. Of the remaining four percent of freshwater stocks over two-thirds (68%) are in glaciers or permanent snow cover. Fresh renewable groundwater sources that are replenished through the hydrologic cycle make up 30% of freshwater stocks in lakes and rivers. These annual renewable water resources were just under 50,000 cubic kilometers (km^3). They are heavily concentrated and unevenly distributed across regions and countries, not unlike most other natural resources. Twelve countries had 61% of these freshwater resources in 2000. (Gleick, 2000, pp. 21 & 199-202)[2]

[2]This does not include the non-renewable sources from aquifers that account for significant amounts of freshwater withdrawal.

Agriculture is by far the most aggressive user of freshwater. Across 159 countries the unadjusted raw mean for percent of water withdrawal allocated to agriculture is 62% with a wide variance across countries. By region the 26 countries of west and east Europe devote 25% of their water withdrawal to agriculture, as much as 63% in Greece and only 3% in the United Kingdom and 4% in Belgium. Africa devotes 43%, ranging from the Congo river fed and water-rich Democratic Republic of Congo (23%) to 89% in Mozambique and Tanzania. Israel used 79% of its freshwater for agriculture and Jordan 75% in the early 1990s.[3] (Gleick, 2002, pp. 245-251) There is a trade-off between using water for agriculture and for other uses as against the use of food imports as a way to import water indirectly by substituting food imports for water allocation to domestic agriculture.

For water deficit countries, supply can be augmented in a variety of ways: improved efficiency with the use of water inputs, especially in agriculture; proper scarcity pricing that provides an incentive to conserve and allocate water more effectively across end uses; so-called hard technologies such as desalination and soft technologies such as better drainage systems to collect rain run-off. One direction that has not been as thoroughly vetted as these others, is the creation of an international market for freshwater that is traded among countries.

INTERNATIONAL WATER MARKETS

Food deficit countries coincide with poor nations in arid and semi-arid regions where agricultural productivity growth has not kept pace with population growth. Arid and semi-arid regions can only close their water deficit either by importing food, importing water, achieving higher productivity per unit of water input, or manufacturing water by techniques such as desalination. The problem arises because of autarky in the production of water and the absence of an international trading market for water. Each country can only use the water within its borders or the water it can pilfer from its neighbor if it is an upper riparian. It is as if every country was confined to the energy it could produce within its own borders and did not have access to imported energy on an international market. Obviously, no one would countenance this policy condition for a

[3] The data reported by Gleick in 2002 are a bit dated: 1990 for Israel and 1993 for Jordan.

moment – very few countries could survive in this regime – and the immediate answer would be to trade energy through an international market. But this is precisely what is not done with water. Every country is autarkic, cannot import water in any meaningful way on an international market, and in fact seeks to monopolize whatever water resources course through it and neighboring countries if it is an upper riparian and can do so with dams, diversions, and reservoirs. Absent an international trading market these schemes to prevent water from flowing down its natural course create national security conflicts among neighboring countries that share a common water resource, whether it be fresh water above ground in a river or below ground in an aquifer. We would never conceive it possible for every country to be dependent only on the energy it can produce. Why not the same with the water?

There are several answers to this question. Water, first, has an existential claim on the psyche, critical to survival and mystically attached to birth itself by emergence from the water-encapsulated womb. Second, its transparent existence as a nation's resource for all to see, consume, and play in feeds water nationalism, a mark of distinctive national identification. There is thirdly an absence of a "property right" in water. Without a clearly defined property right there can be no market, and it is difficult to create a price that reflects allocational efficiencies and domestic scarcities that are needed for assessing the competitiveness of the international, market-based water price. This leads to additional and related problems. Water is under-priced by political authorities who exercise a surrogate property right. Water is heavily subsidized, and there is inattention, as well, to long term conservation. This is particularly important for the price subsidies given to agriculture in order to award political favor to food producers. Every country does this, partly because of the iconic character of water, the mythology surrounding the land and food production, and the base popular fear of not being self reliant in food production.

Countries in fact do export and import water but not in a transparent way and in a form that frequently worsens their water deficit. They do so by importing and exporting food. Since food products contain so much imbedded water in their production process, whenever food is exported, water is exported. And likewise for imports; whenever food

or agricultural products are imported, water is imported. Water deficit countries should then import food but not export food. Many, however, are proud of their food exports – a misplaced national pride that severely threatens their water resources. International agencies such as the International Monetary Fund advise poor countries – even those severely in water deficit – to specialize in export crops, a policy that is counter-intuitive and worsens food security.

Instead of the quixotic quest for food self-sufficiency, water deficit countries can more judiciously achieve food security by importing food while remaining food secure, indeed more food secure. Or they can plan agricultural production so that crops with low water requirements replace those with high water inputs. A water deficit country need not fear a food import boycott from hostile countries, because a multitude of food exporters exists so the prospect of a boycott or cut off from food is remote. Agriculture is a commodity that has many highly competitive producing countries and not susceptible to cartelization. All that is needed for food imports is hard currency that can be more easily acquired if water deficit countries move out of food production and into some other less water intensive commodity that has an international market. Food security, consequently, faces a graver threat from distorted water policies than it does from dependence upon food imports.

The absence of a property right in water hinders the development of an international trading market for water, because it requires political decisions that are difficult for a country to transcend. Selling water in water surplus countries is a symbolic political hurdle that is difficult to clear in the present economic and political environment. Even the idea of importing water either directly or indirectly through food imports is a hard sell as a deliberate policy to shift out of food production and reallocate scarce water resources in water deficit countries to other more efficient uses. This policy configuration will not be available until a real opportunity cost price for water is established that reveals the allocation decisions for water's use as between food production and other uses. There is today no international market for trading water, with one exception that will be discussed later.

The estimated international trading costs of water are probably not competitive today with the alternative of desalination, a process of removing salt from salinated water in order to produce freshwater. However, we do not know this for a fact because the market does not exist for international water trading while it does for desalination. Desalination is very dependent on energy and then there is the problem of disposal of the saline residues. Saline waste disposal will pose an increasingly serious environmental problem as desalination becomes more widely deployed.

We do not know what economies of scale can be obtained once water is traded on an international market. Likewise, desalination is also in its infancy and will be attaining economies of scale and technological change as it becomes more widely used. We also cannot assess the viability of international water trading because existing prices for water are heavily subsidized and therefore water does not even reach its current market price not to mention a more effective long term conservation price. All this will change in this century as water supply becomes scarcer and demands for it increase. Policy will begin to pay more attention to water's pricing, its supply, and the effects of proper pricing on demand for water. Then a more accurate opportunity cost for trading water internationally will become available. The evolution of oil as a primary energy source in the 20th century offers a case study in how a natural resource evolves from one of perceived surplus to scarcity.

Once thought to be so cheap that consumers hardy noticed their energy expenditures, oil prices and dependence upon this resource captured everyone's attention in the 1970s. Taking the lead in exposing a disjuncture between the short term price for oil and its long term conservation price were environmentalists who were far ahead of government public policy. Many of the same environmentalists who recognized the need for a high price on energy – especially gasoline for cars because of its conservation incentives – typically oppose international water markets and proper water pricing. But the argument is the same for both energy and water. Demand is reduced and individuals adjust to higher energy prices by using it more efficiently with less of a unit of input per unit of output. A higher price induces technological change and allows for the search for new supplies. The same reasoning applies to water. Campaigns by

NGOs to make water a human right, give it away free or at highly subsidized minimal prices are inconsistent with the same environmental advocacy of a proper price for energy. Opposition to effective water pricing and to international water markets are truly counter-productive, because they injure the poorest countries that are most challenged by their water and food deficits, particularly in sub-Saharan Africa.

Proposals for more extensive water trade on an international market involve a plan to sell water from Turkey's Manavgat River to Israel, Austria's offer to supply the European Union, and Spain tapping the Rhone River with a pipeline from Montpellier in France to Barcelona. (Gleick, 2002, p. 47) On 6 January, 2004 an agreement in principle was signed between Turkey and Israel in which Israel would import 50 million cubic meters ($m^{3)}$ annually from Turkey for the next 20 years. (Gruen, p. 228) When implemented this will be the first large-scale import and export of fresh water. Canada is a leader in developing transport technology and has broached the idea of selling water to the United States but strong national opposition has so far prevented this.[4] There is one instance of an emerging international market for water in the form of bottled waters. Sales of bottled water worldwide reached nearly 50 billion liters in 1999, starting from about 4 billion liters in 1979. The United States alone accounted for nearly 18 billion liters of which eight percent was imported. (Gleick, 2002, pp. 43-44)

WATER AND SECURITY CONFLICT

The great American man of letters, Mark Twain, is reputed to have said: "Whiskey is for drinking. Water is for fighting over." In the Near East, in the region surrounding what is today Israel, water conflicts are mentioned in the Old Testament. From that point of origin to the modern period water disputes continue to this day in the region. The relationship between water and its attendant

[4]A German shipping company, *Meyer Werft*, has developed a prototype of a vessel for transporting water. ("Water production and Supply Vessel," June 1999) So-called "Medusa Bags" – inflatable containers for towing water is part of the discussion between Turkey and Israel for transporting water. One advantage of water as opposed to oil transport is that if an accident at sea occurs, there is no ecologically damaging spill.

environmental disputes is emphasized by some and downgraded by others as national security challenges. The literature in this field ranges from a position that the environment has minimal to no impact on national security to a point of view that sees environmental degradation as a principal source of security considerations. The fault line is between those who view security in terms of borders and military threat versus security in terms of the political and economic viability of a nation at risk from water and other environmental issues that recognize no national borders.[5]

Although there are limited instances of direct association between environmental degradation, water, and military conflicts among states, water conflicts can nevertheless be a strong contributing factor to direct conflicts. First, water security provides pretexts for conflicts that have collateral causes, culminating in either armed skirmishes or threats and in the extreme direct military engagement. Second, the persistence of resource conflicts involving water are a prime cause of the inability of neighboring countries to settle their relations, move

[5]The single place that best centers the literature on water and environmental security is the Woodrow Wilson Center's *Report* from its Environmental Change and Security project. The Spring 1995 inaugural issue, *Environment and Security Debates: An Introduction,* sets the stage for more specific case studies in subsequent volumes. Articles in that volume by Geoffrey D. Dabelko and David D. Dabelko ("Environmental Security: Issues of Conflict and Redefinition") and Richard A. Matthew ("Environmental Security: Demystifying the Concept, Clarifying the Stakes") are particularly good syntheses. The debate in the literature ranges from Charles Dunlap, "The Origins of the Military Coup of 2012" (*Parameters*, 1992-93) who argues that environment and water conflicts should not be linked to national security to Jessica T. Matthews, "Redefining Security" (*Foreign Affairs*, 1989), who presents the case for the environment as a prime source of security challenges in the 21st century, and Robert D. Kaplan's, "The Coming Anarchy" (*Atlantic Monthly*, 1994) which had a large public impact and caught the attention of Washington policy makers. Two projects on environment and security provide a rich lode of case study materials: The Environmental Conflicts Project, 40 cases published in two volumes, summarized by its co-director, Gunther Baechler in "Why Environmental Transformation Causes Violence: A Synthesis" (Wilson Center *Report*, Spring 1998) and Thomas Homer-Dixon's Project on Environment, Population and Security, in his book co-edited with Jessica Blitt, *Ecoviolence* (1998).

toward more stable cross-border accords that are the goal of stable security compacts, and prevent future military instabilities. Third, water security can lead to an intrastate conflict among groups within a nation that destabilizes regimes and leads them to a more authoritarian hardening inside a territorial space. Distributional consequences over use of a critical resource such as water and their attendant environmental outcomes can lead to intensification of inequality, internal conflicts, and limitations on democratic reforms inside authoritarian regimes. Such a situation has several possible outcomes: a diversion of the conflict onto neighboring countries who are blamed for the water-environmental decay, propagandizing the population against those on the other side of a border, and mobilizing for a military conflict that has other more visceral antecedents. Alternatively, an internal hardening can destabilize the regime, making it vulnerable to intrusion from its neighboring country and potentially leading to armed conflict. Environmental stress over water disputes, therefore, is a significant threat within a conflict matrix.

The literature on hydrological security cites river basin inter-state conflicts as the most direct example of the links between environment and security. This is the conclusion drawn from two international research programs: some 40 case studies conducted by an international team of researchers at the Swiss-based Environmental Conflicts Project and the joint University of Toronto and American Association for the Advancement of Sciences Project on Environment, Population, and Security. Their results point toward the unequal power relations between upper and lower riparians and environmental stress caused by pollution and ecological degradation deriving from two sources: upper riparian export of ecological problems downstream to the lower riparians and the absence of any incentive on lower riparians to control pollution owing to distance from control over the source and the lack of “property rights” over the flow. This becomes a classic economic case of a negative externality that leads to inadequate long-term scarcity pricing of the resource. Everyone sees themselves as a free rider on an indivisible public good. In the region, it is the intersection of such environmental problems as water scarcity and pollution, within a comprehensive historical conflict, that yields important impediments to their resolution.

The one instance often cited that connects water-environmental security to military conflict is the 1967 war in the Middle East when the diversion of the Jordan River and its feeders led to Israel's preemptive strike against Jordan, Syria, and Egypt, leading to the Six Day War, an alteration in the map of the Middle East, and a territorial and resource dispute that remains one of the most serious and intractable unresolved security problems today, some 35 years after the war. The diversion of the Jordan River was but one part of a larger matrix of political conflicts in the region. It has, however, become part of an accepted explanation for the timing of military conflict and remains a perceptual cause of war in the consciousness of Israelis, Syrians, and Jordanians.[6]

The aftermath of the 1967 war has allowed Israel to become an upstream riparian on the Upper Jordan system. This has put it in a favorable strategic position vis-a-vis the downstream riparians of Jordan and the Palestinians. Jordan is in a particularly vulnerable position because it is a downstream riparian as well with the Yarmouk where Syria is upstream. The Palestinians are likewise downstream and are disadvantaged further with respect to ground water on the West Bank. About half of Israel's annual supply of ground water and about one-quarter of its total renewable supply of fresh water originates in West Bank aquifers.

There were three attempts at a resolution of water and environmental security issues in this region prior to Oslo: in 1953-55 (the Johnston Plan), 1976-1981, and 1987-90. Although considerable progress was

[6] Two books provide an excellent analysis, history, and synthesis of water disputes and proposed solutions: Miriam R. Lowi, *Water and Power* (1993) and Daniel Hillel, *Rivers of Eden* (1994). Hydrological engineering analyses are contained in Mashiro Murakami, *Managing Water for Peace in the Middle East* (1995). The proceedings of the first joint Israeli-Palestinian conference on water are in J. Isaac and H. Shuval, eds., *Water and Peace in the Middle East* (1994). The papers from a UN sponsored conference at the University of Illinois that brought together technical experts from countries in the region were published in *Proceedings of the International Symposium on Water Resources in the Middle East* (1993). Specific treaties and agreements are available in full text from either government web sites or in the case of the Israeli-PA agreement on water in Martin Sherman, *The Politics of Water in the Middle East* (1999). Technical analyses of proposed water projects appear in Elisha Kally, *Water and Peace* (1993). The complex negotiations with Syria, including water, are detailed in Itamar Rabinovich, *The Brink of Peace* (1998) and with the PA in Uri Savir, *The Process* (1998).

made on the technical issues, they all ultimately failed because of the absence of a wider political concord. The peace treaty with Jordan (1994) included sections on water and environmental security between the two countries. A subsequent working group has produced proposals and actual projects. Separately, a working group on water resources, consisting of delegations from 29 countries including representation from Africa and the Middle East, as well as Israel, the PA, and Jordan, met as part of the multilateral track. Its purpose was to provide impartial mediation, to develop confidence-building technical projects as a complement to the bilateral political negotiations with the prospect of each informing and influencing the other.

The interim conclusion one can draw is that a water and environmental security accord awaits a broader political settlement. However, this does not preclude sharing technical information, designing projects, collecting accurate data, and considering unique solutions in anticipation of a wider political agreement so that once such an accord is in place these plans can be taken off the shelf and implemented quickly without having to spend several years in their design. One such effort was the first Israeli-Palestinian International Academic Conference on Water (1992) co-sponsored by Israeli and Palestinian academic institutions. These technical efforts constitute a confidence building movement toward conflict management and resolution and become part of a more general security enhancing mosaic.

Scarcity of water, unequal access as between upper and lower riparians in a river basin, and ground water in aquifers that traverse disputed boundaries form one environmental-security subset. Another is pollution of water sources, inadequate treatment of sewage, losses due to runoffs that arise from failures to provide adequate catchments, and inefficient management of existing water resources.The section of the Jordan Basin involving Israel and Jordan has been the subject of considerable formal and informal discussion, joint technical planning, and currently intensive project implementation. These developments have moved farther along than any other. However, they are hampered by the absence of Syria and Lebanon, critical countries in the headwaters of the Jordan River. As between Jordan and Israel, water and environmental security were a significant part of the *Treaty*

of Peace Between the State of Israel and the Hashemite Kingdom of Jordan (October 26, 1994). Article 6 of that treaty spoke of a "lasting settlement of all the water problems" between the two countries and committed them to "jointly undertake to ensure that the management and development of their water resources do not, in any way, harm the water resources of the other party." This was supplemented by a detailed Annex II that contained provisions for allocation of water at varying times of the year, water storage, water quality and environmental protection of the water supply, and groundwater issues. Article 18 of the treaty added an environmental section, supplemented by details in Annex IV of the treaty. A country whose land mass is three-quarters desert with few water resources of its own, Jordan has taken the lead in efforts at regional peace and cooperation but is particularly vulnerable to internal destabilization and the security threat this poses.

FOOD AND WATER SECURITY

Food security is inextricably linked with water security in arid and semi-arid regions and both connect with environmental security and national security conflicts. Israel and its surrounding region is a singular case study in this matrix of security problems. To soft technology policies such as better waste management, use of grey water where appropriate, and water saving agricultural techniques to hard technologies of desalination must be added economic policies. These include the phasing out of most water subsidies, long-term conservation pricing, moving away from water absorbing agricultural production, and finally the development of an international trading market for water where water is put on the same footing as all other natural resources. No single policy can succeed and only a matrix of policies will work.

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