Middle States Geographer, 2012, 45:29-39

WATER AND CONFLICT: THE EVOLVING ENVIRONMENTAL SECURITY LANDSCAPE

Francis A. Galgano
Department of Geography and the Environment
Villanova University
Villanova, Pennsylvania 19085

Abstract: *Environmental security refers to a range of security problems triggered by environmental factors. Water is a particularly complicated factor in the environmental security milieu because it is an essential resource that promises to become scarcer in a greenhouse world. By 2015, about 40 percent of the global population will live in regions that are unable to provide sufficient freshwater to meet basic human needs. Historically, water-related conflicts have been resolved by cooperative means, however, I argue that the security landscape has changed, and the history of cooperative conflict resolution may no longer be a reliable guide to the future. Indeed, 25 percent of all water–related disputes during the past 50–years have resulted in some form of hostilities, and 37 have resulted in violence or military action. This paper suggests that continued peaceful resolution of interstate water conflicts is not consistent with the realities of the emerging national security landscape: climate change is affecting water supply in many critical water basins, and the proliferation of failing states has reduced the potential for diplomatic resolutions. This paper examines linkages between environmental stress, water availability, and conflict and uses the three principal river basins in the Middle East as a case study to highlight these points. The analysis suggests that the region is now more vulnerable to environmental stress and water–related conflict.*

Keywords: *environmental security, water resources, watersheds, climate change, governance, military geography*

INTRODUCTION

Environmental security refers to a broad range of security issues intensified by environmental factors and suggests that environmental stress has the potential to trigger violent conflict (Galgano and Krakowka 2011). Water is a particularly problematical aspect of the environmental security milieu because it is an essential resource that promises to become scarcer in a greenhouse world, thus placing increased pressure on fresh water resources. Today, about one billion people lack access to safe drinking water, and this number is likely to grow to nearly three billion by 2050 (Gleick 2012). To further complicate this problem, 60 percent of the world's population lives in crowded water basins shared by multiple states (Postel and Wolf 2001). This is a compelling problem from a military geography perspective because most of the world's largest river systems are shared by multiple states. In places that are conflict–prone and vulnerable to water shortages, climate change could seriously affect regional stability by intensifying extant water deficits (Trondalen 2009). Thus, the possibility of water wars resonates throughout contemporary national security literature (Gray 2009).

Since the end of the Cold War, linkages between environmental stress and conflict have become an important paradigm in national security planning. President Obama (2010) reinforced this concept in his 2010 *National Security Strategy*, when he listed environmental stress, demographic factors, and resource scarcity as important integers of the national security calculus. The U.S. National Intelligence Council warns that the likelihood of water–related conflict will increase in the coming decades (Conca 2006). Nevertheless, many water scholars dismiss this outlook, and history appears to support their position. An assessment of more than 1,000 international water–related events during the previous half–century suggests that two–thirds were resolved by cooperative means. However, I argue that the security landscape has changed, and the long history of cooperative conflict resolution is no longer a reliable guide to the future. Furthermore, a number of experts now acknowledge that water wars are plausible; especially if we persist in denying the seriousness of the water crisis in key regions (Soffer 1999, Homer-Dixon 1999, Klare 2002, Pearce 2006, Trondalen 2009, Smith and Vivekananda 2007, U.N. 2009, Sappenfield 2007, Burke at al. 2009, Hsiang et al. 2001, Hendrix and Salehyan 2012).

This paper suggests that continued peaceful resolution of interstate water conflict is inconsistent with the realities of the emerging national security landscape. First, climate change is affecting water supply in many critical water basins. Second, the proliferation of failing states has reduced the potential for diplomatic resolutions, and that we can no longer continue to rely on quasi–peaceful means using established diplomatic protocols (Rosenthal 2004). Finally, water is an essential resource; however, since 1950, the renewable supply of water per person has fallen by

58 percent (Fagan 2011). I argue that water shortages will likely provide a tipping point for regions already on the brink of conflict, such as the Middle East.

WATER AND ENVIRONMENTAL SECURITY

Water is a seminal environmental security variable because it is an essential resource for which there is no substitute (Butts 1997). Renewable freshwater is fundamental to human society; however, contemporary water demands are approaching the limits of a finite supply (Hensel and Brochmann 2007). By 2015, some three billion people will live in regions that are unable to provide sufficient freshwater to meet basic human needs (Postel and Wolf 2001). In fact, 25 percent of all water–related disputes during the past 50–years have resulted in some form of hostilities—37 have resulted in violence or military action (Gleick 1998, Postel and Wolf 2001). Therefore, water may be an environmental tipping point with the potential to trigger violent conflict as greater economic aspirations and human population accelerates demands on the freshwater supply, while at the same time climate change makes supply more uncertain (Gleick 1993b, Smith and Vivekananda 2007).

Freshwater supplies are, geographically, highly variable and are not equitably distributed in a spatial sense; nor does its spatial distribution match that of the world's population. The water scarcity problem is further complicated because water does not lend itself to international trade and it is not practical to transport from surplus areas to places of acute scarcity (Pearce 2006). Water supply is often further eroded by water quality issues. Increasing populations require more irrigation and dams, both of which can adversely affect water quality. Finally, sovereignty within trans–boundary river basins remains contentious, and the potential for conflict is certainly elevated (Butts 1997). Consequently, water has two important characteristics that make it a potential source of interstate conflict: 1) its degree of scarcity, which is being affected by climate change and demographic factors; and 2) the degree to which a water basin is shared between multiple states; a problem that is being exacerbated by poor governance (Postel and Wolf 2001, Smith and Vivekananda 2007).

Demographically driven increases in water demand during the past 50–years have forced arid places like the Middle East into an acute water deficit. To put this into practical terms, on an annual basis, each individual needs about a cubic meter of water for consumption, about 100 cubic meters for other personal needs, and 1,000 cubic meters to grow food (Darwish 1994, U.N. 2009). Accordingly, the annual minimum basic need per person is about 1,100 cubic meters. Therefore, a country with less than 1,700 m^3 per capita is regarded as water stressed, while less than 1,000 m^3 is considered water scarce (SIWI 2009). Figure 1 illustrates the geographic distribution of water stressed and water scarce states and it illustrates the chronic problem that exists in the Middle East. The U.N. (2009) now considers 13 states to be water scarce, and four of them—Israel, the Palestinian Authority, Saudi Arabia, and Jordan—are from this region. U.N. projections suggest that another 10 states will be added to this list by 2025, to include Egypt, Ethiopia, Iran, and Syria.

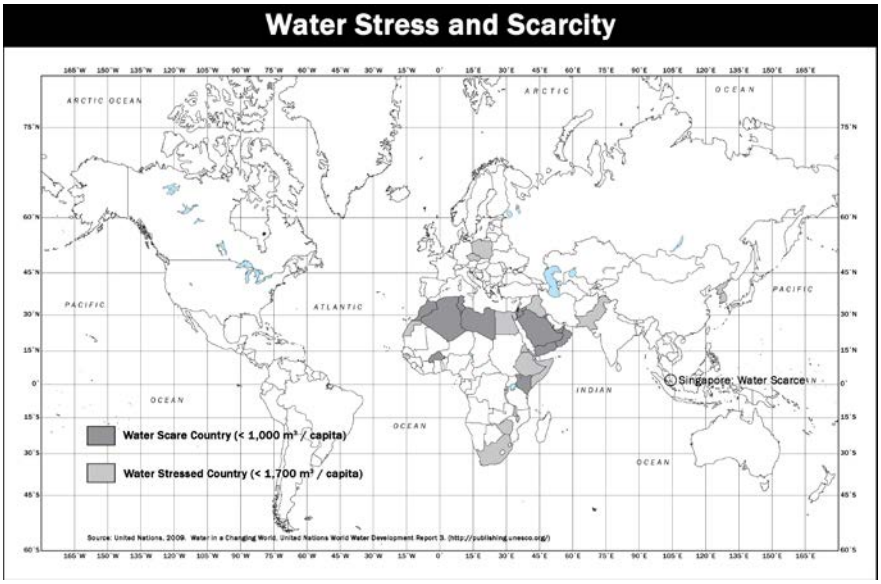

Figure 1. Water scarcity and stress. After U.N. (2009). Cartography by the author.

THE COUNTER–MALTHUSIAN ARGUMENT

The concept of environmental security has emerged as one basis for understanding conflict, however, traditionalist desire to restrict the subject of conflict to a political–military discourse. Detractors of the environmental security perspective argue that conflicts result exclusively from politico–military factors, and are rarely influenced by environmental stress, and hint at environmental determinism (Foster 2001). However, the environment may play a variety of roles in triggering conflict and environmental security doctrine is only one plausible explanation, not a deterministic model (Solow 2011). Environmental stress and scarcity result from the combined influence of anthropogenic effects and the vulnerability of the ecosystem in the context of a state or region unable to adapt. Scarcity and stress contribute to conflict only under particular conditions, but there is no deterministic link (Percival and Homer–Dixon 1995). Dynamics between environmental stress and conflict are complex and the outcome of a potential environmental security scenario is influenced strongly by government policy, social structure, land tenure practices, governance, technology, and infrastructure (Mathews 1989).

Contemporary researchers have defined links between environmental stress and conflict. Hsiang et al. (2011) suggested that a nexus exists between large–scale changes in climate and global patterns of conflict by demonstrating that the probability of conflicts doubled in the tropics during El Niño years. Burke et al. (2009) conducted a comprehensive examination of global climate change and its potential linkages to armed conflict in sub-Saharan Africa. This analysis suggests that there will be a 54 percent increase in the incidence of armed conflict by 2030 (Burke et al. 2009). Hendrix and Salehyan (2012) examined deviations from normal rainfall patterns in Africa and their results indicate that extreme deviations are associated positively with political and civil conflict. Weiss and Bradley (2001) examined archeological evidence in the Fertile Crescent, which suggests that the ancient Akkadian society collapsed in a civil war instigated by an abrupt climate event. Their interpretation of these data suggests that a severe drought contributed to a civil conflict, which essentially destroyed the civilization. They point out that, "*... for the first time, we've indentified abrupt climate change directly linked to the collapse of a thriving civilization*" (Weiss and Bradley 2001, p. 611).

However, a word of caution is required. Not all environmental problems lead to conflict, and not all conflicts stem from environmental problems (Foster 2001). In fact, it is rare for linkages to be directly and exclusively causative. Rather, there is usually a nexus of related destabilizing variables—ineffective government, unjust social practices, latent ethnic conflict, social stratification, economic stagnation—that combine with environmental stress. The critical problem is defining the tipping point between a highly degraded and stressed environment, and those societies and governments that can adapt (Homer–Dixon 1999, Dalby 2002). The geographic riddle is the ability to develop an analytical framework to detect the tipping point between a society's resiliency and adaptability, and chaos and violence.

CLIMATE CHANGE AND WATER SUPPLY IN THE MIDDLE EAST

Climate change is expected to have a significant adverse effect on water vulnerable areas that are already conflict–prone, and the implications of climate models are clear: diminished rainfall, less surface water, lower soil moisture, reduce aquifer recharge, and higher water demand for crops and humans (Trondalen 2009). Recent data from the Intergovernmental Panel on Climate Change (IPCC 2012) suggests that temperatures in the Middle East increased by approximately 2–3 degrees Celsius during the last century; and the IPCC (2012) model projects a 15–25 percent decrease in rainfall over large areas of the Middle East. Yet, it is important to note that the seasonality and spatial variability of rainfall makes projections and generalizations for the Middle East somewhat speculative. Although there is uniformity among temperature predictions, those of precipitation are inconsistent (Trondalen 2009). This is because standard resolution climate models have difficulty representing precipitation in the Middle East, which is modified by complicated topography, inland bodies of water, and proximity of the Mediterranean Sea (Black et al. 2010). While climate models vary, it is nevertheless clear that the Middle East is the world's most water–stressed region, and all projections suggest that climate change will significantly reduce water availably and that water vulnerability could be severe in the near term (Krichak et al. 2005, Black et al. 2010, Weib et al. 2007).

The IPCC (2008) outlines a series of general climate–related problems that are relevant to the Middle East, all of which predict extreme water deficits in the coming decades. Zhang et al. (2005) suggest that the overarching drivers of this problem are the spatially coherent trends that indicate a considerable elevation of temperatures throughout the region. However, Zhang et al. (2005) suggest statistically significant reductions in rainfall through the end of the century (Zhang et al. 2005, Trondalen 2009). Alpert et al. (2008) examined a series of climate models for the Middle East, which suggest that temperatures in the region increased by 1.5–4 degrees Celsius during the

past 100–years, and that regional temperatures are expected to increase by 4–6 degrees Celsius by 2100. Simultaneously, precipitation data from the region indicate a dominant negative trend since 1950 (Alpert et al. 2008). Ragab and Prudhomme (2000) developed a monthly climate model for the Middle East to predict changes in rainfall from contemporary monthly mean values. This model suggests that by 2050, most of the region will experience reduced rainfall amounts up to 20–25 percent lower. Their analysis also indicates that, in the Jordan Valley, it is expected that Israel will exploit 140 percent and the West Bank/Gaza 169 percent of the renewable water supply by the end of the century (Ragab and Prudhomme 2000). Kitoh et al. (2008) analyzed a series of climate models and suggests a decrease in the Jordan River's annual flow by as much as 73 percent.

GOVERNANCE AND FAILING STATES

Contemporary analyses suggest that countries that are poorly governed will be hardest hit by climate change (Galgano and Krakowka 2011). Water scarcity will intensify the strain under which those societies already exist (Smith and Vivekananda 2007). However, environmental stress alone does not, inevitably, trigger violent conflict. Rather, evidence suggests that it enables violent conflict when it combines with weak governance and economic inequities to affect a spiral of violence, typically along ethnic and political divisions (Galgano 2007). Modern trends indicate that environmentally driven violence has been concentrated in the developing world because it exhibits extreme social fragmentation (Homer-Dixon 1999). Furthermore, developing states are more susceptible to environmentally triggered conflict because they are, characteristically, more dependent on the environment for their economic productivity; and lack the resiliency to overcome these challenges because they have weak economies and small capital reserves, shortages of scientists and engineers, and poor distribution infrastructure (Mathews 1989, Myers 1989, Klare 2001, Hensel and Brochmann 2007).

Regrettably, governance is an emergent crisis in the developing world, and since 1990, the number of failing states has grown. The World Bank (i.e., Kaufmann et al. 2003, 2008) examined governance by indexing six key metrics as a means to quantify state stability. Their 2003 findings indicate that of 187 countries examined, 92 exhibited high levels of instability and could be considered failed or failing states (Kaufmann et al. 2003). Their 2008 findings suggest a deepening of this trend. First, government stability and effectiveness in developing regions such as Sub–Saharan Africa, South America, the Middle East, and Asia is becoming weaker. Second, the rift between the developed and developing world is growing. Finally, 2008 World Bank data indicate that the number of failed or failing states has increased. Of 212 state entities examined, 122 exhibit significant levels of instability (Kaufmann et al. 2008).

Figure 2 illustrates the extent of the governance problem within the three key river basins in the Middle East. This graph uses the U.N. Human Development Index (HDI) (U.N. 2010) and a World Bank combined governance index (WBGI) to portray the level of stability and government effectiveness in these countries as compared to the world's 25 most effectively governed states (i.e., according to the World Bank and U.N.). The WBGI (Kaufmann et al. 2008) assigns positive and negative values to states. More positive values suggest more effective governance and increasing negative values equate to failing states. The U.N. (2010) developed the HDI as a means of measuring development by merging indicators of human health, education, economic development, and quality of governance into a composite index that can serve as a frame of reference for the overall level of development within a state. The HDI sets a minimum and a maximum with zero equating to low development and one equating to very high development (U.N. 2010). Thus, the data given Figure 2 suggest that, with minor exceptions, most of the states within the Middle East's three principal river basins exhibit low development (i.e., HDI score < 0.5) and weak governance (i.e., WBGI score < 0.0). The data in Figure 2 suggest that most of the states within the Middle East's principal river basins are experiencing significant governance and stability issues.

Failing states are troubling because they are more vulnerable to environmental stress and suffer from four fundamental causally–related effects: 1) reduced agricultural production; 2) economic decline; 3) population displacement; and 4) civil disruption (Homer-Dixon 1991). These effects essentially determine the vulnerability and adaptability of the society and raise the complexity of the problem for governments as well as non–governmental organizations and intergovernmental bodies as they attempt to develop relief strategies (Galgano 2007). The London based non–profit group *International Alert* (Smith and Vivekananda 2007) examined the nexus of climate change and failing states. Their analysis outlines the scope of potential environmentally triggered violence in a greenhouse world, which indicates that there are 46 states within which the effects of climate change, coupled with weak governance, will create a high risk of violent conflict in the near term (Figure 3). These states have a combined population of 2.7 billion, and coincidently incorporate the world's most contested river basins.

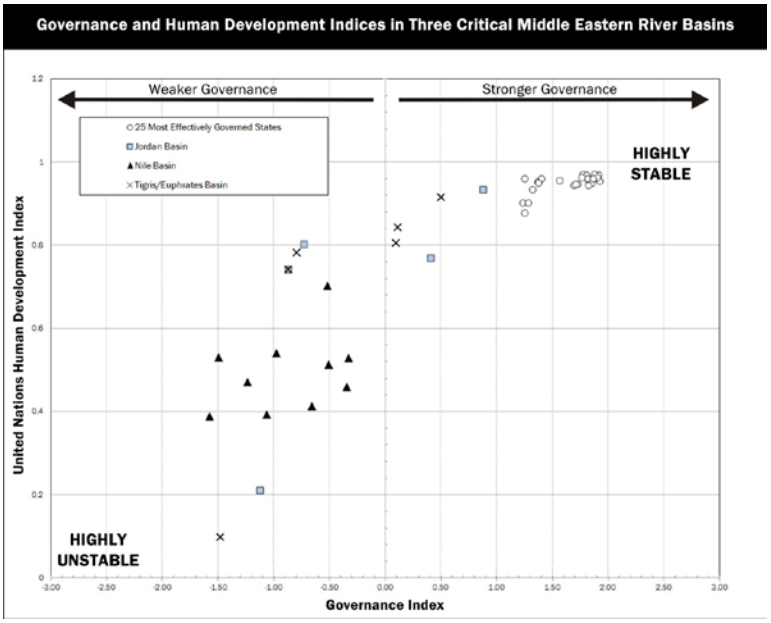

Figure 2. Governance and development in Middle Eastern river basins. The graph indicates development levels and governance indicators of states within the regions three large river basins. Sources: U.N. 2010 and Kaufmann et al. 2008.

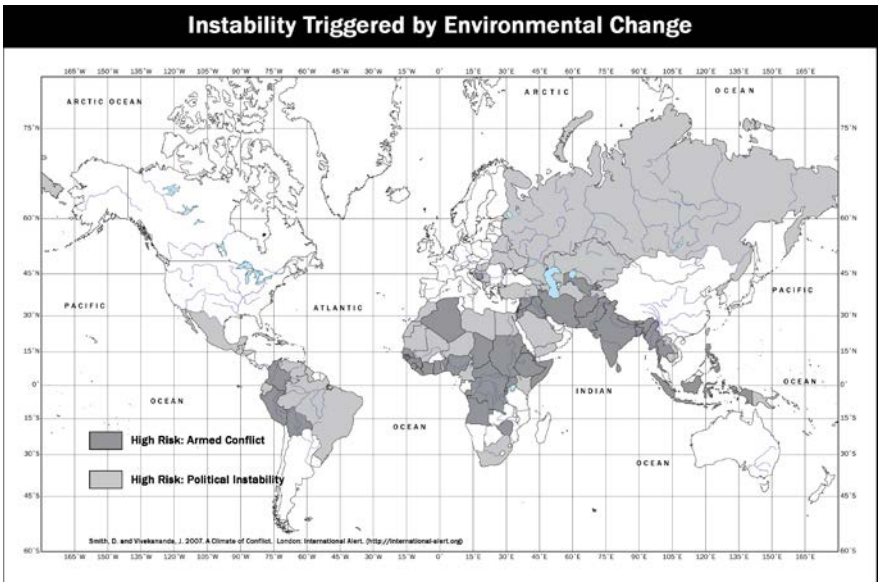

Figure 3. Environmental risk and potential violent conflict triggered by climate change and weak governance (Smith and Vivekananda 2007). Cartography by the author.

The *International Alert* study is compelling because it attempts to illustrate the geographic scope of the combined effects of climate change, water scarcity, and poor governance. History indicates that water conflicts were typically resolved in a peaceful fashion. In many cases, leaders of governmental and non–governmental organizations were able to remedy the problems presented by contested water resources using conventional diplomatic and international protocols. In such cases, well–established doctrine is reasonable as it imparts normative guidance (Rosenthal 2004). However, those same diplomatic protocols and the principles they engender

must be now considered in light of the new national security landscape, which is being significantly altered by the double-edged problem of climate change and failing states.

DISCUSSION

The outcome of a potential environmental security scenario is influenced strongly by government policy, social structure, technology, and infrastructure (Dalby 2002). The insufficiency of water has in the past led to conflict, and it is currently the source of tension in the Middle East; however, we should not assume that water shortage would inevitably lead to war (Amery 2002). Technology, diplomacy, and policy changes can potentially alter the prescription for conflict. However, given rapid population growth, changes in climate, and the imbalance of water, combined with regional political instability, it is reasonable to assume that conflict is a possible outcome. The real problem is that in the Middle East, like the rest of the developing world, the capacity to adapt is declining (Hensel and Brochmann 2007).

The Middle East (Figure 4) includes three large river basins (i.e., Jordan, Nile, and Tigris–Euphrates). The demand for water placed on these basins is dictated largely by the region's population, and projections leave little room for optimism. The Middle East manifests the fastest growing and urbanizing population in the world, and it is also a region within which the withdrawal of water resources are among the highest (Figure 4), while the renewal rate is the slowest (SIWI 2009). In raw population numbers, the region is expected to exceed 700 million by 2050—an increase of some 65% during the next 40 years (PRB 2011). The data also indicate that the average global rate of natural increase is 1.20 percent. However, by comparison, rates of natural increase for the Middle East are striking: the mean rate is 2.23 percent. Even more noteworthy are doubling times. The region's average doubling time is 31 years, which is nearly half that of the average global rate (PRB 2011). These data are problematical because across the region, *per capita* water availability is already the lowest in the world; and Middle Eastern states are already exploiting nearly all of their renewable water resources (Amery 2002). As an example, the level of the problem for the three principal water basins in the region is given in Figure 5. The data illustrate the precipitous decline of water

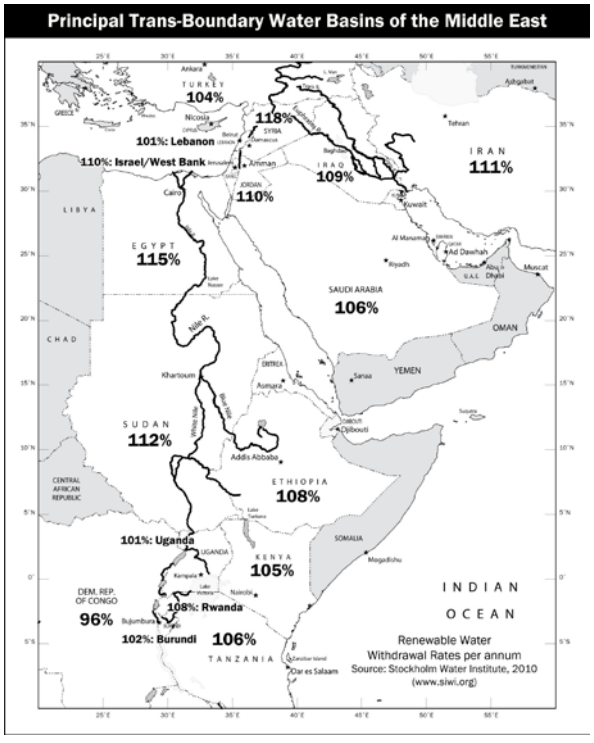

Figure 4. Map of the three major river basins in the Middle East. The map also indicates the percentage of annual withdrawals of renewable water resources for each state. Source: Aquastat 2012. Cartography by the author.

resources and suggest that by 2010, most of the states in each basin were experiencing severe water scarcity and could not meet the needs of their population from internal, renewable water resources. The data given in Figure 5 suggest that by 2025, nearly all states will experience water scarcity (Aquastat 2012, SIWI 2009).

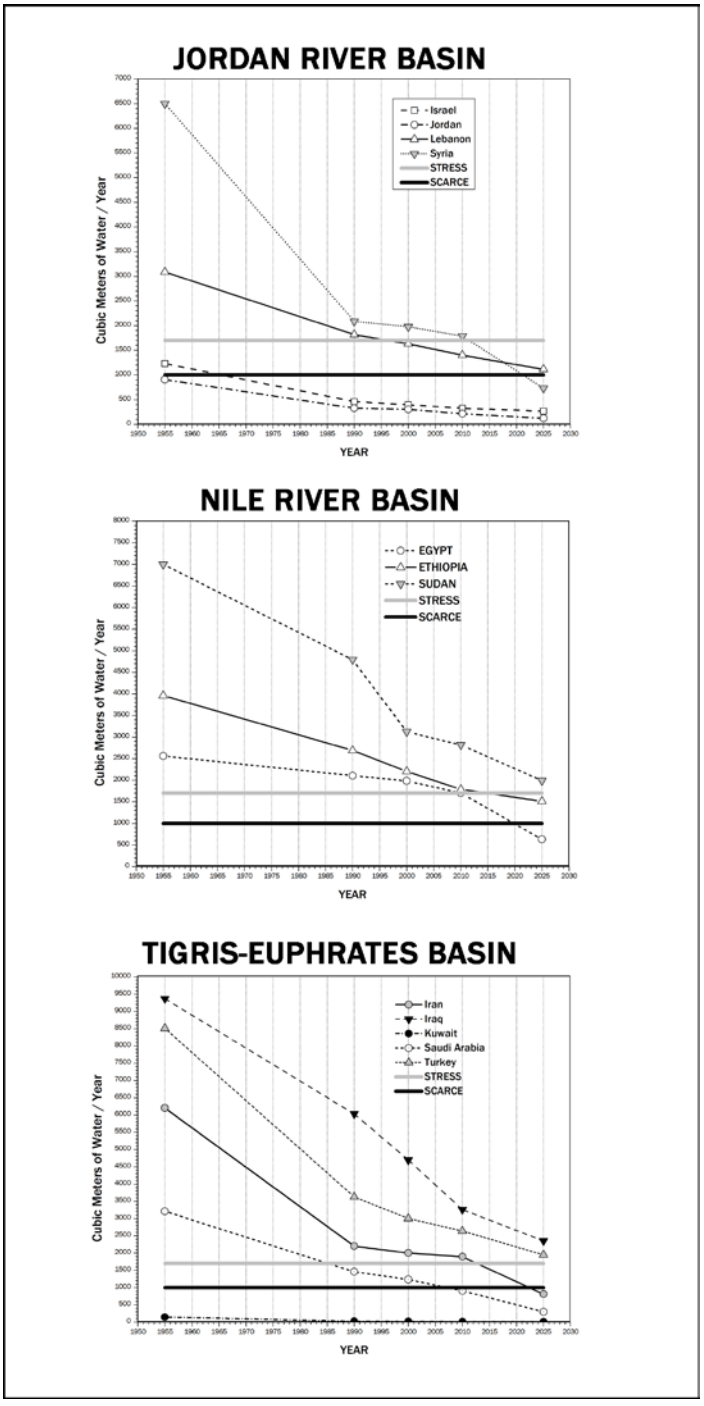

Figure 5. The extent of the water shortage crisis in the Jordan, Nile, and Tigris–Euphrates basins is illustrated on this chart. These data suggest that most of the states are below the water scarcity line. This line is based on the idea that each person requires about 1,000 m^3 of water each year. Source: Aquastat 2012.

Oil has historically been viewed as the likely trigger for warfare in the Middle East; however, water is now an equally critical variable because supplies are being exploited beyond a sustainable level (Amery 2002). During the 1960s, attacks against water–related infrastructure were common between Israel, Syria, and Jordan culminating in the 1967 Six–Day War. General Ariel Sharon placed this into context, "*People generally regard 5 June 1967 as the day the Six–Day war began*," he said. "*That is the official date. But, in reality, it started two–and–a–half years earlier, on the day Israel decided to act against the diversion of the Jordan River*," (Darwish 1994, p. 3) More recently, Turkey demonstrated its ability to control the flow of the two great rivers of the Fertile Crescent, and in January 1990, it stopped the flow of the Euphrates. Officially, the disruption was needed to fill the massive lake in front of the new Ataturk Dam; in fact, it was a demonstration to Syria of what might happen if it continued aiding Kurdish rebels in southeast Anatolia (Soffer 1999). Halting the flow of the Euphrates into Syria also brought water shortages in Iraq as well, thus bringing about a remarkable alliance between two bitter enemies (Darwish 1994). More importantly, however, Turkey's actions demonstrate the strategic advantage of an upstream state within a transboundary watershed, and the potential for such activity to instigate full–scale military confrontation.

There are short–term solutions to mitigate the effects of water scarcity and governments have been able to forestall the consequences of escalating water deficits. In the 1970s, water demands in the Middle East could be met from within the region. However, population growth has forced the region into an acute water deficit; and yet, there has been no water–related war since 1967. Many think that the answer lies in so–called *virtual water*, which is the water contained in imported food (Allen 1998). In fact, more water flows into the region annually as virtual water than flows along the Nile (Darwish 1994). Virtual water has enabled the region to augment its water resources with grain imports and devote scarce resources to domestic use rather than irrigation, which has reduced tensions and raised the threshold for conflict. However, it is not an enduring solution because virtual water is heavily subsidized and the continued reliance on virtual water is on insecure ground (Allen 1998). Water scarce states account for 26 percent of grain imports, however, as an additional billion people are added to these water–stressed basins during the next 15 years, and more states join the ranks of food importers, the demand for international grain will exceed supply, thus unbalancing the virtual water flow into the Middle East (Postel and Wolf 2001).

De–Stalinization is often presented as a popular solution to chronic water shortages and it is being used extensively in localized situations. Nevertheless, desalinization is enormously expensive and cannot meet long–term water demands in the Middle East (Amery 2002). In 2005, more than 13 million cubic meters of fresh water were produced from desalinization each day; nonetheless, this represents just under one one–hundredth of fresh water consumption per day (Conca 2006). Desalination can only be viewed as a short–term solution to resolve or mitigate localized water shortage scenarios.

If warfare over water is to be avoided, we must ensure an equitable distribution of water in a basin and permit a fair resolution of conflicts (Soffer 1999). International agreements and treaties are certainly desirable, but international law is not very robust. Water law in the U.S. and other parts of the world is well developed and backed by many precedents, and thus conflict resolution can typically rely on well–established doctrine (Butts 1997). For example, in many regions, the legal distribution of water is based on *riparian rights*. This doctrine works well in places where there is a considerable renewable water supply. However, in arid regions, *appropriations doctrine* is more accepted, and under this doctrine, priority is given to the first user of the water (Darwish 1994).

SUMMARY AND CONCLUSIONS

Historically, the resolution of water–related conflicts was achieved through diplomacy, economic cooperation, and technology. However, the emerging security landscape is far more complex and is affected by the growing inequities between developed and developing states. Globalization of the economy and population growth, combined with greater expectations of increased economic affluence is placing greater demands on resources and exacerbate the problems of resource supply and demand—certainly the world's renewable freshwater resources will be strained beyond sustainable levels and may become a tipping point for environmentally triggered violent conflict. This would be difficult enough, however the security situation will be intensified by climate change, which may dramatically reduce rainfall and river discharges in the world's most populated and water–stressed regions.

International law is, unfortunately, not robust or clear in settling water conflicts. The alternative doctrine of equitable apportioned is attractive, but predictably, in the context of the Anatolia Dam water conflict, Turkey maintains the position that it has complete sovereignty over the basin because it is the upstream state. However, Iraq and Syria clearly support the doctrine of equitable apportionment, insisting on a reasonable distribution of water based on need and historical use. Noticeably absent, however, and a guarantee that international water law will remain inadequate, is an enforcement mechanism.

Water scarcity is an environmental security issue that currently exercises considerable influence on regional stability. Projected trends in population growth, water demand, and climate change could make water scarcity far more prominent in the geopolitical arena. Although the role of water as a possible trigger for violent conflict on an inter–state scale remains a hypothetical exercise, water issues will continue to be a strategically important variable on the national security landscape, and they should be used as an indicator of impending regional instability and a persistent reminder of the significance of geographical variables to national security affairs.

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