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The Geopolitics of Water Scarcity

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The severe scarcity of freshwater in the Arabian Peninsula has forced the GCC countries to turn to the sea for a solution, rather than to other countries, near or far. They have chosen to desalinate seawater and ground water in order to ensure their supply, largely as a result of their geo-climatic and geopolitical settings. The hydrological reasons are self-evident, but the geopolitical considerations are the focus of this chapter. It will investigate the geopolitics of water scarcity in the Middle East, with a particular focus on what it means for the Gulf states. It will also discuss the political and security risks of reliance on desalination plants and on water imports.

Conceptually, the approach is one of geopolitics and security. Geopolitics is concerned with developing a spatial or geocentric understanding of the whole by studying specific components and mechanisms such as relative location and asymmetric endowments of countries, which in turn affect relative power and relations among states. For Klare,[1] geopolitics is about competition between current and aspiring great powers "for control over territory, resources, and important geographical positions, such as ports and harbors, canals, river systems, oases, and other sources of wealth and influence." Geopolitics can be illustrated in numerous ways, including as a strategic map showing the "flows of vital resources linking regions and exposing their vulnerability and interdependence."[2]

The Arab world is located in a generally arid region, and conditions have been getting worse for the people there. The renewable water resources available in 1950 were over 4,000 m^3 per capita per year, declining to 1,312 m^3 in 1995, and 1,233 m^3 in 1998, and are projected to reach 547 m^3 per capita by 2050.[3] For example, Yemen, one of the most water deficient countries in the world, has an annual per capita water availability of only 125 m^3, compared to the global average of 2,500 m^3.[4] The freshwater that is available for the people of Yemen, or for the GCC countries (Table 3.1), is significantly lower than the global average, underscoring the severity of the situation in this region. Hydrologists classify a country as experiencing "water stress" when its annual renewable water supplies are lower than 1,700 m^3 per person, slipping into "water scarcity" when it reaches 1,000 m^3 per person, and "absolute scarcity" at below 500 m^3 per person.[5] All the Gulf states fall into the latter category.

The hydrological effects of climate change are also exacerbating current conditions. A study commissioned by the World Bank reviewed the results of nine global climate change models and reported that the gross recharge between 2010 and 2050 is expected to drop sharply in "almost all" the MENA countries. In relative terms, Oman, the UAE, and Saudi Arabia are expected to experience the largest declines in the period. The models revealed the largest decreases in internal and external renewable water resources are observed in Jordan (-138 percent), Oman (-46 percent), and Saudi Arabia (-36 percent).[6]

Table 3.1
Renewable Freshwater Resources per Capita, and Percentage of Arable Land in the GCC Countries

	Renewable fresh water resources (m^3 /capita)(1)*	Arable land (% of agricultural land)(2)
Bahrain	-12	17
Kuwait	07	8
Oman	354	3
Qatar	52	20
Saudi Arabia	95	2
United Arab Emirates	33	11

Notes: *Renewable fresh water resources per capita = (internal flow + inflow of surface and groundwaters) / total population.

Sources: (1) United Nations Statistics Division, "Environmental Indicators: Inland Water Resources," March 2011; (2) United Nations Statistics Division, "Environment Statistics Country Snapshot," 2011 (http://unstats.un.org/unsd/ environment/waterresources.htm).

A new UN report[7] states that the population of the Arab region increased by about 43 percent between 1991 and 2011, and its population of 359 million (2010) is projected to rise to 461 million by 2025.

Variable degrees of water insecurity are prevalent in most arid or semi-arid countries of the world. This insecurity is amplified in the Arab Gulf states because of the accelerated pace of economic development, which has attracted a large number of guest workers, accelerating their rate of natural population growth. From the 1980s to the mid-2000s, natural population growth rates in the GCC countries have been 2.5–3.2 percent per year, which translates into a population doubling time of around 27 years. This high growth rate has been accelerated significantly by the massive number of guest workers that have come to the region since the 1970s. For example, Saudi Arabia's per capita water consumption in 2008 was increasing by about seven percent per year,[8] while population growth was only 2.6 percent per year.[9] Therefore, population growth is not the only force that has been driving the expansion in water consumption, it is also a result of improving quality of life. As the people become better educated, they will develop greater awareness about the importance of hygiene. Similarly, higher incomes often result in greater consumption of protein. Both behaviors yield sizable increases in the demand for more freshwater.

In this respect, it is worth noting that since the early 1900s, water use around the world has been growing at more than twice the rate of population increase.[10] This helps explain the stark empirical results of Maplecroft, a risk analysis firm, which used the following indicators to develop a Water Security Risk Index: countries water stress; population rates; reliance on external water supplies; sustainability of water use; intensity of water use in the economy; government effectiveness; and virtual water use. It found that 14 of the 18 countries that are in the 'extreme risk' category are located in the MENA region: Mauritania (1); Kuwait (2); Jordan (3); Egypt (4); Israel (5); Iraq (7); Oman (8); the United Arab Emirates (9); Syria (10); Saudi Arabia (11); Libya (14); Djibouti (16); Tunisia (17); and Algeria (18). In addition to these, Iran and Qatar were found to be in the "high risk" group.[11] All the Gulf states, therefore, are experiencing severe or high levels of risk, except for Bahrain.

Water insecurity along with socio-cultural dynamics exacerbate some national security concerns such as existing border disputes, ethnic or sectarian cleavages in society, economic frustrations due to loss of income (e.g., climate change causing agricultural losses), and other divisive challenges. Climate change is making it harder and harder to predict weather patterns. Furthermore, weather events are becoming more intense so, for example, while some regions are experiencing lower precipitation, what rain they receive tends to be very temporally concentrated. This makes it harder for governments and farmers to plan for and adequately manage their meager (hence precious) water resources.

Similarly, just as desalination facilities are becoming ever larger, so is the range of potential threats they face, including earthquakes, cyclones, human error, pirates, trans-national terrorists, and groups of frustrated residents. These threats are real, even though the likelihood of their occurrence varies from very high to rare, depending on location of plants and related facilities, socio-political harmony in the country and the competency of its security services. Although desalination plants have not been the target of terrorist attacks or subject to catastrophic damage from natural hazards, Gulf countries need to plan for the eventuality of extended failure of water supply to a large segment of the population. In a speech titled "The Geopolitics of Climate Change," Chris Huhne, Britain's Energy and Climate Change Secretary, said:

> We cannot be 100% sure that our enemies will attack our country; but we do not hesitate to prepare for the eventuality. The same principle applies to climate change, which a report published by the Ministry of Defence has identified as one of the four critical issues that will affect everyone on the planet over the next 30 years.[12]

This type of reasoning applies to direct and indirect threats to water security, and measures should be taken to prevent both creeping threats and sudden disruption of potable water supplies.

In short, fresh water, already a scarce resource, is becoming harder to find due to population pressure, mismanagement, and climate change. Desalinated water is critical to the well being of the people of the Gulf and to the modern economies they have come to depend on. Enduring disruptions to water supply could have serious ramifications for the social and political stability of the affected country. Therefore, a better understanding of threats to water supplies would gauge the social resilience of affected countries, provide useful information to the business sector, and provide respective government agencies with an early warning, while considering preventative or mitigating measures that would ensure water security for all.

The Geopolitics of Water Security

Owing to its arid landscape, absence of perennial rivers, and deficiency of renewable aquifer water, the GCC states have pegged their water security on desalination technology. Desalination plants offer a technological solution to water shortages affecting arid countries that can afford their associated capital, maintenance and operational costs. This technological dependency introduces known and unknown threats to freshwater supply. The notion of "security" has been extended and now encompasses numerous non-military threats such as cyber-attacks, climate change, and degradation of the natural environment. Tindall and Campbell define water security as:

> … the protection of adequate water supplies for food, fiber, industrial, and residential needs for expanding populations, which requires maximizing water-use efficiency, developing new supplies, and protecting water reserves in event of scarcity due to natural, [manmade], or technological hazards.[13]

Grey and Saoff view water security as:

> [The] availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies.[14]

These conceptualizations of water security are centered on people and ecosystems, with some being more explicitly eco-centric. However, given the semi- to hyper-arid landscape, the absence of perennial rivers in the Arabian Peninsula, the rapid depletion of most aquifers, and the fact that the GCC states have pinned their hopes on desalination technology, have all made water security in this region more people- and technology-dependent than in most other parts of the world. Between 1980 and 2005, for example, the water level in the Al-Ahsa aquifer in Saudi Arabia's Eastern Province dropped 150 meters.[15] The high speed of ground water depletion, a shortage of data about the volume of usable water in aquifers, and the agricultural sector's almost complete reliance on aquifer water all point to an unsustainable management of natural waters, and to an agricultural sector that will have to be reformed, modernized, and likely abridged.

In conclusion, the meaning and implications of water security vary in time and space, whereby a nomadic Bedouin's understanding of it is different to that of a dental hygienist, and its impact on the livelihood of a traditional peasant farming marginal lands is more severe than on an urban professional. In the absence of economic means and good governance, water insecurity will endure. This variable understanding of water security necessitates tailoring solutions suitable to the affected area. The policy measures that had been taken by the GCC countries to ensure water security for their citizens are understandable from historical and geopolitical perspectives because when these countries started their major push towards desalination technology, they were quite young, small and unsure of their future. These policies continue to evolve as the Gulf countries mature and learn from their own experiences.

Desalination is Destiny

A UN report states that about 66 per cent of the Arab states' surface waters arise from outside the Arab region, a situation that has at times "led to conflict with upstream countries. Local-level water conflicts can also exist between administrative districts, communities and tribes."[16] Such conflicts are evident in Yemen, and are an emerging issue in Iraq. The symptoms are a weak(ened) central government, peripheral areas that are difficult to govern, and an autonomous Kurdish region which is increasingly assertive. The major Arab countries most affected by trans-boundary water challenges are Syria, Iraq, Sudan, and Egypt. The latter is the most vulnerable because the Nile is its only source of fresh water. This total dependence on one water source carries significant risks for Egypt. What would happen to its water security if climate change were to cause a drop in precipitation levels received in eastern and central Africa or if precipitation patterns were to shift southwards, away from the springs of the Nile? Water consumption, especially for farming, is very wasteful and hence a lot of water can be "found" through greater efficiency. Yet, the people of Egypt are youthful, many are poor, and some are impoverished. In other words, as quality of life improves, Egypt's per capita water consumption is likely to grow, which makes the country's water security even more tenuous. The same applies to upstream states like Ethiopia, which has been actively developing its water resources.

The Gulf states' reliance on nationally-produced water offers them a significant degree of control and security, something not enjoyed by some of the largest Arab countries who share a watercourse with other states. Cooley et al. state that desalination facilities are an important water source in the arid parts of world, such as the Arabian Gulf, "where the natural availability of fresh water is insufficient to meet demand and where traditional water-supply options or transfers from elsewhere are implausible or uneconomical."[17] The authors state that desalination needs to be the very last option that water-deficient countries should explore; in other words, the natural conditions in a state dictate the resource acquisition choices available to its residents which, in some ways, is an extension of the idea of environmental determinism. This notion, which was developed in the early decades of the twentieth century, posits that the physical environment, rather than social conditions, has a deterministic influence on the cultural practices of a given region. For example, natives of mountainous terrain will likely be conservative, and freedom-seeking, while those living in coastal areas tend to be fishermen, traders, and socially tolerant of other cultures. In the Gulf states, the meager water resources initially dictated nomadic lifestyles and oasis-based communities, then water from small wells supplemented the resources of small but emerging urban centers, and then in the early decades of the twentieth century, water was brought in from further and further away including from what is today southern Iraq. This may explain why the founding fathers of the Gulf states found it so natural to choose desalination, an option that amounts to a state-centric, independent, and sovereign solution to the pervasive scarcity. They did not need highly-paid consultants to realize that importing fresh water from other countries carries, arguably, significant political risks. Furthermore, oil endowments made it feasible for the Gulf states to follow this capital-intensive path.

The Gulf states realized that water and food security are central pillars of human security, they made them national priorities. Since the 1980s, there has been rapid cumulative improvements in the quality of life of residents and this has produced an evolution in people's diets and other social habits; hence per capita water consumption has been on the increase. People have been consuming a lot more protein, for example, from beef—which requires the equivalent of 15,000 liters of water to produce one kilogram, while the same amount of wheat requires around 1,500 liters. Furthermore, wealthier residents of the Gulf states are embracing non-native water-intensive amenities such as having green lawns and swimming pools in their residences.

The idea of separating salt from seawater to make it potable is an ancient one. References to desalination go back to the Bible and Aristotle. Around 2,400 years ago, Aristotle reported on a scientific experiment that he had carried out. He wrote that:

> Salt water when it turns into vapour becomes sweet, and the vapour does not form salt water when it condenses again. This I know by experiment. The same thing is true in every case of the kind: wine and all fluids that evaporate and condense back into a liquid state become water. They all are water modified by a certain admixture, the nature of which determines their flavor.[18]

Julius Caesar's legions drank fresh water condensed from sea water during his siege of Alexandria in 48-47 BCE.[19]

In around 1500 BC, the Bible (Exodus 22–25) reports that Moses brought the sons of Israel from the Red Sea to the desert, where they walked for days but could not find potable water. When they arrived at Merra, they could not drink the water because it was bitter:

> '[Moses] gave to the place the name Bitterness. And the people murmured against Moses. Saying: What shall we drink? and Moses cried onto the Lord. And the Lord showed him a wood and he put it into the water and the water became sweet.' It is conceivable that the 'wood' mentioned above had ion-exchange properties[20]

Solar energy has for centuries been used to distill water. Malik et al.[21] and Delyannis[22] report that an Arab alchemist in the 15th century had used polished Damascus concave mirrors for solar distillation. During his voyage to the south seas in 1662, Sir Richard Hawkins used ship-based distillation to supply his men with fresh water, then in 1852 the government of Great Britain issued a patent for a distillation device. The island of Curaçao, the first territory to make a major commitment to desalination, began operating its first plant in 1928, while Saudi Arabia had its first seawater desalination plant by 1938.[23]

In 2011, the total worldwide inventory of contracted desalination capacity is 77.4 million m^3/d of water produced by almost 16,000 desalination facilities around the world.[24] Of these plants, 52 percent are located in the Middle East, concentrated primarily in Saudi Arabia, where 30 desalination plants supplement the country's dwindling aquifer supplies. North America has 16 percent of the world's desalination plants, Asia 12 percent, Europe 13 percent, Africa four percent, Central America three percent, and Australia 0.3 percent. All these regions and continents are expected to invest more heavily in desalination; so much so that the desalination market is forecasted to grow by 12 percent per year between 2009 and 2015, and to grow at a faster rate after that period. The forecasts call for 20 percent or more growth in China, India, Australia and the United States.[25] The data for 2011 shows a significant increase from 2009, when the world produced 59.9 mcm/d of water from around 14,700 plants.[26] The need to augment domestic supplies from non-traditional sources like desalination is, therefore, a worldwide issue that happens to afflict the Middle East, and particularly the Gulf states, disproportionately. For example, Saudi Arabia is set to double its annual volume of desalinated water from 1.05 to 2.07 bcm in the period 2010–2015, and will operate the world's largest solar power desalination plant, set to produce 10 mcm per year. Desalination plants provide around 50 percent of the Kingdom's drinking water, while ground water provides around 40 percent.[27]

While there have not been any major reported failures of desalination plants in the Gulf states, there have been numerous incidents where critical infrastructure has been targeted by criminals or terrorists. Vulnerability of infrastructure becomes a concern when the delivery network is extensive, the dependency is high, and the security climate is prone to domestic or regional turbulence.

This inward-looking technology-centric security offers clear advantages but also raises questions about, for example, its long term financial and ecological sustainability, as well as its vulnerability. Richard Perrow[28] writes that "Even highly reliable systems are subject to everyday failures, and even if we avoid these, there is always the possibility of normal accidents—rare but inevitable in interactively complex, tightly coupled systems."[29] While the author was referring here to technological systems like those in Japan's Fukushima Daiichi Nuclear Power Station that was damaged in the 2011 tsunami, his comments should inform approaches to the security of huge and complex desalination systems. Perrow adds that, "It is much more common for systems with catastrophic potential to fail because of poor regulation, ignored warnings, production pressures, cost cutting, poor training, and so on."[30] Human error is a known cause of accidents. Many desalination plants are designed in a modular fashion, hence a catastrophic system failure may be less likely, but the probability is not zero, and therefore it cannot be ignored.

To minimize the adverse effects of water supply interruptions, the security of water-related infrastructure becomes a central element in emergency planning. This needs to be integrated at the community, provincial, and national levels because water-related infrastructure includes electrical power generation plants, pumps, and pipelines, to name a few. Also, there is a constant need to maintain, upgrade, and sometimes replace portions of the infrastructure. This requires investment at all levels, from updating the skills of resident scientists and technicians to purchasing modern technology. In times of economic challenges and budget cuts, water services may go underfunded, introducing system vulnerabilities that could lead to governments and societies paying a heavy price in terms of economic decline and social instability. In this context, vulnerability is about nation states' ability to grapple with and adjust to exogenous stresses that are either sudden or gradual. This is influenced by institutional dynamism, economic strength and diversity. In short, water emergency planning amounts to a "stress test" of how the entire system would react in case potable water suddenly become unavailable.

Researchers in the areas of hydropolitics and climate change differ in their definition of terms such as "resilience," "adaptiveness," and "adaptation capacity," and continue to debate these ideas (for an overview, refer to Gallopin[31]). A resilient system – one that can bounce back after an incident – is an indicator of the degree of water security in an area or country. A task force within the US Department of Homeland Security (DHS) reports that resilience is the "ability to resist, absorb, recover from or successfully adapt to adversity or a change in conditions." In the context of critical infrastructure protection, the DHS defines resilience as the "ability of systems, infrastructures, government, business and citizenry to resist, absorb, recover from, or adapt to an adverse occurrence that may cause harm, destruction, or loss of national significance." It also adds a precautionary, preemptive dimension to this conceptualization because resilience is also about the "capacity of an organization to recognize threats and hazards and make adjustments that will improve future protection efforts and risk reduction measures," as quoted by Sullivan.[32] This comprehensive framework would help states reduce the vulnerability of their infrastructures to catastrophic collapse. To be sure, however, this is a tall order for young states such as those in the Gulf.

A state is considered resource-vulnerable when it is susceptible to external political pressures or natural shocks. On the other hand, a state is resource-secure when it is able to adapt and successfully resist internal or external pressures or shocks. Normally, the development of a resilient system requires an advanced economy, and well-established, independent and streamlined institutions.

A recent illustration of water resource vulnerability and interdependence occurred in Australia. A power outage caused an electrical surge and blew over 100 fuses which irreparably damaged three motor drive starters forcing authorities to halt operations of a water pumping station. The fuses had to be flown in from Sydney. The station distributes water treated at the Bray Park Water Treatment plant to 75,000 residents in Tweed Heads, Banora Point, Tweed Coast, Mirwillumbah and neighboring smaller areas. A local water and sewerage operations engineer said the "failure of fuses powering the pumps was 'unheard of'," and suspects that the initial problem had occurred in a distant location, where "touched power lines … took out transformers." He also said that when the plant was built, it was one of the most advanced in Australia hence, "It was built for the future."[33] Reflecting on the high level surge protection placed on the facility, a local water manager said it was "just unlucky that all three (fuses) went at once." He then added: "We had hoped the fuse replacement was all that was necessary to fix the pump station, however once the drives were energised, further significant damage was discovered."[34]

Techno-optimists become heavily invested in the immense human benefits that technological advancements provide, which makes it difficult for them to accept the vulnerability of this dependence. Learning about these "normal" and induced accidents and failures will help water planners and decision makers introduce more informed policies that are responsive to the needs of the community and the country as a whole.

Sabotage of Critical Infrastructure

Attacks on critical infrastructure have been going on for as long as human societies have been around. It used to take local, primitive forms, such as throwing dead animals into the enemy's water wells. In recent decades, these attacks have grown in their scale, methods, and lethality. Iraqi forces occupying Kuwait in 1990–91 deliberately released three to four million barrels of oil, set over 700 of Kuwait's 800 oil wells on fire, and damaged other wells causing them to flow unchecked. Daehler and Majumdar argue that one motive for causing the oil slick was Iraq's interest in, "depriving civilians and soldiers there (mostly in Saudi Arabia) of drinking water and also possibly of generation of electricity."[35] The lasting damage was extensive, resulting in major ecological devastation. Given the shallow nature of the Gulf, the massive size of the slick, and the threat it posed to the desalination plants supplying Riyadh, Saudi authorities shut down many of the plants as a precautionary measure.

Like other GCC countries, Kuwait's power generation and water desalination systems are fueled by – and therefore dependent on – oil and gas supplies. What saved the people was their country's post-war ability to produce, "about 200,000 barrels per day, or just enough to keep people alive and maintain essential services" in terms of power and fresh water supplies.[36] With this experience in mind, a Colonel in the Kuwaiti military writes that his country, "will have to draw its water from easily targetable desalination plants."[37]

Saudi Arabia is also facing potential threats to its water infrastructure. Comparable to the deadly but un-successful 2004 attack on a major petroleum shipping terminal in Yanbu, Saudi Arabia, there was an attempted attack on Abqaiq oil facility in the Winter of 2006; one that was foiled by Saudi security forces. Al-Rodhan states that Abqaiq's importance is due to the fact that, "nearly two thirds of Saudi Arabia's crude oil is exported" through this port, and it "mostly produces Arab Extra Light crude, which requires little refining compared to other heavier crudes," and is the location of "the most important processing facility in Saudi and the world."[38]

These attacks raised doubts about energy security, but no "public" attention was given to the possibility of copycat attacks on the desalination infrastructure in the Kingdom or anywhere else in the GCC states. Targeting national infrastructure should not surprise the experts, however, because Al-Qaeda has been preparing its foot soldiers for exactly that type of battle. Ahmed Ressam, a member of Al-Qaeda, stated that the 1998 training that he and others like him had received in the organization's camps in Afghanistan included how to blow up "airports, railroads, large corporations" and how to wage urban warfare.[39]

The issue of terrorism and piracy in the Gulf is of growing concern to American and Arab governments in the area. US warships, in collaboration with the naval forces of Arab Gulf states, seek to obstruct the movement of terrorists, weapons of mass destruction (WMD)-related technology, and narcotics in the Gulf and the adjacent Arabian Sea. These forces also seek to contain piracy in the Arabian Sea. For the Americans, this is driven by national and strategic interests. For the Gulf states, their concern is the extreme vulnerability of critical high-capacity, long-lead-time replacement infrastructures such as energy installations and desalination plants.

After stopping in the United Arab Emirates, *M Star*, a 160,000-ton Japanese oil tanker, was struck by pirates in the Strait of Hormuz in July 2010. The ship's owner, Mitsui O.S.K. Lines, said the incident was probably a terrorist attack, according to a report for the US Congress. It also stated that "The explosion is widely suspected to have been a terrorist attack, and a faction linked to Al-Qaeda (Abdullah Azzam Brigades) claimed responsibility."[40]

It is worth noting that in 2000, Al-Qaeda used a speed boat to deliver a deadly attack on the United States Navy destroyer USS *Cole* while in port at Aden, Yemen. This method of warfare can be adapted and used by national and sub-national actors. Iran has been increasing its abilities to wage warfare suitable for "asymmetrical" battle. For this, it relies heavily on the irregular forces of the Iranian Revolutionary Guards Corps (IRGC), which includes a naval branch that is capable of attacking Gulf shipping, and numerous other vulnerable soft targets. Connell argues that "In 2010, Iran had the largest inventory of ballistic missiles in the Middle East," which "are probably intended for strategic targets such as cities, oil production and export facilities, ports and water desalinization plants."[41]

Wilner states that:

> The development of lightly armed, low-tech, cost-effective weapons systems such as armed speed boats and seaplanes … could very well be used to strike at US economic interests in the Arabian Gulf …[42]

They could also strike critical infrastructure along the shoreline of the Gulf. Since 2007, Iran has been increasing, modernizing and upgrading its high-speed crafts with core missile and torpedo capabilities; some are assumed to be radar-evading.[43] Therefore, Wilner's observation is incomplete because speed boats laden with explosives can be used on the high-seas like car bombs in urban settings, and can be more accurate and "effective" against their target than many missile systems. Furthermore, desalination infrastructure would face greater risk of becoming a target because Iran has territorial disputes with the UAE, Sunni–Shia distrust is at an all time high, and Arab–Iranian tensions have also been on the rise in recent years.

It should be noted that the United States and its Arab allies in the Gulf are capable of retaliating in the event of any aggression by Iran, and that its own infrastructure is also quite vulnerable to attacks. While this is a real strategic vulnerability for the Iranians, the focus of this chapter is on the Arab countries of the Gulf.

It is widely understood that Iran would retaliate if it were attacked by American or Israeli forces. The likely targets would be the Arab Gulf states and perhaps Israel. Colonel Salem Al Jaberi of the UAE Army argues that Al-Qaeda is likely to activate its so-called "sleeper-cells" to avenge Gulf states' support of American policies in the region.[44] He argues that they will likely target strategic installations that go beyond oil and gas infrastructure (pipelines, refineries, loading facilities) to include other offshore facilities like desalination plants.

There are frequent assertions that Iran has funded, trained, and armed Shia groups in Bahrain and Saudi Arabia, and liberation movements be they Shia or non-Shia.[45] In the spring of 2011, anti-government protesters in Bahrain took to the streets and occupied a public square. Because they were overwhelmingly Shia, the government viewed them as having a sectarian, geopolitical agenda; hence the security forces suppressed them with force which stoked Sunni–Shiite tensions. At one point, when the protesters blockaded the financial district in the capital city, Manama, the government became concerned about the impact the political crises might have on the economic outlook of the country. This was compounded by the fact that at one point, local "security forces were overwhelmed" by the protesters.[46] On March 14, 2011, and upon the request of the government of Bahrain, the Gulf Cooperation Council (GCC) dispatched the Peninsula Shield force that helped security forces in Bahrain quell the protest movement. This included 1,200 Saudis, some equipped with tanks and armored vehicles, and 600 UAE policemen. Their task was to protect key locations and infrastructure. Their land forces were bolstered by Kuwaiti naval forces who helped secure Bahrain's maritime borders. The protesters accused members of the Peninsula Shield force of taking part in suppressing them, a charge denied by Bahrain and Saudi Arabia.

In the fall of 2011, Bahrain announced that Qatar had arrested five Bahraini nationals who were reportedly planning to blow up the King Fahd bridge, the main causeway linking Bahrain to Saudi Arabia, in addition to the Bahrain Interior Ministry and the Saudi embassy in Bahrain's capital, Manama. According to a statement by the Bahrain Interior Ministry (November 2011), the apprehended men were, "encouraged by others to head to Iran through Qatar and Syria, in order to establish an organization in Bahrain that would carry out terror attacks on vital infrastructure and target personalities."[47]

Subnational and national actors appear to be considering attacks on critical infrastructure in the Gulf states, be it used for water, energy transportation or other purposes. Authorities are taking measures to prevent such threats and to ensure the safety of the people and the infrastructure on which they are so vitally dependent. However, the laws of probabilities work in favor of those who are set on a destructive path.

Geopolitics of Water Imports

Because oil is shipped across international borders, it is tempting for countries to consider extensive trade in fresh water over long distances, which is precisely what the Gulf states have done. In 1986, they turned down a dual pipeline project that would have moved water from the Ceyhan and Seyhan rivers in eastern Turkey to the Gulf states at an estimated cost of around $22 billion.[48] The pipelines, some 6,500 kilometers long, would provide six million cubic meters (mcm) of water per day or 2.2 bcm annually. The project was to be paid for by its primary beneficiaries in the Gulf states, hence the oil-for-water formulation. The project, proposed by Turkey's Prime Minister Turgut Ozal, was dubbed the "Peace Water Pipeline,"—"peace" because water scarcity was seen as a source of instability. Turkey re-floated different versions of the idea in 1993 as its contribution to a peaceful settlement of the Arab–Israeli conflict.[49]

In addition to this mega, multi-state proposal, some Gulf states have explored the possibility of bilateral water imports. Qatar receives 75 mm of rainfall per year, has an expanding farming sector (cultivated area grew from 2,256 ha in 1980 to 8,312 ha in 1994), and is "almost entirely dependent on irrigation from pumped groundwater." Because groundwater levels are falling by 0.5–1.1 m per year, the aquifers are experiencing intrusion of sea water and "saline water from deeper aquifers."[50] Furthermore, based on current rates of extraction (188 mcm in 1994) and recharge (50 mcm per year), Qatar's aquifer will be depleted by 2030. Given this grim hydrological reality, Qatar carried out a feasibility study for importing water from Iran for the purpose of recharging its dwindling groundwater reserves, and for irrigation. The pipeline was expected to carry 5 m^3 per second (or 160 mcm per year) of water from Iran's Karun River.[51]

Similarly, a recent paper by Amery assessed the security implications of a proposed 30-year project in which Iran would export 300 mcm of water per year to Kuwait. It found the potential hydropolitical costs to be unacceptably high for Kuwait.[52] Here, Iran tried to leverage its freshwater resources to serve its geopolitical and foreign policy goals in the Middle East. Kuwait feared that the proposed linkage would have aggravated its vulnerability and dependence on a neighbor with whom it had a rocky relationship since 1980. This raises a question of the conditions under which water imports can be realized without jeopardizing the national security of a country. None of these proposals was successful. The countries involved either turned silent on why they did not follow through with the projects and/or provided curt, unconvincing answers. For example, the Gulf states claimed that the cost of water desalination was lower than imports from Turkey, this at a time (mid-1980s) when the cost of desalination was significantly higher (around \$3–4 per m^3) than in 2011 (\$0.6–1.0).

Baldwin (1980 as quoted by Kroll[53]) finds that interdependence which affects vulnerability should be understood as mutual dependence, a relationship that manifests itself in power projection. He concludes that while dependent states lack power, interdependent ones have power. National economic power that emerges out of dependence can be used as political leverage.[54] In the case of exports of critical natural resources, leverage can create a political and economic linkage between the trading countries, and produce a diversification of security for the exporting state. If Iran, for instance, were to export water to a Gulf state like Qatar or Kuwait, their own national security would then be linked to that of Iran. In other words, this trade would create a dependency for the importing state and generate leverage for the exporting one. In their formulation of resource dependence theory, Davis and Cobb argue that trade relations between countries should be guided by policies that are least-constraining, and which "minimize uncertainty and dependence" and maximize the importer's autonomy.[55] This is the type of relationship Kuwait was seeking, because its water imports would have been small compared to its national water consumption. In other words, Kuwait was planning to avoid the "most-constraining" policies because it did not want Iran to be the primary supplier of this critical resource.

The relationship between trade and conflict is the subject of much debate among academics. An empirically-based study suggests that the type of trade affects the quality of relations countries are likely to have. It finds that trade involving manufactured products (both low-tech and advanced) has more of a pacifying effect than trade in primary (non-manufactured) goods and food products.[56] These findings imply that trade in water or virtual water (food products) is not likely to have a noticeable or pacifying effect on relations between states. Water imports that use a permanent physical infrastructure like a pipeline (as opposed to trucks or ships) tend to simulate upstream–downstream hydro-political dynamics, which makes the downstream state vulnerable to the up-stream one, especially if the exporting state is the stronger actor. Such an arrangement is harder for importers to break if the volume received is significant relative to the total consumption. By the same token, a state that is dependent on desalination is not vulnerable to external political pressure and blackmail.

Pollution, drought, upstream dams and other withdrawals have significantly reduced water flow in the Tigris and Euphrates rivers and increased salinity levels—to the point that in 2009 their water became un-potable when it reached the southern city of Basra on the Shatt-al-Arab. In some cases, it was not fit even for animal consumption. The governor of the Province of Basra, Shaltah Aboud, described salinity as "enemy number one" because it makes water unfit for drinking or irrigation.[57] To alleviate the pressure, the province mobilized a fleet of 70 water tankers to import water from Iran to Basra. Because the trucked amounts were insufficient to meet demand, the governor had asked the central government to build a pipeline from Iran.[58] There is no indication that this request was met.

John Mearsheimer argues that countries that "depend on others for critical economic supplies will fear cutoff or blackmail in time of crisis or war."[59] This would increase when the sending state is more powerful than the receiving one, which allows the former to pressure or blackmail the latter with a minimum cost to itself. States that aspire to greater regional roles and international respect, such as Turkey, would think hard before using a critical resource like water as a political tool to pressure opponents. In some instances, however, water-rich but politically weak states can curry favor with thirsty but stronger countries by offering to sell them water resources. Some dub Lebanon as a "water tower" because few of its mountain tops are covered with snow year-round and it receives a significant amount of precipitation compared with other countries in the region. Mountains are thought of as water towers because the snow melt feeds the watershed below, and sustains springs and rivers in the region. Precipitation in the highlands of Lebanon "averages 1,500 mm/year, and the mountain peaks along the western ranges receive about 2,000 mm," dropping to as low as 250 mm near Hirmil and rising to around 800 mm along the coast.[60] In 2010, the Speaker of the Parliament in Lebanon, Nabih Birri, offered to export Lebanese water to the Gulf states. He said that it would earn Lebanon money and lessen its debt burden, and went on to describe water as Lebanon's oil.[61] While he was explicit about the economic benefits, Birri remained silent on a major implicit political ramification: bringing Lebanon closer to the political orbit of the Gulf states. Such a move would likely not sit well with his more radical Shia compatriots who support Hezbollah. Their world view is more traditional, religious, and is more aligned with Iran than with the Arab Gulf states. On the other hand, the world view of Birri's primary constituency and members of his political party, Amal, tend to be urban, more secular and liberal Shia than their counterparts in Hezbollah. It is perhaps significant that Birri appears to have dropped the proposal. From the perspective of the Gulf states, water imports from Lebanon could enhance water security by diversifying sources of supply; this time from a friendly, weaker Arab state. It could have an added political benefit as well. Historically, Lebanon was very nervous about being perceived as water-rich. This apprehension stemmed from concerns that it would come under pressure to export water to Israel, something Lebanon would not be able to carry out because of its divided religious communities, and geopolitical location between Syria (which has some allies among the Lebanese) and Israel, which continues to occupy a small part of Lebanese territory.

The ideas and proposals discussed to import water, whether from Iran, Lebanon or Turkey, have geopolitical and security ramifications for both potential water importers and for exporters. In addition to the economic and engineering considerations that must be worked out regarding water imports, this type of trade can pull countries closer together or push them apart, and therefore affect the national security of the respective states. This security influence varies according to the volume of water imported, the number of political boundaries that will be traversed in the (physical) trade, harmony in political and economic relations between trading states, and by the power relations between them.

Conclusions

Fresh water is a scarce resource in the Arab world, a condition that is exacerbated in the Gulf states. Since the 1970s, these states have experienced very high natural and net population growth rates, significant improvements in their quality life, and over exploitation of their aquifers. These conditions have led to rapid increases in levels of water consumption and motivated the Gulf countries to consider options that would help them augment their supplies. They considered water imports as they were building ever larger desalination plants. This technology is generally very reliable and has been critical to the Gulf state's success in improving water security for their people. However, as this chapter has shown, desalination technology, like any other, is susceptible to natural hazards, system failures ("normal accidents" affecting the plant or its related infrastructure), and terrorist threats. It has also analyzed the geopolitical ramifications of water imports, and argued that, for the Gulf states, the geopolitical and security costs of such a measure far outweighs the benefits.