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Islamic Foundations for Effective Water Management: Four Case Studies

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Islamic Foundations for Effective Water Management: Four Case Studies

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Abstract

Islamic Foundations for Effective Water Management: Four Case Studies

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This thesis project addresses Islamic water management by presenting case studies on regional water issues and analyzing the extent to which Muslim-majority states behave in a way consistent with Islamic *shariah* law. The case studies presented in this thesis address both international cooperation related to the management of trans-boundary water basins (the Nile and Tigris-Euphrates River Basins) and domestic water management strategies employed by Muslim-majority states in the MENA region (Jordan and Yemen). In each case, it is not clear that there is consistency between the Islamic ideals discussed by academics and the actual techniques employed by various states. In international attempts at managing the shared waters of the Nile and Tigris-Euphrates Basins, the fact that many riparian states have Muslim-majority populations does not

appear to make the management of trans-boundary resources any easier or more successful. The implications for Islamic water management at the domestic level is also unclear – with *shariah* playing a positive role in Jordanian attempts at water conservation but promoting the over-exploitation of resources in Yemen. Although *shariah* appears to play a limited role in the management of trans-boundary water resources, it seems to be better suited for informing how states internally manage their endowments of freshwater resources.

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Chapter 1: Introduction

Situated in what the World Bank terms the world's most water scarce region, states in the Middle East and North Africa (MENA) region face major obstacles in effectively managing their water resources.[1] When renewable water resources are apportioned on a per capita basis, residents of the region have access to an average of approximately 1,100 cubic meters of water per person per year (m^3/p/y), much less than the global average of 8,900 m^3.[2] The region's water is expected to become increasingly scarce due to high population growth rates. By 2050, it is estimated that per capita water availability will decrease by 50 percent, a figure which does not account for the potential effects of climate change on regional weather patterns during the same period.[3] Given this situation, there is a need to devise and implement water management techniques that will enable MENA states to conserve and protect their freshwater resources. Although scholars have identified a number of water management techniques that are applicable worldwide, evidence suggests that the forces of culture and religion have a considerable effect on how societies manage a resource like water.[4] Given the region's Muslim majority population and the extent to which Islam affects the daily life of most of the region's inhabitants, the relationship between Islam and the management of water resources must be addressed.

Although scholars and non-governmental organizations (NGOs) working in the water sector have begun to address the role that Islam plays in water management, the existing literature on the subject is limited and does not address conditions in specific

1 World Bank, Making the Most of Scarcity: Accountability for Better Water Management in the Middle East and North Africa, Washington: The World Bank (2007), xiii.
2 Food and Agriculture Organization of the United Nations, AQUASTAT, online database, at http://www.fao.org/nr/water/aquastat/
3 World Bank, xiii.
4 Nassser Faruqi, "Introduction," Water Management in Islam, Water Management in Islam, Faruqui, Biswas, and Bino Eds. (New York: United Nations University Press, 2001), xii.

states. Perhaps not surprisingly, the bulk of the literature that exists on water resource management neglects to account for the role that Islam or other religions play. In the few works that do exists most academics (i.e., Abdel Haleem, Hamed, etc.) attempt to show how the tenants of water management are consistent with the calls for the responsible stewardship of environmental resources in Islamic sources like the *Quran* and *hadith*. This interpretation of the role played by Islam in water management may not provide the nuance needed for regional governments to effectively manage their water resources. While relevant, these works tend to treat Islam as a mere value system and convey little about how the religion is actually used to address water scarcity in the Muslim-majority states and the extent to which Islamic principles can be leveraged to improve water management regimes in the region.

To address these shortcomings, this thesis spans the divide between the theoretical role of the religion in promoting the responsible use of water resources and the extent to which these principles are put into action in daily life. In addition to providing an overview of the existing literature on Islamic water management, I present four case studies that highlight the interaction between Islamic legal frameworks and the management of freshwater resources. To illustrate the challenges posed by applying Islamic legal principles to the management on trans-boundary surface water basins, one section of this document addresses current disputes over water resources in the Nile and Tigris-Euphrates river basins. The remaining section address the management of water resources within Muslim-majority states in the Middle East by presenting two case studies. One case documents how Islamic law has been used to determine ownership of groundwater resources in Yemen by providing a *de facto* legal justification for the rule of capture and enabling an unprecedented expansion of groundwater extraction. The final case study addresses water resources within the Jordan, specifically how religious

principles have been used to legitimize the government's attempts to promote water conservation.

Although *shariah* law has not been utilized extensively by Muslim-majority states in attempts to manage trans-boundary water resources like the Nile and Tigris-Euphrates River Basins, this is likely representative of the fact that there exists few international legal mechanisms for resolving disputes over such resources. While Muslim-majority states do not appear to be more likely to manage trans-boundary resources effectively, further study of the interplay between *shariah* and secular law may be beneficial in identifying regional mechanisms for enhancing cooperation among riparian states. Islamic law appears to play a larger role in a state's domestic management of water resources. In contrasting water management policies in Yemen and Jordan, it is apparent that *shariah* has the potential to result in both positive and negative impacts on a country's water supply. Further study is needed to determine the precise impact that *shariah* will have on the water supply in a given state.

Chapter 2: Literature Review

Over the past several decades, a vast body of literature has developed to address the topic of water management. At least some of these works make an implicit assumption that the findings they present have universal applicability despite the numerous social, cultural, and political differences that may differentiate one water management challenge from another. Due to this project's specific focus on the management of water resources in the MENA region, there is a need to analyze Islam's treatment of water resources and the extent to which widely accepted water management techniques can be implemented in Muslim-majority states. Although the available literature in this area is limited, there has been an increasing focus on this topic in recent years, reflecting in part the water scarcity that exists in many of these states.

This chapter provides an overview of the existing academic literature on the subject of Islamic water management. Focus areas include: the treatment of water in Islamic sources; Islamic *shariah* law pertaining to water management; and the potential role of Islam in the effective management of water resources.

THE ISLAMIC PERSPECTIVE ON WATER

Much of the published material available on the subject of Islamic water management relates to the theoretical consistencies that exist between the Islamic faith and the dutiful stewardship of natural resources, including freshwater. Many of these works discuss the importance of water in Islamic texts and highlight calls for the equitable distribution of resources and the need to conserve and protect these resources. These references to humankind's relationship with water are central to discussions about Islamic water management because they represent widely held cultural views about

humankind's relationship with water in many Muslim-majority states and form the basis for *shariah* law's treatment of water issues. An understanding of these principles beneficial for gaining insights into current water practices and determining how water management can be adapted to an Islamic context.

Given the desert environment in which the Islamic faith emerged, it is perhaps not surprising that water features prominently in many of the religion's key teachings, including those contained in the *Quran* and the *hadith* (the documented sayings and actions of the Prophet Muhammad). In one oft-cited verse, the *Quran* highlights the importance of water by noting that, "We made from water everything living."[5] The word "water" appears over 60 times in the *Quran*, with numerous references to other water-related words like "rivers," "the sea," "fountains," "springs," and "rain."[6] The *Quran* describes water as a gift from God that is used so that, "We may give life to a dead land, and give it for drink to cattle and many people that We have created."[7] In addition to its obvious utility for preserving life, water has particular significance in Islam due to the faith's emphasis on cleanliness and water's centrality to the purification rituals that must be performed by Muslims prior to praying.

Due to its importance, Islamic sources call for the equitable division of water resources and, to achieve this goal, establish common ownership of natural resources like water. The necessity of an equitable division of water is made apparent in the Quranic verse, "And inform them that the water is shard between them; every share of water shall be attended."[8] A number of *hadith* provide additional insight by noting that God withholds his favor from individuals who deny others the use of water when they have a

5 Holy Quran, Trans. Maulana Muhammad Ali, (Dublin, OH: Ahmadiyya Anjuman Isha'at Islam Lahore Inc., 2002), 652.
6 Muhammad Abdel Haleem, "Water in the Quran," Islamic Quarterly 33, 1 (1989): 34.
7 Holy Quran, 724.
8 Ibid., 1039.

surplus.[9] These statements regarding the sharing of water are consistent with the religion's emphasis on charity and the equitable distribution of wealth in society. As Faruqui notes, "virtually all of the *hadith* relate to the preservation of equity, and those related to water are no exception."[10] One of the mechanisms used to ensure that water is not monopolized is its status as a resource owned by the public. Public ownership of water is justified by the Prophet Muhammad's declaration that, "Muslims have a common share in three (things): grass, water, and fire."[11] As Hamed notes, "Muhammad dealt with monopoly or 'imperfect competition' by ruling that indispensible resources such as pasture, woodlands, wildlife, certain minerals, and especially water, cannot be privately owned in their natural state."[12]

In addition to these general principles relating to water resources, the *Quran* and *hadith* provide clear instruction on the need for mankind to protect water and other natural resources from overuse and pollution. Although Islam grants humankind the ability to exploit natural resources, there is an expectation that this will be done in a way that does not damage the environment – consistent with the *Quranic* verse, "make not mischief in the land."[13] The mechanism for ensuring the protection of the environment is that of *khalifah* or steward of the earth's resources. The concept of *kahlifah* is grounded in Islamic philosophy and based on the notion that man, because of his status as God's most favored creation, is entrusted with the task of preserving the Earth's resources. This notion is supported by the *Quran*'s assertion that, "We made you rulers in the land after

9 Abdel Haleem, 47.
10 Nassser Faruqi, "Islam and Water Management: Overview and Principles," Water Management in Islam, Faruqui, Biswas, and Bino Eds. (New York: United Nations University Press, 2001), 2.
11 Qtd. in Dante Augusto Caponera, "Ownership and Transfer of Water and Land in Islam," Water Management in Islam, Faruqui, Biswas, and Bino Eds. (New York: United Nations University Press, 2001), 95.
12 Safei El-Deen Hamed, "Seeing the Environment Through Islamic Eyes: Application of Shariah to Natural Resources Planning and Management," Journal of Agricultural and Environmental Ethics 6, 2 (1993): 154.
13 Holy Quran, 11.

them, so that We might see how you act."[14] Khalid argues that the concept of *khalifah* does not render man masters of the natural world, but rather friends and guardians.[15]

The concept of *khalifah*, which establishes a system of environmental ethics, is reinforced by specific commandments to avoid the over-exploitation of water resources. For example, in one *hadith* the Prophet Mohammed limited the amount of water that could be used in crop irrigation to an ankle's depth.[16] This stipulation, which effectively limits water use in irrigation to the amount necessary to provide adequate soil moisture for the growing season, sets a clear precedent that prohibits negative appropriation and speculation over water resources.[17] *Hadith* like the one presented above are useful in promoting sound environmental practices like water conservation. Such *hadith* establish general requirements that Muslims protect the environment more concrete by providing specific examples of acceptable behavior.

This general framework for humankind's relationship with water is particularly powerful because it is rooted in the religion itself. Islam is more than a set of principles that adherents must strive towards. Principles inspired by Islam become expectations that observant Muslims are obliged to obey. According to Abdel Haleem, "In Islam refraining from monopolizing water, wasting or polluting it is not merely a matter of being wise, civilized or showing good conduct as a citizen – it is, above that, an act of worship."[18] Amery takes this argument one step further and notes that the system of rewards and penalties associated with the faith creates incentives for Muslims to utilize

14Holy Quran, 435.
15 Fazlun Khalid, "Guardians of the Natural Order," Our Planet 8, 2 (1996): n.p.
16 John C. Wilkinson, "Muslim Land and Water Law," Journal of Islamic Studies 1 (1990): 61.
17 Ibid.
18 Abdel Haleem, 49.

natural resources in a manner consistent with the principles outlined in the *Quran* and *hadith*.[19]

ISLAMIC LEGAL FRAMEWORKS FOR WATER MANAGEMENT

The principles presented in the previous section have been interpreted by Islamic legal scholars to develop a system of laws governing the use of water resources in Islamic states. Since *shariah* law must be consistent with Islamic sources like those discussed above, it acts as a mechanism for translating general Islamic principles on water use into reality. *Sharia* continues to play an important role in the water sector of many states in the MENA, even those that have adopted Western legal systems as a result of colonialism. The supremacy of *shariah* is most obvious in theocracies like Saudi Arabia and Iran. However, nearly all other states in the region profess to have a legal system consistent with Islamic jurisprudence because of their religious identity. This is true even in the comparably more secular states of Jordan and Egypt. Islam, therefore, affects directly how water is treated in these countries. In addition to Islamic laws that deal explicitly with water, *shariah* indirectly impacts the management of water through its treatment of other issues like land law.

Despite Caponera's contention that the water sector in present day Saudi Arabia was essentially unregulated and the introduction of Islam resulted in the implementation of the area's first water laws,[20] there is some evidence that various techniques were employed for water management during the pre-Islamic period. One must only to look to the *Code of Hammurabi*'s numerous references to water to recognize this early emphasis

19 Hussein A. Amery, "Islamic Water Management." Water International 26, 4 (2001): 481.
20 Dante Augusto Caponera, Water Laws in Moslem Countries (Rome: Water Resources and Development Service, Land and Water Development Division, Food and Agriculture Organization of the United Nations, 1954), 14.

on water management in Babylon.[21] Given the lack of historical records from this period, however, it is difficult to account for the range of water management techniques employed during the period. Nevertheless, it is apparent that practices like those related the *falaj* system in present-day Oman had origins in the pre-Islamic period. According to Nash, the system's development is predicated on pre-Islamic practices of star gazing that form the basis for calculating the optimal time for planning crops.[22] Similarly, the ancient Egyptians utilized Nilometers to measure the Nile's annual floods. While the narrow focus of this project prevents a comprehensive treatment of the connection between pre-Islamic and Islamic water management techniques, it seems likely that the Islamic techniques discussed in this thesis are at least partially based on some pre-Islamic practices.

Historically, *shariah* has played an important role in determining how water resources are treated in the Muslim World. The various sects of Islam have created a complex system of legal customs regulating the use and ownership of water resources.[23] Rather than being a static system of laws, *shariah*'s interpretation of different issues varies over time and by religious sect; this is also true of Islamic law's treatment of water issues. As Caponera notes, "Scholars of the two major branches of Islam, the Sunnites and Shi'ites, by interpreting the inner meaning of the Prophet Muhammad's prophecies, sought to adapt the principles to local exigencies arising from more complex situations."[24] In addition to the variations that exist between Sunni and Shi'a laws, the various schools of religious thought within these branches interpret water law differently.

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21 King of Babylonia Hammurabi, The code of Hammurabi, king of Babylon, about 2250 B.C. (Chicago: University of Chicago Press, 1904).

22 Harriet Nash, Water Management: the use of stars in Oman, (Ph.D Thesis: University of Exeter, 2008), 3.

23 M. E. Norvelle, Water use and ownership according to the text of Hanbali Fiqh, M.A. Thesis, McGill University, Montreal, Canada, 1974, n.p.

24 Caponera, "Ownership and Transfer of Water and Land in Islam," 95.

For example, within Sunni Islam, the *Maliki* and *Shafi'i* schools of jurisprudence allow for the sale of water supplies whereas the *Hanifi* and *Hanbali* schools of Sunni Islam generally only allow for the sale of water in receptacles.[25] Little information is available about the diversity of thought that exists on this subject within Shia' Islam.

Table 1: Sale of Water by Sunni School of Thought

	Sale of water supplies	
School	**Unlimited**	**Limited**
Maliki	X	
Shafi'i	X	
Hanifi		X
Hanbali		X

In more recent history, laws governing water resources in the Middle East have been codified and/or harmonized with Western legal systems. In the Ottoman Empire, Islamic law – including those laws dealing with water resources – were codified in the Ottoman Majalla and the Ottoman land laws of 1858.[26] The laws contained in the Majalla continue to influence water law in modern-day Israel, the Palestinian Authority, Jordan, Lebanon, Syria, and Iraq.[27] Following the collapse of the Ottoman State, colonialism continued the trend towards the codification of traditional laws based in *shariah* and also resulted in the importation of Western legal frameworks. This process

25 Ibid., 98.
26 Chibli Mallat, "The Quest for Water Use Principles: Reflections on Shari'a and Custom in the Middle East," Water in the Middle East: Legal, Political, and Commercial Implications, Allan and Mallat Eds. (London: I.B. Tauris, 1994), 130.
27 Ibid.

of creating modern legal codes based on traditional law has been a protracted process, particularly attempts to reform land law.[28] Despite the adoption of many European laws through the process of colonial rule, it should be noted that this did not necessarily undermine the extent to which water laws were compatible with *shariah*. For example, under both Islamic and Western legal systems, water retained its status as a state-owned resource in most cases.[29]

While *shariah* expressly addresses water issues in many situations, it is important to note that Islamic jurisprudence has both direct and indirect influence on water resources. Given the scarcity of water in the MENA region, it should come as no surprise that Islamic legal scholars often issued explicit guidance on how adherents to the religion should utilize water. A good example of this is the jurisprudence which establishes the right to thirst or *haq al-shafaa*. Under this principle, all Muslims are bound by duty to offer any excess water they posses to sustain the life of other humans and animals. Although Sunnis and Shiites vary in how they reconcile the right to thirst with private ownership of water, the principle is largely consistent across the faith.[30] This concept has been further developed by Muslim jurists like Hanbali to set priorities as to how water is used throughout Muslim societies.[31] As Mallat notes, the right to thirst prioritizes the use of water resources to satisfy human and animal needs above agricultural use.[32] This prioritization creates a precedent for limiting the amount of water that can be utilized in other sectors of the economy during times of scarcity.[33]

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28 Farhat J. Ziadeh, "Property Rights in the Middle East: From Traditional Law to Modern Codes," Arab Law Quarterly 8, 1 (1993), 12.
29 Mallat, "Quest for Water Use Principles," 131.
30 Caponera, "Ownership and Transfer of Water and Land in Islam," 96.
31 M. E. Norvelle, Water use and ownership according to the text of Hanbali Fiqh (M.A. Thesis, McGill University, Montreal, Canada, 1974), 1.
32 Mallat, "Quest for Water Use Principles," 131129.
33 Nassser Faruqi, "Intersectoral water markets in the Middle East and North Africa," Water Management in Islam. Faruqui, Biswas, and Bino Eds. (New York: United Nations University Press, 2001), 118.

Details relating to the ownership of water are also addressed by *shariah*. As Islam considers water to be a public resource, there exist uncertainties about the circumstances under which water can be owned, bought, and sold. Although the Prophet Muhammad discouraged the sale of water, he did condone the sale of water sources like wells. Most Muslim scholars agree that the act of capturing the resource – whether by filling containers or by digging a well or irrigation canal – creates the ability for water and other public commodities to be sold and traded.[34] Furthermore, Islamic water law varies based on whether the resource in question is considered a private good, a restricted public good, or a public good. Under this categorization system, private water resources are those stored in man-made objects like private containers, private distribution systems, and reservoirs. *Sharia* places very few limitations on the use, sale, trade, or donation of private goods. Water resources, such as streams and lakes that are located on private land, are classified as restricted public goods. Although Islamic law does not allow for ownership of these resources, it does grant special rights to the land-owner, including the ability to prevent others from using the resource for a purpose other than human and animal consumption. The waters contained in natural reservoirs like rivers, lakes, aquifers, and the oceans are public goods. The sale of public goods is forbidden unless individuals render the water a private good by adding value through treatment, transportation, or storage.[35]

In addition to these cases that deal explicitly with water, Islamic jurisprudence also affects water indirectly through its treatment of property rights and land tenure. Wilkinson alludes to this tendency when he notes that "in the physical environment in which Islam developed its system of government, water management inevitably formed

34 M. T. Kadouri et. al., "Water rights and Water Trade: An Islamic Perspective," Water Management in Islam, Faruqui, Biswas, and Bino Eds. (New York: United Nations University Press, 2001), 89.
35 Ibid., 89-90.

an important sub-set of the laws and practices subsumed under 'land management.'"[36] *Sharia*h's treatment of land ownership is important because it touches on issues like riparian rights, water ownership, and water use in the agricultural sector.

For the purposes of this project, the concept of dead land is one of the most relevant aspects of land law that affects water use. *Shariah* defines dead lands as uncultivated lands that lack an owner. The cultivation of dead land is one means by which private ownership can be established. In some schools of Islamic jurisprudence, this is the only way that ownership can be established over such lands.[37] Since water is a prerequisite for bringing new land under cultivation, this system has the potential to provide encouragement for increased water use in the agricultural sector. In a water scarce region, this increased demand for the already limited water resources may conflict with existing uses.

ISLAMIC WATER MANAGEMENT PRINCIPLES

Although many scholars have addressed the issue of water management,[38] it is less common for researchers to address how established water management techniques should be adapted to account for differences in local culture and values. As Amery notes, "The role that human cultural diversity plays in how water and other resources are perceived and consequently managed has been under-emphasized by researchers and practitioners."[39] In recent years, scholars, most notably Faruqi, have attempted to overcome this shortcoming by investigating the role played by religion in the effective management of water resources. A number of international NGOs that work in the area

36 Wilkinson, 55.
37 Caponera, Water Laws in Moslem Countries, 35.
38 Due to the large volume of literature that exists on this subject, it is impractical to provide a comprehensive listing of sources.
39 Amery, 481.

of water management – including the United Nations, World Bank, and Canadian International Development Agency – have attempted to account for variations in local culture and customs in development projects.[40] Inquiries in this area appear to be particularly applicable to water management in the Muslim World where Islam, "regulates virtually all aspects of individual and collective human life, for example, issues such as buying and selling, contracts, inheritance, marriage, family and intimate relations, and even elemental issues such as eating and personal hygiene and sanitation."[41]

Although many academics have noted the theoretical consistencies between Islam and the responsible husbandry of water and other natural resources,[42] a smaller group of academics has taken this one step further by arguing that there exists an unique style of water management that can be harmonized with Islam – creating a distinct brand of Islamic water management.[43] Faruqi and his colleagues have attempted to demonstrate how Islam can complement or be harmonized with the various techniques that Western scholars have identified as potential mechanisms for improving the management of water resources.[44] This research has the potential to address the acute water scarcity in the MENA region if it could be applied. This is particularly true given the propensity for culturally appropriate water management techniques to improve the effectiveness of efforts to address water scarcity.

The extent to which Islamic ideals are consistent with the modern water management techniques identified in the broader literature has been a source of disagreement. For example, the *shariah's* complicated treatment of water ownership

40 Faruqui, "Introduction," xiv –xv.
41 Ibid., xv.
42 For examples of this trend, see Abdel Haleem and Hamed.
43 Faruqui, xv.
44 Ibid.

rights would suggest that the religion prevents Muslim states from implementing techniques like wastewater reuse or the pricing systems that form the basis for water demand management. Nevertheless, scholars like Faruqui note that water management and Islamic *shariah* law are not mutually exclusive.[45] Rather than precluding the implementation of these techniques, Muslim-majority states simply need to adapt the techniques to be consistent with the Islamic principles outlined above. Furthermore, in many settings the environmental values that are advocated by the religion, such as humankind's role of a steward of environmental resources, can reinforce efforts to implement water management techniques in the MENA region.

The issue of whether modern water management techniques can be successfully extrapolated to Muslim states is connected to beliefs that the faith's strict guidelines on sanitation and personal hygiene preclude the implementation of wastewater reuse. An example of this tendency is seen in Almas and Scholz argument that the reuse of wastewater effluent is socially unacceptable in Yemen because of Islam's focus on cleanliness and purity.[46] Despite this contention, wastewater reuse has been implemented effectively in Saudi Arabia. As part of the government's broader effort to address water scarcity, a lengthy study was undertaken to determine the extent to which wastewater reuse could be harmonized with Islam. This process resulted in 1978 religious decree that endorsed the reuse of treated effluent in the agricultural sector.[47] Similarly, a recent public opinion survey undertaken in the West Bank illustrates the broad public support that exists for wastewater reuse within Palestinian society.[48]

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45 Ibid.

46 Ahmed Almas and Miklas Scholz, "Agriculture and Water Resources Crisis in Yemen: Need for Sustainable Agriculture," Journal of Sustainable Agriculture 28, 3 (2006): 55.

47 Walid A. Abderrahman, "Water Demand Management in Saudi Arabia," Water Management in Islam, Faruqui, Biswas, and Bino Eds. (New York: United Nations University Press, 2001), 74-75.

48 Nader Al-Khateeb, "Sociocultural acceptability of wastewater reuse in Palestine," Water Management in Islam, Faruqui, Biswas, and Bino Eds. (New York: United Nations University Press, 2001), 79.

There also exists debate about whether key aspects of water demand management can be implemented in Muslim-majority states because of the complicated legal issues relating to the ownership and sale of water resources. Webb and Iskandarani, for example, contend that, "there are religions (for example Islam) that prohibit water allocation by market forces."[49] Although Webb and Iskandarani are correct in alluding to the potential complications of market-based allocation of water resources in the Muslim World, Islam does not entirely preclude the implementation of water demand management principles. Despite these complications, Khadouri et. al. note that Islam generally supports of markets so long as they ensure accessibility, fairness, and social justice.[50] Islam technically allows for the sale of water and market-based approaches to water demand management have been successfully implemented in a number of Muslim states. This is true in Saudi Arabia where the government implemented water tariffs in 1994 to encourage the conservation of costly desalinated water.[51] In Iran, the government has reconciled the need for market-based solutions with the right of thirst by providing citizens with a small amount of water free of charge and utilizing market prices for all additional water use.[52] The ability for two theocracies in the MENA to reconcile water demand management with Islam suggests that Islam does not necessarily prevent market-based solutions to water management.

Despite these areas of contention, Islam has the potential to contribute to and reinforce the vast majority of modern water management techniques discussed in the literature. In his overview of the subject, Farouqui notes that Islam is consistent with

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49 Patrick Webb and Maria Iskandarani, Water Insecurity and the Poor: Issues and Research Needs (Bonn: Center for Developmental Research, Universität Bonn, 1998), 34.
50 Kadouri, 90.
51 Abderrahman, 72.
52 Kazem Sadr, "Water Markets and Pricing in Iran," Water Management in Islam, Faruqui, Biswas, and Bino Eds. (New York: United Nations University Press, 2001), 110.

many water management techniques including: family planning, water conservation, and the reallocation of water use across sectors of the economy.[53] Family planning has the potential to improve water scarcity in the region because high population growth rates reduce per capita endowments of water resources. Despite the tendency for family planning to be controversial amongst some religious groups in the West, it is encouraged by the government in many states in the MENA region and has been endorsed by Muslim jurists.[54] Nevertheless, high population growth rates remain an issue throughout much of the region. Although, Islam's role in legitimizing family planning practices has the potential to contribute to government-led attempts to manage water resources, the region's demographic trends suggest that it alone is insufficient to fully address the problem.

Conservation is one area where Islam has the potential to play a major supporting role given the faith's role in the areas of education and cultural change. A number of non-governmental organizations (NGOs) working to address water scarcity in the region have noted the benefit of incorporating religion into attempts to promote water conservation. One study on the effectiveness of these campaigns notes that "it has been shown over the last 10 years that campaigning for the conservation of the environment within the Islamic faith is productive, and specifically that using the Islamic education system to address the public of the [Eastern Mediterranean Region] on important issues such as water conservation has beneficial effects in raising public awareness."[55] In addition to the role that the religion has played in NGO-sponsored conservation efforts, religion has played a role in state efforts to promote water conversation, even in relatively

53 Faruqui, "Islam and Water Management," 5-15.
54 Ibid., 10.
55 Sadok Atallah et. al., "Water Conservation Through Public Awareness Based on Islamic Teachings in the Eastern Mediterranean Region," Water Management in Islam, Faruqui, Biswas, and Bino Eds. New York: United Nations University Press, 2001.

secular states. For example, Jordanian authorities have used Islamic communication channels and religious texts to support its efforts to promote water conservation nationwide.[56]

In an unique application of *shariah* principles, Farouqui argues that Islam's water use preferences – which gives priority to human and animal consumption – has the potential to improve the efficiency of water use by encouraging intersectoral shifts in the allocation of water resources because it has the potential to reduce water use in the agricultural sector.[57] This prioritization of human and animal uses for water likely comes out of a nomadic culture that was not dependent on crop production. In addition to being the largest use for water in virtually all states in the MENA, agricultural water use tends to be the least efficient in the sense that it provides the lowest economic return per unit of water used. If combined with well functioning water markets, the right of thirst may be a viable mechanism for intersectoral reallocations of water resources.[58] With no *shariah* protections for agricultural water use, it appears as if food production or a right of hunger is not necessarily protected. This may be desirable in an era where food imports have the potential to expand the water supply through the importation of the virtual water implicit in their production. This is yet another case where Islam creates a culturally-specific opportunity for improving water management.

In addition to its potential to improve the domestic management of water resources, Islam also can play a role in the management of resources shared among states. This is particularly important given the high number of trans-boundary resources that exist within the region, including the Nile, the Tigris-Euphrates, and the Mountain

56 Francesca Gilli, "Islam, Water Conservation, and Public Awareness Campaigns." Presented at the 2nd Israeli – Palestinian – International Conference: Water for Life in the Middle East, October 10-14, 2004.
57 Mallat, "Quest for Water Use Principles," 134.
58 Faruqui, "Intersectoral Water Markers in the Middle East and North Africa," 125.

Aquifer in Jordan, the Palestinian Authority, and Israel. Mallat argues that international principles relating to the management of trans-boundary resources are largely consistent with those advocated by Islam.[59] Despite the consistencies between *shariah* and international water law, further work is needed to develop an Islamic water management strategy for these resources.[60] Unfortunately, like the work completed by the International Law Association on trans-boundary water management, Islamic principles which call for the responsible sharing of international waters have yet to have had a noticeable effect on the management of these resources, a topic discussed in chapter 3.[61]

59 Mallat, "Quest for Water Use Principles," 136.
60 Iyad Hussein and Odeh Al-Jayyousi, "Management of Shared Waters: A Comparison of International and Islamic Law," Water Management in Islam, Faruqui, Biswas, and Bino Eds. (New York: United Nations University Press, 2001), 134.
61 Thomas Naff and Joseph Dellapenna, "Can there be confluence? A comparative consideration of Western and Islamic freshwater law," Water Policy 4 (2002): 482.

Chapter 3: Management of Trans-Boundary Resources in the Nile and Tigris-Euphrates Basins

It is often noted that the boarders of man-made nation states rarely correspond to the naturally-occurring boundaries of surface and groundwater basins. Many of the earth's freshwater resources are, therefore, trans-boundary – shared between two or more states. It is estimated that over 40 percent of the world's total population depends on these shared resources.[62] Prominent examples of such resources include the Indus River and the Rio Grande - Rio Colorado river basin. Trans-boundary water resources pose unique challenges for joint management. Although international law has made progress in recent decades on mechanisms to promote the cooperative management of trans-boundary resources, there exists no consistent framework that is universally accepted. As a result, the management regime for a given river or aquifer tends to be based on bilateral or multilateral agreements among riparian states. There exist more than 286 agreements of this type that govern the management of trans-boundary resources worldwide.[63]

As noted above, trans-boundary water resources comprise a significant share of the total freshwater resources available to states in the MENA region. The Nile, Jordan, and Tigris-Euphrates River Basins are examples of major river systems in the region that are not confined to the boarders of a single state. In addition to these rivers, many of the region's groundwater resources are also trans-boundary. Naff and Dellapenna remark that, "although groundwater has increasingly become the focus of disputes between nations, a consistent body of state practice has yet to emerge."[64] Accordingly, this thesis focuses exclusively on the management of trans-boundary surface waters. However,

62 Waltina Scheumann and Manuel Schiffler, "Introduction," Water in the Middle East: Potential for Conflicts and Prospects for Cooperation, Scheumann and Schiffler Eds. (Berlin: Springer, 1998), 1.
63 Naff and Dellapenna, 485.
64 Ibid., 472.

future scholarship ought to provide a more comprehensive understanding of how trans-boundary groundwater resources are managed in Muslim-majority states.

The importance of trans-boundary water resources in the MENA combined with the region's low per capita freshwater endowments have led many to predict that future conflicts in the region will be over water resources. Most notably, the former UN Secretary General Buotros Buotros-Ghali, an Egyptian, warned that, "the next war in our region will be over the waters of the Nile."[65] This remark is reinforced by Egypt's numerous statements about its willingness to employ its presumed military superiority over neighboring states to ensure continued access to Nile water. In Egypt's view, its historical role as the primary recipient of the Nile's water justifies such a use of military power.[66] The debate about whether water scarcity is likely to result in violent conflict continues in the academic literature. A group known as the neo-Malthusians argues that violence is the inevitable result of water scarcity.[67] Fortunately, as Naff and Matson note, "water as an impulsion towards conflict carries its own corollary, being as well an impetus toward cooperation.[68] Regardless of whether water wars are in the in region's future, it is clear that forces like climate change, population growth, and economic development create increased demands on existing resources and necessitate inter-riparian cooperation. In the context of Islamic water management, capitalizing on the religiously inspired value system established by Islam may encourage such cooperation in the MENA region.

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65 Okbazghi Yohannes, Water Resources and Inter-Riparian relations in the Nile Basin: The Search for an Integrative Discourse (Albany: State University of New York Press, 2008), 6.

66 Terje Tvedt, "About the Importance of Studying the Modern History of the Countries of the Nile Basin in a Nile Perspective," The River Nile in the Post-Colonial Age: Conflict and Cooperation among the Nile Basin Countries, Tvedt Ed. (London: I.B. Tauris, 2009), 7.

67 For examples of neo-Malthusian arguments, see: Thomas Homer-Dixon, "On the Threshold: Environmental Changes as Causes of Acute Conflict," International Security 16, 2 (1991) and Leif Ohlsson, "Environment, Scarcity, and Conflict: A Study of Malthusian Concerns." (Ph.D. diss., University of Göteborg, 1999).

68 Thomas Naff and Ruth Matson, "Introduction," Water in the Middle East: Conflict or Cooperation?, Naff and Matson Eds. (Boulder: Westview Press, 1984), 3.

Although the MENA is home to a number of trans-boundary water resources, this text focuses on cooperation in the Nile and Tigris-Euphrates River Basins. Due to the extent to which the management of the Jordan River Basin is entangled in the ongoing peace process with Israel, this thesis will avoid discussion of this resource. Nevertheless, Jordan's domestic water management policies are a source of discussion in the next chapter of this thesis. In both the Nile and Tigris-Euphrates Basins, downstream states like Egypt and Iraq have historically been the primary users of the resource. In the modern era, this arrangement has begun to change as upstream states like Ethiopia and Turkey begin seeking a larger share of water resources to satisfy domestic needs as well as demand for increased agricultural production and hydroelectric power. Increasing water demand by upstream users has required a reassessment of water use within the respective basins, the results of which are not yet apparent.

The lack of a widely accepted legal framework for the cooperative management of trans-boundary water resources is a major hindrance to the effective management of international river basins. Despite the large number of trans-boundary resources that exist worldwide, there are comparatively few international agreements that clearly delineate how such resources should be governed. The situation is particularly troublesome in developing states, since the bulk of the agreements that do exist relate to shared water resources in Europe and North America.[69] Nevertheless, there has been limited progress in developing a comprehensive international legal framework for the management of trans-boundary surface waters, most notably through the 1966 *Helsinki Rules of the Uses of the Water of International Rivers* and the closely-affiliated *Convention on the Law of the Non-navigational Uses of International Watercourses*.[70]

69 Naff and Dellapenna, 485.
70 Dahilon Yassin Mohamoda, Nile Basin Cooperation: A Review of the Literature (Uppsala, Sweden: Nordic Africa Institute, 2003), 14.

Although these documents are useful in analyzing relations among riparian states, their lack of widespread acceptance prevents their enforcement. The lack of an enforcement mechanism is a major obstacle to cooperation and one that cannot be rectified without riparian states forgoing their claims to sovereignty over the shared resource. According to Barandat and Kaplan, states will only surrender their sovereignty rights in exchange for tangible gains.[71] It remains to be seen how such a scenario might play out in the Nile and Tigris-Euphrates River Basins.

INTERNATIONAL WATER LAW

Consistent with international law's status as a decentralized system that lacks institutional structures for the enactment and enforcement of laws, the management of trans-boundary water resources is dependent largely on self-help, custom, and agreement. The primary mechanism for resolving conflicts between riparian states is custom.[72] Since customary international law is derived from existing state practices that are "undertaken out of sense of legal obligation," it can be based on treaties, international agreements, decisions of international assemblies, courts, and arbitrators, or unilateral actions.[73] As noted above, the lack of a reliable enforcement mechanism is a major shortcoming of this system, limiting the ability for international law to address trans-boundary water management issues effectively.

Participants in discussions about the apportionment and management of trans-boundary freshwater resources may seek to argue for one of three primary positions

71 Jörg Barandat and Aytül Kaplan, "International Water Law: Regulations for Cooperation and the Discussion of the International Water Convention," Water in the Middle East: Potential for Conflicts and Prospects for Cooperation, Schuemann and Schiffler Eds. (Berlin: Springer, 1998), 26.
72 Joseph W. Dellapenna, "Rivers as Legal Structures: The Examples of the Jordan and the Nile," Natural Resources Journal 36 (1998): 220-221.
73 Ibid., 226-227.

which may or may not be reflected in treaty language. These include: (1) absolute territorial sovereignty, (2) absolute integrity of the river, and (3) limited or restricted territorial sovereignty. Upstream nations are among the states that are most likely to argue for the position of absolute territorial sovereignty. Under this principle, a state has an unmitigated right to utilize the resource in any way it sees fit. Any criticisms of such practices by downstream states are viewed as interferences in the upper riparian's domestic affairs. This position is contrasted with that of absolute integrity of the river. More commonly employed by downstream states, this argument holds that lower riparian states can criticize or even punish their upstream neighbors for taking any action that negatively affects the water resource downstream. Since these two positions can be mutually exclusive, a third argument, limited or restricted territorial sovereignty, calls for sovereignty limited by considerations for the interests of other riparian states.[74] A less commonly cited fourth principle that has been referenced in the academic literature is that of community of interest, which holds that freshwater resources should be shared equitably amongst the community.[75]

In recent years there has been an increasing tendency for the rights of riparian states to be codified in explicit bilateral and multilateral agreements. Although such agreements are more common in Europe and North America, they do govern some resources in the MENA region, including the Nile. As a result of Great Britain's colonial presence in the region, the Nile River is subject to many such agreements, all of which were negotiated on a bilateral basis.[76] An example of this type of agreement is the 1959 Nile Water Agreement between Egypt and Sudan that establishes a quantitative distribution of the river's annual flow. In general, these agreements have favored the

74 Barandat and Kaplan, 15-16.
75 Mahamoda, 14.
76 Ibid., 13.

principle of limited territorial sovereignty. The application of the principle of restricted or limited sovereignty has extended beyond these agreements, however. Dellapenna contends that, "restricted sovereignty, based on the concept that an international drainage basin is a coherent judicial and managerial unit, has become the customary rule of international law as shown by the many treaties based on the concept, international judicial and arbitral awards, and the near unanimous opinion of the most highly-qualified publicists."[77] Not surprisingly, this principle has also found its way into attempts by the United Nations (UN) to codify international laws governing shared freshwater resources.

The most significant effort to codify international water law was undertaken by the United Nation's International Law Commission (ILC) in 1966 and resulted in the creation of the *Helsinki Rules of the Uses of the Water of International Rivers* (from now on, the Helsinki Rules). These rules have since been revised as the Berlin Rules of 2004. The Helsinki Rules, articulate that each state's utilization of an international river basin or "hydrogeographic unit" be recorded, assessed, and evaluated. This expectation, in addition to further legitimizing the principle of restricted sovereignty, gave explicit support to the "equitable apportionment and utilization-doctrine."[78] Despite an attempt by Finland to gain formal approval for the Helsinki Rules in the UN General Assembly, the measure was defeated on the grounds that the rules were developed by a professional organization rather than nation states. These rules remain controversial amongst member states because they restrict sovereign action and are based on the notion that rivers should be approached as complex drainage basin systems rather than merely a channel through which water flows.[79] Although the UN General Assembly did not adopt the Helsinki

77 Dellapenna, 230.
78 Barandat and Kaplan, 16.
79 Asti Biswas, "Management of International Water Resources: Some Recent Developments, " International Waters of the Middle East: From Euphrates-Tigris to Nile, Biswas Ed. (Oxford: Oxford University Press, 1994), 192.

Rules, the resulting resolution tasked the ILC with authoring a new document that addressed the concerns that prevented the formal codification of the rules.[80]

Over the course of several decades, the ILC compiled a proposed text that would become the *Convention on the Law of the Non-navigational Uses of International Watercourses* (from now on, the Convention). Throughout the negotiation process on the draft text, various states with equities in the management of trans-boundary rivers, including Turkey and Ethiopia, attempted to affect the final form of the Convention.[81] On May 21, 1997, the General Assembly formally adopted the convention. Primary among the principles advanced by the document are those of "equitable and reasonable utilization" and "no significant harm."[82] These principles have since been employed by the states that are discussed in this paper. In the case of downstream states, most notably Egypt and Sudan, the concept of historical use has been employed to emphasize the fact that increased upstream water use has the potential to cause harm to downstream riparian states. Conversely, upper riparian states argue for a more equitable utilization of the water resource.[83] However, the convention has not been ratified because few states have acceded to it.

As noted above, it has been argued that there exist numerous consistencies between international principles guiding the management of trans-boundary water resources and Islamic jurisprudence. Such a view is predicated on *shariah*'s similar dependence on customary law as well as its emphasis on the responsible stewardship of environmental resources. Despite this theoretical consistency, none of the states involved in disputes over major river systems in the Middle East have invoked Islamic law in their

80 Ibid.
81 Barandat and Kaplan, 21.
82 Mahamoda, 14.
83 Ibid.

official legal claims.[84] It, therefore, remains unclear what role *shariah* can or will play in the management on trans-boundary resources. Nevertheless, the Islamic principles that dictate humankinds' interaction with the environment continue to apply in the Muslim-majority states that are referenced in this analysis. As the current international legal framework governing trans-boundary resources is admittedly weak, *shariah* has the potential to provide additional mechanisms for managing such resources.[85]

THE NILE RIVER BASIN

The Nile River, the world's longest river, is located in the northeastern quadrant of the African continent. The river's basin encompasses nearly 2 million square miles (772,240 square kilometers) and is home to approximately 150 million people. The basin traverses through ten countries: Burundi, the Democratic Republic of the Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda. Contributions to the river's flow vary considerably by country – with Ethiopia contributing the majority of the river's water and Egypt, the primary user of the resource, contributing none.[86] Although Egypt and Sudan are the only Muslim-majority riparian states, most are home to Muslim populations that comprise a significant percentage of each country's total population.

As with many international river systems, there exists considerable disagreement amongst riparian states about the proper allocation and utilization of the Nile's water resources. Unlike many other trans-boundary water resources in the developing world,

84 Naff and Dellapenna, 484.
85 Chibli Mallat, "Law and the Nile River: Emerging International Rules and the Shari'a," The Nile: Sharing a Scarce Resource, Howell and Allan Eds. (Cambridge: Cambridge University Press, 1994), 380-381.
86 Mohamoda, 7.

Source: Encyclopedia Britannica

Illustration 1: Map of Nile River Basin.

a number of international agreements between the riparian states dictate how water is allocated within the basin. Despite the existence of these agreements, riparian states are unable to reach a common understanding on their legitimacy. Egypt and Sudan, which are granted the full use of the river's water through the agreements, argue that the documents remain in effect. Conversely, most other riparian states argue that the agreements are no longer applicable on the grounds that they were negotiated on their behalf and without their input during the colonial period.

Great Britain's desire to increase Egypt's cotton production in the early part of the 20th century resulted in policies that maximized Egypt's share of Nile resources at the expense of upstream states. Accordingly, it was the goal of the colonial administrators to maintain order in the upper riparian states while investing heavily in water development in Egypt and northern Sudan.[87] This policy resulted in the formulation of multiple agreements between Egypt and its neighbors that were negotiated on their behalf by colonial administrators and provided Egypt with the majority of the basin's water resources. Despite an end to the colonial period in the Nile River Basin, these agreements continue to be a source of conflict. So great was the United Kingdom's impact on the development of the Nile River Basin that Tvedt advocates referring to the present era as the "post-colonial age."[88]

Although most international agreements that were brokered by colonial powers continue to affect the management of the Nile River Basin, the most commonly cited of these agreements are the 1902, 1929 and 1959 Nile River Agreements. The 1902 agreement was negotiated been the British and Emperor Menelik II of Ethiopia. Under the agreement, Ethiopia agreed that it would not undertake any works on the Nile without

87 Tvedt, 4.
88 Ibid., 6.

the express consent of both Egypt and Sudan.[89] In light of Ethiopia's status as the primary contributor to the Nile's flow as well as the country's ongoing interest in expanding its hydroelectric generation capacity, this agreement has become particularly problematic for the Ethiopian Government. Like other riparian states, Ethiopia has attempted to argue that the agreement is no longer applicable on the grounds that it was the product of the colonial legacy in Africa.

As the primary recipients of the Nile's waters, Egypt and Sudan were the focus of both the 1959 and 1929 agreements. In the 1929 agreement, which was carried out through an exchange of diplomatic notes, the need for Sudan to develop irrigation was formally recognized. However, the agreement stipulated that any development in Sudan could not infringe upon Egypt's historic rights – which were noted to include the entire natural flow of the river from January to July.[90] Thus, out of the river's annual flow of 84 cubic kilometers (km^3), 48 km^3 were allocated to Egypt with only 4 km^3 going to Sudan.[91] By the 1950s, this agreement was becoming unacceptable to Sudan. In an effort to secure Sudan's support for the construction of the Aswan High Dam, the 1959 agreement was negotiated which significantly increased Sudan's share of the Nile waters. The entire annual flow of the river was allocated under the agreement – with Egypt receiving 55.5 km^3, Sudan receiving 18.5 km^3, and an estimated 10 km^3 lost through evaporation at Lake Nasser.[92] This agreement has not been well received by other riparian states because it comes at the expense of other basin states. According to

89 Dellapenna, 243.
90 Yahia Abdel Mageed, "The Nile Basin: Lessons from the Past," International Waters of the Middle East: From Euphrates-Tigris to Nile, Biswas Ed. (Oxford: Oxford University Press, 1994), 166.
91 O. Okdi, "History of the Nile and Lake Victoria Basins Through Treaties," The Nile: Sharing a Scarce Resource, Howell and Allan Eds. (Cambridge: Cambridge University Press, 1994), 334.
92 Ibid.

Waterbury, is is a common trend in bilateral agreements on water resources to come at the expense of third parties.[93]

Since gaining independence, most of the upstream states have attempted to negate past international agreements governing the allocation of Nile waters – claiming that they were negotiated on their behalf by colonial powers and are therefore no longer binding. Ethiopia's position on this point has been particularly important given the country's desire to increase it's utilization of the Nile for irrigation and hydroelectric purposes. In Ethiopia's renouncement of the 1902 Agreement, it cited similar behavior on the part of Egypt and Sudan in renouncing colonial-era treaties unrelated to water issues that were deemed inconsistent with state interests.[94] Despite the appeal of this argument, the position is difficult to defend in the wake of the 1978 Vienna Convention, which clearly establishes the concept of the Succession of Treaties, which obligates successor states to adhere to past international agreements.[95] Regardless of whether riparian states have the ability to abandon these agreements, they remain a source of contention among the Nile Basin countries. In 2002, the issue of the 1929 agreement was raised in both the Kenyan and Ugandan parliaments, with members of parliament questioning the legality of the agreement and calling on their respective governments to denounce it.[96]

Rather than promoting an equitable and sustainable distribution of Nile water resources, these contested agreements have inhibited cooperation among riparian states. The current set of agreements has given a clear advantage to the lower riparian states of Egypt and Sudan. Although the current distribution of resources is admittedly

93 John Waterbury, "Between Unilateralism and Comprehensive Accords: Modest Steps toward Cooperation in International River Basins," International Journal of Water Resources Development 13, 3 (1997): 286.
94 Naff, 243.
95 Hosam E. Rabie Elemam, "Egypt and Collective Action Mechanism in the Nile Basin," The River Nile in the Post-Colonial Age: Conflict and Cooperation among the Nile Basin Countries, Tvedt Ed. (London: I.B. Tauris, 2009), 233.
96 Mohamoda, 28.

inequitable, any recognition of an upstream riparian's right to additional water has the potential to undermine Egypt's position of power. Egypt's apprehension to cede ground to upstream states can be seen in its opposition to small projects on the White Nile sub-basin that would have little or no impact on its water supply. As evidenced by this behavior, Egypt's current position of power creates incentives for it to forgo cooperation with other basin states. Dellapenna notes that, "to create the sort of regime necessary to allay conflict and optimize the use and preservation of the resource will require a new treaty, one that includes all basin communities, creates appropriate representative basin-wide institutions, and has the clout to enforce its mandates."[97]

Despite the fact that Ethiopia contributes approximately 86 percent of the total flow of the Nile, it is severely limited in its ability to harness these resources to better the lives of its citizens. This fact is reflected in the widely publicized poverty and hunger that have plagued the country in recent decades. Although Ethiopia has between 3.6 and 5.7 million hectares (ha) of potentially irrigable land, only 30,000 ha are presently under irrigation. Similarly, while 58 percent of the basin's hydroelectric potential occurs within its borders, Ethiopia has harnessed a mere 2 percent of this value.[98] While it is clear that Ethiopia can benefit from an increased share of the Nile's resources, Egypt's historical use of the resource, as codified in the various international agreements, limits the realization of these benefits. This has put Ethiopia on a collision course with the hydrological interests of its downstream neighbors.

As an upstream riparian state, Ethiopia advocates for the concept of absolute territorial sovereignty in international negotiations. In an attempt to make use of the vast quantities of water that flow through its boundaries, Ethiopia has argued that former

97 Dellapenna, 250.
98 Yohannes, 79.

agreements governing the resource are invalid and need to be renegotiated to provide the country with a greater share of the Nile's water. Such a position is consistent with the view of most Ethiopians. One scholar notes how, in contrast to past generations of Ethiopians that viewed the Nile as a symbol of national pride, the current framework for sharing the Nile has incited the resentment of many younger Ethiopians who have suffered under drought and famine – while Egypt and Sudan monopolized the water of Ethiopia's Blue Nile.[99] Since the 1980s, the subject has been a irritant in the bilateral relationship between Egypt and Ethiopia. In addition to making legal arguments for why past agreements should be considered null, Ethiopia has labeled ongoing and planned water projects in Egypt and Sudan as wasteful, noting that water storage in the Ethiopian plateau has the potential to be much more efficient given the country's more moderate climate.[100]

Ethiopia continues to advocate for an increased share of the Nile's water and has made a number of proposals for utilizing the river to increase the country's share of irrigated land and hydroelectric generation capacity. Although these demands are predicated on the hydrological realities of the Nile Basin, Ethiopia's demand for hydroelectric power is equally connected to the remnants of Cold War politics. In the wake of Egypt's decision to employ Soviet financing and technical assistance in the construction of the Aswan Dam, the United States undertook a survey of the Blue Nile sub-basin in 1957 with an eye towards maximizing its irrigation and hydropower potential. As noted by Waterbury, the more than twenty major projects identified by the study were, "a clear shot across the bows of Egypt and the USSR; Egypt may have its Soviet-financed dam, but Ethiopia has Egypt's water."[101] This issue continues to be a

99 Cited in Mohamoda, 25.
100 Tvedt, 9.
101 John Waterbury, "Is the Status Quo in the Nile Basin Viable?" The Brown Journal of World Affairs 4, 1 (1997): 288.

source of conflict for the two nations. Ethiopia's announcement in the late 1990s of its intent to construct a network of "micro-dams" for hydroelectric generation and irrigation was met with strong condemnation from the Egyptian government.[102] Unfortunately for Egypt, it has been forced to contend with similar developments from the other riparian states that comprise the White Nile sub-basin.

Although Ethiopia, by nature of the large percentage of total Nile waters that originate within its borders, is the most vocal of the upstream states, the countries in the White Nile sub-basin share Ethiopia's desire to challenge the downstream states' domination of the resource. Of these states, Kenya, Tanzania, and Uganda have the greatest interest in the outcomes of any decisions related to the allocation of water resources because they border the sub-basin's primary bodies of water. Similar to the course of action advocated by Ethiopia in the Blue Nile sub-basin, these states have begun to request increased rights to the sub-basin's resources and permission to build the infrastructure needed for expanded irrigation and hydroelectric power projects.

Although the states of Burundi, the Democratic Republic of Congo, and Rwanda have a clear interest in how the Nile is managed, their roles are more limited than those of the co-riparian states mentioned above. Nevertheless, they collectively contribute 13 billion cubic meters to Lake Victoria each year.[103] From the perspective of the Nile's downstream users the relative importance of the upper riparian states may not be all that important. In recent years, a proposal by Tanzania to divert water from Lake Victoria for use in the interior of the country has been met with stiff resistance from the Egyptian Government. Although the project, which Tanzinia is committed to pursuing unilaterally, will have little to no impact on users downstream, it creates a precedent for expanded

102 Manuel Schiffler, "Conflicts Over the Nile or Conflicts on the Nile?" Water in the Middle East: Potential for Conflicts and Prospects for Cooperation, Scheumann and Schiffler Eds. (Berlin: Springer, 1998), 143.
103 Yohannes, 145.

upstream development.[104] From the perspective of downstream users like Egypt and Sudan, which purport to be entitled to the entire annual flow of the Nile, any such development has the potential to upset their monopoly over the river's resources.

As the primary historical user of the Nile, a role codified in the existing international agreements governing the allocation of water resources in the basin, Egypt has reason to be concerned about attempts by upper riparians to alter the status quo. Although this thesis does not attempt to make a normative judgment about whether the river's resources should be more equitably divided amongst co-riparian states, it is important to note that the river is critical to Egypt's national security as it is the country's only source of freshwater and the primary input to the country's agricultural sector which sustains nearly a third of its total population.[105] Despite these concerns, Yohannes identifies a number of factors that increase the likelihood that Egypt will take a more cooperative stance in the future. Among these factors are the potential for future Nile flows to fluctuate in terms of their quantity and quality and the fact that upstream users are unlikely to abandon their efforts to increase their utilization of the Nile waters.[106] For the time being, however, Egypt appears undeterred in its attempts to continue to monopolize the resource.

Rather than looking for opportunities to share the rivers waters with co-riparians, the domestic policies that Egypt has outlined in recent years with respect to its water resources indicates that it anticipates sustained or increased demand for freshwater resources. These plans include a state-led effort to bring large tracks of desert land under cultivation. Egypt's desert reclamation projects aim to develop agricultural lands in the country's Western Oasis and northern Sinai regions. The large quantities of water needed

104 Ibid., 118.
105 Ibid., 146-147.
106 Ibid., 42-43.

to sustain the projects are contributing to water scarcity in Egypt. According to official government estimates, population growth and increased water demand from agriculture will result in an annual demand of 86.75 billion cubic meters (bcm) by 2017, considerably higher than the state's annual 55.5 bcm share of Nile waters.[107] Thus, even if Egypt is able to maintain its share of the Nile's annual flow, freshwater from the Nile would be insufficient to meet growing water demand. Presumably, this will deter Egypt from earnestly pursuing cooperation in the region, which is likely to limit upstream countries' access to the river's water resources.

Given Egypt's interest in maintaining it's current monopoly over the Nile's waters, the state has employed a number of strategies in its interactions with other riparian states. These tactics have included: reminding other basin states of its willingness to employ military power in efforts to guarantee access to its historical endowment of Nile waters; advancing legal arguments that justify the current apportionment of resources; and employing tactics geared at denying upstream states access to financial and technical assistance for water development projects.[108] Although these tactics have been largely successful to date, it remains unclear how long they can be effective in limiting upstream development.

As a fellow downstream state, Sudan's position on Nile Basin cooperation is most closely aligned with that of Egypt. Like Egypt, Sudan benefits from the codification of its water rights and has an interest in ensuring that past agreements are recognized by other riparian states. Nevertheless, the country's fast growing population and increasing demand for irrigated land has resulted in Sudanese claims of "shortages in the midst of plenty."[109] Although Sudan would prefer a larger share of the river's waters than what it

107 Ibid., 38-40.
108 Ibid., 53.
109 Dellapenna, 242.

is afforded under the 1959 agreement, Sudan is forced to tread carefully on the subject of Nile cooperation. This, among other factors, has complicated its bilateral relationship with Egypt.

Although Sudan is Egypt's strongest ally among the states in the Nile Basin – a result of their shared interests as downstream states – cooperation between the two countries is rarely straightforward. Sudan's interest in exploiting increasing amounts of Nile water for irrigation purposes is not consistent with Egypt's attempt to maintain the status quo. Due to the economic crisis and civil wars that have plagued Sudan in recent years, however, the Khartoum government has been unable to pursue such a course of action.[110] In addition to the hydrological debates, the bilateral relationship has been strained on the political front as well. In the mid-1990s, Sudan's alleged support for Islamist groups in Egypt became a source of conflict between the two nations.[111] Though not directly related to the subject of Islamic water management, Sudan's support for Islamist group in Egypt may suggest that religious considerations factor into its foreign policy decisions. While tensions between Egypt and Sudan have since improved, the potential succession of Southern Sudan may further complicate relations in the Nile Basin.[112]

The current situation in the Nile River Basin is unsustainable and, by nature of the fundamental inequality that exists in the distribution of water resources, inconsistent with some of the international legal principles that have been identified by the ILC, such as equitable utilization. On the other hand, modifying the status quo would be inconsistent with other ILC principles, including historical use. Although all riparian states have recognized the need for cooperation in the management and development of the basin,

110 Mohamoda, 27.
111 Schiffler, 144.
112 Mohamoda, 18.

water resource actions by the basin's inhabitants on occasion still dissolve into unilateral action.[113] Given the disparate positions held by the upper and lower riparian states, this seems unlikely to change in the near future. As Durth notes, "despite large potential efficiency gains, there will be no cooperation if upstream and downstream states have radically different ideals about the fair usage or division of international resources."[114] This observation has negative implications for the prospects for future intra-basin cooperation.

Despite the disparate positions taken by basin states, the post-colonial era has witnessed a number of attempts to promote basin-wide cooperation. The first attempt that expanded cooperation beyond bilateral institutions was the creation of HYDROMET in the 1960s to address flooding in the basin. The project, which lasted for 25 years, focused on the collection and sharing of hydro-meteorological data on the basin. As the project concluded in 1992, it was replaced with an similar initiative known as TECCONILE. Notable in the creation of TECCONILE is the fact that all basin countries were represented either as members or observers. This contrasts with earlier organizations like Undugu, a joint Egyptian and Sudanese undertaking to promote inter-basin cooperation in the 1980s, which lacked full representation from Nile Basin countries.[115] Although the development of these organizations gives some hope for potential cooperation, they have yet to yield tangible results.

The current mechanism that is being promoted as the key to inter-riparian cooperation is the Nile Basin Initiative (NBI). The successor to TECCONILE, the organization was established in 1999 and has full representation from all Nile Basin

113 Abdel Mageed, 171.
114 Rainer Durth, "Transboundary Externalities and Regional Integration," Water in the Middle East: Legal, Political, and Commercial Implications, Allan and Mallat Eds. (London: I.B. Tauris, 1994), 58.
115 Raphael M. Tshimanga, "The Congo Nile: Water Use, Policies, and Challenges," The River Nile in the Post-Colonial Age: Conflict and Cooperation among the Nile Basin Countries, Tvedt Ed. (London: I.B. Tauris, 2009), 85.

countries. The body is tasked with encouraging information sharing amongst member states, promoting technical cooperation, and undertaking joint development projects.[116] Although the initiative is meant to be a temporary mechanism to promote cooperation in the absence of a formal legal framework, there is hope that the NBI will form the basis for a lasting solution to the issues currently facing the basin and a model for the management of other trans-boundary water resources. The ultimate aim of the NBI is the creation of a new treaty that would be used for the management and development of the basin.[117]

The introduction of the NBI has been well received in academic circles, with scholars noting that a "spirit" of cooperation among Nile Basin states is a largely new development. To this group, the NBI represents a new framework that has the potential to result in the peaceful resolution of conflicts related to the apportionment of the Nile's resources.[118] As Brunné and Toope note, the results of this new initiative remain to be seen. Nevertheless, the initiative appears to be making progress on securing buy-in from the various stakeholders and articulating principles for adjudicating joint development projects.[119] Unfortunately, last year's meeting of NBI member states in Egypt found renewed attempts by the host country to assert its historical claims to the Nile's entire annual flow. As a result, great uncertainty surrounds the future of the NBI and its efforts to establish a new international legal framework for the Nile River Basin.

116 Jutta Brunneé and Stephen J. Toope, "The Changing Water Basin Regime: Does Law Matter?" Harvard International Law Journal 43, 1 (2002), 108.
117 Ashok Swain, "The Nile River Basin Initiative: Too Many Cooks, Too Little Broth," SAIS Review 22, 2 (2002): 302.
118 Pascal Nkurunziza, "Burundi and the Nile: Water Resource Management and National Development," The River Nile in the Post-Colonial Age: Conflict and Cooperation among the Nile Basin Countries, Tvedt Ed. (London: I.B. Tauris, 2009), 24.
119 Brunneé and Toope, 139.

THE TIGRIS-EUPHRATES RIVER BASIN

In contrast to the Nile River Basin, which encompasses ten African states, the Tigris-Euphrates Basin is shared by just three Middle Eastern states, each of which is a Muslim-majority nation: Iraq, Syria, and Turkey. Similar to the Nile, however, the Tigris-Euphrates Basin has an established usage pattern for its water resources that developed over millennia and favors the downstream user, Iraq. Both rivers were home to some of the world's most advanced civilizations, which flourished as a result of their ability to harness water resources from the rivers. Despite Iraq's role as this historical recipient of the Tigris-Euphrates waters, the development of water resources by the upstream nations of Turkey and Syria have in recent decades resulted in conflicts over the allocation of water resources.

Source: Encyclopedia Britannica

Illustration 2: Map of Tigris-Euphrates River Basin.

Located north of the Arabian Peninsula, the Tigris and Euphrates rivers are primary sources of freshwater for the riparian states. Although water discharge from the river varies considerably by year and season, experts estimate the basin's annual flow is between 68 billion cubic meters (bcm) and 84.5 bcm.[120] The basin covers a total area of 831,600 km^2, with the break down by riparian state as follows:

Table 2: Distribution of Tigris-Euphrates River Basin Area by State

(km^2)							
	Turkey		**Syria**		**Iraq**		**Total**
Euphrates	146,520	33.0%	84,360	19.0%	240,240	46.0%	444,000
Tigris	57,600	14.9%	1,000	0.3%	292,000	75.3%	387,600
Total	204,120	23.0%	85,360	9.0%	456,240	60.5%	831,600

Source: Kibaroglu, 167.

Despite the relatively small portion of the total basin area that lies in Turkey, as the upstream riparian for both rivers, it contributes a disproportionate amount to the river system's total discharge. Based on data presented by Kibaroulu, it is possible to calculate the contributions of riparian states as follows:

Table 3: Contribution to Tigris-Euphrates River Discharge by State

(bcm/year)							
	Turkey		**Syria**		**Iraq**		**Total**
Euphrates	28.922	90.0%	3.213	10.0%	0.000	0.0%	32.135
Tigris	20.840	44.0%	0.000	0.0%	26.571	56.0%	47.411
Total	49.762	62.5%	3.213	4.0%	26.571	53.6%	79.564

Adapted from: Kibaroglu, 166-167. Author's calculations.

120 Aysegul Kibaroglu, Building a Regime for the Waters of the Euphrates-Tigris River Basin (New York: Springer, 2002), 165.

The information that is presented in the table above illustrates the extent to which the downstream riparians in the basin, Syria and Iraq, benefit from the large share of water that Turkey contributes to the watercourse. Despite the large quantity of water carried by the system, it is estimated that demand for water resources in the basin will significantly outstrip supply by the year 2040. This is particularly true for the Euphrates River, for which Kibaroglu predicts that demand will exceed supply by some 20.1 bcm per year.[121] This disparity highlights the need for future cooperation amongst basin countries in order to ensure the proper management of the resource.

As noted above, Iraq has historically been the primary beneficiary of the annual flows of the Tigris and Euphrates rivers. The indication of the value of these flows is evidenced in the number of laws related to water resources contained in the *Hammurabi Code*.[122] Although upper riparian states in the basin have begun to increase their off-take of water resources, Iraq remains that largest user of the basin's waters. Even as recently as 1997, upwards of 1.29 million hectares (ha) were irrigated from waters from the Euphrates. This contrasts sharply with the totals in Turkey and Syria, at 140,000 and 274,000 ha, respectively.[123] Plans to increase water use in upstream states, however, threaten Iraq's ability to use its historical share of the basin's resources.

Turkey's ongoing project to develop irrigation and hydroelectric infrastructure in the Tigris-Euphrates River Basin is the primary source of this increased water demand. The Turkish Southeastern Anatolian Project, known as the GAP, is the Turkish Government's attempt to promote economic development in rural Turkey by investing in the development of water resources at the headwaters of the basin. Through the GAP

121 Ibid., 166-167.
122 King of Babylonia Hammurabi, The code of Hammurabi, king of Babylon, about 2250 B.C. (Chicago: University of Chicago Press, 1904).
123 Waltina Scheumann, "Conflict on the Euphrates: An Analysis of Water and Non-water issues," Water in the Middle East: Potential for Conflicts and Prospects for Cooperation, Scheumann and Schiffler Eds. (Berlin: Springer, 1998), 115-116.

project, Turkey intends to generate enough hydroelectric power to satisfy 25 percent of the country's electricity demand and bring upwards of 1.7 million ha under cultivation in the southeastern corner of the country.[124] Despite the GAP's obvious benefits for Turkey and its citizens, the project has resulted in conflict between Turkey and other riparian states because of the dramatic effect it is having on the water resources in the basin.

In contrast to the current levels of distrust that exist between riparian states, scholars like Kibaroglu note that prior to the 1960s relations among basin states were strong. This good will could have reflected the minimal development of the upstream basins, which enabled cooperation because demand for water did not exceed supply. This relationship, however, changed as states began to undertake development projects within the basin.[125] Although there is a tendency to place blame on Turkey for this shift, development has not been limited to the GAP project. During this same period, both Syria and Iraq undertook projects of their own aimed at further exploiting the waters of the Tigris-Euphrates. This is particularly true in the case of Syria, where a number of projects were undertaken to increase the amount of irrigated land.[126] The result of this extensive development in the basin was a series of talks between the riparian states.

Between 1962 and 1998, the basin states participated in at least 16 rounds of multi-party discussions to promote cooperation on the management of the basin. Even simple agreements on maters like information sharing proved to be impossible to achieve during these forums.[127] In the absence of written agreements, like the ones that at least hypothetically govern water allocation in the Nile River Basin, the participants have been unable to reach a consensus on the distribution of water resources in the basin. In

124 Ibid., 115.
125 Kibaroglu, 169-170.
126 Ibid., 194.
127 Durth, 65-66.

addition to states using the discussions to serve their own interests, Durth points to a number of political issues such as Syria's interactions with Kurdish separatist groups, the Gulf War, and other political obstacles that have impeded progress.[128] The current U.S.-led military conflict in Iraq has also done little to enable cooperation among the riparians on water issues in recent years.

In discussions on the status of the basin's water resources, the riparian states often adhere to predictable positions in their negotiations. Iraq and Syria, by nature of their status as downstream riparians, argue the doctrine of absolute integrity of the river to leverage their historical use of the resource. Conversely, Turkish negotiators tend to adhere to the position of absolute territorial sovereignty – claiming that ownership of the resource allows them to use the Euphrates as they see fit.[129] The resulting conflict has limited the riparian states' abilities to manage the resource. Although cooperation in the Nile River Basin has certainly been less-than-ideal, some progress has been made. By contrast, the riparian states of the Tigris-Euphrates River Basin have made comparatively little progress on the joint management of the resource. The majority of the cooperation thus far has been confined to discussions among the riparians.

The limited cooperation in the Tigris-Euphrates River Basin is interesting because it is not subject to the same complexities found in the Nile River Basin. In addition to involving significantly fewer states, the riparian states of the Tigris-Euphrates Basin are connected by a shared history as a result of their inclusion in the Ottoman Empire as well as a common Islamic religious identity. Although these two case studies do not comprise a representative sample of trans-boundary water resources involving Muslim-majority states, the outcomes in the two basins are surprising. In the case of the Tigris-Euphrates

128 Ibid., 65.
129 Scheumann, 127.

Basin, the presence of exclusively Muslim-majority states does not appear to make cooperation more likely. In fact, the outcome may provide empirical evidence for the opposite finding. Nevertheless, it is apparent that the current system of international law that attempts to address trans-boundary issues provides an unsatisfactory framework for the management of both basins. In discussing the relationship between secular and Islamic legal principles for the management of trans-boundary resources, Mallat advocates for regional frameworks that would augment the current system by applying Islamic legal principles. The ineffectiveness of the current arrangement suggests that this proposal should be explored in greater detail in future scholarship on the subject.[130]

130 Chibli Mallat, "Law and the Nile River: Emerging International Rules and the Shari'a," The Nile: Sharing a Scarce Resource, Howell and Allan Eds. (Cambridge: Cambridge University Press, 1994), 380.

Chapter 4: Domestic Water Management Techniques: The Cases of Yemen and Jordan

Although many states have a need to employ the techniques outlined in the previous chapter to ensure their access to adequate amounts of water resources, the bulk of water management actually takes place at the domestic level. By reducing the demand for water within one's own borders, a state may be better able to cope with the forces of water scarcity. Fortunately, domestic management of water resources is a considerably easier undertaking than what has previously been presented. In contrast to the crude policy tools available for the management of trans-boundary resources, a greater number of effective techniques and mechanisms have been developed to address the management of water resources within a given country. While these techniques are most often applied in secular settings, chapter one highlights the fact that the majority of these techniques are consistent with and can be framed within an Islamic context.

As a result of widespread water scarcity in the region, domestic water management is a particularly important topic for states located in the MENA region. Compounding the natural water scarcity that exists in the region are a variety of forces common throughout the MENA that further limit per capita water resources. Among these forces are region's fast population growth rate, rising living standards, the degradation of water resources, and changing weather patterns. As a result of these forces, many nations face unique challenges in their attempts to effectively manage their water resource endowments. By reconciling existing water management techniques with the Islamic alternatives presented above in this paper, states will likely be better equipped to deal with these challenges.

In an effort to better understand how *shariah* law currently affects the region's water supply, this chapter presents brief case studies on the water management techniques employed in Yemen and Jordan. Although both states face acute water scarcity, their respective strategies for the management of water resources are dictated by such factors as urbanization, primary water sources, and the efficiency of the central government – all of which are state-specific. Although the case studies are not comprehensive in their analysis of the water management techniques employed in each state, they provide some insight in the potential the pros and cons of relying on water management techniques that are rooted in *shariah* law.

WATER RESOURCES IN YEMEN

When its annual share of renewable water resources are apportioned on a per capita basis, residents of Yemen have access to just 95 m^3 of water per year. This figure, which is considerably less than the MENA regional average of 1,250 m^3 per year, renders Yemen one of the most water scarce states in a region that is know for its lack of freshwater resources.[131] Given Yemen's fast rate of population growth, its per capita share of water resources will continue to shrink in the coming years. The country's acute water scarcity provides the central government with justification to implement a comprehensive strategy for the management of its water resources. Such a strategy could employ water demand management to limit consumption of the resource while simultaneously expanding the water supply through techniques like waste water reuse. Unfortunately, the latter aspect does not appear to be a viable option in Yemen as a result

131 World Bank, Yemen Towards a Water Strategy: An Agenda for Action (Washington, DC: World Bank, 1997), 1; author's calculations.

of localized religious opposition to waste water reuse which, as noted in chapter 1, is not consistent with state practice in Iran and Saudi Arabia.

Source: U.S. Central Intelligence Agency, *World Fact Book*

Illustration 3: Map of Yemen.

Rather than limiting water demand to bring it in line with the state's resource endowment, Yemen has engaged in a consumption pattern that has resulted in the overexploitation of the country's water supply in recent decades. Although this behavior has prevented the central government from implementing the politically unpopular policies that are needed to manage water demand, the overexploitation of water resources has been the cause of numerous environmental ills. Throughout the country, aquifers are being drawn down at a rate theat exceeds their natural recharge. In some of the most overexploited basins, the water table is falling by as much as 6 meters per year.[132] Over-pumping has subjected the country's costal aquifers to increasing levels of salinity as

132 World Bank, Yemen: Rationalizing Groundwater Resource Utilization in the Sana'a Basin (Washington, DC: World Bank, 2003), 6.

seawater begins in infiltrate the aquifer. International experts have predicted that Sana'a will become the first of the world's capital cities to become unable to supply adequate water resources to support its population.[133]

Unlike most other countries, Yemen's primary source of water resources is the country's extensive network of aquifers. Although surface water exists in limited quantities, its presence is subject to seasonal variations. Groundwater, therefore, serves as the country's only reliable source of water. Since the introduction of groundwater lifting technologies in the 1970s, Yemen has experienced extensive groundwater development. The introduction of these technologies has allowed the country to cope with water scarcity by drawing down groundwater resources at a rate that exceeds the natural rate of recharge. In addition to the tendency for this overexploitation to degrade the resource, the lack of wastewater treatment facilities in most parts of the country further risks damage to the aquifers through wastewater recharge from anthropogenic wastes stored in unlined cesspools.[134]

As in other regional states, high rates of population growth and rising living standards are increasing overall demand for water. Given that Yemen's population is largely rural and dependent upon agriculture, it should not be surprising that the bulk of the country's water use is devoted to agriculture.[135] The amount of water use in agriculture has increased in absolute terms as a result of the introduction of groundwater lifting technologies. For example, in the Sa'ada basin over 2,500 wells extract water at a rate that exceeds natural recharge. The vast majority of these wells are used for

133 Almas, 126.
134 J.W.A. Foppen, "Impact of high-strength wastewater infiltration on groundwater quality and drinking water supply: the case of Sana'a, Yemen," Journal of Hydrology 263 (2002), 198.
135 Food and Agriculture Organization of the United Nations, AQUASTAT, online database, at http://www.fao.org/nr/water/aquastat/

irrigation.[136] The increased water made available through the large-scale exploitation of groundwater resources has resulted in altered cropping patterns which prioritize water-intensive cash crops like the narcotic *qat,* the production of which represents one of the most efficient allocations of water resources within Yemen's agricultural sector, as measured by economic return on water use.[137]

Although Yemen's central government pays lip service to the importance of effective water management, it has failed to implement policies that have reduced water demand. This lack of progress on water issues could be related to the state's disinterest in the subject or it could reflect the Sana'a limited control over territories outside the capital. Indeed, the central government has actually created incentives for expanding rather than limiting water use through a variety of flawed policies like state subsidies on the fuel used to run groundwater pumps and import tariffs designed promote domestic self sufficiency in the production of water-intensive citrus crops.[138] Given the dearth of rational water conservation politics, it is hard to see how Yemeni water management is related to the tenants of Islamic *shariah* law.

Despite Yemen's flawed approach to water management, *shariah* has had a surprising impact on the country's water supply. In the absence of a state-led management regime, *shariah*'s position on the reclamation of dead land has encouraged Yemenis to expand the area under cultivation in order to gain ownership of the land. Lichtenthäler documents this tendency and notes that a combination of state policy encouraging domestic food self sufficiency and the notion of reclaiming dead lands

136 Rafik A. Al-Sakkaf, et.al., "A Strategy for Controlling Groundwater Depletion in the Sa'dah Plain, Yemen," Water Resources Development 15, 3 (1999), 349.
137 Jonathon Walz, "Yemen, Qat, and the Water Supply: A Strategy for the Efficient Allocation of Water Resources," (Honors thesis, University of South Dakota, 2008).
138 Gerhard Lichtenthäler, Political Ecology and the Role of Water: Environment, Society and Economy in Northern Yemen (Aldershot: Ashgate, 2003) 98.

resulted in a considerable uptick in land reclamation attempts near Sa'ada during the 1980s.[139] Such an occurrence was made possible by groundwater lifting technologies that were increasing in popularity during this same period. This situation suggests that, in the absence of state policy related to the management of water resources, applications of *shariah* have the potential to result in behaviors that are not consistent with Best water management practices.

WATER RESOURCES IN JORDAN

Jordan's per capita endowment of renewable water resources amounts to approximately 120 m^3/p/y, a volume similar to the magnitude of water scarcity in Yemen.[140] Although the country is considerably wealthier than Yemen, it lacks the large oil endowments of neighboring states. This prevents Jordan from artificially increasing its supply of freshwater through desalinization like its Gulf neighbors. In the absence of a mechanism for increasing supply, water management techniques are an important part of Jordan's attempts to address the issue of water scarcity. By contrast, Jordan has been more effective than Yemen in employing such techniques.

Residents of Jordan rely on a combination of surface and groundwater resources to satisfy their demand for water. The country contains a number of river basins, including the trans-boundary Jordan River Basin that is shared between Syria, Lebanon, Israel, Jordan, and the Palestinian Authority. As a result of the country's limited water resources, there has been an increasing emphasis placed on exploiting groundwater in recent decades. Although this has helped to augment the water supply, Jordan's capital has nevertheless faced considerable challenges in providing adequate water resources to

139 Ibid.

140 Food and Agriculture Organization of the United Nations, AQUASTAT, online database, at http://www.fao.org/nr/water/aquastat/

sustain the city's population. Often the city is only able to provide users of the municipal water system with service one day per week.[141] This has resulted in an increasing dependence on private water delivery services that truck water to residents who are willing to pay a premium for its use.

Source: U.S. Central Intelligence Agency, *World Fact Book*

Illustration 4: Map of Jordan.

Although the water situation is already a challenge for the Jordanians, it is predicted that increasing future demand will exacerbate the problem. In addition the high population growth rates which are found throughout the MENA region (despite state-led attempts to limit the per capita births), the influx of refugees in recent years from neighboring Iraq only compounds this water scarcity. According to Kuffer, Jordan's government has also contributed to high demand though its efforts to promote an

141 Natalia Antelava, "Jordan faces up to water crisis," BBC News (06 October 2009), n. pag.

expansion of irrigated lands in the country.[142] In light of Jordan's scarcity of freshwater resources, the country should be pursuing the opposite strategy. By shifting the allocation of water resources away from the agricultural sector, a move justified under *sharia*'s preference for human uses for water, the Jordanian Government would be acting in a manner consistent with its need to improve the management of its water resources.

In recent years, Jordan has been proactive in its efforts to implement water management best practices. For example, the state has undertaken the difficult role of regulating groundwater extraction in an effort to improve the management of the resource. Jordan's progress on this front demonstrates the government's willingness to adopt much-needed policies that are likely to be unpopular with the citizenry. In addition the regulation of water use, the state has attempted to promote conservation by educating its citizens. As in other Muslim-majority states, the Jordanians have attempted to frame these messages by delivering them in an Islamic religious context. The state's decision to utilize religion for this purpose has undoubtedly increased the effectiveness of the campaign.[143] The Jordanian Government has been proactive in implementing an national water strategy that has helped promote water conservation and worked to invested in infrastructure projects aimed at augmenting the country's water supply. Although there is still room for improvement, the progress that Jordan has made in the area of water management are an impressive, particularly when compared to the lack of progress being made in other water scarce states like Yemen.

Unlike the negative impact that the application of *sharia* has had on Yemen's water resources, Jordan's decision to integrate religious teachings into public awareness

142 Ulrich Kuffner, "Contested Waters: Dividing or Sharing?" Water in the Middle East: Legal, Political, and Commercial Implications, Allan and Mallat Eds. (London: I.B. Tauris, 1994), 83.
143 Francesca Gilli, "Islam, Water Conservation, and Public Awareness Campaigns," Presented at the 2nd Israeli – Palestinian – International Conference: Water for Life in the Middle East (October 10-14, 2004), 12.

campaigns on water scarcity have improved the management of the resource. Although this is just one example of how the Jordanian Government has attempted to reconcile modern water management techniques with Islam, it nevertheless demonstrates the benefits of doing so. As the country continues to grapple with water scarcity, it may undertake additional measures to improve its management of the resource. The state should continue to explore new ways to integrate modern water management techniques with Islam in an effort to improve the effectiveness of its water management regime.

Chapter 5: Conclusion

This thesis has attempted to demonstrate the extent to which it is possible for states in the MENA region to utilize the principles of *shariah* law to improve their management of scarce water resources. Despite the consistency between Islamic water law and the water management techniques advocated in contemporary academic literature on the subject, the concept of Islamic water management remains an underdeveloped area of study. Although this thesis project has attempted to explore the extent to which Islamic water management techniques are or can been implemented in the region, additional work is needed in order to realize a comprehensive treatment of the subject. In light of the widespread water scarcity that exists in Muslim-majority states, particularly those in the MENA region, such an undertaking is both necessary and worthwhile.

From the material presented in chapter three of this document, it is apparent that secular law has proven ineffective in regulating the interactions between the riparian states of trans-boundary river basins. Although the precise role that Islamic law can play in perfecting the existing system is unclear, Mallat's advocacy for regional frameworks based on religious foundations seems like a good starting point for future analysis. While it remains to be seen whether such frameworks would enhance the existing international system for the management of international rivers, any refinement of the secular system that increases the potential for a cooperative outcome would be a welcome development. Admittedly it is unlikely that *shariah* will become the basis for future agreements between riparian states, even those that hold Islam in common. Nevertheless, the extent to which Islamic law informs modern jurisprudence in the MENA region as well as its explicit focus on water issues renders it a subject worthy of continued study.

The case studies of the Nile and Tigris-Euphrates River Basins do provide some preliminary insights into the cooperative management of trans-boundary resources amongst Muslim-majority states. While the findings of this thesis do not necessarily have applicability beyond the two river basins analyzed, there is an implication that a state's religious make-up does not fundamentally alter whether it is willing to cooperate with other riparian states. Cooperation does not appear to be easier among states with similar religious views. The theoretical treatment of the Islamic principles governing water resources would lead to an expectation that Muslim countries are obliged to subscribe to certain views. In practice, however, Muslim-majority states do not appear to be any more likely to have positions informed by these religious ideals. Rather, a state's position is most easily predicted based on its status as either an upstream and downstream riparian. In can be inferred from this observation that the positions taken by each state are likely a reflection of that state's own interests.

In contrast to what seems to be a limited role for *shariah* at the international level, Islamic principles appear more suited for informing the management of water resources within a community. This suggestion is reinforced by the numerous consistencies that scholars have identified between modern water management techniques and *shariah* law. Given the potential for locally sensitive adaptations of water management techniques to increase their effectiveness, it is not surprising that a number of regional states have attempted to harmonize internationally accepted techniques for the management of freshwater resources with the prescriptions outlined by Islamic law. Although this has likely worked to Jordan's advantage in its efforts to promote water conservation, in the absence of state oversight in Yemen, *shariah* has resulted in an undesirable expansion in the amount of land under cultivation and, therein, demand for water resources. It is not

clear whether this is an isolated case or a common shortcoming with respect to Islamic law's ability to promote the responsible utilization of water resources.

Along these lines, the two domestic case studies presented in chapter four on this highlight important differences in the effects that *shariah* has on water resources. The different outcomes that were experienced in the two states raise a number of questions about the causes of such divergent outcomes. Was Yemen more likely to be negatively affected as a result of its weak state institutions? What about the differing patterns of development between the two states? Is dependence on groundwater more likely to result in a particular outcome? While these are questions that may help to explain the different outcomes from *shariah* in Jordan versus Yemen, additional inquiry is needed to resolve this point and other key questions related to Islamic water management techniques.

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Vita

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