The Future of Water Resource Management in the Muslim World*

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Abstract

This article provides an insight into water availability and usage in the Muslim world, based on the global data on water consumption and availability with respect to specific geographical regions and an extensive literature review to categorize the regions with similar socio-economic and hydro-geological make up into distinct water zones. Causal Layered Analysis futures technique is used to examine the way water has been valued and managed, and the systems and worldviews that have influenced the current human-water relationships in the Muslim world. The zones and their inherent water paradigms are then contrasted with emerging international perspectives and trends that might herald a change in the way water is managed in the Muslim world. Finally Muslim religious philosophy and the importance of water is revisited as a potential linchpin that could influence future policies and begin to answer some of the water demand challenges these nations face in the 21st century.

Keywords: Water futures, Muslim World, causal layered analysis, religious philosophy, socio-economic and hydro-geological zones, water policy.

Introduction

This paper looks at the future of fresh water availability and usage in the Muslim world and aims to identify factors that determine and may change the way water is currently accessed and consumed. Water has immense spiritual importance to Muslims as water is a symbol of purity and cleanliness, which is the essence of Islam. Water concerns in the Muslim world vary from being negligible to severe, spatially contained to nationwide and at times transcending

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boundaries, including concerns over quality and quantity. Countries in this region typically confront a combination of these problems.

This paper focuses on the current and emerging trends in water availability and management in the Muslim world because water is of profound importance to Muslims. The Quran, the holy book of Muslims, mentions water in sixty three different verses. In one verse Allah says, 'And we created from water every living thing' and in another verse he says that the most precious creation after humans is water. The Quran describes Allah's throne as floating on water and there is clear reference to streams flowing underneath the gardens of paradise. The life giving properties of water is reflected in the verse, 'And Allah has sent down water from the sky and therewith gives life to the earth after its death' (Faruqui et al., 2001).

All humans rely on water for sustenance and health but Muslims have a special relationship with water. One of the five pillars of Islam is praying five times a day and each prayer is preceded with wudu or ablution which is a ritual cleansing of hands, feet and face with water. Without this ritual a prayer stands void. Prophet Muhammad (peace be upon him) compared the five prayers to the cleansing property of water in the following saying; 'the similitude of five prayers is like an overflowing river passing by the gate of one of you in which he washes five times daily'(Faruqui et al., 2001).

Muslims also observe certain hygiene practices that set them apart from other cultures. As an Islamic tradition, all Muslims wash with water after urination or defecation and toilet paper is used merely as a drying agent. This signifies the importance of water and the need for accessing clean water in toilets. There are special sanitary fixtures attached to the plumbing that supply water in the toilet such as hand showers or water spouts fitted into the toilet bowls or bidets. The need to wash prior to the five prayers daily and to wash every time the toilet is used, increases the per capita water demand and consumption of all Muslims. As per the Pacific Institute's data on water resources, approximately 75% of Muslims have access to clean drinking water and 60% have access to sanitation (Gleick et al., 2009).

According to the Islamic principles, humans may consume and utilize natural resources, but should not manipulate nature in a way that irreversibly degrades the environment. Islamic doctrine asserts that the ecosystem belongs to Allah, who entrusts humankind to pass it on, relatively unharmed, to their succeeding generations. This is consistent with the notion of sustainable development and inter-generational equity. People ought to share in the abundance as well as in the scarcity of all resources because they are finite and people as inheritors are accountable to Allah for their actions on earth (Ameri, 2001).

The Muslim world experiences varying environmental, economic, and political challenges, but it is united by its common religious and ethical guidelines, which can form the bases of water management policies. Globally, there is a greater recognition of resource management and policy influenced by traditions and knowledge of indigenous people, however the potential role of religion as the basis for policy making is underestimated. In countries where the majority of people are practicing Muslims, a water management policy that is grounded in the tenets of Islam has greater potential for being effective. (Ameri, 2001)

The Water Map - Five Distinct Socio-Economic and Hydro-geological Zones

This section introduces six socio-economic and hydro-geological zones which will form the basis of the analysis. The framework behind the division of the Muslim world into six distinct zones depends on three basic elements; the geographical location of the country, the natural occurrence of water in that country and how the water is managed by that country. This methodology builds on the work done by Marcus Barber (2007), who uses these categories to understand what water means to different cultures and to people in differing geographic zones, and how these zones and cultures approach the use of water. The categorization of the Muslim world into distinct water zones was based on the global data on water consumption and availability for specific geographical regions published in FAO's Statistical Year Book (2009) and the Pacific Institute's The World's Water 2008-2009, coupled with case studies from the Muslim world.

Countries with similar natural water distribution and strategies to the use of water are clumped together to form a zone. These zones, for the ease of reference are called the 'Oil Barons in the desert', 'Water stressed', 'Mediterranean to Tropical', 'Global Charity', 'Tension driven' and the 'Disaster prone', each with its own socio-economic and hydro-geological blue-print. These zones are distinct either due to their geographic location or hydrological makeup, strategies of water management, are experiencing similar water related events such as floods, glacial melt, droughts or are sharing water resources with their neighbors. Most countries have over lapping attributes that make them fit under more than one zone, however, I will be using the discrete characteristics and assumptions highlighted below to simplify my analysis. For pictorial reference, the geographical zones are illustrated in Figure 1 – The Water Map.

- **Zone 1 – Oil Barons in the Desert –** This zone includes all the Muslim countries that are rich in oil and are located in the arid desert belt of the Middle East and Western Asia including but not limited to Saudi Arabia, United Arab Emirates, Qatar and Oman. This is one of the driest regions of the world and gets only 1% share of the world's renewable fresh water resources. According to the 2010 report of the Arab Forum of Environment and Development, the precipitation in the region is expected to drop by 25% and evaporation to increase by 25% by the year 2015. As a result, the average crop yields in the region will drop by 20%. Some of these countries have annual rainfall as low as 29mm per annum (FAO, 2009). To meet the growing demand for water especially in the agriculture sectors, most of these countries are augmenting their water supply by tapping into non-renewable transboundary groundwater aquifers, and investing in sea water desalination and waste water treatment. The increased dependence on groundwater has lead to a decline in aquifer water levels and saltwater intrusion is contaminating the aquifers and causing disturbance of the dynamic equilibrium among aquifers, a decline in agricultural productivity

and an increase in migration away from rural areas. Tapping nonrenewable groundwater sources or fossil water also means that there may not be enough water left for future generations (Barghouti, 2010).

- **Zone 2 – Water Stressed –** The Muslim countries with low GDP and low fresh water access of North Africa and parts of South and Central Asia including Algeria, Morocco, Tunisia, the Central Asian countries of former USSR and Afghanistan, among other countries. They are experiencing physical or are approaching physical water scarcity. Physical water scarcity occurs when water resource development is approaching or has succeeded sustainable limits. Physical water scarcity relates water availability to water demand and implies that dry areas are not necessarily water scarce[1]. In this region, more than 75% of river flows are withdrawn to meet the world's agricultural, industrial and domestic needs, with irrigation taking up the larger share[2]. Substantial resources have been diverted to expansion of the irrigation systems and water management. However the mounting demographic stresses and climate change are reducing the available water supply. This zone comprises the sub-tropical arid or semi-arid countries where summer temperatures are soaring and rainfall is low. The river systems experience seasonal variabilities due to variabilities in precipitation due to climate change.

- **Zone 3 – Mediterranean to Tropical** – The countries in this zone have high fresh water access, are rich in biodiversity and have low to medium GDP. These countries include Albania and Bosnia and Herzegovina located in the Mediterranean region, Guyana and Surinam from South America and Malaysia, Indonesia, and Brunei Darussalam located in South East Asia. These countries do not face immediate water shortages and have allocated substantial resources for the development and management of water for irrigation to attain significant economic growth and poverty reduction. Countries such as Turkey, Malaysia and Brunei Darussalam have also paid significant attention to integrated watershed management in water planning and development projects and have ensured equity of services and distribution to all households, especially the poor (Mokhtar & Tan, 2009). However, although water supply per capita is adequate in this zone, some social and environmental problems still exist in the river basins, such as population growth, non-point source pollution and degradation of water resources quality (Barghouti, 2005).

- **Zone 4 – Global Charity –** Most countries in the Sub Saharan Africa are experiencing economic water scarcity, which occurs when human, institutional and financial capital are the constraints to accessing water, even though water in nature is available locally to meet human demands. Most of these nations are also dependent on foreign aid for food and

medicines. Investment in water management infrastructure has been slow and inadequately financed (Barghouti, 2005). Vulnerability to climate change will aggravate the economic water stress in the region. The resulting droughts and famine are attracting considerable attention of international donor agencies. With poverty on the rise, women are the most vulnerable segment of the society as they are burdened with the responsibility of fetching water for the household. Countries in this zone require financial assistance in building large water storage facilities and infrastructure to mitigate the impacts of water scarcity (Barghouti, 2005).

- **Zone 5 - Tension Driven –** This zone comprises of countries sharing transboundary rivers and/or groundwater aquifers with their neighboring countries. These countries include Pakistan, Bangladesh, Egypt, Jordan, Kuwait, Syria, Sudan, Somalia, West Bank and the Gaza Strip, to list a few. Kuwait and Bahrain are sharing their groundwater with Saudi Arabia. The Tigris-Euphrates River basin is shared by Turkey, Syria and Iraq with tributaries originating in Iran. Egypt, Sudan and eight other countries share the Nile River Basin. The Jordan River is shared by Jordan, Lebanon and Israel. Increasing water shortages in most of these countries are leading to conflicts as the management and allocation of water resources goes beyond local communities and border regions. Shared water resources can become a contentious issue especially when water governance ignores international rivers and their respective watersheds, and groundwater aquifers that transcend borders.

- **Zone 6 – Disaster Prone –** All nations in this zone face or are vulnerable to natural or manmade disasters such as floods, droughts, glacial melts and sea level rise. Most countries that are expected to experience such disasters more frequently in the coming years lie in the South & Central Asia including Pakistan, Bangladesh, Indonesia, Maldives and Kazakhstan. Pakistan and Bangladesh have a long history of floods and more recently are affected by glacial melt in the upper reaches of their river basins. Kazakhstan is also reporting its glaciers melting at a faster rate. Maldives, like Indonesia, was adversely affected by recent Tsunamis in the region. Maldives' existence, including its inhabitants, plants and animals, is also directly under threat from ocean level rise due to global warming and the resulting Polar ice melt and subsequently the country's residents will be forced to move to other countries, such as India or Sri Lanka or elsewhere. These nations are largely low income countries and the onslaught of any disaster, whether natural or man-made, is likely to economically weaken them further.

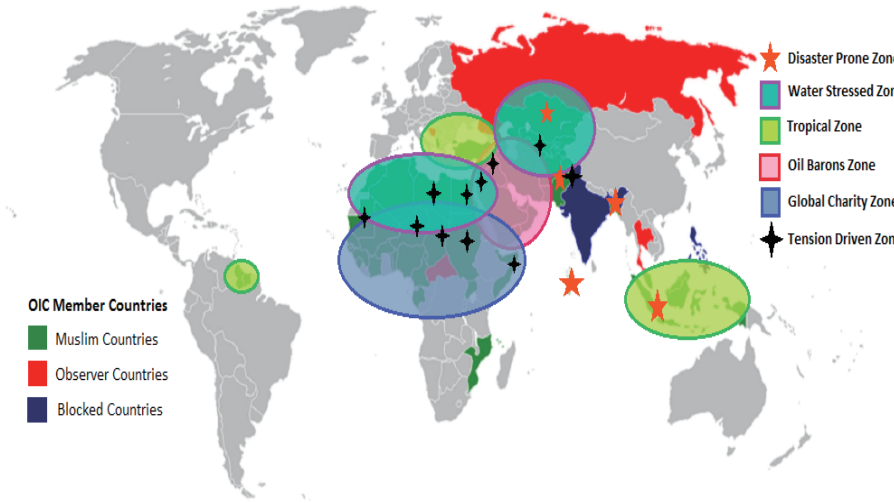

Figure 1. The Water Map

Methodology: Causal Layered Analysis

Most methodologies dealing with analysis tend to be linear and stay at the unquestioned acceptance of stated facts or perceptions about a given problem or may go slightly deeper to explore the social causation or systemic perspectives behind a given problem. For my study I will use Causal Layered Analysis (CLA) futures technique, that transcends the boundaries of the unquestioned view of reality, and explores the depths of analysis down to the world view and metaphor level of a given study question. As a theory, CLA seeks to integrate empiricist, interpretive, critical and action learning modes of knowing. As a method, its utility is in constructing transformative spaces for the creation of alternative futures. It is also likely to be of use in developing more effective, deeper, inclusive and longer term policy (Inayatullah, 2004).

CLA has four levels of analysis; litany, social causes, world view and myth-metaphor. The first level is the 'litany' - which is essentially the unquestioned popular acceptance of stated facts or perceptions. At this level reality is fragmented and events, issues and trends appear disconnected. The second level deals with 'systemic causes' (social, economic, technological, demographic) – interpretation is given to quantitative data to determine what a society stands for and why things happen a certain way. The third level goes deeper and is concerned with the 'discourse or worldview' or the unconsciously held ideological perceptions and discursive assumptions shared by a particular class of society. Worldview provides the paradigm that supports the system in its working. At the final tier of analysis, the level of 'myth or metaphor', the deep stories, the unconscious and often emotive drivers of a problem or the collective archetypes of how a society sees itself, are exposed (Inayatullah, 2004).

Applying Causal Layered Analysis to Fresh Water Availability and Usage in the Muslim World

The CLA in this section is based on literature review of emerging trends in addition to cultural, gender and location specific interpretation of how water as a resource is perceived and managed in each of the six zones. The analysis was carried out based on sample case studies of water usage and availability in each of the zones.

Table 1. *CLA – The 'Oil Barons in the Desert' Zone*

CLA Level	Societal Approach/ Thinking
Litany (what we say)	Water is an expensive commodity but the nation is wealthy. Desalination, ground water withdrawal and virtual water trade is the means for sustenance.
Social Causes (what we do)	Society accepts the need to conserve water. Using oil reserves to desalinate sea water for drinking and pumping fossil water to grow food is the means for meeting population's drinking and food requirements.
World View (how we think)	There is a need to establish more water reserves through desalination to increase living standards. Drinking imported bottled water is a status symbol and is the purest form of drinking water.
Myth and Metaphor (who we are)	"Power from oil". Wealth from oil means power. As long as there is oil there will be drinking water for a healthy society. "Power from fossil water". Future generations will find their own solutions to water shortages.

Table 2. *CLA – The 'Water Stressed' Zone (physical scarcity)*

CLA Level	Societal Approach/ Thinking
Litany (what we say)	Damming the rivers and pumping groundwater provides water for competing uses. Agriculture takes up the biggest share of fresh water usage.
Social Causes (what we do)	Building dams, reservoirs and tube wells ensures future supply of water and supply population's drinking, food and energy needs. Water seen as a right for agricultural and domestic use, disposal seen as government's problem.
World View (how we think)	Downstream impacts of dams, diversion of water from rivers for agriculture are ignored or denied in order to preserve self benefit and potential. Agricultural productivity is the only way to prosperity. Traditional irrigation methods are time tested no matter how wasteful.
Myth and Metaphor (who we are)	"Power from dams". Water abundance and control indicates wealth and security – a right assigned by Allah. "We have the right to exploit water"

Table 3. *CLA – The 'Mediterranean to Tropical' Zone*

CLA Level	Societal Approach/ Thinking
Litany (what we say)	Water will continue to be in abundant supply as it has always been as rainy season never fails. Water sustains food, income and economy.
Social Causes (what we do)	Water drives the plantations, so more forests are cut for palm tree plantations which are exported. Loss of natural habitats. Most water borne diseases are avoidable but precautions are not always taken. The gap between rich and poor grows as the rich pocket the wealth.
World View (how we think)	Rainforest timber brings instant rewards. Water degradation seen as minimal due to abundance of water supply. The west will buy natural assets feeding many more mouths.
Myth and Metaphor (who we are)	"Wealth from the rainforest" Water helps grow trees that are a source of wealth (palm oil, rubber, timber) and have medicinal and healing qualities. Meeting western demands helps feed the domestic populations. "Nature will provide".

Table 4. *CLA – The "Global Charity" Zone (economic scarcity)*

CLA Level	Societal Approach/ Thinking
Litany (what we say)	Water provision is the role of the government on a national level and a role of women on a local level, who carry water over long distances. Education on disease is limited. Water is seen as a gift from Allah. Tainted water is a curse from Allah. Oceans and rivers supply food.
Social Causes (what we do)	Water quality and access are a major concern. Men work to earn a living while women are responsible for unpaid labor which includes fetching water. Water borne disease has huge impact on survival rates, medical costs and self sustainability but means are limited so we make do with what we have. Low water access reduces food supply increasing dependence on foreign aid.
World View (how we think)	Women carrying water for the household is an androcentric world view. Birth rates remain high to combat high mortality rates. Western scientific interventions are seen as a silver bullet. Food aid always come in time to save the masses.
Myth and Metaphor (who we are)	"Water means life and death - the prayer to Allah brings rain". Every drop is a gift and water is sacred no matter how dirty. In a patriarchal rural society women are water suppliers, men are water consumers. Changing seasons bring hope or despair.

Table 5. *CLA – The 'Tension Driven' Zone*

CLA Level	Societal Approach/ Thinking
Litany (what we say)	If a river passes our land or if there is a ground water available below our land, we have the right to its water. Increasing demographic pressures on the water require us to make the most of available water resources. Most multilateral treaties fail to reach a far-reaching agreement or framework especially when there is a contentious issue.
Social Causes (what we do)	River basins transcend national boundaries. Exclusive ownership of water is preferred. Unilateral agreements that do exist are not holistic or inclusive especially those on shared groundwater aquifers.
World View (how we think)	Upper riparian nations have the right on water. The country with most power to exert has the right over water in a given basin (Might is right).
Myth and Metaphor (who we are)	"Power from individual ownership of nature" and "Might is right". The proverbial idea of the sovereign individual/ state as a single entity. Inequitable sharing due to political strength one nation exerts over another.

Table 6. *CLA – The 'Disaster Prone' Zone*

CLA Level	Societal Approach/ Thinking
Litany (what we say)	There is drought and then there is flood. There is lack of effective use of water. Population increase and competing uses put stress on water resources.
Social Causes (what we do)	Watersheds are not managed properly so are prone to disasters. Each sector of society has distinct beliefs about water, at times in conflict with each other, that go unquestioned. What gets flushed is out of sight and out of mind.
World View (how we think)	Our society is confounded by how or when to tackle a problem. Industry in denial looks for most cost effective methods. Someone else is responsible for environmental degradation. Repeating mistakes made by other nations. We have been making use of our rivers in this manner for centuries.
Myth and Metaphor (who we are)	"Wrath of mother nature – punishment of our sins" We are in denial about our dying rivers, inefficient water usage, and melting glaciers. Success means a bountiful crop and plenty of water for agriculture.

The CLAs in tables 1-6 deconstruct the cultural practices and societal approaches revolving around water management into four levels of analysis. The goal is to discern that although Islam is a common factor in each of the zones, there are diverse value systems, cultures and lifestyles playing a part in how water is managed in each of the zones. These cultural and geographical

underpinnings allow for reconstruction of location specific alternative futures for each zone. This analysis is continued in section 7 where a triangulation between the common sense Muslim understandings, culture and the hydro-geological zones is used to explore alternative solutions for future water management.

What will challenge the current Water Map?

Now that we have mapped the six distinct zones forming our water map and the different strategies around the Muslim world for water consumption and usage and the various layers of perception that drive the different strategies, we look at certain global phenomena that might change this water map as these zones move into the future. These phenomena include 'Planetization of water', 'Geo-politics of water' and 'Globalization of water'.

Planetization of water

The amount of water present on Earth is finite. Nearly 97 percent of all water on the Earth is stored in the oceans. The freshwater accounts for about 2.5 percent of the total storage out of which 69.6 percent is contained in the polar icecaps and glaciers while 30.1 percent is contained in groundwater. The freshwater contained in lakes, streams, rivers, and marshes represents only 0.26% of all freshwater available on Earth (Hornberger et al., 1998). Water is required both for humanity and biodiversity. According to Falkenmark and Rockstrom (2004). Nearly 80 percent of the world's population is exposed to high levels of water security threats, largely in the developing world where 1.1 billion people lack access to formal water supply and 2.5 billion people lack safe sanitation. Most of the developed world uses technology to remedy the symptoms rather than limiting the threats at their source. Built infrastructure jeopardizes biodiversity, and renders habitats associated with 65% of global river discharges, moderately to highly threatened (Vorosmarty et al., 2010)

The biggest threat to secure availability of water for ecosystems is the pressure exercised by humans on finite fresh water resources. These pressures involve human water demand and water dependent land use agriculture (Falkenmark & Rockstrom, 2004, p.45). A recent study conducted in Finland and the Netherlands shows that the effects of changes in population on water shortage are roughly four times more important than changes in water availability as a result of climatic change (Kummu et al., 2010). It is predicted that by year 2050 the world's population will reach 9.1 billion, 34 percent higher than today. Nearly all of this population increase will occur in developing countries. In order to feed this larger, more urban and richer population, food production must increase by 70 percent, preferably by limiting the irrigation of non-food crops like cotton and biofuels. Annual cereal production will need to rise to about 3 billion tons from 2.1 billion today and annual meat production will need to rise by over 200 million tons to reach 470 million tons (FAO,2009), all of which are water and energy intensive processes. In a carbon-constrained world, the large amounts of energy needed to pump and desalinate water, will increasingly require that the water and energy footprints of economic development be considered jointly.

There is plenty of freshwater in the world to meet the current consumption

patterns, however the regional and local averages of water availability and access vary greatly. Some regions or nations have high hydrological water availability yet suffer from water stress due to inadequate funds to invest in water infrastructure. Others may appear to be statistically water stressed but are able to alleviate the natural shortcomings through capital investments into desalination, storage reservoirs and groundwater extraction. According to IPCC's 4th Assessment Report, Climate Change will have a significant impact on the global sustainability of water supplies in the coming decades. By the 2050s, the area of land subject to increasing water stress due to climate change is projected to be more than double that with decreasing water stress, however in many regions, climate change will lead to increased precipitation variability and seasonal runoff shifts in water supply, water quality and flood risks. This is expected to lead to decreased food security and increased vulnerability of poor rural farmers, especially in the arid and semi-arid tropics and Asian and African mega-deltas (IPCC, 2008).

Geo-politics of water

Most of the world's fresh water resources are contained in watersheds and sub surface aquifers that traverse national boundaries and are shared by more than one nation. According to the IPCC, climate change is expected to change the timing and quantity of precipitation and runoff and its impacts will vary from region to region and from basin to basin. The drier regions in the mid latitudes are expected to receive reduced runoff and the number of extreme events of flooding and drought is expected to rise, both in frequency and in duration. The groundwater pumping will increase to offset the reduced surface water flows due to climate change in some regions (Gleick et al., 2009).

The impact of the changes in runoff will be felt multifold when a system is shared amongst nations with disparate adaptive capacities. According to Timmerman & Bernardini (2009), fresh water supply is limited and dwindling as the global population increases and with it the demand for water increases leading to a potential increase in water conflicts especially in shared watersheds. A recent study on floods in a transboundary context concluded that although only 10 percent of all river floods are transboundary, these floods represent a considerable amount of the total number of casualties, displaced or affected individuals and financial damages worldwide. The situation is compounded by the inherent difficulties in managing floods that cross borders (Timmerman & Bernardini, 2009).

Prevention and resolution of potential conflicts between water uses in riparian countries, and avoidance of severe effects of floodings, droughts, accidents, etc., especially in transboundary waters, compel countries sharing a water resource to reach agreement on common rules and procedures of cooperation to jointly manage these water resources. Transboundary water management therefore requires coordination over different political, legal and institutional settings as well as over different information management approaches and financial arrangements (Timmerman & Bernardini, 2009). Countries with economies in transition and less developed countries are among the most vulnerable to the adverse effects of climate change; in addition, widespread poverty limits their adaptive capacity. The fact that many water bodies cross boundaries, means that risks and challenges are shared and that

solutions therefore need to be coordinated. Transboundary cooperation in developing adaptation strategies is urgently required. Implementing integrated water resources management supports adaptation and is the way forward for many developing countries. As stated by the United Nations Economic Commission for Europe (2009), the core principles of integrated water resources management (IWRM) include planning at the river basin level, strong inter-sectoral cooperation, public participation and making the best use of water resources.

In recent years there has been some momentum around signing global water treaties. According to Fred Pearce, water is the most important global resource that does not have an international agreement. More than 40 percent of the world's people live in 263 river basins that traverse international borders. Transboundary rivers contain 60 percent of the world's river flows, out of which two thirds have no agreements on water sharing (Pearce, 2012). Two treaties that could potentially fill this void include the UN Convention on the Non-Navigable Uses of International Watercourses which was a statement of principle that nations should ensure the "sustainable and equitable use of shared rivers". This treaty has 28 signatories to date and requires 35 nations to ratify it in order for it to come into force. The second treaty with the potential of becoming global is the Helsinki convention. This began as a deal on river cooperation between European nations under the UN Economic Commission for Europe, but at the recent Meeting of the Parties in Rome, its members have voted to allow any nation to join. Under this convention an implementation committee was established to render practical case-tailored assistance to prevent water-related disputes and support Parties in their efforts to implement the Convention (UNECE, 2012). These treaties could end the habitual hydrological secrecy of many upstream nations, who treat river flow data as state secrets (Pearce, 2012).

Globalization of water

As a result of the changes brought about in the global economy by neo-liberal globalization, water will become a global commodity as a coping mechanism to water scarcity, characterized by water property rights, free markets and free trade (Olmstead, 2003). Many goods consumed in a country are produced abroad. Consumption in a country impacts water systems elsewhere in the world where the production processes take place. Virtual water flows across national and regional borders. This makes most countries dependent on water resources in other parts of the world, making water a global commodity.

The globalized world has given rise to virtual water trade. The water footprint of western countries on the rest of the world has now become a contributing factor to the global water crisis. Whenever a T-shirt made of Pakistani cotton is bought, Thai rice is eaten or coffee is consumed made from Central American coffee beans, the hydrology of these regions is influenced because a portion of water is taken from The Indus, the Mekong or the Costa Rican rains. It requires 25 bathtubs full of water to grow the 9 ounces of cotton needed to make a T-shirt, 25 gallons of water to grow a portion of rice and 2650 gallons or 10 tons of water to grow a 1-pound jar of coffee (Pearce, 2006).

A classic case of water becoming a global commodity is the sale of pristine glacial water from Alaska to the Middle East, through privatization and allowing

market mechanism to allocate a scarce resource. The Blue Lake of Sitka, Alaska, is fed by snowpack and glaciers, housing trillions of gallons of water so pure it requires no treatment. The city's population of 8,600 barely makes a dent in this precious resource. A staggering 6.2 billion gallons of Sitka's reserves go unused annually. That amount of water is enough to meet the annual domestic needs of a city of 500,000 using 50 gallons per person per day. True Alaska Bottling Company has purchased the rights to transfer 2.9 billion gallons of water at one penny per gallon a year from Sitka. And S2C Global Systems, a water supply management company is building the bottling facility in India posing as a water hub in the Arabian Sea. In a few months time, 80 million gallons of Blue Lake water will be siphoned to a bulk bottling facility in Mumbai via oil tankers. From there the water will be shipped to a number of drought plagued cities of the Middle East (Interlandi, 2010).

Major constraints on water access in many countries are the growth in population, increase in water withdrawals for industry and agriculture and lack of funds to build water infrastructure. By 2025, water withdrawal for most uses is projected to increase by at least 50 percent; this will severely limit irrigation water withdrawal, further restraining food production (Rosegrant et al., 2003). To cope with short-term and long-term water shortages, Olmstead (2003) argues that clean water can be efficiently allocated for human consumption by making use of market based incentives for consumption and conservation of water through water pricing within and between various markets, including agricultural, industrial and domestic use.

Global Perspectives on Water Futures

The futures of water call for a global initiative much like ozone layer depletion and climate change. The solution to future water problems require concerted efforts on the part of all nations based on their local science, culture and knowledge; also known as glocalization of water. These local efforts include control of population growth, conservation of water through water pricing, being cognizant about water footprints, taking measures to augment water supply and adopting integrated watershed management techniques.

The local efforts also require striking a balance between human water needs and ecosystem health in order to be sustainable. The huge amounts of money spent on water infrastructure globally has safeguarded water supply in the developed world at the expense of nature but most developing countries cannot afford such investments. An article titled 'Global threats to human water security and river biodiversity', published in the journal 'Nature', urges developing countries not to follow the same path as the developed world. Instead, it suggests that 'governments should invest in water management strategies that combine infrastructure with "natural" options such as safeguarding watersheds, wetlands and flood plains' (Vorosmarty et al., 2010). Development organizations are advocating the idea of integrated water and watershed management, where the needs of all users are taken into account and where natural features are integrated with human engineering as a solution to the global water stress. The developing world can opt for greener, less expensive options like using wetlands and flood plains for water purification and aquaculture instead of draining them for agriculture. The watershed should be managed so as to provide adequate

supplies for all other competing uses (Black, 2010).

Alternative CLA Approach to Water Management Incorporating Islamic Ideology

This section explores alternatives to the current world view and metaphor around water management in the Muslim world by incorporating basic Islamic principles into water management policies or public awareness campaigns. These alternative approaches to managing water are based on the common understanding of the Quranic text and Islamic religion and the importance of nature and environment within. These principles are often not made the basis of water policy in most of the Muslim countries because up until recently there was no need for nor was there any tradition in the Islamic history of forming specific water policies for water management and distribution. Water was always seen as a human right and a gift from Allah whereas water shortage was perceived as a stroke of fate and Allah's prerogative. The paradigm shifted with the advent of new water management and storage technologies, mostly developed in the west, that allow humans to play a part in water availability and not solely depend on nature. As water shortages meet with other stressors of present times such as population increase and climate change, there is a need to internalize the Islamic principles into water management strategies just the same way as they are a part of every other aspect of Muslim life. The analysis is given in the CLA format for each zone.

Table 7. *Zone 1 – Oil Barons in the Desert*

CLA Level	Alternative Approach
Litany	Solar and tidal powered desalination plants and water treatment help augment sustainable water supplies.
Social Causes	The oil industry invests in renewable energy technologies
World View	Fossil water and oil are limited in supply and are blessings from Allah which should be preserved for future generations. Sustainability is the way forward.
Myth and Metaphor	"Trust in Allah but tie up your camel." Taking ownership of our future and securing our resources will help us achieve a desirable water future.

Table 8. *Zone 2 – Water Stressed (physical scarcity)*

CLA Level	Alternative Approach
Litany	Environmental flows in rivers allow for healthy watersheds. Treated effluent and water preserves rivers and biodiversity.
Social Causes	Exploring alternative methods of augmenting water supply in times of water shortages such as rain water harvesting, water treatment and putting available resources to their most efficient uses.

World View	Water is finite and increase in demand does not always come with increase in supply. There is a need to conserve the available water resources and the health of watersheds.
Myth and Metaphor	"Among the most beloved of deeds to Allah is the one that is continuous, even if it is little." Water is a blessing from Allah and should be preserved in a manner that would allow the future generations to benefit from it.

Table 9. *Zone 3 – Mediterranean to Tropical*

CLA Level	Alternative Approach
Litany	Extensive water treatment prevents water borne diseases and preserves health of the watersheds.
Social Causes	Preserving the quality of water bodies helps preserve human health
World View	Human and environmental health are interlinked and are blessings from Allah. All other life forms upon which humans depend are sacred and are all Allah's creations.
Myth and Metaphor	"Cleanliness is half the faith". Water is precious, it brings life and purifies sins and its sanctity should be preserved.

Table 10. *Zone 4 – Global Charity (economic scarcity)*

CLA Level	Alternative Approach
Litany	Rainwater harvesting and introduction of water markets helps alleviate the effects of droughts.
Social Causes	The civil society joins hands with the government to find local solutions to water shortages. Female empowerment through education increases domestic health and wealth and stabilizes fertility rates.
World View	For long term solutions to water shortages one needs to look beyond what the government and foreign aid has to offer. Men and women are equal in the eyes of Allah and should share domestic and social responsibilities and move toward social equity.
Myth and Metaphor	"Allah helps those who help themselves".

Table 11. *Zone 5 – Tension Driven*

CLA Level	Alternative Approach
Litany	Countries unite to create neutral water management bodies for transboundary integrated water resource management.
Social Causes	Equitable distribution of water resources can prevent water wars.

World View	Joint management of watersheds provides synergistic solutions. Less political and social tension supports domestic harmony.
Myth and Metaphor	"Share in the abundance (as well as the scarcity) of all the blessings of Allah because they are finite and people as inheritors are accountable to Allah for their actions on earth. Human beings are stewards of Allah on Earth."

Table 12. *Zone 6 – Disaster Prone*

CLA Level	Alternative Approach
Litany	Integrated watershed management, sewage and drinking water treatment, and better planning of urban settlements helps reduce the impacts of natural disasters.
Social Causes	Protection against all the stressors on water systems is the key to protecting our water resources.
World View	Access to water is the fundamental right of every human being and this blessing should be sanctified and equitably distributed.
Myth and Metaphor	"Disowned future shows no mercy". We need to address the issues in a sustainable manner now to mitigate the impacts of natural disasters on our populations and future generations. We can create better futures.

Conclusion

The Muslim world cannot afford to waste a single drop of water. Governments should urgently implement sustainable water management policies which rationalize demand to ensure more efficient use. This can be achieved by attaching an economic value to water, measured by the value of the end product from each drop. Governments should implement water efficiency measures, shift from irrigation by flooding to more efficient irrigation systems including drip irrigation, introduction of crop varieties that are resilient to salinity and aridity, recycle, treat and reuse wastewater, and develop affordable technologies for water desalination.

Islamic principles stress women's rights, especially their equal rights to education and inheritance. According to a saying of Prophet Muhammad, "Acquisition of knowledge is binding on all Muslims (both men and women without any discrimination)". Providing equal educational and inheritance opportunities would empower women with wealth and education, enabling them to become valuable members of the labor force and the economy. Taking women away from solely domestic roles has many long term benefits such as economic development, a lower fertility rate and prevention of water borne diseases thus improving public health and reducing stresses on water and food production.

Given the importance of water in Islam, a management instrument that broadens traditional economic water management approaches to include nontraditional cultural and spiritual approaches is more likely to succeed in

the Islamic world. This would involve looking for solutions beyond the litany level and changing the world view and metaphor around water management by incorporating the Islamic principles into water management policies or public awareness campaigns. This grassroots, bottom-up, culture and religion based approach to water conservation and protection may help the Muslim world look beyond the neoliberal globalization of water, where water is just a commodity.

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Note

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