

**A Recipe for Sustainable Drink:
Comparative Analysis of Clean Water Practices in North Africa**

by
Jennifer L Meyer

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The Universal Declaration of Human Rights establishes the right to clean water, entitling everyone to “sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses”. This rationale is the inspiration for comparing the effects of clean water strategies. A comparison between Tunisian and Egyptian approaches will evaluate best practices for providing sustainable clean water services to growing urban and rural populations. There is a global effort to monitor a country’s self-help capabilities; and the international attention given to sustainable development motivates state commitments to this issue. Identifying the competence of current water policies will address modifications needed to improve clean water management strategies. To provide a more comprehensive examination of resources and the different sustainable water practices available in the North African region, some information will be included on neighboring states.

Natural resources are manipulated as a tool to gain economic advantages, political leverage, and or exploited. Water management is a vital issue in countries with ecosystems akin to Tunisia and Egypt. A lack of certain resources can be a source of tension, therefore reshaping policies to promote sustainable action is imperative. The Millennium Development Goals in conjunction with the objectives of Earth Summit will provide insight into current sustainable approaches as well as recommend useful resources.

The review will identify international goals for sustainable development, then Tunisian and Egyptian statistics in how relevant water issues in North Africa can be addressed in a sustainable manner that can improve state relationships. The findings of my research emphasize the impact of clean water on urban and rural populations, and the most successful water management techniques in the region. The conclusion then highlights the recipe for developing sustainable water management in North Africa. This recipe includes the best ways to monitor progress and why decentralized water management is successful in delivering potable water.

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I do, on this Friday of March 12, 2010, dedicate this unique pile of literature to the lovers of knowledge, my fellow world travelers, and the fans of Beaver Nation. J'espère que vous apprécierez ma petite contribution de la littérature et que vous apprenez quelque chose. Je vous remercie Dieu; vous m'avez donné la force finir.

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Maps and Graphs¹

Figure Key (Lower Right of Image):

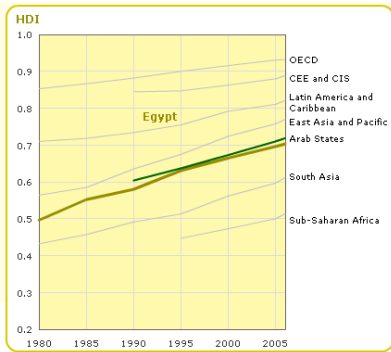
- A) Egypt Map
- B) Tunisia Map
- C) Human Development Graph (Egypt)
- D) Human Development Graph (Tunisia)
- E) North-Western Sahara Aquifer System



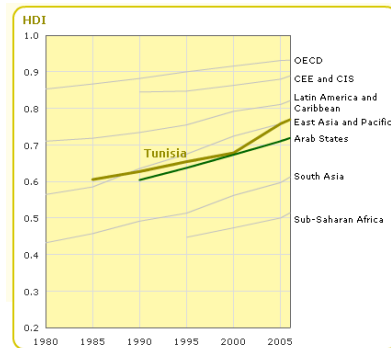
(A)



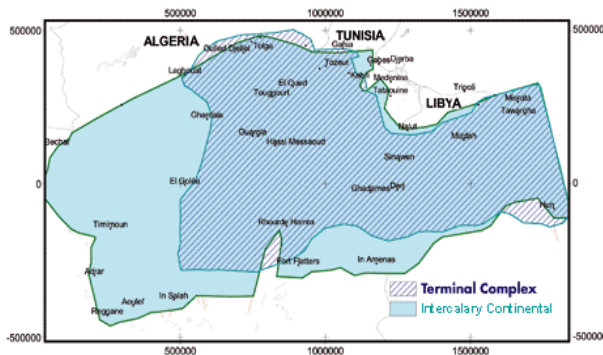
(B)



(C)



(D)



(E)

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A Review of the Literature

The United Nations created eight Millennium Development Goals (MDG) to “respond to the world's main development challenges” by the year 2015 (United Nations Development Program [UN DP], 2006). One of these challenges is to “reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015” (Living Water International 2009, & UNDP, 2006).

The Seventh MDG (MDG-7) targets the integration of sustainable development principles into country policies and programs (also reversing loss of environmental resources). Under MDG-7 are several targets, but this thesis will focus on MDG-7, Target 7-C, which is: Reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation (United Nations Development Programme [UN DP], 2006). The World Summit for Sustainable Development (WSSD) also accepted this goal including two specific components found under WSSD Target-10: Reduce biodiversity loss and reducing by half the proportion of people without sustainable access to safe drinking water and basic sanitation (UN DP, 2006). The ways different states are approaching Target-10 oriented goals are an essential to this thesis. According to MDG documents focused on MDG-7, it is difficult to monitor and report “progress towards environmental sustainability” (UN DP, 2006).

After reviewing progress reports of over sixty countries, MDG experts wanted to improve monitoring capacities. It is important to establish that MDG recognizes the challenges related to the MDG-7 in this statement:

Environmental sustainability is a complex, multi-faceted, holistic, value-laden concept that is not easily quantified. While it is generally recognised that environmental

sustainability is about meeting human needs without undermining the capacity of the planet's ecological systems... there is no universal agreement what environmental sustainability means at an operational level (UN DP, 2006).

MDG experts differentiate between the capabilities of developing countries versus more industrialized states; for this reason, many goals will be state specific. Some indicators to measure the progress of MDG-7 include reporting the "Proportion of population with sustainable access to an improved water source, urban and rural" and the "Proportion of population with access to improved sanitation" (UN DP, 2006). There are different components of environmental sustainability and therefore countries will have specific goals for maintaining the long-term integrity of natural resources. There is no universal quantitative standard for meeting this qualitative target and so countries must adopt alternative approaches.

In addition to MDG, the Human Development Report (HDR) reveals a broader measurement in how living conditions are influenced by certain variables. The HDR has been publishing the human development index (HDI) since 1990, providing:

A composite measure of three dimensions of human development: living a long and healthy life (measured by life expectancy), being educated (measured by adult literacy and gross enrolment in education) and having a decent standard of living (measured by purchasing power parity (PPP), income)... What it does provide is a broadened prism for viewing human progress and the complex relationship between income and well-being (Human Development Report [HDR], 2009).

Many factors are used to measure the HDI and the right to accessible clean water is a factor

that also represents the progress a state has made to improve its standards of living. Literature on the effect of clean water is abundant and the appropriate strategies for creating policies that support sustainable water management are growing.

Before going further, I want to establish that one of the factors for water deficit is “low annual rainfall, distributed unevenly over space and time, and increasing water demand” in addition to how natural resources are being utilized (Hill & Woodland, 2003). The Geographic Journal studied a 1997 National Report by Hill and Woodland (2003) providing insights into the region. The differing water availability arising from the climatic differences presents the need for distinctive and appropriate methods of water management. The needs for Egypt will be different from those of Tunisia, and the focus of this paper is to address primary water issues including: shared water (underground, rivers, etc.), sustainable resource approaches, and potable water strategies that are successfully implemented.

A condensed review of Tunisian and Egyptian participation in both MDG-7² and each country’s progress toward alternative clean water practices will highlight obstacles and solutions for the North African region. Synthesizing international (sustainable development) objectives with the progressive initiatives of these countries will draw attention to the reality of their performance.

Republic of Tunisia

The country better known by its conventional short form name, Tunisia, is one of the Al-Maghreb states in North Africa. The Arabic term Maghreb translates to “place of sunset”

² MDG Seven, Target 10 (UN DP, 2006)

referring to the Arab perspective on its western Arab states. Though Tunisia received independence from France in 1956, the French and Arab cultural ties are very apparent. Arabic is the primary language, but French is commonly spoken and original French titles are still used for an abundant number of national and non-governmental institutions and policies. Throughout this report will be a mixture of foreign acronyms with English translations.

Tunisia is 163,610 square kilometers (slightly larger than the US State of Georgia) and has a population of approximately 10.5 million people located primarily in urban districts in the North, where the climate is more favorable (CIA: World Factbook, 2009). Tunisia is located in North Africa between Algeria and Libya with the Mediterranean Sea providing the north and east shore border and the Sahara Desert making up the South. Away from the coastline, the climate becomes semi-arid, then arid in the South. For research purposes, I have divided Tunisia into two comparative regions (North and South-Central) to better understand climate and resources.

The Euro-Mediterranean Information system³ reports that in comparison with other developing states, Tunisia is successfully improving access to safe drinking water. However, current literature suggests that further improvements can be made to provide rural Tunisia better access to clean water and sanitation services. These noted improvements to decrease pollution in urban centers and encourage sustainable practices (like recycling), will help further this development in Tunisia and other countries in North Africa. Appropriate water allocation is a primary factor for development especially in rural areas. However, as pointed out in “A History of Islamic Societies” understanding traditional methods of water management is

³ Cascão, A.E. (2009). Water Alternatives, Vol. 2.

important for understanding the options available and the effects on the environment and people (Lapidus, 2002). Development shall be defined in this paper by the movement toward sustainable living and access to potable water.

Today, there are five agencies under the Ministry of Environment and Sustainable Development responsible for implementing national policy in specific areas. These organizations are: National Environment Protection Agency (ANPE)⁴, National Renewable Energies Agency (ANER)⁵, Tunis International Center for Environment Technologies (CITET)⁶, National Agency for Coastal Protection (APAL)⁷, and National Office of Sanitation (ONAS)⁸.

The Tunisian government responded to the Earth Summit of 1992 in Rio de Janeiro, Brazil, by developing the National Sustainable Development Commission (CNDD)⁹ the following year. CNDD works with Tunisia's Ministry of Environment and Sustainable Development and reports progress back to Earth Summit officials. This major United Nations conference brought together over one hundred heads-of-state in order to address environmental and sustainable development concerns (Earth Summit, 1997).

During the UN Conference on Environment and Development (Earth Summit, 1997), the Commission on Sustainable Development (CSD) was formed as means to identify states adhering to the Earth Summit agreements and report on the implementation process. Conference leaders also created Agenda 21 to address four critical elements of development: Social and Economic Dimensions, Conservation and Management of Resources for

⁴ Original French Acronym: Agence Nationale de Protection de l'Environnement

⁵ Original French Acronym: Agence Nationale des Energies. Renouvelables

⁶ Original French Acronym: Centre International des Technologies de l'Environnement

⁷ Program referring to: L'Agence Nationale pour la Protection du Littoral

⁸ Original French Acronym: L'Office National de l'Assainissement

⁹ Original French Acronym: Commission Nationale de Développement Durable.

Development, Strengthening the Role of Major Groups, and Means of Implementation.

This thesis will use Agenda 21 (**section III**) as a measuring tool to report on the progress of Tunisia and Egypt from Earth Summit to the present year of 2010. Important chapters listed among Agenda 21 (by section) include:

I: International cooperation to accelerate sustainable development in developing countries and related domestic policies, combating poverty, promoting sustainable human settlement development, and Integrating environment and development in decision-making.

II: Protection of the quality and supply of freshwater resources: application of integrated approaches to the development, management and use of water resources

III. Recognizing and strengthening the role of indigenous people and their communities, strengthening the role of non-governmental organizations: partners for sustainable development, Local authorities' initiatives in support of Agenda 21

IV: Sharing environmental technology

These chapters are relevant because they highlight the broader goals of Tunisia's CNDD. Earth Summit was a milestone for the sustainable movement at the international level. Conference members and non-members alike addressed a very important issue of the time: the growing scarcity of water.

Agenda 21 is significant to this analysis because it adopted the strategy for achieving sustainable development in the 21st century. To clarify, the Commission on Sustainable Development was created to monitor Earth Summit agreements and review progress of states, according to the United Nations (Earth Summit, 1997). The aforementioned agencies in Tunisia have responded to the goals of Agenda 21 and which the difficulties/ progress will be described in the *Analysis* section.

Tunisia's National Agency of Environmental Protection serves as Secretariat to the CNDD

and will be given an assessment to reveal if it is in accord with Earth Summit's overall mission under the *Findings* section. This literature demonstrates the types of effort Tunisia is making to honor its commitment to Earth Summit agreements.

CNDD is chaired by the Prime Minister of Tunisia and is comprised of members for government, parliament, and various representatives (Tunisian Union for Industry, General Union of Tunisian Labor... and environmental protection non-governmental organizations). CNDD is also supported by a "technical committee chaired by the Minister of the Environment and Land Use Planning, and composed of representatives of relevant Ministries, experts ...research institutes, and NGOs" (Tunisia Online, n.d.). Different national actors working for economic and social development report to their respective ministries, which get reported to CNDD.

Programme 26-26 is another Tunisian initiative and is associated with the National Solidarity Fund, whose case study will be assessed in the *Findings* section. The National Solidarity Fund was "established by virtue of the 1993 Finance Law (articles 29 through 33), and is better known as the 26-26 Fund or Programme 26-26 (Carthage Palace, n.d.). The 26-26 Fund, a title referring to its current account number, "aims at financing the various interventions decided by the Head of State for low-income social categories and for regions deprived of the basic infrastructure... which are not covered by the ordinary projects and programs of the State and local collectivities" (Carthage Palace, n.d.). This fund is important for the implementation and advancement of projects that serve the central and regional administrations, allowing decentralized management to handle issues region to region. Means

are financed by donations (public and private) from individuals, organizations, and other countries. Micro-credit grants are also utilized to support Programme 26-26 ventures.

The public mission statement of the 26-26 Fund is to provide assistance in certain areas that “cannot benefit from the state’s ordinary programs because of high costs” (Carthage Palace, n.d.). Primary projects are focused in the following: roads and tracks, electricity, drinking water, schools, health care centers, youth centers, leisure areas (n.d.). Other associations of this social policy include economic and social development. Improving living conditions is the goal of the initiative, and this goes back to the importance of clean drinking water. According to Tunisia’s 26-26 statistics, the “rate of connection to potable water supply networks in rural areas increased from 60.6% in 1994 to 93.5% in 2008” and is expected to continue increasing (n.d.). Case studies on programs like this one and other initiatives will be analyzed later on in this thesis

Now, with a better understanding of the managing agencies, it is important to refocus the review of literature on the allocation of clean water. The actual water management approaches will be addressed in two primary regions of Tunisia: North and South Central. There are three climate zones (Mediterranean, semi-arid, and arid) and different methods designed specifically to deal with water deficit in these areas. The majority of UN case studies will be identified and analyzed within the *Findings* and *Analysis* sections while this section will serve to introduce relevant background information specific to Tunisia.

The Tunisian Water Forum is an opportunity to present the latest technology and research in various aspects of water resources development, protection and management. As a

forum for debating policy matters relative to water conservation and environmental protection, it provides the opportunity to present the latest technological developments (Tunisian Water Forum Home, 1996). The outcomes of the TWF and other case studies will be analyzed in the *Findings* section.

Another UN case study later focused on is the “AQUIFER: Tunisia exploiting Space for the management of the transboundary aquifer NWSAS (SASS)” (UN CSD WAND, 2007: A)¹⁰. As aforementioned, the United Nations Division for Sustainable Development (UN DSD) gave approval as a best practice for preventative action, and the Water Action Network Database (WAND) has received appraisal for the support it provides in the international effort to address goals on water and sanitation.

Additional UN WAND cases show the steps Tunisia is taking by working with the African Development Bank, and other agencies to push for joint efforts to address issues like the Rural Water Supply and Sanitation Initiative, The African Water Facility (for Financing Local Actions) initiative, the SAI project (addressing shared aquifers) and numerous others that are working for the progress of improving the quality of life in North Africa through means of potable water. These initiatives will be assessed in the *Findings* section. It is important to keep the broader picture in mind of the global proposal to improve access to better sanitation/ drinkable water and to see how specific state action can influence regional relationships.

Arab Republic of Egypt¹¹

The country better known as Egypt is located in northeast Africa, bordering the Mediterranean Sea, with Libya to the west and Israel and Red Sea to the east. Egypt can be

¹⁰ United Nations Commission on Sustainable Development Water Action Network Database

¹¹ Country name in Conventional Long Form (CIA: World Fact Book, 2009)

divided into two regions: Upper Egypt and Lower Egypt. Lower Egypt actually refers to northern Egypt, and Upper is the southern half; this is because the Nile River flows toward the Mediterranean, and Upper Egypt encounters the river first. The Nile is the longest river in the world and also the primary source of water supply in Egypt. This river has brought fertile soil to a narrow valley of Egypt that hosts the majority of the population, which has grown to over seventy-two million. Without the Nile Egypt would be almost entirely desert except for scattered oases.

According to World Bank reports (2008), Egypt is over ninety-five percent desert, leaving less than five percent of the country habitable. Since Egypt is dependent on the waters of the Nile, the majority of the Egyptian population lives along the river and Mediterranean Sea. The majority of the country being desert, most agricultural activity also takes place along the Nile causing dense population centers that are constantly growing.

The World Bank (2008) reports that Egypt's population is predicted to increase and with that comes the pressure of also increasing water supplies to the already high demands. The water issues in Egypt also pertain to agriculture aspects, which uses approximately eighty-six percent of the water withdrawn from the Nile. Dependency on a trans-state-boundary water source brings up political issues related to the lack of water supply in that region of the world.

Egypt's Holding Company was established in 2004 by presidential decree in order to restructure the "Drinking Water and wastewater sector to benefit Egyptian citizens" (Egypt Holding Company, 2008). The purpose of the Holding Company is "to purify, desalinate, distribute and sell Drinking Water and collect, treat and safely dispose of wastewater, either

itself or through affiliate companies” in attempts to provide high quality water and wastewater services and keep clean environment to protect the health of the Egyptian citizens” (Egypt Holding Company, 2008).

Egypt is an ideal country to study for there is already extensive literature on its water-sharing issues, along with an abundant number of case studies on the Nile River basin, and underground water supply, affecting more than just Egypt. By also understanding important case studies, the *Findings* and *Analysis* sections will reveal the pros and cons of current strategies increase sustainable development as defined earlier by United Nations MDG. One such case study from the UN DSD, is another Water Demand Initiative, abbreviated as WaDIMENA. This acronym is also “inspired by the Arabic word ‘wadi’ which means ‘stream’ or ‘riverbed’” in combination with the Regional Water Demand initiative for the Middle East and North Africa abbreviated as MENA (UN DSD, 2009: B). Included in the case are a few relevant themes related to sustainable development in Egypt: Safe Drinking Water, Means of Implementation, Integrated Water Resource Management, Sustainable development in a globalizing world, Ecosystem Management, Monitoring and Evaluation, etc. (UN DSD, 2009: B).

The Water Demand Initiative reveals that “low annual rainfalls and a low per capita volume of renewable water resources make the Middle East and North Africa region the most water-scarce area in the world” (UN DSD, 2009: B). Studying this United Nations case study also reveals expert opinions who are saying that “countries with less than 500 cubic metres of water per person per year have reached the “water barrier” — a critical line below which it becomes difficult to survive. Several MENA countries have already fallen below the water

barrier, while others hover close to the line” (UN DSD, 2009: B). The purpose behind studying WaDI in the MENA region is to illustrate the way international relations plays into sustainable development.

This initiative was actually supported by the Canadian International Development Agency and the International Fund for Agricultural Development in order to share regional and state to state information and experiences. A successful end result would produce policies that would strengthen Water Demand Management (WDM) programs in the MENA region and further research. Egypt, Tunisia, West Bank and Gaza, Algeria, Syria, and other countries were included in this case study. The majority of case studies will be identified and analyzed in the *Findings* and *Analysis* sections, though for some background perspective some will be mentioned in this section.

While reviewing literature on Egypt, author Cascão, in *Water Alternatives* (Vol. 2), analyzes vital points in understanding the causes of geopolitical influence for this region. An article about state relations regarding the Nile River basin addressed the concept of unilateralism versus cooperation (Cascão, 2009). The author highlights how power relations “have changed over the past decade, and... how these dynamics have influenced not only the political relations... but also the management and allocation of the shared Nile water resources”(2009).

The first Nile Water Agreement, signed in 1929 “between Egypt and Great Britain on behalf of Sudan and other British colonies in the basin (Uganda, Kenya, Tanzania)” allocated “specific volumetric water” and institutionalized the “belief that Egypt and Sudan had ‘natural and historic rights’ to the Nile water” (2009). However, when former colonies and state

became independent, the former agreement was contested and replaced. The dynamics of balancing regional cooperation will be analyzed in the *Analysis Section*.

Again, in 1959, another agreement was made with upgraded volumetric allocations that were renegotiated to fit Egypt's High Aswan Dam. This new agreement "reinforced downstream claims of "natural and historic rights" to the Nile waters" but the "upstream riparians were not included in the Agreement, and have continuously criticised its bilateral nature" (Cascão, 2009). Historically and now still the Nile basin remains a source of tension as populations continue to increase. In 1999, the Nile Basin Initiative was established as the "first cooperative institution in the basin to include all ten riparian states. Its goal is to "achieve sustainable socio-economic development through the equitable utilisation of, and benefit from, the common Nile basin water resources" (Cascão, 2009). Though power sometimes has a lot to do with technical control it's also important to take note that the "evolution of the hydropolitical relations in the Nile basin has been influenced greatly by asymmetric power relations between downstream and upstream riparians" (2009).

The Nile is the primary source of water and countries in the Middle East and North Africa (MENA) region feel an urgent need to develop an integrated strategy that includes strong demand management policies, especially with regard to water resources. The literature from *Water Alternatives*, Volume 2, argues that there will be consequences if natural resource policies and macroeconomic policies are not fully assessed (Cascão, 2009). Nile basin hydropolitics have the ability to influence the agriculture sector, trigger socioeconomic changes in many MENA countries, affecting rural poverty, migration patterns, and so forth. The

literature also reveals changes of agreements and negotiations from 1929 to the present decade. It is important to note that the “1959 Agreement represents the backbone of the hydropolitical dilemma in the Nile basin – downstream riparians want to maintain it, while upstream riparians want to replace it with a multilateral agreement based on equitable sharing” (Cascão, 2009).

In addition to using the Nile, Egypt was able to increase harvesting and land cultivation with the construction of the Aswan High Dam during the 1960's and 70's. This water management strategy impacted Egypt's infrastructure and economy by providing stability by generating hydroelectric power. The use of dams in Egypt significantly shapes the control people are able to exercise within the Nile Valley, but understanding the negative impact needs to be weighed against the water management's ability to meet sustainable measurements. Dam issues include diminished fertility of Egypt's coastal waters, salination, decreased soil quality, and sediment build-up leading to erosion, but with the dam come improved technology and opportunity. Another important factor involving economical factors includes the tourism industry.

Keeping current practices in mind, it's also important to know economical and political strategies play a part in shaping the direction for water management in Egypt. Dialogue on an initiative for sustainable tourism will be addressed later in the thesis. This background information on Egyptian water management and resources are mentioned to provide an understanding of the tools and methods being used, and the case studies on Egypt in the *Analysis* section will decide needed modifications.

Methods

Three primary techniques were utilized to collect and analyze information. First, submersion in Tunisia for three months and travelling around the country provided direct access to observe the reality of living conditions to be used in comparison to former literature reports. Second, the opportunity to talk with representatives of national agencies, compare current media reports, and the official recorded statements allowed my analysis to bring in the professional components of Tunisia. Finally, the process of researching literature focused on the areas of appropriate technology development, the Human Development Index, water management policies, and pertinent background information on relevant countries. This data served to constitute the method for highlighting germane insights into the broader topic of sustainable water management in Tunisia and Egypt.

The main tools used for finding literature on related information are derived from United Nations documents (including Earth Summit reports, agendas, and case studies), National reports from Tunisian and Egyptian agencies, and scholastic and professional journals linked to credible publishers. Applying the use of the OSU Library Search Engine, the JSTOR database, and the support of professors and professional librarian assistance to the search of relevant literature produced a variety of texts, which I used to compile my own review of literary data.

The process by which a developing country is able to improve its standard of living correlates to the conditions of Human Rights practices. When basic needs are met, developing nations are more capable of improving other dimensions correlated to progress. Distinguishing

current conditions will aid the pursuit for a suitable course of action to provide sufficient resources to its population (rural and urban). The comparative analysis will conclude with a recommendation for bringing clean water services to regions currently deficient of sustainable water resources.

By identifying strategies and reviewing obstacles in the movement for sustainability, especially in water management, appropriate water policies have been ascertained for the North African region. Narrowing the study of resulting effects that current approaches have on environmental and social conditions based on information gathered (on Egypt, Tunisia, and aforementioned states) enhance the knowledge on current management techniques. The overall comparative analysis benefits states with similar environmental conditions/ resources and is made feasible by keeping the focus of this thesis on actual state conditions and raw data from impartial and capable sources. During the research process and review of literature I learned that data can easily be misinterpreted and incorrectly reported and the best way to analyze progress is by using multiple credible and impartial references. Reviewing international goals for sustainable development and Tunisian and Egyptian statistics provided a good foundation needed before conducting an educated comparative analysis of sustainable development. By also defining specific political terms appropriate to particular state audiences makes an important distinction needed to understand the basic goals of states in the North African region.

Processing and separating relevant data from excessive prose proved a fiddly and tedious practice, but does ensure that valuable information is synthesized into this comparative analysis. There are limited numbers of English literatures on the topic of water management in

North Africa, and understanding the pre-translated text coming from government agencies requires comprehensive knowledge of the primary language of text and the cultural component influencing the writing.

During my research in Tunisia and review of the literature, I encountered language barriers many times. This dimension of international research is important to note because in order to understand the meaning of many official documents and policies, specifically in global and geopolitical matters, it is imperative to be aware of the context and framework for whatever subject is being addressed. The notion of errors caused by words lost in translation can cause inaccuracy in reports. I found it best to compare my sources in their original written language with any English translations I might've used. In addition to double checking the accuracy of interpretations, I found it beneficial to verify the results or findings of a given report with the outcomes or testimonies from a different or completely separate source accounting for the same issue or subject.

It is necessary to note the dimension of language because much of the literature on Tunisian and Egyptian policy is in either French or Arabic. Overcoming this obstacle required finding where to look for English versions of documents and how to find appropriate sources pertaining to sustainable development in correct context to a state's policy and the perceptions of international institutions.

Findings

The United Nations recognizes that "Africa is particularly touched, with more than half the population without access to clean water" and the UN Commission on Sustainable

Development (CSD) is collaborating with agencies and governments to address the issue of water deficiency in the MENA states. The United Nations developed the CSD, which created WAND¹². WAND organizes “web-based tools to disseminate information on implementation and best practices to support international efforts” to meet goals related to water and sanitation (UN CSD WAND, 2006). State progress is measured by the CSD depending on how sustainable goals are being met as well as the state approach to creating policies that promote development for the region.

A statement from the fourth World Water Forum (2006) reiterates that a “lack of access to safe drinking water is a problem of dimensions: More than one billion people are affected worldwide today, and it is estimated that by 2025 this number could grow to three billion people” (UN CSD WAND, 2006: A). The issue of potable water and shared resources transcend the borders of states. The first water management strategy this section will address is shared water resources (state to state).

Another UN case study analyzes the regional action plan of the initiative titled: AQUIFER: Tunisia exploiting Space for the management of the transboundary aquifer NWSAS (SASS¹³). The NWSAS¹⁴ “covers well over 1,000,000 km² of which 700,000 are in Algeria, 80,000 in Tunisia and 250,000 in Libya. It is composed of sedimentary deposits which, from bottom upwards, includes the Intercalary Continental and the Terminal Complex, the two main aquifers level” (UN CSD WAND, 2006: A). In fact, over several decades, Tunisia and Algeria have been

¹² WAND: Water Action Network Database

¹³ SASS: Système Aquifère du Sahara Septentrional (original French acronym)

¹⁴ NWSAS: North-Western Sahara Aquifer System

harvesting these groundwaters in the Sahara. The forum examines regional action plans and organizes global partners to collaborate on issues of shared interest. Tunisia played a major role working with the European Space Agency and other agencies to address the topic of shared aquifers. The agencies reported that “over-pumping of ground water are causing water tables to fall” (UN CSD WAND, 2006: A).

Included in the objective are a few motivating factors for operating together to estimate costs and discuss means of implementation. The World Water forum also stated: Shared water resources are increasingly a source of conflict both within and between countries. Transboundary river basins have been on the agenda for a number of years, but internationally shared (transboundary) aquifers have not been in focus until recently. This is partially due to the hidden nature of ground water resources, making them difficult to evaluate and, consequently, resulting in a lack of reliable information on which to base discussions and decisions. With a large and increasing number of cases of international tension and conflicts related to shared groundwater, there is an urgent need for objective spatial information that can be used effectively by the different countries sharing an aquifer (UN CSD WAND, 2006: A).

These remarks reveal the motivation behind preventative international cooperation in relation to the topic and the broader goals of the UN Commission on Sustainable Development. The targeted case study (also mentioned in Literature Review of Tunisia) is one that will also provide additional benefits by promoting the “the activities and results...to other countries, in particular in Africa” and the data learned now can be used to help find other methods dealing with aquifers (UN CSD WAND, 2006, A).

There is an increasing number of agencies working together to find a solution to the lack of potable water. It is feasible to agree with the World Water Forum's statement that "interest in these resources is growing as a result of population growth and lack of sufficient levels of renewable waters" (UN CSD WAND, 2006: A). The research from this case study also presents "estimates of annual water extraction from this basin amount... 540 hm³ in Tunisia, 1,100 hm³ in Algeria and 250 hm³ in Libya" and "efforts to intensify offtake are likely to be continued in the coming years with over 90% of the water being used for agriculture" (2006: A).

What can be ascertained from this information is that the management of NWSAS¹⁵ will require "integrated study at the basin scale in order to enable management of water resources in a sustainable fashion" and this includes "project aims at developing and demonstrating products and services that are useful to the users, and facilitating their uptake in the daily working operations" (UN CSD WAND, 2006: A). The project recommends laying the groundwork for building and improving "independent service provision capacity, which is the key to achieving the longer-term goal of sustainability" (2006: A). This Aquifer project also aims at involving "African expertise in remote sensing and preparing for a locally provided service delivery after the project" and by incorporating localized help the population benefits and (2006: A). This case teaches the basic needs for sharing transboundary aquifers in North Africa. Groundwater will undergo characteristic changes as it is continually harvested and further study of this Aquifer initiative showed that after the Johannesburg World Summit, Tunisia received several recommendations on how space-based techniques can be used for sustainable development (UN CSD WAND, 2006: A).

¹⁵ NWSAS: North-Western Sahara Aquifer System

Several lessons can be taken away from this study. Projects have been successful when states use an independent organization to monitor reports and when communication is clear between states measuring estimated abstraction of water. Knowing which countries are sharing the Sahara Aquifer System and the specific needs of those countries for withdrawal will provide essential tools for approaching the shared natural resource. Depending on how water is replenished will impact availability and use. The next case review (WaDIMENA)¹⁶ focuses on the idea that water saved equals water increased.

Harmonizing water policies in the Mediterranean basin empowers countries, like Egypt and Tunisia, to frame water usage and minimize injury to the source. Another case study from the UN Commission on Sustainable Development involves the MENA¹⁷ region's water crisis (UN CSD WAND, 2006: B). The case study emphasized the increasing need for more involvement through seawater desalination and more transparency for Water Demand Management (WDM) between states. The emphasis is on the idea that WDM programs can "ensure that less water is used with greater impact" (2006: B). The case study argues that the concept behind "preventing water waste is, in effect, a cheaper and sensible way of increasing the available water supply" (2006: B).

Ideas to take away from this case study include WDM program creativity. It is possible for lower quality water to be used for other purposes than drinking. WDM looks at treated greywater¹⁸ as a freshwater substitute that can be used for irrigation/ watering plants. The

¹⁶ Water Demand Initiative for Middle East and North Africa

¹⁷ MENA: Middle East and North Africa

¹⁸ Low quality water from sinks and bathrooms

difficulties of implementing policies and codes are that they may infringe on freedoms. Most governments don't focus their capacities on enforcing laws requiring homeowners to only water the lawn between specific hours, so this is where education plays a role. Educating communities about low-flow plumbing, drip irrigation, etc. is another recommendation for saving water. An especially important part of this Water Demand Initiative for the MENA region is the concept of "reforming the pricing and valuation of water delivery" (UN CSD WAND, 2006: B).

Dialogues about raising water tariffs in order to have the cost proportionate to the "cost of delivery... generate more revenue to fund water system improvements", and encourage consumers to "rationalize their water consumption patterns" (UN CSD WAND, 2006: B). However, this route can also negatively impact the population that cannot afford increased tariffs, thus policy change must take into account all factors. Overall, the initiative aims to develop partnerships in the MENA region, create practical policies for communities of civil society to benefit water practitioners as well as rural populations in poverty that lack potable water.

It is also helpful to include studies of different country profiles and cases in order to recognize why certain techniques are more successful than others. The following Tunisian case study was deemed a Best Practice report by the UN Department of Economic and Social Affairs under the Division for Sustainable Development. The case study reports again on the fourth World Water Forum in 2006, which determined that "low annual rainfalls and a low per capita volume of renewable water resources make the Middle East and North Africa region the most

water-scarce area in the world” and “several MENA countries have already fallen below the water barrier” (UN DSD, 2009: C). Also, because of “high population growth rates, increased urban migration, and the high proportion of youth within national populations”, the demand for water is only going to increase (2009: C). Therefore, in order to provide a solution, funding must be found and to reiterate, countries involved in the initiative should “prepare for service sustainability by supporting” the local level providers (2009: C).

In addition to reports from the DSD, a National Report in the Geographical Journal also stated that for “terms of water resources for agriculture, sustainability means using water equitably over space and time, replenishing current reserves and safeguarding future supplies” (Hill & Woodland, 2003). An operation dealing with transboundary surface and groundwater resources requires cooperation, compromise, and policies that will have affect on each state involved. Tunisian agencies manage transboundary aquifer issues through the Tunisian Water Forum (TWF), which also brings together international partners. The TWF conducts research and presents the latest technology in the “various aspects of water resources development, protection and management” (Tunisia Water Forum, 1997).

During the TWF, international experts, high level policy makers, and round table panels addressed the ground work that needed to be done as well as share about innovative programs, environmental management techniques, and which systems have been successfully used in Tunisia and could be applied elsewhere. Additional topics included cases studies “in countries and regions with characteristics similar to Tunisia”, dialogue on water economics (public education, demand management, transfer lost, water markets), irrigation technology,

energy-efficient desalination technology, and risk assessment for preventing pollution and negative ecological impacts on water sources (Tunisia Water Forum, 1997).

Findings to take away from the Tunisia Water Forum include the advantage of collaborating with experts on these topics. The policy makers who attend these forums can bring back the programs best suited for their country or region and create the change needed. Without expert opinion, policies can sometimes harm instead of help. The purpose behind the TWF was to also support regions with similar climate to Tunisia in order to verify the best practice for sustainable water use and management in addition to monitoring the needs of the region. When a country makes the effort to adopt sustainable initiatives, organizations like the World Bank and others take notice and are able to assist or make recommendations.

Reviewing literature of Egypt and other MENA countries illustrates the different needs of different climates. Even within one country, such as Tunisia, the climatic differences require a “number of distinctive methods of water management for agriculture” (Hill & Woodland, 2003). Since the North Tunisian region experiences an annual water surplus, a modern reservoir-fed irrigation supply is used. Though the South-Central region does receive some annual rainfall it is not sufficient and so “modern dams have been constructed in the north of the zone, but rainwater harvesting and terraced wadi systems predominate towards the south” (2003). Traditional rainwater harvesting is typically practiced in communities in the South-Central “within small hillside catchments or oasis irrigation using artesian water” because “surface storage of water is unfeasible” (2003). The country profile(s) posted by the UN Division for Sustainable Development allow state experts to give reports on the varying programs and initiatives that indicate progress.

Before going on to the next case study, it is important to acknowledge my findings on how global targets are the indicators for the monitoring of a state's progress toward environmental sustainability for MDG-7. The UN, NGOs¹⁹, and government agencies believe that these indicators are "often of limited relevance for developing countries" because national/ local priority issues don't always directly correlate to "country-specific targets and indicators" that MDG experts are looking for (UN DP, 2006). This is verified when even the "UNDP's 2003 Development Effectiveness Report makes reference to the 'extremely limited country capacity to address' MDG7" (2006).

MDG experts conducted over sixty country reports on monitoring and don't believe the findings to be reflective of the environmental capacities. In order to improve reports, MDG reporters "suggest that many countries have not fully incorporated or integrated available sources of global or in-country data, including data from ongoing sustainable development planning and environmental monitoring processes" and the only country that actually reported on all eight global indicators was Thailand (UN DP, 2006). This realization spurs the idea that improved monitoring needs to be established, which reports systematically on targets reached as well as reflective on "environmental conditions and/ or development aspirations" need to be established (2006).

In general, another challenge reported back (besides financial/ technological capacities), was difficulty finding representative indicators of specific country conditions, goals, and interrelationships between governance levels. Also, visibility of integration of environmental sustainability is difficult to clarify and so the UNDP implemented new strategies to help

¹⁹ NGOs: Non-Governmental Organizations

developing states with these obstacles, like creating measurable and quantitative data; examples include: population without access to basic needs (clean water, sanitation).

The case studies show that new opportunities are arising from the concept of sustainable tourism. The next initiative reveals that municipal, industrial, agricultural, and tourist wastes are discharged directly or indirectly in the Nile River and canals and drains without proper treatment causing chemical and biological water pollution. Tunisia, Egypt and other countries experiencing the economical benefits of Tourism learn from the initiative titled: Economic Development through Sustainable Tourism.

Since tourism is now one of the world's largest industries, the UN-World Tourism Organization has defined sustainable tourism as an "enterprise that achieves an effective balance among the environmental, economic, and socio-cultural aspects of tourism to guarantee long-term benefits to communities" (UN DSD, 2009: A). This initiative devises "well-planned and well-implemented tourism projects" that can improve "local governance, natural resources management, biodiversity conservation and other development goals" (2009: A). Sustainable tourism practices help "reduce poverty and improve livelihoods in the world's developing countries" (UN DSD, 2009: A). The changes of sustainable tourism involve environmental protection of parks and natural resources, "opportunities to diversify local economies... "promoting formation of micro and small enterprises" (many of them women-owned), and "payback for water and energy efficiency investments in hotels can occur within 1-2 years" (2009: A). The initiative also concluded that decentralization of "land tenure and natural resources property rights to local communities are vital governance reforms that enable sustainable tourism-based development" (2009: A).

Furthermore, according to Tunisia Online (government site), the Tunisian agency ANER, attached to the Ministry of Environment and Planning (1998), is responsible for “conceiving and implementing strategies for the promotion of renewable energies”(n.d.). The national framework consulting these imperatives is once again CNDD, which integrates the “Environment into development” promoting “the approach of sustainable development in all national development plans” (Tunisia Online, n.d.).

We learn from Tunisia’s country profile and related literature that in geographical context, the Central Tunisia (Zeroud Basin) utilizes two contrasting strategies: decentralized and centralized water management (Hill & Woodland, 2003). According to record the annual rainfall in the north is around 1000mm and in the south-central is 150mm (UN DSD, 2009: C). Current tools to address shortages in countries with similar climates include rainwater harvesting, dam irrigation, and water cultivation. Two other water management strategies mentioned are the traditional small-scale rainwater harvesting and large-scale dam irrigation. These methods are specifically geared to address the climates and resources available. In all the aforementioned case studies, local management and mobilized communities have proven capable and successful at utilizing these sustainable water practices.

Concluding Analysis

Prior to the first Earth Summit the concept of sustainable development was simply an alternative approach to one formerly based on economic growth. As this thesis illustrates, Earth Summit goals were to lay a foundation for global partnerships between developing countries and the more industrialized. Sustainable development is about common interest in

meeting mutual needs, ensuring a healthy environment (long-term), and promoting responsible state behavior. Transparency between regional and state governance equates to visibility in the process of communication and policy shaping. When transparency is incorporated into decentralized management, local policy needs to be supported at the national level; this change needs to happen at the top level before changes can be made at the regional level. For sustainable policies to be practiced, a specific description of what sustainability entails is needed, which includes (but not limited to): environmental protection, resource replenishing, and educating communities about recycling and pollution.

Further exploration and effort need to go into implementing these sustainable strategies into everyday living by making them known and available in the regions they are needed most. When communities are mobilized to help themselves and citizens are educated, the population becomes empowered to foster sustainable development. Socio-cultural and economic factors also play into the capabilities of bringing water to Tunisia, which is needed for sustainable water development in a land where it is scarce. Just because state governments participate in forums and summits doesn't necessarily reflect that these countries are making progress on the ground. Human Development correlates to the UN Universal Declaration of Human Rights. HDR is not about the state financial wealth; rather it emphasizes the standard of living for citizens as a true representative to a country's development. Raising the standard of living is accomplished through satisfying the targets of MDGs.

The first step in determining movement toward MDG-7 is assessing the policies/ programs providing sanitation and potable water is first verifying the criterion that is

measurable. Regional leaders need to identify the population number(s) who are without sufficient supply of water and find the root(s) of the cause and report these findings to experts so a suitable solution can be determined efficiently. The purpose behind all the case studies is to provide a variety of proven-successful responses to the wide range of problems in MENA. Transparency from community needs to regional management to governing bodies and global experts is imperative for the sustainable movement to be successful.

In addition to transparency, it is important to understand motivation for International cooperation in water sharing issues and how the sustainable movement, set forth by Earth Summit's Agenda 21, is transforming research goals. Identifying the appropriate strategies implemented in order to work successfully in developing nations is the purpose of this paper, and my analysis includes a recipe for improving access to clean drinking water and managing water resources in a sustainable fashion.

Referring back to Agenda 21²⁰, it is apparent that Tunisia, Egypt, and other MENA countries have taken steps to collaborate together and with organizations like the African Development Bank to accelerate sustainable movement. However, the reality is there is still a long way to go before everyone in North Africa can boast about accessible clean water and sustainable sanitation management. Section III of Agenda 21 reiterates the theme of this conclusion. A recipe for sustainable water practices needs to integrate alternative approaches, as well as strengthening the role of people and their communities to partner with NGOs and local authorities to support decentralized water management.

²⁰ Review of the Literature: Page 13 (*A Recipe for Sustainable Drink*)

Water quality is an issue just as important as the lack of adequate supplies and is why the Water Demand Initiative promotes decentralized management for MENA, which includes Tunisia and Egypt (UN DSD, 2009: B). The most cost-effective way to increase fresh water supply is by managing its demand, and reducing waste. It sounds simple, but requires the mobilization of civil society for it to be successful. WaDIMENA initiative shows that past approaches that encouraged large-scale projects did deliver water, but did not favor sustainability in its approach and fell short of household expectations. The new focus for MENA is to “curb water demand and alleviate poverty” through “community-based or local water management” (UN DSD, 2009: B).

In another UN case study, “Siraro Water Supply”, Tunisia partnered with the African Development Bank to bring water to communities formerly lacking (UN CSD WAND, 2006: B). This action reported to the World Water Forum “has proven that given the chance, communities can operate and maintain complex water schemes (UN CSD WAND, 2006: B). Not only has this proven the power of community mobilization, but the scheme has also added benefits like “reduced travel distances to water sources and the times for water collection, it has provided potable water to the communities” and will also improve overall general health, which in and of itself has numerous benefits for the community (UN CSD WAND, 2006: B).

Experts, research evidence, and regional experience prove that “scarce water supplies are used more sustainably if they are managed locally” and local management empowers the poor/ disadvantaged populations (UN DSD, 2009: B). With this analysis in mind, it is important to also remember that local water systems need to work within the levels of government

overseeing watershed management, etc. Field research needs to be integrated into policy decisions and traditional practices of small-scale water supply need to be combined with improved wastewater treatment to achieve long-term success.

In general, global initiatives and summits are here to promote state responsibility and provide the foundation for the sustainable movement, but it is up to each country to partner up in research and create the necessary framework for turning these ideas into action. This is where the concept of micro-credit makes a difference in developing countries. The supply is available, and funding can provide this, but the sustainable movement is about empowering people to manage resources in a way that can provide accessible drinking water to everyone. The water supply may be here today, but sustainable management ensures it will outlast our generation, and the next. Managing groundwater and aquifer supplies is essential and starts with confronting scarcity trade-offs, in determining fairly the allocation of water, and to educate local management on the available resources. Global leaders have ascertained that local people need to first recognize the need for change. Building new neighborhoods with modern plumbing isn't always the solution, and this can actually put the poor at a disadvantage. Rural communities should be adopting sustainable management that is appropriate for their lifestyle.

The World Bank offers insights on the cost estimates to reach Millennium Development goals; and estimated cost of reaching "basic levels of coverage...in water and sanitation" at around \$9 billion at the low end, and \$30 billion a year for "achieving universal coverage" for water and sanitation" (Living Water International, 2009). However, the UN and partners

participating in sustainable development want to go beyond satisfying thirst, they want to develop states' capacities to reuse water resources in a long-term sustainable way. To overcome these obstacles, MDG reports several options mentioned in the *Findings* section, some of which are also derived from successful case studies. In conclusion to these results, we get a recipe for sustainable water management, which fairly allocates potable water and instigates a decentralized approach for local water control.

Result of this knowledge encourages groups such as the African Development Bank to support opportunities that promote sustainable practices, often through decentralized management. One such response from the African Development Bank is the Rural Water Supply and Sanitation Initiative (RWSSI), which was a reaction to Africa Water Vision and the Millennium Development Goals. The African Development Bank Group conceived RWSSI in “2002 with the view to accelerating access to water supply and sanitation services in rural Africa” (UN CSD WAND, 2006: C).

Taking another UN example, it's easy to analyze the outcome of the initiative: The African Water Facility- An Instrument for Financing Local Actions. Through capital investment, this initiative provides “targeted investment for small-scale water infrastructure development”, effective planning for policy and institutional development, and support for “Transboundary Water Resources Management” (UN CSD WAND, 2006: D). The bank and African Water Facility maintain flexible financing, making “it a suitable instrument for supporting local initiatives and projects” while also hoping to encourage other organizations to emulate funding (UN CSD WAND, 2006: D).

In conclusion, it's reasonable to conclude from these UN case studies that decentralized management, and/ or in combination with central management will provide strong transparency and allow for more efficient assistance. The allocation of potable water is an issues negatively affecting people every moment. The programs and initiatives analyzed in this collection of literature prove that help can be given, and the communities lacking these resources can be alleviated from this burden. Access to clean water is a universal human right, and the following recipe will provide amusing yet efficient instructions for developing sustainable water practices. Give people the opportunity and don't be surprised when they rise to the occasion to do better for their communities.

Five-Step Recipe for Sustainable Drink

Required Ingredients:

- Identify root causes of the problem
- Physical indicators to monitor progress
- Transparent communication from the bottom-up.
- Leaders that will take advantage of localized knowledge and water harvesting traditions in conjunction with new technology

Stove-Top Preparation:

1. Educate affected communities about sustainable changes
2. Make sustainable policies a financial precedence
3. Give local communities a chance and the tools to stir the pot and manage the local level
4. Communicate, cooperate, and compromise with other state actors in the region to:
 - manage shared water sources; report the condition of affected population(s) and learn from other successful sustainable practices
5. Use appropriate technology to meet renewable water/ sanitation needs; decentralize management to get things done by enabling the underrepresented population.

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(The * refers to citation sources for Maps and Graphs, page 7)

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