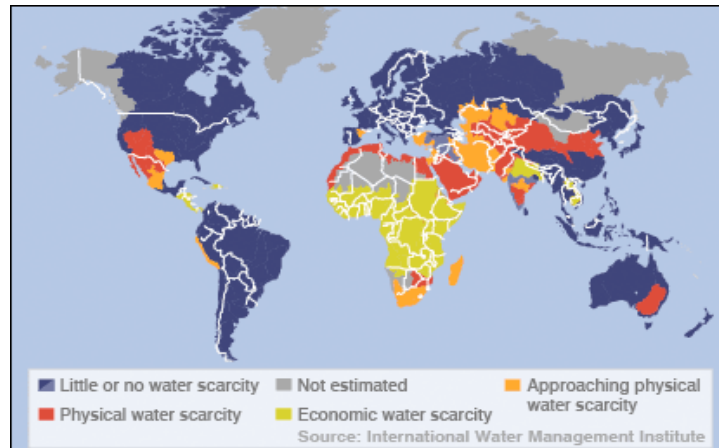


WATER SCARCITY IN THE MIDDLE EAST

Background on The Water Crisis:

The Middle East has experienced many environmental concerns lately. Water resources are becoming increasingly scarce, especially for the millions there who already lack access to sanitary water. Some of these countries, including Yemen, the United Arab Emirates, Saudi Arabia, and Iraq, are facing unique problems that require global, immediate attention. Beside their neighboring location, one shared factor of all these countries is their lack of water resources and poor water management. Desertification is a sweeping environmental problem, with vast effects in countries such as Syria, Jordan, Iraq, and Iran. Universal causes for a spread of arid environment are unsustainable agriculture practices and overgrazing. Agriculture uses 85 percent of water in this region. It is common to misuse land by heavy irrigation in the Middle East. In the area droughts are more frequent, and contribute to the changing landscape. The overuse of water in agriculture is affecting the countries' already undersized water resources.



Map of the Global Water Distribution

Current Situation:

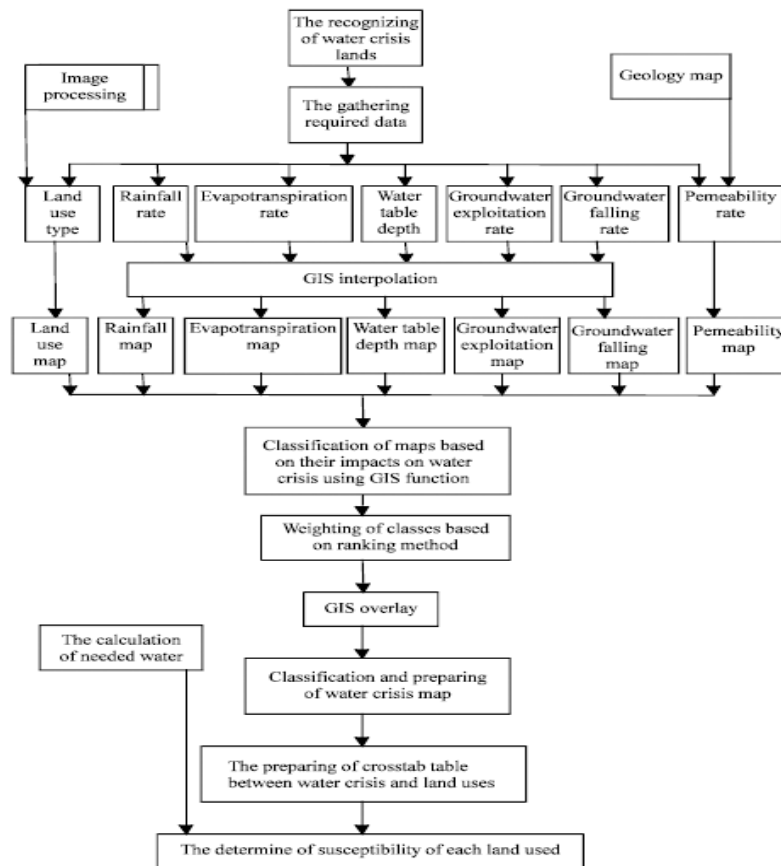
Access to safe water is a fundamental human need, and therefore a basic human right. In reality, however, the nations of the Middle East, specifically the UAE is confronted with a serious depletion of their available water resources. A report from the Emirates Industrial Bank in 2005 said that the UAE had the highest per capita consumption of water in the world. Additionally, for the past thirty years the water table of this region has dropped about one meter per year. At this current rate, the UAE will deplete its natural freshwater resources in about fifty years. Even with a large amount of desalination plants to reduce water deficiency, the UAE needs to adjust its water use habits before its energy consumption doubles in 2020. Desalination plants are an overuse of water resources in the Middle East. Seventy percent of desalination plants in the world are located in this area, found mostly in Saudi Arabia, the United Arab Emirates, Kuwait, and Bahrain. While the plants produce water needed for the arid region, they can manufacture problems for health and the environment. The seawater used most in desalination plants has high amounts of boron and bromide, and the process can also remove essential minerals like calcium. Also, the concentrated salt is often dumped back into oceans where the increased salinity affects the ocean's environment. The plants harm local wildlife and add pollutants to the region's climate. In addition, desalination is the most energy-costing water resource. The Pacific Institute explains that the high use of energy results in raised energy prices and higher prices on water produced, hurting the consumer. The water produced can be

beneficial towards substituting any lack of freshwater, but these areas have tendencies towards overuse of their natural resources. Concerns with the large amount of desalination plants in the Middle East focus on the improper dependency they will cause, instead of encouraging alternate forms of water and energy and conserving freshwater.

The Middle East has numerous struggles with its current water resources, and the region needs more than one solution to generate an optimistic environmental position for the future. It is worth researching because water issues affect us globally, and in order to ensure a sustainable, healthy environment for our current and future population growths, we need to address the heavy concerns of our depleting natural resources. Water supply varies greatly over space and over time on the continent, giving rise to a number of more complex aspects. For instance, from a political perspective, given that water basins and river networks do not respect national borders, there is room for efficient transboundary water management requiring supra-national cooperation. From a physical perspective water can be more efficiently allocated over time and space by investments in irrigation schemes and transboundary water supply networks. Moreover, the question of water scarcity in the Middle East should not be viewed in isolation to that continent, as locally available water is in part determined by exports of water intensive agricultural goods to the developed world. Additionally, much of the water infrastructure investment tends to come from outside non-governmental and private sources, which in view of limited resources must decide between competing projects. Nevertheless, research on these questions, though growing, is still in their infancy. The implementation of GIS will allow researchers and experts to address the climatological, hydrological and socio-economic processes and functions that exist in landscapes related to water scarcity. It can be applied to planning procedures and real world application processes. It can be employed as an early warning system against water shortage based on existing operational methodologies and to characterize the main anthropogenic and naturally defined surface water and groundwater systems.

Literature Review:

There was a case study performed in Nishapur Plain, in the NE of Iran to discuss the management of the water crisis currently taking place. There were various data layers including precipitation and evapotranspiration rate, water table and groundwater exploitation, groundwater infiltration, permeability and land use layers were prepared. After weighting the gathered data based on their importance in water crisis with ranking method, GIS overlay function was used to produce the water crisis map. The result of this study indicates that the whole plain is confronting with water crisis of different severity level. The most important factor affecting the existing water crisis is the quality of cultivation for agricultural purposes. So, in order to reduce the gravity of water crisis, the necessity of new administrative strategies including the improvement of some land use classes and the cultivation of species with lower water need was highlighted.



Map of the GIS process

Hypotheses:

- Can GIS be the tool of the future to aid in early warning water issues globally?
- How do water issues relate to even greater social and political problems?
- Will global water issues, especially in those developing economic countries, place a burden on future sustainability?

I am interested in how GIS can be used as a tool for water policy planning throughout the world, specifically in the Middle East. The ME region is the most water-scarce region in the world, and faces many challenges related to water availability, food security, pollution, and environmental degradation. My current research is focusing on water policy analysis in the region. Spatial analysis may prove a crucial element in recommending feasible policy options, and I am therefore investigating the literature on GIS and water policy. I am interested in studies that have been conducted in any area of the world, as well as studies specific to the region.

Data:

In order to carry out this specific research, we must focus on the economic, social, and political impacts of the nation. The groundwater and surface water levels should already be available in digital form, as well as climate change tools. There are also several tools we've utilized on ARCGIS that allow us to look at changing ecological implications to the system over a 30-year period to be assessed through different color-scales and ramp structures. It is also important to emphasize the food and economic disparity, which may or may not be in digital form but must be incorporated. My data will be structured as a raster approach because it is more in-depth and shows a more detailed view of what is being shown and tested.

Methods:

We must approach this issue in a way that includes remote sensing, special, and hydrology data. I would utilize an interactive policy planning and analysis approach which would further explore the trade-offs and future demands on water resources on a national scale. It is intended to foster dialog and stakeholder participation, and provide a basis for multi-sectoral planning and analysis. One of the weaknesses would be the quantitative data as much because numbers are constantly evolving and being updated, however it does provide an awareness to explore the complex interactions of water scarcity, food security, and environment needs, in light of increasing populations and changing national diets.

Anticipated Results/Policy Application:

I am anticipated that I will find a solution to early warning systems concerning water issues. The current problem facing our international community is not the amount of water available, but rather a serious distribution problem. I am also hoping to address and solve where the "gaps" are in regards to why GIS implementation may not be entirely sufficient. The assessments address fully water scarcity and in The Middle East. Overall, three types of gaps have been identified. These include: conceptual gaps, i.e. an inadequate understanding of the causal relationships between drivers, pressures, states and impacts that would help identify the adequate (most cost-effective), Information and assessment gaps, i.e. insufficient information and assessments on the magnitude and recurrence of water scarcity (including the socio-economic dimensions of impacts), on the measures effectively proposed for addressing it, Policy, governance and implementation gaps, i.e. the lack of adequate policy response and governance (including those actions aiming to ensure that water security issues are internalized into water policy, sector policy and land-use planning)

I think we need to make immediate changes in governmental and political roles in regards to the issue, sooner rather than later. We must approach this in a proactive manner, rather than a reactive. Overall, additional policy efforts will be required in the Middle East for tackling water security in a cost-effective manner. A few short proposals I believe could aid in helping with the problem include:

1. Establishment of efficiency targets
2. Economic incentives towards efficient water use - main purpose of this policy area is to widen the scope of economic instruments to ensure they provide incentives for "sustainable" water abstraction and use.
3. Strengthening international governmental cooperation

Budget:

GIS Equipment= ~ \$35,000 estimate
--Expert Researchers (2) = ~\$60,000/year
--Transportation to/from the Middle East and back – ~\$4,000
--Workplace established in ME- = ~\$4,000
Total= \$163,000

Time Frame:

The research required would take approximately 6-8 months to gather economic and geographic data based on the areas being observed (most of the Middle East). The application and GIS processes could take several more months to get the system accuracy in accordance to changing patterns and population growth at the time. Overall, this is an issue that needs to be monitored indefinitely in order to help for a sustainable future.

Projected Water Scarcity in 2025

