

Clean Water for Developing Countries

A Senior Project

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By

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Research Proposal

Through my senior project I hope to gain a deeper understanding of the problem of availability of clean water in our world today. I plan to take a deeper look at the availability of potable water in developing countries; looking at the problems presented by the lack of potable water as well as the potential solutions. The availability and accessibility of potable water is an issue for much of our world and is a growing crisis, not only in developing countries, but also in developed countries. My goal is to gain a better understanding of the numerous and vast issues brought about by the need for clean water.

For my senior project I will be writing a research paper on the importance and availability of clean water. In order to discover more on the subject I will be utilizing scholarly journals and books for background research as well as volunteering with a local fundraiser that is raising money to provide clean drinking water in Kenya. From this local fundraiser and organization, I will be obtaining information from interviews with specialists on water-borne illnesses and the first-hand experience of a woman who grew up struggling everyday to gain access to clean water in Africa. Through my involvement with the organization, I hope to gain a better understanding of not only the importance of clean water availability, but also the process that goes into providing a community with the relief of a well. With the emergence of these problems in more developed countries, I have found many articles that address the problems of accessibility and availability of clean water.

A major crisis in our world today is the availability of potable water in countries around the world, while the problems are more prevalent in developing countries; we are starting to see problems in developed countries as well. Clean water is a necessity to live and as this issue becomes more widespread more problems emerge. This research paper is aimed at gaining a greater understanding of not only the problems faced by people around the world, but the potential solutions to this crisis.

Annotated Bibliography

This report summarizes the risks of contaminated drinking water and the effects that are seen on a daily basis around the world due to the lack of clean water. The study is focused upon the major health risks that revolve around our most basic necessity, water. The article also takes a deeper look at current solutions that have been implemented to alleviate the devastation of this vital issue, focusing on the ability to create and implement sustainability. This article will be of use to my research, as I will also be looking at the health risks that are brought about by the consumption of contaminated water as well as looking at current and potential solutions to this crisis.

Batterman, S., Eisenberg, J., Hardin, R., Kruk, M E, Lemos, M. C., Michalak, A M, Mukherjee, B., Renne, E., Stein, H., Watkins, C., and Wilson, M L (July 2009). Sustainable control of water-related infectious diseases: a review and proposal for interdisciplinary health-based systems research. (Review)(Report). *Environmental Health Perspectives*, 117, 7. p.1023 (10). Retrieved September 24, 2009, from Expanded Academic ASAP via Gale.
<http://find.galegroup.com.ezproxy.lib.calpoly.edu:2048/gtx/retrieve.do?contentSet=IAC-Documents&resultListType=RESULT_LIST&qrySerId=Locale%28en%2C%2C%29%3AFQE%3D%28ke%2CNone%2C45%29sustainable+control+of+water-related+diseases%24&sgHitCountType=None&inPS=true&sort=DateDescend&searchType=AdvancedSearchForm&tabID=T002&prodId=EAIM&searchId=R1¤tPosition=1&userGroupName=calpolyw_csu&docId=A206048832&docType=IAC>

In this article, Cooper investigates the availability of sanitized water around the world and the ever-growing depletion of resources. The article looks at the issue of drought in places around the world as well as water use and current trends that are putting even more pressure on the issue at hand. Cooper presents the current and future trends and statistics necessary to understand the issue and the potential solutions as well as the political issues that are involved. This article is be important in looking at the places that have the greatest need of resolution in addition to the political aspect of the battle over land use rights and access to clean water.

Cooper, M. H. (2003, August 1). Water Shortages. *CQ Researcher*, 13, 649-672. Retrieved September 24, 2009, from CQ Researcher Online.
<<http://library.cqpress.com.ezproxy.lib.calpoly.edu:2048/cqresearcher/document.php?id=cqresrre2003080100&type=hitlist&num=1>>

Behr's article explores the regions with the greatest risk of water depletion, one of his main points being that it is not that the world is running out of water, focusing not on the fact that this is a finite resource, but rather looking at the fact that we are using in inefficiently, creating an even larger problem. The article also discusses the issues of privatization of water and the potential conflict brought about by this issue. Behr addresses the issue of inefficient use of water; the current problems that we face and the potential solutions to curb our unsustainable ways. This article will be useful in looking at the political aspect of access to clean water and the struggle over privatization of water.

Behr, P. (2008, February 1). Looming Water Crisis. *CQ Global Researcher*, 2, 27-56. Retrieved September 24, 2009, from CQ Global Researcher.
<<http://library.cqpress.com.ezproxy.lib.calpoly.edu:2048/globalresearcher/document.php?id=cqrglobal2008020000&type=hitlist&num=0>>

This article focuses upon the health risks and effects of contaminated drinking water, examining the impact of waterborne illnesses on societies around the world. The article addresses the nature of clean drinking water and the many factors that must be looked at to evaluate water's quality and those factors that could potentially produce harmful effects. As the article explores the effects of these harmful diseases, I can use the information, more specifically the statistics, about the waterborne illnesses that are killing people around the world everyday.

Lawrence, Robert S., Nappier, Sharon P., and Schwab, Kellogg J. Dangerous Waters: Natural History; Nov2007, Vol. 116 Issue 9, p. 46-49. Retrieved October 7, 2009, from Academic Search Elite.
<<http://web.ebscohost.com.ezproxy.lib.calpoly.edu:2048/ehost/detail?vid=4&hid=105&sid=5644c49c-9f87-4746-9339-b38e884639e0%40sessionmgr110&bdata=JnNpdGU9ZWwhvc3QtbGl2ZQ%3d%3d#db=afh&AN=27195010>>

The EPA drinking water pamphlet discusses the potential contaminants that may be in drinking water and discusses how these contaminants are infiltrated into the water system. The pamphlet explores the effects of these contaminants in both acute and chronic cases. While this pamphlet does research many of the same aspects of the other articles, this pamphlet also looks into the affect of these contaminants among people that have special health needs, most importantly for my research it addresses the added risks for those who are suffering from HIV/AIDS.

EPA Drinking Water and Health: What You Need To Know. Washington, DC: U.S. Environmental Protection Agency, Office of Water, 1999.

Kate Eshelby's article presents the realities of life in Sub-Saharan Africa; discussing current and future development actions. The article compares the development of the Britain in comparison to the development of Africa, and the differing priorities that continue to plague people throughout the country. As action has been made to alleviate the issue of availability of clean drinking water, there are still many problems at bay. Eshelby discusses the need for government action and also presents the obstacles that are preventing such action from taking place. This article explains the current issues of the people struggling with the lack of clean water, how it affects people on a daily basis and what must be done in order to curb this tragedy. As my research is looking to explore the access, or lack there of, clean drinking water, this article demonstrates the common struggle that people face everyday, from the process necessary to gain access to clean water, to the effect it has upon development in the region.

Eshelby, Kate. Dying for a drink. *British Medical Journal* 334.7594 (March 24, 2007): 610(3) Retrieved October 7, 2009, from Expanded Academic ASAP.

<http://find.galegroup.com.ezproxy.lib.calpoly.edu:2048/gtx/retrieve.do?contentSet=IAC-Documents&resultListType=RESULT_LIST&qrySerId=Locale%28en%2C%2C%29%3AFQE%3D%28ke%2CNone%2C17%29dying+for+a+drink%24&sgHitCountType=None&inPS=true&sort=DateDescend&searchType=AdvancedSearchForm&tabID=T002&prodId=EAIM&searchId=R2¤tPosition=3&userGroupName=calpolyw_csu&docId=A162906701&docType=IAC>

The authors of this article focus upon water-related issues, depicting several different illnesses and how they relate back to quality of water. Barry and Hughes explain the many ways that water affects public health, from the waterborne pathogens to the lack of clean water for sanitation purposes. The authors discuss the current studies being conducted on the matter, but also point out that much needed action continues to be of great concern, but political action remains to be stagnant. The relevance of this article is important to note, as the authors also point out the impending importance to address how more intense and more frequent natural disasters will affect the current water crisis. The details of water-related diseases are an important aspect of my report as they address many potential risks of unsafe water.

Barry, Michele, and James M. Hughes. Talking dirty - the politics of clean water and sanitation. *The New England Journal of Medicine* 359.8 (August 21, 2008): 784(4). Retrieved October 7, 2009, from. Expanded Academic ASAP

The article from the World Health Organization explores the mortality rates among children around the world, specifically looking at the cases caused by diarrhea. The article represents the death tolls among children under age five, separated by country and region. The article also depicts the rates visually showing the where the higher rates are concentrated around the world. This article will be useful to see the mortality rates, but also the future goals that have been set for countries around the world to curb this issue.

Boschi-Pinto, C., Velebit, L., & Shibuya, K. (Sept 2008). Estimating Child Mortality Due to Diarrhoea in Developing Countries. *Bulletin of the World Health Organization*, p.710 (8). Retrieved October 07, 2009, from Expanded Academic ASAP.

<http://find.galegroup.com.ezproxy.lib.calpoly.edu:2048/gtx/retrieve.do?contentSet=IAC-Documents&resultListType=RESULT_LIST&qrySerId=Locale%28en%2C%2C%29%3AFQE%3D%28ke%2CNone%2C13%29talking+dirty%24&sgHitCountType=None&inPS=true&sort=DateDescend&searchType=AdvancedSearchForm&tabID=T002&prodId=EAIM&searchId=R3¤tPosition=1&userGroupName=calpolyw_csu&docId=A185187204&docType=IAC>

This book takes a scientific perspective about the drinking water, evaluating both pollution and protection of drinking water sources. The book takes a look at the different ways that pollution can enter our sources of water and how contaminants ultimately affect consumers overall health. The other major aspect that the book covers is the protection and treatment of water resources. The authors also address the risk of polluted water and the standards for water. This book will be important to look at the many factors that play into the contamination of a water source, but also to compare the drinking water standards that we have in the United States and the drinking water available to some people around the world.

Sullivan, Patrick J., Agardy, Franklin J., Clark, James J.J. (2005). The Environmental Science of Drinking Water. New York: Elsevier.

Zuane's book also looks at the chemistry of drinking water and looks at specific contaminants of water and their affect upon the quality of the water source. The book looks at the scientific composition of water quality and what makes water dangerous to consume, detailing the specific chemicals and the concentrations that would make a resource unsafe to ingest. The most useful information in this book will be the calculations and scientific aspect of water quality and contaminants, looking at the overall standards and determinants of potable water.

Zuane, John De. (1990). Handbook of Drinking Water Quality: Standards and Controls. New York: Van Nostrand Reinhold.

The UNICEF website was very helpful in finding different statistics and information for the developing countries and the effect the global water crisis is having upon them. The website contained information about current actions being taken to curb the impact this crisis is having upon poorer and developing nations. This website will be useful to find information about current trends and actions being taken as well as current statistics about those that most highly effected, such as the women and children in developing nations.

"Water, Sanitation, and Hygiene." *UNICEF*. Unite for Children. Web. 26 Oct. 2009.

<http://www.unicef.org/wash/index_3951.html>,
<http://www.unicef.org/wash/index_womenandgirls.html>,
<http://www.unicef.org/wash/index_43106.html >

The Human Development Reports take a deeper look at current statistics as well as the effect it is having upon development around the world. As water directly affects development, these reports look at the various factors that play a role in the everyday struggle for developing nations. The reports look at the impact of global cooperation to this imminent crisis. These reports contain important information about the current vulnerabilities and threats in developing nations around the world and the impact this issue has upon the rest of the world.

"Beyond Scarcity: Power, Poverty and the Global Water Crisis." *Human Development Reports*. United Nations Development Programme. N.d. Web. 26 Oct. 2009.

<<http://hdr.undp.org/en/reports/global/hdr2006/>>

The CDC website was useful in looking at the impact of contaminated water on communities around the world. As billions of people lack access to clean water and sanitation, disease threatens the lives of vulnerable populations everyday. The CDC provides current information on the most prevalent contaminants in developing nations and the illnesses that are killing thousands of people, mostly children, on a daily basis.

“Global Water, Sanitation, and Hygiene.” *CDC* . Centers for Disease Control and Prevention. N.d. Web 28 Oct. 2009.

<<http://www.cdc.gov/healthywater/global/>>

This article primarily looked at the implications of water scarcity on women around the world. The article took a deeper look at the role women and children have in developing nations that don't have adequate access to clean water resources. The article looks at the impact water scarcity has upon development and education, looking at the inequalities that face women and children when it comes to acquiring water. Among other issues that must be addressed in order to solve the global water crisis, the main objective of this article is looking at women and the need for empowerment and education.

“Gender, Water and Sanitation: A Policy Brief.” *UN Water*. Water for Life. June 2006. Web. 4 Nov. 2009.

<<http://www.unwater.org/downloads/unwpolbrief230606.pdf>>

The World Health Organization's website provided information for many different diseases and illnesses that affect the developing world. The website depicts the different water-related illness, in particular, the most prevalent vector-borne illnesses and their prevention and control. The website provides statistics on areas that are most highly affected by the diseases as well as potential solutions to these diseases that are devastating populations across the globe. The website also looks at the development implications these diseases have upon societies and current and future action to promote development.

“Vector-borne Disease.” *The Health and Environment Linkages Initiative*. World Health Organization. N.d. Web. 16 Nov. 2009.

<<http://www.who.int/heli/risks/vectors/vector/en/index.html>>

Outline

- I. Chapter 1: Introduction
 - a. There is a growing need for access to clean water around the world, this problem is faced by peoples across the globe and is an imminent threat to societies everywhere.
 - b. Description of project
 - i. Research Paper
 - ii. Volunteer Work
 1. Village to Village
 - a. Charity: Water and WineforWater.org
 - i. Millie Klumpp and Ryan Broersma
 - b. October 11, 2009
 - c. Avila Bay Club
 - i. Live and Silent Auction
 - c. Explanation of why this topic is pertinent in our world today
 - i. Globally, both Developed and Developing countries
 1. Daily challenge for people around the world to gain access to clean drinking water, predominantly in the developing world, but it is as a growing threat to the developed world.
- II. Chapter 2: Clean Water Availability and Access
 - a. Background information about water supply and availability around the world.
 - i. Compare Developed and Developing world
 - b. Finite Resource
 - i. Of all the water on Earth's surface, only 1% is available for human use, the rest remains in the oceans, glaciers, and snowpack. (Water Shortages 652)

- ii. Of fresh water available for human use, it is further divided up into different uses: agriculture (70%), industry (22%), and personal uses (8%).
(Looming Water Crisis 32)
 - c. Global Warming and it's impact
 - d. Affect/Implications upon development
 - e. Drinking water standards
 - i. Standards and policies in place within the United States
 - ii. Water in developing world
 - 1. Regulations and Policies vs. Guidelines
 - f. Risks and Dangers
 - i. Physical risks
 - 1. Women under threat
 - a. Daily responsibilities and consequences for development
 - 2. Water-related illnesses
 - a. Vector-borne illnesses
 - b. Water-borne illnesses
 - ii. Statistics
 - 1. Number of people affected by lack of sanitation
 - 2. Number of children under five killed each day by contaminated water
- III. Chapter 3: Volunteer Work
 - a. Organizations
 - i. Charity: Water (Millie Klumpp)
 - 1. Organization focused on providing clean water for villages and communities around the world.
 - a. Previous Event
 - i. \$17,000 raised, enough to cover the development and upkeep of a well in Kendu Bay

- ii. WineforWater.org

1. Local organization, started by Ryan Broersma of Paso Robles, focused on providing wells in Africa, particularly Ethiopia and now expanded to Kenya.
2. Connected with Millie Klumpp to put on a second fundraiser in order to raise money to provide mosquito nets and rebuild the dorms that were destroyed in a fire in Kendu Bay.

- b. Fundraiser

- i. Description

- ii. My involvement

- iii. Event

1. Village to Village

- a. Oct. 11, 2009

- b. People Involved: Millie Klumpp and Ryan Broersma of WineforWells.org

- iv. Outcome

1. Money Raised

2. Projects funded and dates to begin construction

- IV. Chapter 4: Current and Future Work

- a. Current political issues

1. Battle over Regional vs. Federal Legislation

- b. Proposed solutions

- i. Small-scale sustainable practices

1. Current Actions

- ii. Privatization of Water

1. Political Struggle

2. Risks and Benefits

- Chapter 5: Conclusion

- c. Summary of findings
- d. Restatement of importance and relativity
- e. Final Thoughts/Conclusion

Clean Water for Developing Countries

Chapter 1. The Case of Millie Klumpp

A. Introduction

With an expanding population and increasing demand, the need for clean water is a growing issue in our world today. In recent years the awareness and attention to this impending crisis has increased, but it still remains a major crisis in countries across the globe and has yet to be resolved. Water is a basic need for life, from agriculture and irrigation for food production to our daily intake and consumption, the need is the same across the globe; while the need is equal, access to clean water is far from equal.

This senior project investigates the varying availability and access to drinking water around the world, looking at both developed and developing countries. Among this impending crisis and its potential solutions surface other issues that must be addressed and bring about mounting concerns. Alongside this research paper, I worked with a local organization focused on providing clean water to villages in Africa. Through the combination of both the research and a volunteer position, the urgency of this impending crisis became all the more evident. The crisis expands to both developing and developed countries, with varying degrees of concern and urgency, the issue is world wide and greater than ever as our global population continues to increase.

B. The Importance of Water

The global water crisis is a growing concern in our world today, and continues to increase with population pressure and increasing demand. In recent statistics, about one-fifth of the world's population lacks adequate access to clean water, while the demands of the crisis are distributed unevenly across the globe, the stress can be felt around the world, in both developing and developed countries. From privatization and drought to simply the lack of access, the struggle is ever present in our world today. Unsustainable practices within the United States and other developed countries create a need for greater federal government intervention and oversight. As our world feels the pressure of growing population and demand for water, so does the need for implementation of sustainable water-use practices. The evidence of the water crisis is blatantly apparent in the developing world today, with current numbers showing nearly 2.5 billion people, almost 50% of the developing world's population, lacking adequate access to clean water.

C. Village to Village

For more supplementary research, I was able to get involved with a local organization and fundraiser that is helping bring clean water to villages in Africa. The particular event was a fundraiser called Village to Village, sponsored by a woman, now living locally, who grew up in Kenya. This event was a spin off of an earlier fundraiser that she hosted and she was continuing her efforts to provide basic needs for the current students and staff of her Alma Mater in Kendu Bay, Kenya. The fundraiser held was held at the Avila Bay Athletic Club on October 11th of this year, a wine tasting event that was accompanied by appetizers and both a live and silent auction. Due to the success of these fundraisers Millie Klumpp was able to raise enough money

not only to provide the construction and upkeep of a well in Kendu Bay, but also provide mosquito nets for the students, proper toilets, as well as the reconstruction of a dormitory that was destroyed in a fire last year. This volunteer work created a deeper understanding and relevance with this subject that I otherwise might not have felt from literary review.

D. Political Influence

As our population grows and the demand upon our Earth for this precious resource increases, our world is facing many challenges to ensure adequate access for people around the world. Alongside proposed solutions come the various debates and challenges to determine the best option. With a growing trend in the privatization of water, there exists the ever-increasing heated dispute over the human right to have access to clean water and how privatization may affect this human right. Today, so much of this debate surrounds a political challenge and the fight for the control over water.

E. Conclusion

The importance of this subject grows each day with the growing demand for clean water resources. The crisis that we are in can be felt around the world by peoples in need of water; as each day passes our population continues to grow and directly related to this expansion in population is the demand for clean water. One article was able to sum up the importance of this issue in a brief statement, "One thing will never change: people need water for survival" (Nappier 2). Water is life; it is a necessity that cannot be substituted by anything.

Chapter 2: Water Availability and Accessibility

As our world is already facing a shortage of clean water around the globe, it is expected to only get worse with population growth and an increase in demand unless something is done. Currently, there is an approximation that one-fifth of the world's population (nearly 1.2 billion people) lack access to clean water and furthermore, it is estimated by the United Nations Development Programme's Human Development Report that 2.6 billion people lack access to sufficient sanitation. While the degree to which it is felt varies from place to place, pressure to gain access to clean water can be felt around the world.



“ONE IN EIGHT PEOPLE ON THE PLANET DON'T HAVE ACCESS TO SAFE, CLEAN DRINKING WATER.”

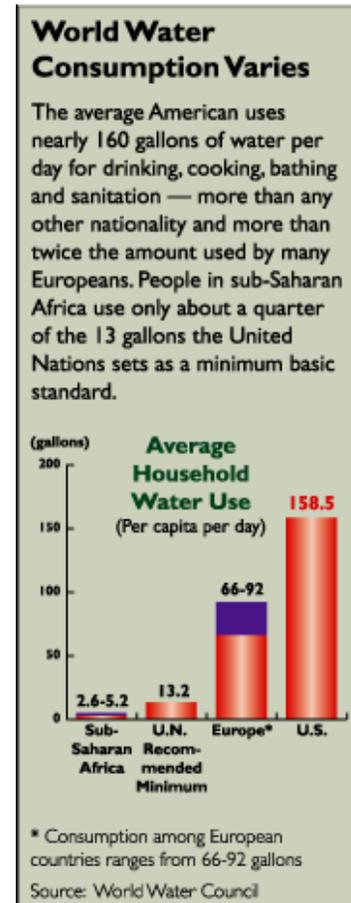
Source: www.charitywater.org

In a recent study by the International Water Management Institute it was shown that an estimated 1.2 billion people on Earth “live in areas experiencing ‘physical water scarcity,’ or insufficient supplies for everyone’s demands...Another 1 billion face ‘economic scarcity’ in which ‘human capacity or financial resources’ cannot provide adequate water” (Behr 2008, 29). It is predicted that the number of people lacking sufficient water will increase to nearly 3 billion in the next fifteen years. “As water depletion accelerates, drought is undermining nature’s

capacity to replenish this essential resource, punishing the planet's midsection--from eastern Australia and northern China through the Middle East and sub-Saharan Africa to the U.S. Sun Belt, the Great Plains and northern Mexico" (Behr 2008, 29). This depicts the unequal distribution of clean water from place to place, highlighting geography and development as crucial elements in the degree to which a region feels the strain on its access to clean water.

Although nearly 70% of Earth is made up of water, there is only a limited amount of clean water available for our use. While there is a high percentage of water on Earth's surface, this number is deceiving as much of the water is not accessible; while there may be an abundance of water on Earth, that which is accessible and available for human use is scarce, of all the water on our planet, "97.5% of it is salt water, virtually useless for most human needs" (Cooper 2003, 652). Of all the water present on Earth's surface, only 1% is available for human use, the rest is contained in our oceans, glaciers, and snowpack around the world. Furthermore, of the 1% that is available to human use water is additionally divided up by the different uses and applications of the resource. According to researchers, "irrigation claims 70 percent of total water withdrawals, 22 percent is used by industry and the rest goes for homes, personal and municipal uses" (Behr 2008, 32). Thus, while it may seem as though there is a vast amount of water available on Earth, when broken down into appropriate sources and uses, approximately .08% of the water on Earth is available for human consumption.

As introduced earlier, geography and development are key elements when looking at water scarcity around the globe. While geography is the key factor is the distribution of water availability, development affects the ability of a region to acquire access to a water resource. In Peter Behr's article Looming Water Crisis, he points out that "Access to safe, fresh water separates the well off—who can treat water as if it were air—from the world's poorest, who hoard it like gold. In the United States, the average consumer uses nearly 160 gallons of water per day, summoned by the twist of a faucet. In much of Africa, women often trudge for hours to and from wells, carrying the two to five gallons per person used by the typical person in sub-Saharan Africa" (Behr 2008, 31). While both regions fall within the planet's "midsection", which is said to suffer the most from water shortages, the difference of water availability is striking. The same alarming discrepancies exist for sanitation amongst regions across the globe; UNICEF states that, "Sanitation coverage is lowest in South Asia and in sub-Saharan Africa, where two-thirds of people do not have access to improved sanitation" (UNICEF 2008, 1).



With our growing population the needs and demands to gain access to clean water increase and this finite resource continues to diminish. "Water problems around the world are more than just shortages ...There are problems with water quality; physical shortages where there just isn't enough; economic shortages, where people can't get to the water resources

they need; and there are political shortages, where water is denied to people” (Cooper 2003, 652), states Peter H. Gleick, president of the Pacific Institute for Studies in Development, Environment and Security. Many different factors contribute to water shortages, such things as population growth, improving living standards, industrialization, and urbanization. Population growth is an important factor to look at, as long as our population continues to increase, there remains a growing need for clean water. Mary H. Cooper, author of *Water Shortages*, states that, “If the world’s population continues to grow at the current rate, humans will consume 70 percent of available fresh water by 2025, up from 54 percent today, according to the United Nations” (Cooper 2003, 667). While our population continues to grow, many regional growth rates around the world seem to be slowing, giving hope to this dire situation.

Many, if not all factors are interrelated and can be linked to one another and shown how they each affect one another, the next three factors are very important to look at as the collective affects they have on our water resources. Improving living standards, industrialization, and urbanization place a great strain on our clean water resources. While these factors are indicators of development in an area, they are also major contributing factors to the depletion of our world’s clean water resources. According to the United Nations, “As industrialization spreads, water pollution is becoming a growing threat to water supplies, especially in the developing world, where 70 percent of industrial wastes are dumped untreated into rivers and lakes. Some 2 million tons of human waste, fertilizers, pesticides and chemical and industrial wastes are released into waterways each day” (Cooper 2003, 659). While clean water and development go hand-in-hand, world regions continue to develop, sustaining the growing need for clean water. “Urbanization further depletes usable water

supplies, because it concentrates waste in waterways in towns where sanitation and plumbing are lacking. Ironically, those who use the least amount of water are exposed to the most water pollution” (Cooper 2003, 660). Again perpetuating the discrepancies brought about by geography and development between world regions.

As population growth and development continue to sustain the water crisis that our world faces, another major factor continues to exacerbate the crisis around the world. No matter what someone’s beliefs are about climate change, it is undeniable that it is happening and it is affecting Earth’s natural processes. “The United Nations predicts that the climate change alone will account for about 20 percent of the expected increase in global water scarcity” (Cooper 20003, 657). The impact of climate change upon the global water crisis is brought up throughout Behr’s article as well as a major element perpetuating the issue. “Climate change is expected to expand and intensify drought in traditionally dry regions and disrupt water flows from the world’s mountain snowcaps and glaciers” (Behr 2008, 30). In our recent history, there has been a mass migration of people from locales with cooler climates to those with warmer climates; these arid regions are also the most threatened by potential drought. This is supported by a report by the Met Office Hadley Center for Climate Prediction and Research in London that states ““Even though (globally) total rainfall will increase as the climate warms, the proportion of land in drought is projected to rise throughout the 21st century”” (Behr 2008, 31). As developing countries are the most fragile and susceptible to the mounting problems associated with the lack of water, the predicted droughts brought on by climate change bring about an immense risk to both developing and developed regions alike.

In the United States, problems with water availability due to the impact of climate change are already being observed. While much of our water renewal relies upon the seasonal water flows brought about by the melting of snowpack, current trends show a disruption of normal flow. Not only are scientists seeing a decrease in overall snowpack, but also a shift in seasonal melting patterns; bringing about earlier melts, leads to water shortages in the summer. "In parts of the Western United States, for example, the snowpack is down to 40 percent of normal" (Behr 2008, 45). In the Western United States, much of our water resources depend upon the snowpack, and as this continues to decrease, so does our annual water supply. In a study conducted by the University of Colorado's Western Water Assessment, "The amount of snow melting into the Colorado River Basin has declined by 10 to 30 percent over the last 30 years" (Behr 2008, 47). The impacts that global warming has upon water availability around the world is just another element that continues to add pressure to the global water crisis, while the multiple factors that affect water availability around the world differ from place to place, this is one that will continue to threaten resources worldwide, if action is not taken.

Up to this point, much of this paper has focused upon the diminishing sources of clean water around the world, but perhaps an even graver element to the world's water crisis is a matter of quality. As pointed out earlier, many in the developed world take for granted the easily accessible clean drinking water that is available at the simple turn of a faucet; this is a far cry from the harsh realities faced on a daily basis by people in developing countries. Within the United States governmental agencies regulate the quality of the water that is distributed to the public, at minimum, our water is safe to consume. For billions of people around the world, after struggling to simply gain access to a water source, there is no room to scrutinize the quality.

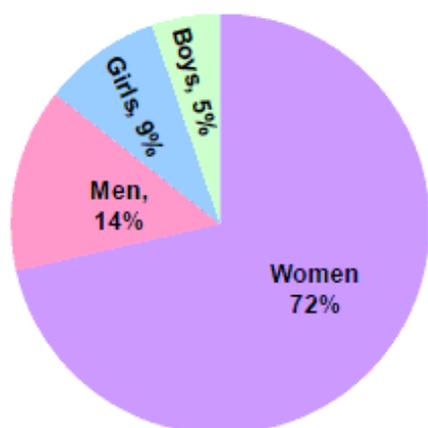
In the United States, there are many levels of regulation and oversight to water systems to ensure the quality of water being provided to the general public. “The Safe Drinking Water Act gives the Environmental Protection Agency (EPA) the responsibility for setting national drinking water standards” (EPA 6). The EPA falls under what is considered the United States’ “Health Authority”; an organization that is set up in order to create and uphold the necessary regulations. Beyond standards set and maintained by national agencies, drinking water in the United States is under further scrutiny by state and even local standards. There are many different factors of water that are subjected to review and analysis under specific public health standards that ensure quality control. *The Handbook of Drinking Water Quality* specifies the necessary criteria necessary to achieve potability; “...it can be summarized that potable water must meet the physical, chemical, bacteriological, and radionuclide parameters when supplied by an approved source, delivered to a treatment and disinfection facility of proper design, construction, and operation, and in turn delivered to the consumer through a protected distribution system in sufficient quantity and pressure. In addition, water should have palatability, be within reasonable limits of temperature, and possibly gain the confidence of the consumer” (Zuane 1990, 6). With strict standards and regular evaluations, it is obvious to see that the drinking water supply and quality in the United States is under much scrutiny by the public health sector. Similar to the EPA in the United States, many other developed countries have their own regulating agencies.

While many of the developed countries of the world have the ability to enforce strict regulations to ensure a specific level of quality in the public water systems, many places in the developing world do not have the luxury of inspection, forcing many to consume unsafe

drinking water. Statistics from the Centers for Disease Control and Prevention (CDC) state that “Worldwide, 884 million people do not have access to an improved water source[An improved water source is defined as water that is supplied through a household connection, public standpipe, borehole well, protected dug well, protected spring, or rainwater collection]”. Like the CDC, UNICEF also focuses upon the dire consequences of the lack of clean water in developing countries around the world. “Water quality is a growing concern throughout the developing world. Drinking water sources are under increasing threat from contamination, with far-reaching consequences for the health of children and for the economic and social development of communities and nations. Deteriorating water quality threatens the global gains made in improving access to drinking water. From 1990 to 2006 more than 1.6 billion people gained access to improved water sources, but not all of these new sources are necessarily safe. Unsafe handling and storage of water compounds the problem. Water drawn from safe sources may be contaminated by the time it is ultimately consumed in households” (“Water, Sanitation and Hygiene”). This illustrates the uphill battle that our world faces today, beyond the fight to gain access to water, is the struggle to gain access to safe, clean water; a crisis that continues to plague billions of people around the globe.

In the developing world, the struggle to gain access to clean water is coupled with many other risks that people must face on a daily basis in order to survive. From the threat of water or vector-borne illness to the threat of rape; the dangers confronted by the people facing water scarcity are vast and numerous. An important aspect of the risks and dangers that are presented by water scarcity is the increased threat to women and children. “In the developing world, the job of hauling water rests, literally, almost entirely on women’s shoulders” (Behr

2008, 40). Most communities rely upon women and children to retrieve water from sources, both near and far. “A UNICEF study in 23 sub-Saharan countries found that a quarter of women spent 30 minutes to an hour each day collecting and carrying water, and 19 percent spent an hour or more” (Behr 40). According to UN Water reports, “When water is scarce, women and girls may have to travel longer distances to obtain water, and conditions are more dangerous” (“Gender, Water, and Sanitation” 10). A report by UNICEF states that “Women and girls bear the burden of fetching water – and as a result miss out on opportunities for education, productive activities or leisure time” (“Water, Sanitation and Hygiene”).



“Women bear the burden: time spent fetching water in Africa (MICS and DHS surveys from 18 African countries in 2005 and 2006)”

Source: http://www.unicef.org/wash/index_womenandgirls.html

In addition to the daily journey to obtain water, women and girls face the threat of harassment and assault. In an interview conducted with woman who grew up in an impoverished area of Kenya, the threat of rape was discussed. As this woman discussed the number of rapes her cousin endured while retrieving water and the child that resulted from one of the incidents. While it may not be the most common risk, it is a fact of the matter.

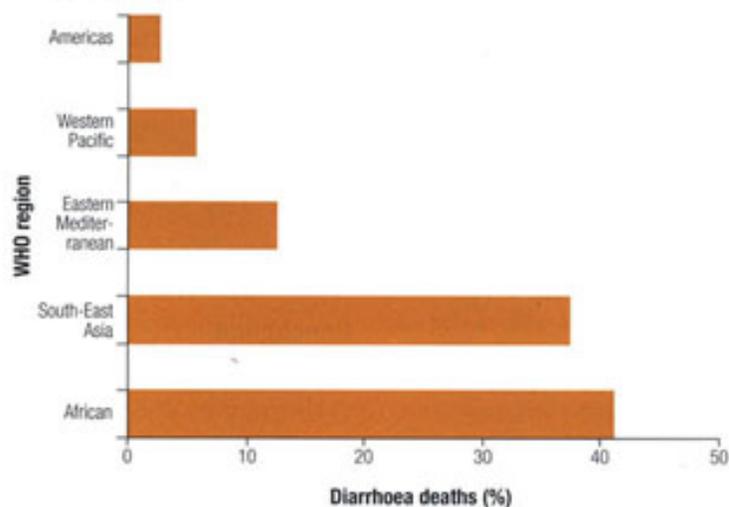
The largest risk that is incurred by civilians in regions suffering from water scarcity is that of water-related infectious diseases; “Water related illness is one of the most common causes of disease and death in developing countries” (Cooper 2003, 660). The United Nations estimates that “Each year 1.8 million children – 5000 per day – die from waterborne illnesses such as diarrhea” (Behr 2008, 31). Being one of the most vulnerable populations, children are the most highly affected population when it comes to water-borne illnesses. As these people lack access to adequate sanitation, it forces them to consume contaminated water, combined with pre-existing low health standards and care this lays the groundwork for devastating vulnerabilities to other disease. The consumption of unsanitary water leads to many different illnesses; reported by the non-profit organization Charity: Water, contaminated water and inadequate sanitation cause 80% of all sickness and disease and kill more people than war. Studies done by the World Health Organization show that the two regions of the world that most affected are Africa and South East Asia. Water-borne illnesses such as diarrhea are brought on by poor sanitation and ingestion of contaminated water; these are represented in the graphs below, depicting the devastating statistics that can result from their emergence.

Table 2. Estimates of diarrhoea deaths among children aged less than 5 years in low- and middle-income regions of the world, 2004

WHO region	Mortality stratum ^a	Average of diarrhoea-proportional mortality (%)	Estimated diarrhoea deaths (thousands)	Uncertainty ranges (thousands)
African (AFR)	D	17.8	402	346–455
	E	17.5	365	315–413
Americas (AMR)	B	13.3	35	30–40
	D	14.9	14	12–16
Eastern Mediterranean (EMR)	B	13.4	12	10–14
	D	16.9	221	190–250
South-East Asia (SEAR)	B	22.3	44	34–53
	D	24.5	651	500–793
Western Pacific (WPR)	B	13.8	105	90–118
World		18.7	1870	1558–2193

^a WHO subregions are defined on the basis of levels of child and adult mortality: A, very low child and very low adult mortality; B, low child and low adult mortality; C, low child and high adult mortality; D, high child and high adult mortality; E, high child and very high adult mortality.

Fig. 2. Distribution of deaths due to diarrhoea in low- and middle-income countries in 5 WHO regions



Source: Bulletin of the World Health Organization

Water-related illness can be divided into two separate groups, water-borne and vector-borne infectious diseases. Vector-borne illnesses include diseases such as malaria and dengue fever, brought on by insects, and Schistosomiasis, transmitted through worms that live off aquatic snails. The World Health Organization has reported that “The most deadly vector borne disease, Malaria, kills over 1.2 million people annually, mostly African children under the age of five. Dengue fever, together with associated dengue haemorrhagic fever (DHF), is the world's fastest growing vector borne disease” (“Vector-borne Disease”). Both water-borne and vector-borne illnesses account for millions deaths each year, “Millions of other children are made sick, weakened or are disabled by other water- and sanitation-related diseases and infections including cholera, malaria, trachoma, Schistosomiasis, worm infestations and Guinea worm disease” (“Water, Sanitation, and Hygiene”).

These diseases are becoming more prevalent and more devastating with our diminishing water sources, the devastation is seen, overwhelmingly so, in developing countries around the world as not only are they suffering from water scarcity, but also a lack of sufficient sanitation as well. “The concentration of poverty...is a key force behind the spread of water-related (and other) diseases” (Batterman 2009, 6).

Chapter 3: Community Work

Growing up in rural Kenya, Millie Klumpp was subjected to facing the real life struggles with water scarcity. She recalls the hours she and her classmates spent each day travelling to the river to provide just enough water for the students and staff to get by on. Now living in Arroyo Grande, California, Millie teamed up with the organization Charity: Water to provide a clean water well for the students and staff of her Alma Mater in Kendu Bay, Kenya and the surrounding community. Founded in 2006, Charity: Water is a non-profit organization that is dedicated to providing clean water to impoverished regions around the world, whether it is maintenance of an existing well or construction of a new well. In combination with other organizations, Charity: Water has adopted over 1,200 projects as of January 2009, and continues to grow. In the first fundraiser, Millie was able to successfully raise \$17,000 to provide a clean water well at her former High School, the construction of the well will begin in early 2010.

In her continued efforts to provide the staff and students at her Alma Mater with life's basic needs, she teamed up with a local non-profit organization, Wine for Wells (formerly, Wine for Water) in an attempt to further help the community. Wine for Wells is another non-profit organization, based out of Paso Robles, California, where the founder Ryan Broersma operates The Paso Robles Wine Center, a wine tasting room that donates all profits to water projects in Africa; current projects residing in Ethiopia, Uganda, and now Kenya. The organization is committed to providing "clean drinking water, sanitation and hygiene education to those in need around the world" (wineforwells.org), in an effort to increase sustainability, the

organization focuses on involving the community members in the construction and development of the well in order to gain an internalized sense of association and protection between the community and the well.

In order to continue in her attempt to help her former school and the surrounding community, Millie Klumpp organized another fundraiser event. Millie Klumpp teamed up with Ryan Broersma of Wine for Wells in order to put on a fundraiser at the Avila Bay Athletic Club to raise money for her Alma Mater in Kendu Bay, Kenya. After raising enough money to fund the development of a clean water well, Klumpp was inspired to continue her efforts, this time looking to raise enough money to rebuild the school's dormitories that were destroyed in a fire in the last year, provide adequate toilets and provide mosquito nets for the students and staff.

With donations and help from many local community members and businesses, Klumpp was able to put on an afternoon of wine tasting, appetizers, music and both live and silent auctions. The event, Village to Village, was held on October 11, 2009, hosting upwards of 150 guests, the afternoon was a success. Village to Village was successful in that community members from one corner of the world worked together in order to help a community half-way across the globe. The event raised a total of \$30,000 to be donated to the community of Kendu Bay. The dorms are to be rebuilt and mosquito nets will be provided to students, staff, and community members, and continued efforts are still being made to earn enough money to fund proper toilets at the school.

Overall, the fundraiser was extremely successful, not only in raising the funds to provide the basic necessities to the community, but also raising awareness to the people of the Central

Coast and bringing hope to the people of Kendu Bay, Kenya. This fundraiser has shown a new light on the global water crisis, highlighting the severity of this crisis around the world.

Chapter 4: Current Political Issues and Future Work

As the effects of the global water crisis continue to grow and affect people around the world, there is a greater need for regulation and oversight in order to change the current trends that are threatening people's lives across the globe. Without a doubt there is a need for change in the system; as the extreme discrepancies of access to clean water is seen from place to place, there is one constant and that is the need for this vital resource. Many potential solutions have been both proposed and implemented; ranging from large-scale desalinization plants to small-scale community wells, alongside these solutions, there remains a strong influence from politics that plays a vital role in the implementation and acceptance of any solution.

Currently in the United States, while there is local and state political regulation to our water-use practices, there is an increasing concern that potential water shortages and drought are bringing about a need for greater regulation and potentially federal oversight. "Although 35 states have begun developing long-term drought-preparedness plans in recent years, some experts say the threat of water scarcity is too critical to leave water policy to an ad-hoc, state-by-state approach" (Cooper 2003, 656). One report has suggested that water-rich states establish "water banks", which would allow for these saturated areas or states to essentially sell their excess to water-poor areas. With much debate over this topic, both regional and federal regulation have their benefits and disadvantages, a many believe keeping local control of water provides a better solution for potential drought, others criticize this suggestion as it may promote conflict over resources that extend across multiple borders and boundaries, suggesting that federal regulation would allow for an all-encompassing plan.

For those that are concerned with local restrictions on water policies and legislation, a more generalized plan would be a better solution. “Some lawmakers agree that greater federal oversight is in order, especially with regard to drought preparedness” (Cooper 2003, 656). For many the ultimate goal being a national drought plan, the decision to create a comprehensive prevention plan would allow for the federal government to hold greater authority over the use of water resources. Supporters of national policy see the concern of those opposed and have said that, “...have no intention of infringing on the states’ control over water. But efforts to strengthen the federal government’s water policy decision-making powers may spark resistance at the state and local levels...” (Cooper 2003, 657). Manifested around the world, the issue of access to water is a problem that is ever present in both developing and developed countries.

The President of the Pacific Institute for Studies in Development, Environment and Security, Peter H. Gleick, stated “One of the things that we’ve learned in the last three decades is that there is no one solution to water problems. What works in southern India may not work at all in sub-Saharan Africa” (Cooper 2003, 666). As our world approaches increased affects and pressures stemming fro the global water crisis, many different regions around the world are searching for potential solutions, many striving to develop and implement sustainable water-use practices. Current trends are showing that many places are shying away from the big water projects, such as dams, that have historically been so common. With greater knowledge and concern about further environmental degradation from hydro projects, “Pressure is mounting to encourage the leading institutions to play a bigger role in small-scale water projects...” (Cooper 2003, 666). Around the world, many regions are developing these small-scale solutions; some of the approaches that are being taken around the world include rooftop

rainwater collection tanks as well as the utilization of previously used water or “gray water”. “Japan and Singapore, which have long contended with limited water supplies, have installed parallel water systems that supply households with clean water for drinking and cooking and gray water for gardens and toilets” (Cooper 2003, 666). This system of recycling used water is a way to conserve our water resources and promote more efficient and sustainable water use practices.

With many potential solutions being proposed, one carries more weight than the rest of them and that is the privatization of clean water sources. As our world recognizes the impending global water crisis, privatization has been seen as both a viable solution and a catalyst to further fuel the problem. “The World Bank and other international leaders had been supporting privatization strategies in hopes that investments and better management by private industry would help bring water and sanitation to more than a billion poor people whose governments couldn’t or wouldn’t do the job”(Behr 2008, 35). To those that support the privatization of water, by putting a price on the commodity, the value comes to a front, creating a greater awareness of the need for conservation and protection. For many the issue of privatization gets at the question of human rights, and whether or not someone has the right to control another’s access to a basic human need, such as water. Many see the privatization of water as way that corrupt multinational corporations exploit our life’s basic requirements to make money, bringing about the issue that those who have the greatest need for clean water are also those that can’t afford to pay for it. The debate over water privatization is ongoing and will remain an issue as long as the global water crisis exists.

Chapter 5: Need for Action

The need for water is unchanging, but as population demands and climate change continue to negatively affect our supply, and diminish our available resources, the crisis continues to grow. The stress is felt around the world, but as expressed in this paper, there are great discrepancies to the degree in which these pressures are felt. As much of the developed world is focused upon eluding future shortages, many in the developing world are currently struggling to achieve access to a clean water resource on a daily basis. The devastating effects of the global water crisis can have on a community are evident from the statistics, as over a fifth of the world's population does not have access to clean drinking water and deadly illnesses continue to take thousands of lives each day. While current statistics are dire, they are only going to get worse with our growing population and diminishing resources.

It is vital that people around the world come together in order to develop effective and sustainable solutions. While the politics of this issue remain a hindrance to many solutions to be implemented, the issue continues to grow and expand in its importance and affect. An opportunity to volunteer with the non-profit organization, Wine for Wells, it allowed for greater insight and understanding to the issue, the global water crisis became much more relevant. The fundraising event Village to Village brought to life the issues that plague billion's of people each day. Although large-scale projects may have provided an effective solution in the past, people seem to be looking to efficient small-scale projects for the future. Water is an irreplaceable need for life, far-reaching across boundaries and borders, the challenge expands as our resources are under continuous threat.

Bibliography

1. Barry, Michele, and James M. Hughes. Talking dirty - the politics of clean water and sanitation. *The New England Journal of Medicine* 359.8 (August 21, 2008): 784(4). Retrieved October 7, 2009, from Expanded Academic ASAP
2. Batterman, S., Eisenberg, J., Hardin, R., Kruk, M E, Lemos, M. C., Michalak, A M, Mukherjee, B., Renne, E., Stein, H., Watkins, C., and Wilson, M L (July 2009). Sustainable control of water-related infectious diseases: a review and proposal for interdisciplinary health-based systems research. (Review)(Report). *Environmental Health Perspectives*, 117, 7. p.1023 (10). Retrieved September 24, 2009, from Expanded Academic ASAP via Gale.
3. Behr, P. (2008, February 1). Looming Water Crisis. *CQ Global Researcher*, 2, 27-56. Retrieved September 24, 2009, from CQ Global Researcher.
4. "Beyond Scarcity: Power, Poverty and the Global Water Crisis." *Human Development Reports*. United Nations Development Programme. N.d. Web. 26 Oct. 2009. <<http://hdr.undp.org/en/reports/global/hdr2006/>>
5. Boschi-Pinto, C., Velebit, L., & Shibuya, K. (Sept 2008). Estimating Child Mortality Due to Diarrhoea in Developing Countries. *Bulletin of the World Health Organization*, p.710 (8). Retrieved October 07, 2009, from Expanded Academic ASAP.
6. Cooper, M. H. (2003, August 1). Water Shortages. *CQ Researcher*, 13, 649-672. Retrieved September 24, 2009, from CQ Researcher Online.
7. EPA Drinking Water and Health: What You Need To Know. Washington, DC: U.S. Environmental Protection Agency, Office of Water, 1999.
8. Eshelby, Kate. Dying for a drink. *British Medical Journal* 334.7594 (March 24, 2007): 610(3) Retrieved October 7, 2009, from Expanded Academic ASAP.
9. "Gender, Water and Sanitation: A Policy Brief." *UN Water*. Water for Life. June 2006. Web. 4 Nov. 2009. <<http://www.unwater.org/downloads/unwpolbrief230606.pdf>>
10. "Global Water, Sanitation, and Hygiene." *CDC*. Centers for Disease Control and Prevention. N.d. Web 28 Oct. 2009. <<http://www.cdc.gov/healthywater/global/>>
11. Lawrence, Robert S., Nappier, Sharon P., and Schwab, Kellogg J. Dangerous Waters: Natural History; Nov2007, Vol. 116 Issue 9, p. 46-49. Retrieved October 7, 2009, from Academic Search Elite.
12. Sullivan, Patrick J., Agardy, Franklin J., Clark, James J.J. (2005). The Environmental Science of Drinking Water. New York: Elsevier.

13. "Vector-borne Disease." *The Health and Environment Linkages Initiative*. World Health Organization. N.d. Web. 16 Nov. 2009. <<http://www.who.int/heli/risks/vectors/vector/en/index.html> >
14. "Water, Sanitation, and Hygiene." *UNICEF*. Unite for Children. Web. 26 Oct. 2009.
<http://www.unicef.org/wash/index_3951.html>,
<http://www.unicef.org/wash/index_womenandgirls.html>,
<http://www.unicef.org/wash/index_43106.html >
15. "Why Water." *Charity: Water*. Web. 9 Nov 2009. < <http://www.charitywater.org/whywater/>>
16. "Mission Statement." *Wine for Wells*. Web. 9 Nov 2009. <<http://wineforwells.org/> >
17. Zuane, John De. (1990). Handbook of Drinking Water Quality: Standards and Controls. New York: Van Nostrand Reinhold.