The Ultimate Thirst: The Link between Water Supply and Quality of Life

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Abstract

As world population continues to increase and finite natural resources are spread increasingly thin, the security of water supplies has become an emerging issue of both national and global importance. As a result, global water availability and its link to quality of life factors, such as life expectancy, fertility, and population density, will likely manifest more commonly in domestic and international conflict. The data presented in this project shows the initial link between the availability of water resources and its impact on quality of life.
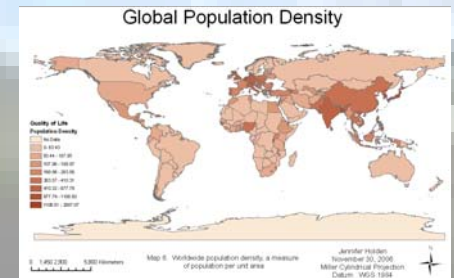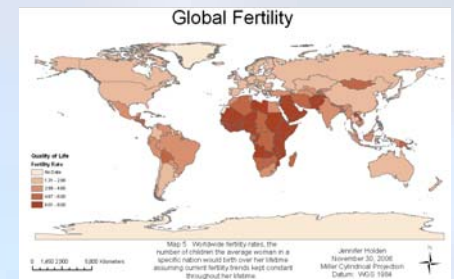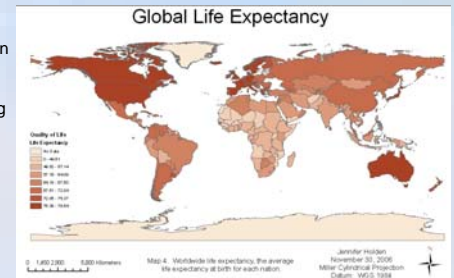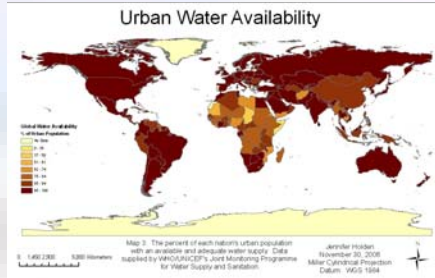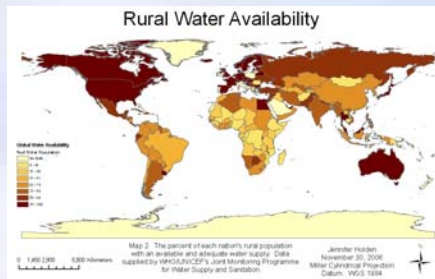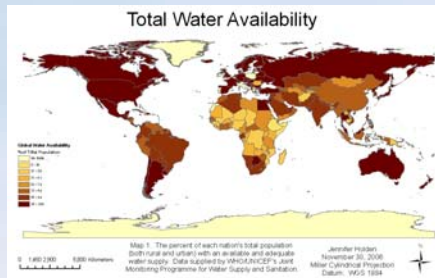
Introduction

According to UNICEF's website, over one billion people in the world today utilize unsafe drinking water sources[1]. The ramifications of this are far-reaching: thousands of children die each day from water-borne illness, workers are less productive, quality of life is lowered, and sustainable growth in developing countries is hindered. In addition, there are public safety concerns which arise as a result of limited water availability. In this project, I attempted to establish what, if any, correlation exists between water scarcity and quality of life. I also hypothesized that water stressed nations would have a lower quality of life and be more likely to experience domestic and international conflict. After some basic background research and establishing my initial expectations, I then began the process of gathering and analyzing international data through the use of ArcGIS.

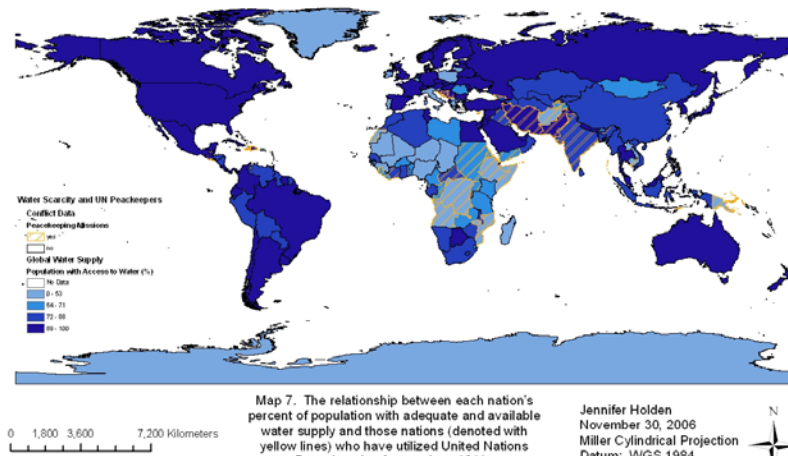[1] http://www.unicef.org/wes/index_water_quality.html

Methodology

My goal was to utilize GIS to analyze global water availability. To begin, I located United Nations data which documented global water supply as well as rural and urban water supply for each nation (Maps 1-3). I also researched various quality of life factors, which included life expectancy (Map 4), fertility (Map 5), and population density (Map 6), to see if water availability serves as an indicator of overall well-being. Lastly, I located data regarding the deployment of UN peacekeepers and compared the most water stressed nations with those countries with conflicts necessitating United Nations forces (Map 7).   The data which was not already available in a GIS-friendly format (all except quality of life factors) I entered manually into Microsoft Excel and then exported as a DBF file. I then joined this information to a 2005 map of the world's political boundaries in ESRI ArcMap 9.1and generated the maps revealed here. These images allowed me to draw conclusions regarding the link between water scarcity and quality of life.

Map 7. The relationship between each nation's percent of population with adequate and available water supply and those nations (denoted with yellow lines) who have utilized United Nations Peacekeeping forces since 1941.

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Miller Cylindrical Projection
Datum: WGS 1984

Results/Conclusions

First of all, a visual analysis of total water availability shows that there is a great deal of global variation in potable water resources. The region of the world which suffers most from water scarcity is the central portion of Africa (Map 1). A closer look at the availability of water supplies shows that, in general, rural populations suffer more greatly from water scarcity than their urban counterparts (Maps 2 and 3). This is expected, as cities generally have better water and sanitation infrastructure, in addition to the population base needed to support the development of water resources. Much of Africa, Asia, and South America has some type of water deficiency in rural areas.

There does appear to be a relationship between water scarcity and some quality of life factors. High fertility rates and low life expectancies are both indications of a lower quality of life, and those countries which illustrate these two trends appear to correlate to those nations with the most limited water availability (Maps 4 and 5). The continent of Africa in particular shows this relationship. In addition, the suggestion that the most water stressed areas of the world are also experiencing the highest fertility rates indicates that water scarcity will continue to continue to plague these regions. Population density does not appear as closely related to water stress as these other factors (Map 6). This finding is interesting because it suggests that factors in addition to overpopulation are creating water scarcity. Possible causes include the local ecosystem, environmental problems, and poor management.

The link between total water scarcity and UN Peacekeeping missions also exists, although not as strongly as I had originally hypothesized (Map 7).   The majority of those countries which have required peacekeeping missions are indeed water stressed, but the majority of countries with low levels of water availability have not experienced this type of conflict.

Looking Ahead

Throughout this project, I learned how GIS can be used to effectively analyze and present large volumes of spatial data. I also gained much insightful knowledge regarding patterns of water scarcity and the social implications of these shortages. In the future, I would like to improve on the visual comparison I have provided by establishing whether the correlation between water supply and quality of life is statistically significant. I would also like to explore other factors which indicate political unrest. This could include nations requiring the assistance of NATO forces or those which have experienced a coup d'État. I look forward to continuing research into water resource policy and conflict for the rest of my time at Furman and in graduate school, and hope to learn more about the economic, political, and environmental implications of this preliminary study.

Total Water Availability

Rural Water Availability

Urban Water Availability

Global Life Expectancy

Global Fertility

Global Population Density