Regional and State Level Water Scarcity Report: Northeast United States

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Index Terms

Human impacts [1834]
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Abstract

There are an abundance of large-scale, coarse resolution global water scarcity studies, but the existing literature fails to address regional and state specific scarcity measures. Moreover, while environmental water requirements are an integral factor in the development and implementation of sustainable water management practices, only recently has this notion been introduced to water scarcity research. In this paper, we argue that developing a preliminary measure of water scarcity, at the regional and state levels, will allow for more informed policy development. The goal of this study is to generate a more comprehensive understanding of water scarcity in the Northeast, by gathering fine scale data, applying a consistent methodology to the calculation of a scarcity index, and analyzing the results to see relative trends in spatio-temporal water scarcity. Public supply, irrigation, rural, industrial and thermo-power withdrawals have been compiled from USGS state water use publications from 1950 to 1985. Using the WBMplus water model runoff data, state specific in-stream environmental water requirements were calculated using the accepted hydro-ecological methodology. Water scarcity was then calculated as a ratio of water withdrawals to total available water minus environmental flow requirements for the system. In so doing, this study generates a spatially explicit...
and temporally varying water scarcity indicator (WSI) for the Northeastern United States between 1950 and 2000 at the regional and state levels at a five-year time interval. Calculation of a spatial and temporal water scarcity indicator enabled us to identify regions and specific states that were: slightly exploited (WSI < 0.3), moderately exploited (0.3<WSI< 0.6), heavily exploited (0.6<WSI<1.0) and over exploited (WSI>1.0). The minimum environmental water requirements to maintain in-stream aquatic and riparian ecosystems for the Northeastern states ranged between 27.5 to 36.3 percent of the mean annual runoff within Vermont and Maryland, respectively. The regional WSI values ranged between 0.199 in 1950 and 0.512 in 1995, indicating increasing water scarcity over time as population and employment growth has placed greater demands on water resources. Additionally, our study revealed that in 1980, Massachusetts, Pennsylvania and New Jersey scarcity levels were 0.733, 0.790 and 0.857, respectively. Although the Northeastern United States is commonly perceived as a water rich region, moderate to heavily exploited levels of water stress were observed over the time period when a finer spatial scale is utilized. Water scarcity indicator values were disaggregated by state for each time period and illustrated using a series of maps. Additional descriptive statistics were used to elucidate the differences in water scarcity between states over time.

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