International Journal of
Environmental Sciences & Natural Resources
ISSN: 2572-1119

Juniper Publishers
key to the Researchers

Mini Review Article
Volume 1 Issue 4 - February 2017
DOI: 10.19080/IJESNR.2017.01.555569

Int J Environ Sci Nat Res

Water poverty Analysis using Water Poverty Index (WPI) -A critical Review

AM Anju[1], SE Vicky[1] and PJ Sajil Kumar[2]*

[1]*Institute for Environmental and Process Technology, Brandenburg University of Technology, Germany*

[2]*Institute of Geological Sciences, Freie Universitat Berlin, Hydrogeology Group, Germany*

Submission: February 20, 2017; **Published:** February 22, 2017

***Corresponding author:** PJ Sajil Kumar, Freie Universitat Berlin, Institute of Geological Sciences, Hydrogeology Group, Malteserstr 74-100, 12249 Berlin, Germany Email: pjsajil@gmail.com

Abstract

Water poverty is a condition in which people does not have access to safe, clean and enough quantity of water to satisfy their needs. This brief review gives a glimpse to the water poverty analysis using a holistic water management tool called Water Poverty Index (WPI), which is developed by Sullivan et al. to consider all the aspects involved with water management.). Water poverty index (WIP) encapsulates data on water resources, access, use, socio-economic capacity and the environmental water quality, which aids water monitoring agencies to analyze water situation in the giver region. The major advantages and the challenges in the implementation of this method is critically evaluating in this mini review.

Keywords: Water Stress; Water poverty index (WPI); Water Poverty; Water Management; Water Analysis; WPI Components

Introduction

Water as essential life giving compound, which is vital in keeping all the live alive life on the earth. In the recent decades, anthropogenic activities and many other reasons have created so much difficulties even in providing basic water supply for inhabitants from both surface and groundwater resources. This poverty for water or richness of water within the area, has to be calculated not only based on available water resources, but also by considering the factors such as accessibility, capacity, use and environmental factors Sullivan CA [1]. Water stress is an emerging issue in many of the developing countries since the rapid urbanization led to increase in population rate, economic growth which forced in increase in the solid waste generation and thereby decreasing the quality of water due to the pollution, deforestation and other anthropogenic activities and the water became inaccessible for human use. Water stress can effectively be evaluated using several methods among which Water Poverty Index (WPI) is the most widely used method. In this short review, we will be critically discussing about the same Sullivan CA [1].

Water Poverty Index (WPI)

Water Poverty Index (WPI) is a simple, open and transparent tool, one that will appeal the politicians and decision makers, and at the same time empower poor people to better participate in water sector interventions and budgets development in general Sullivan CA [1]. The elementary advantage of the index is that it encapsulates more than one measure of influencing factors in a single number, and one line representation of the whole picture.

In its first iteration, Sullivan et al. [2] developed the WPI to consider all the aspects involved with water management. Consequently, the WPI explains water poverty according to five components – Resource(R), Access (A), Capacity(C), Use (U) and Environment (E). The calculation process for the WPI is simple, cost effective and easy to understand even though it requires large micro data sets. Today, the WPI method is extensively used to study water poverty. To calculate the values for the above-mentioned five components of WPI, Cook et al. [3] used Bayesian Networks connecting water and poverty in the Volta Basin of Ghana. Lawrence et al. [4] published a comparative study, showing the WPI of different countries across the world. Castelazo et al. [5] incorporated the concept of flood risk vulnerability as a variable into the WPI for Juarez Municipality in Mexico. In addition, Vyver [6] calculated WPI and established Water Poverty Maps for some regions in South Africa. Within no time the research of WPI ranged from small scale community to country level. Identifiable work has also been carried out in Nepal where Merz [7], used Sullivan et al method, quantifies the components of WPI for the Jhiku and Yarsha catchments, both bordering the Indrawati Basin. Moreover, the WPI is one of the best tools to study climate vulnerability. In fact, with the addition of just a few components, the WPI can be used to calculate the Climate Vulnerable Index (CVI) Sullivan CA [8].

WPI Structure

The five components explained above are combined to calculate the WPI. The final value of WPI for a particular location can be calculated as described by Sullivan et al. [1] is presented below.

$$WPI = \frac{W1 \times R + W2 \times A + W3 \times U + W4 \times C + W5 \times E}{W1 + W2 + W3 + W4 + W5}$$

Where, Wi is the Weight applied to each of five components

R – Resource

A – Access

U – Use

C – Capacity

E – Environment

These weights (WI) are constrained to be non-negative and sum to unity. Each of the components is standardized so that the value of WPI falls between 0 and 100.The highest value 100 is taken to describe the best situation whilst the worst is 0.

The various sub components which help to calculate the five components of WPI are listed in below (Table 1).

Table 1: Various sub components which help to calculate the five components of WPI.

WPI Component	Sub Components
Resource(R)	Runoff potential
	Rain potential
	Variability of rainfall
Access(A)	Time required to carry water
	Reliability of pipe water supply
	Percentage of agricultural land with access to river for irrigation
Capacity(C)	Percentage of households with economic activities
	Literacy rate
Use (U)	Total percentage of households owning only agricultural land
	Total percentage of household with agricultural land
Environment (E)	Quality index of water sources with percentage of people dependant on similar water quality.
	Percentage of area with natural vegetation.

Critical evaluation

If the In case WPI is updated at reasonable intervals, it can be used to monitor the progress. . Even though WPI had found a great relevance in the sustainable water management sector in policy making, there are few defects in the current index. In particular, two major weaknesses of WPI index have been identified by Gine Garriga [9]. Rather than using the available data for the calculation of WPI, the writer's developers of the index have used the data needed to construct WPI. Another major drawback of the current WPI is the equal weight age given to the components is not justifiable. Moreover, a single number alone cannot reveal anything about the complexity of water issues. So alternatives to tackle these issues are very important. Further studies have proved that multivariate techniques can be used to give the weight age. In this technique, weight age is given based on the variations in the original variables Gine Garriga [10,11]. Furthermore, detailed studies are required to criticize the existing WPI and to suggest a new improved WPI calculation method for the sustainable future.

Conclusion

This brief review tries to portray overall picture of water poverty index as a tool to evaluate water situation of the particular region, which helps policy planners to evaluate the threats and to take immediate action. Similarly, decision makers, after estimating all the five components, will be able to realize and identify the sectors which need significant attention in regards to the water needs. In a nutshell, the WPI makes us understand the difficulties of water issues by integrating the physical, social, economic and environmental aspects by linking water issues to poverty. Most importantly it is suggested to make further detailed research to overcome the critics to have a holistic tool which yields precise results. Use of multivariate techniques to the weight assessment is suggested to get better results.

References

1. Sullivan CA (2003) The water poverty index: development and application at the community scale. Natural Resources Forum 27: 189-199.
2. Sullivan CA (2002) "Calculating a Water Poverty Index." World development 30(7): 1195-1210.
3. Cook S, Jorge Rubiano, Caroline Sullivan, Winston Andah, Felix Ashante, et al. (2007) Water Poverty Mapping in the Volta Basin: Looking for linkages between water and poverty. Accra, Ghana.
4. Lawrence PM, Jeremy Meigh, Caroline Sullivan (2003) The Water Poverty Index: An International comparison. Keele Economic Research Papers from Centre for Ecology and Hydrology (CEH), Wallingford USA.

How to cite this article: A Anju, S Vicky, PJ Sajil K. Water poverty Analysis using Water Poverty Index (WPI) -A critical Review. Int J Environ Sci Nat Res. 2017;1(4): 555569. DOI: 10.19080/IJESNR.2017.01.555569

5. Castelazo (2007) Incorporating Flood Vulnerability to the Water poverty Index in the Juarez Municipality. UCOWR, Paper 14 Southern Illinios University, Mexico.

6. Vyver CV, Dawid B Jordaan (2011). Water Poverty Mapping and its Role in Assisting Water Management. Communications of the IBIMA, 13p.

7. Merz J (2004) Water balances, Floods and sediment Transport in the Hindu Kush-Himalayas. University of Berne, Switzerland.

8. Sullivan CA (2011) Quantifying water vulnerability: a multidimensional approach. Stochastic Environmental Research and Risk Assessment 25(4): 627-640.

9. Gine Garriga (2008) The Enhanced Water Poverty Index: Targetting the Water poor at Different Scales. A: WISA Biennial Conference. "WISA 2010 Biennial Conference" Durban.

10. Gine Garriga (2010) Improved Method to calculate a Water Poverty Index at local scale. Journal of Environmental Engineering 136(11).

11. CBS/UNFPA (2001) Population of Nepal VDC/Municipalities, Data Book-Central Region of Nepal.

DOI: 10.19080/IJESNR.2017.01.555569

How to cite this article: A Anju, S Vicky, PJ Sajil K. Water poverty Analysis using Water Poverty Index (WPI) -A critical Review. Int J Environ Sci Nat Res. 2017;1(4): 555569. DOI: 10.19080/IJESNR.2017.01.555569