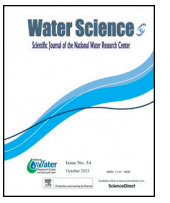
Water Science
ScienceDirect
Water Science xxx (2017) xxx–xxx
journal homepage: www.elsevier.com/locate/wsj



Research Article

Water poverty in upper Bagmati River Basin in Nepal

Jay Krishna Thakur [a,b,*], Mahesh Neupane [c], Anju Andezhath Mohanan [a]

[a] *Environment and Information Technology Centre — UIZ, Neue Grünstraße 38, 10179 Berlin, Germany*
[b] *Health and Environment Management Society (HEMS), Basundhara, Kathmandu, Nepal*
[c] *School of Civil and Environmental Engineering, University of New South Wales, Sydney, Australia*

Received 1 October 2016; accepted 25 December 2016

Abstract

Water Poverty Index (WPI) is a simple and transparent tool to measure water stress at the household and village levels so that local an'd national water agencies can manage problem of access to water, quality and variability; water uses and capacity for water management considering environmental aspects. The research aims to calculate WPI in the upper Bagmati river Basin of Nepal in order to analyse the real water situation in the project area. WPI was estimated using five key components through the consultation with wide range of stake holders, policy makers and scientists for resource, access, capacity, use and environment.

The WPI was calculated for the upper Bagmati river Basin together with High–Medium–Low category scale and interpretations. WPI intensity scale depicts Sundarijal and Lubhu are in a range of very low water poverty, which means the water situation is better in these two areas. Daman region has a medium level, meaning this region is located into poor-accessible water zone. Kathmandu, Sankhu and Thankot have a low to medium low WPI, what characterize them as neutral. WPI can be used as an effective tool in integrated water resources management and water use master plan for meeting sustainable development goals. Based on the observation, the water agencies required to focus over water-poverty interface, water for sanitation, hygiene and health, water for production and employment generation, sustainable environmental management, gender equality, and water rights.

Keywords: Water poverty; Upper Bagmati River Basin; WPI for integrated water resources management

1. Introduction

Easy access to safe and adequate water throughout a year is a big challenge amongst the inhabitants of the river basins predominated by perennial rivers (Wigmosta et al., 1994). An area within a basin can be defined as water poor or water rich, not only on the basis of available water resources, but also by considering the factors such as accessibility, capacity, use and environmental factors (Coppin and Richards, 1990; Neupane et al., 2015).

* Tel.: +49 17655367884; fax: +49 17655367884.
E-mail address: jay@thakur.co (J.K. Thakur).
Peer review under responsibility of National Water Research Center.

Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.wsj.2016.12.001

Please cite this article in press as: Thakur, J.K., et al., Water poverty in upper Bagmati River Basin in Nepal. Water Sci. (2017), http://dx.doi.org/10.1016/j.wsj.2016.12.001

Water poverty in Nepal is an emerging issue for the local government and the country is facing challenges related to water pollution, poverty and scarcity through the country hold 2.27% of world water resource (HEMS, 2015). Water resource is the most important natural resource of Nepal. The major sources of water are snow melt from Himalayas, glaciers, rainfall and groundwater (Nepal, 2013).

The rapid urbanization led to increase in population rate and economic growth which forced an increase in the solid waste generation and thereby decreasing the quality of water due to the pollution, deforestation and other anthropogenic activities and therefore water became inaccessible for human use (Diwakar and Thakur, 2012). The harsh mountainous topography, which composes about 70% of the country's total area, is another cause of water poverty in hilly and mountainous region of Nepal (Schwartz et al., 2001). Most of the households have little or no access to basic social services for instance primary health care, higher education, clean drinking water and sanitation services in the mid-hill and high mountain regions of Nepal. In addition, nearly 80% of the mountain labor force is committed in agriculture despite poor irrigation facilities (Matteo et al., 2006).

Due to the combination of rigorous topography and the population's lack of capacity, water poverty prevails over the rural mountain regions than anywhere else in Nepal (Palmer et al., 2008). The poverty survey conducted by the Central Bureau of Statistics during 2010/2011 reflects that 25% of the total population is below the poverty line, the percentage boosts extremely in the rural regions, with 27.43% of the total rural population. The range of poverty index varies from 9 to 22% between urban Hills and urban Terai, while the same index in rural hills ranges from 16 to 37% from Eastern to Mid and Far Western region. The poverty range from East to West in rural Terai varies from 21 to 31%. Aim of this research is to calculate the Water Poverty Index (WPI) in the upper Bagmati river Basin of Nepal in order to analyze the real water situation. The research is carried out at the VDC level, the smallest administrative unit of the country.

1.1. The Water Poverty Index

Water Poverty Index (WPI) is a simple, open and transparent tool, one that can 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 (Coppin and Richards, 1990; Franklin, 2001). The elementary advantage of the index is that it encapsulates more than one measure of influencing factors in a single number, and single line representation of the whole picture. As such, WPI reflects the status of water resources of the basin and thus, aids in the effective water management in the needy water stress zones. Lack of adequate and efficient water supplies, i.e., where "water poverty" is pre-dominant, any measures to reduce income poverty are unlikely to be successful (Franklin, 2001). WPI can enable progress towards developmental targets to be monitored, and water projects to better be targeted to meet the needs of current generation, while securing water availability for the needs of future generations, as recommended in the Brundtland Report (Calder, 1992).

The WPI was developed to consider all the aspects involved with water management (Franklin, 2001). Consequently, the WPI explains water poverty according to five components – Resource (R), Access (A), Capacity (C), Use (U) and Environment (E) – which are described in detail in Section 3.1. The calculation process for the WPI is simple, cost effective and easy to understand even though it requires large micro data sets (Alexander et al., 2006).

During the current studies of water poverty, the WPI method is extensively used. To calculate the values for the above-mentioned five components of WPI, HEMS (2016) used Bayesian Networks connecting water and poverty in the Volta Basin of Ghana. Bosch and Hewlett (1982) published a comparative study, showing the WPI of different countries across the world incorporated the concept of flood risk vulnerability as a variable into the WPI for Juarez Municipality in Mexico (Hirel et al., 2007). In addition, Brush and Meng (1998) calculated WPI and established water poverty maps for some regions in South Africa.

The research of WPI ranged from small scale community to country level within last decade. Identifiable work has also been carried out in Nepal where Gerten et al. (2004) used Sullivan method, quantifies the components of WPI for the Jhiku and Yarsha catchments, both bordering the Indrawati Basin.

The development of WPI is aimed to produce a holistic policy tool, drawing on both the physical and social sciences, and having application throughout the world. By identifying and tracking the physical, economic and social drivers which link water and poverty, it is estimated that the development of such an index will enable decision makers to target the crosscutting problems in an integrated way (Gerten et al., 2004).

Please cite this article in press as: Thakur, J.K., et al., Water poverty in upper Bagmati River Basin in Nepal. Water Sci. (2017), http://dx.doi.org/10.1016/j.wsj.2016.12.001