Water shortage in towns of Hindu Kush Himalayan (HKH) Region

The term "water shortage" or "water scarcity" hobbles between "demand" and "supply" of water, and it is primarily determined by physical (climate, environment, topography) and socioeconomic (demography, institutional capacity) factors (Molden, 2007). Nevertheless, a lack of awareness has caused the debate to focus largely on physical factors and encouraged the planners and government agencies to overlook the socioeconomic aspects leading to deep crisis (Prakash & Molden, 2020). Thus, it is important to understand the depth of both these factors equally to deal with the problem of water shortage.

The Hindu Kush Himalayan (HKH) region, often called "the world's most important water tower" – a life savior for 1.3 billion people living in eight different countries namely Nepal, India, Pakistan, Bhutan, Bangladesh, Afghanistan, Pakistan and China (GRID-Arendal, 2018), is at great risk of water shortage due to climate change (Ball State University, 2020; Scott et al., 2019; S. Singh, Tanvir Hassan, Hassan, & Bharti, 2020; V. Singh & Pandey, 2020). Besides polar regions, HKH region is the largest freshwater reservoir in the form of glacier, snow, and ice giving rise to Asia's 10 largest rivers which serve the population downstream as a source of drinking water, irrigation, industrial production and various other purposes (GRID-Arendal, 2018; Shrestha, Singh, & Prakash, 2020). Meanwhile, analyzing both the present and future scenarios of climate change (Eriksson et al., 2009), it seems obvious that the severity of water shortage is going to have a significant effect on the livelihood and economic development of the people in this region in near future. Even though, climate change, in one hand, is the primary cause of water shortage in the region, I argue that there are some important socioeconomic factors like centralized population growth driven by one-directional migration from rural to urban areas, and water management system failure driven by political instability and corrupt federal system, that play significant role to intensify this shortage. Therefore, this essay tends to present the insights on these factors, besides climatic factors, in deepening water shortage in the HKH region and provide some recommendations to planners, government authorities and locals to deal with the problem effectively.

Climate change and its elements influencing the hydrology in HKH region:

The HKH region is very sensitive to climate change as it is experiencing the fastest receding glacier and snow cover in the world in recent decades along with rapid increase in surface temperature (You et al., 2017). It is even more threatening to know that the rate of increase in temperature is higher in higher elevation in this region, such as in Tibetan Plateau (Liu, Cheng, Yan, & Yin, 2009) and higher belts of Nepal (Eriksson et al., 2009) with more than half a Degree Celsius per decade. As a case in point, these regions which are located at the heart of HKH region are already experiencing a greater number of extreme warm days and a lesser number of extreme cold days influencing the entire hydrology of the region (You et al., 2017). Particularly, the rapid melting of glaciers and thus resulting rapid flow of water downstream during warmer seasons is causing more damage to people from flash floods, outburst floods, and landslides than improving the water availability (Panday, Thibeault, & Frey, 2015).

Compared to temperature, the trend in precipitation in the HKH region is unpredictable. However, the more frequent extreme precipitation events are observed during monsoon season in the eastern side as compared to the western side of HKH region (Panday et al., 2015). Meantime, the number of rainy days has decreased as compared to past decades leaving rest of the year dry. To mention, Nepal received not even 50% of average precipitation in 2008 and 2009 and 2.6 million people in 14 provinces of Afghanistan got hit hard by drought in the year 2011 (Qamer, 2019). Under different scenarios such as RCP 4.5 and RCP 8.5 used in climate modelling, it is projected that by mid-21st century, the regional temperature of HKH region will increase to a range of 1.8 to 2.2 Degree Celsius even if the global average temperature rise is maintained to 1.5 Degree Celsius (Krishnan et al., 2019), so it is highly certain that the region will experience more intense and more frequent droughts in near future.

In recent decades, climate change is greatly influencing the hydrological cycle in HKH region because of above-mentioned variations in climate elements. To put the context in place, the HKH region includes 5 major river basins namely Ganges, Indus, Yellow, Yangtze, and Brahmaputra which are major source of water downstream and they are fed with glacier melt, snow melt and rainfall water. Out of these three inputs, glacier melt water contributes more to these river basins (You et al., 2017). A study on surface water input in Langtang Khola Basin in Nepal conducted by Brown et al., 2014 showed that glacier melt, snowmelt, and rainfall water contributed 62%, 30%, and 8% of total input water in the basin respectively. The situation is somehow similar throughout the HKH region (You et al., 2017). With increasing surface temperature, the percentage contribution of glacier and snow melt water significantly increases with decrease in “Albedo effect” – an ability of a surface to reflect the sunlight and heat back to the space (GRID-Arendal, 2016). Technically, when snow and ice get melted, the surface below them are exposed to sunlight which is generally hard rock or dark soil. These surfaces absorb light and heat from the sun and increases the surface temperature melting more of the ice and snow surrounding them. This effect is called “Positive feedback” which accelerates the rate of melting and rapid flow of water downstream (GRID-Arendal, 2016). By 2050, it is estimated that there will be considerable reduction in glacial area in HKH, from -20 to -28% in Indus basin, and from -35% to -45 % in Ganges and Brahmaputra basins (GRID-Arendal, 2015), therefore, there will be even higher rates of discharge in the perennial rivers, most probably causing more damage due to floods and landslides. Contrarily, the water resources like springs and non-perennial rivers which are only recharged with rain water are drying out and are expected to dry out due to increased evapotranspiration and elongated rain-deficit seasons (Scott et al., 2019; V. Singh & Pandey, 2020).

Changes in socioeconomic factors and their impact on demand and supply of water:

Research and scientific theories have already proven that climate change is affecting the hydrology of the HKH region. Based on the results of the studies, it is also evident that the flow of water downstream from the glaciated mountains is increasing, yet the towns of the HKH region are facing the problem of water shortage. Therefore, in this situation, it can be assumed that there are other reasons besides climate change that need to be understood by the locals, government officials, and planners to deal with this shortage. At least in the current scenario, it is more likely that changes in socioeconomic factors are influencing more significantly to water shortage than climate change in the HKH region.

According to International Center for Integrated Mountain Development (ICIMOD), a pioneer organization to protect Hindu Kush Himalayan (HKH) region, the region will experience a rise of 2.1 Degrees Celsius, if the global average reaches the target of 1.5 Degree by 2100, resulting in loss of about one-third of whole glaciers (Oseland, 2019), so the future is even more detrimental than we assume. However, some studies have recently stressed that water shortage in the Himalayan towns will be even worse because of several other socioeconomic reasons (Mukherji, Scott, Molden, & Maharjan, 2018; S. Singh et al., 2020). For instance, by 2050, more than 50 % of the population in HKH region will migrate towards cities (ICIMOD, 2020), and the gap between current demand and supply of water will be doubled by then (Prakash & Molden, 2020).

Rapid urbanization and migration from rural to urban areas is a megatrend in South Asian countries which leads to centralized population growth. Because of such one-directional migration, on one hand, the rural areas which are rich in natural resources like water and forest are deprived of human population and on the other hand, the urban areas are facing more population pressure on limited resources (Mukherji et al., 2018). By early 2010, such internal migration constituted of 30% in India, 16% in China, 14% in Nepal, and 10 % in Bangladesh of the total national population, and this percentage is increasing rapidly every year (Mukherji et al., 2018). Consequently, during the year 2015 to 2018, the gap between the demand and supply of water was significantly high in the region. For example, in Darjeeling (India), the water demand was 7.0 million liters per day (MLD), but the actual supply was only 1.9 MLD, giving a deficit of 5.1 MLD. Likewise, in Kathmandu valley (Nepal), the demand was 362 MLD, but the actual supply was 184 MLD with a deficit of 178 MLD and in Rawalpindi (Pakistan), the demand was 79 MLD but the actual supply was only 20 MLD with a deficit of 59 MLD. The situation is similar in other Himalayan towns in the region and the demand is expected to rise even more with densification (S. Singh et al., 2020). With rapid urbanization, and centralized over-population, the local water resources are heavily exploited to meet the demand for energy and water for industrial, commercial, agricultural and domestic sectors (Scott et al., 2019).

Most towns of the HKH region are governed by local governments and there are several managerial problems leading to delay or failure to satisfy the water demand of residents. Out of all, political unwillingness, corruption, lack of cooperation between national and regional governments, insufficient investments, and constructional failure from use of weak materials are some major factors influencing the development and management of water supply projects in HKH towns (Prakash & Molden, 2020). For instance, in Kathmandu, the capital city of Nepal with population of more than 1.3 million, a project named “Melamchi Water Supply Project” was started in the year 1998 with an aim to supply about 170 MLD of water to the valley, but it has not been completed yet because of corruption and political unwillingness (Poudyal, 2019). Other smaller projects in small towns also suffer from lack of governance which degrades the whole water supply system. Therefore, it seems promising that the current water shortage in HKH towns can be attributed to the lack of management of existing resources.

Conclusion and Recommendation:

It is undeniable that climate change will have a significant impact on the hydrology of the HKH region as already proven through different scientific studies. While the non-perennial rivers and springs are drying out in non-perennial regions, seasonal flows in perennial rivers that originate in the Himalayas are increasing. Considering both physical and socioeconomic factors of water shortage, it nevertheless seems convincing that local governments are not able to utilize the resources wisely due to uneven changes in socioeconomic factors such as population growth and management. The use and management of water resources in the HKH region is following a critical road and therefore, the prompt actions undertaken at present will determine the faith of people residing in future.

To reduce the problem of water shortage, the government should primarily introduce programs that encourage decentralized population growth. For instance, opening markets and employment opportunities in different parts of the country so that the important natural resources like water are proportionally allocated for the whole population. Secondly, the government should assure good governance in its implementing agencies so that the projects related to water supply and management could run smoothly as planned. Lastly, Himalayan towns should plan and implement water-resilient adaptation activities such as conservation of local springs, construction of recharge ponds, rainwater harvesting techniques, and plantation in barren lands to maintain moisture in soil and aquifer. Overall, balancing the socioeconomic elements is vital to reduce water shortage in the HKH region and reforms in them can assist the adaptation now and in future.

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