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Water security and its scarcity: A review

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Abstract

Water underpins the very fabric of human life – our food and drink, the clothes we wear, the landscapes we enjoy, the societies we live in, the length and quality of our lives. The essential role that water plays in national life – in energy supply, infrastructure, economic growth, healthcare, education and culture – makes water a central concern for national policies. The water resources are not evenly distributed, across different continents; some countries have surplus water while many other countries are already facing scarcity of water. Sustainable development cannot be achieved without a water secure world. Water scarcity affects every continent and around 2.8 billion people around the world at least one month out of every year.

More than 1.2 billion people lack access to clean drinking water. India is not a water poor country but due to growing human population, severe neglect and over-exploitation of the resource, water is becoming a scarce commodity. India is more vulnerable because of the growing population and in-disciplined lifestyle. This calls for immediate attention by the stakeholders to make sustainable use of the available water resources. The World Bank estimated that 21 percent of communicable diseases in India are linked to unsafe water and the lack of hygiene practices. Further, more than 500 children under the age of five die each day from diarrhea in India alone.

Keywords: water, rainfall, environment, urbanization, population

Introduction

Water security is "the reliable availability of an acceptable quantity and quality of water for health, livelihoods and production, coupled with an acceptable level of water-related risks". Sustainable development cannot be achieved without a water secure world. Water security also means taking into account environmental protection and the negative effects of poor management of it. It is also concerned with the ending fragmented responsibility for water and integrating water resources management across all sectors: agriculture, finance, energy, tourism, planning, industry, health and education. The areas of the world that are most likely to have water insecurity are places with low rainfall, places with rapid population growth in a freshwater scarce area, and areas with international competition over a water source. It is a sobering reality that, in many places, water is a scarce and a contaminated resource. It is achieved when there is enough water for everyone in a region and the water supply is not at risk of disappearing. The UN proposed the following definition of water security in 2013 "The capacity of a population to safeguard sustainable access to adequate quantities of an acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability" (Walton, 2013)^[1].

Water scarcity is the lack of sufficient available water resources to meet water needs of a region. It affects every continent and around 2.8 billion people around the world at least one month out of every year. More than 1.2 billion people lack access to clean drinking water. Water scarcity involves water shortage, water stress or deficits, and water crisis. Water shortages may be caused by climate change, such as altered weather-patterns (including droughts or floods), increased pollution, and increased human demand and overuse of water. The term water crisis labels a situation where the available potable, unpolluted water within a region is less than that region's demand. Two converging phenomena drive water scarcity: growing freshwater use and depletion of usable freshwater resources.

Global water security

Earth is the only planet, so far known to have water and this makes it fit for human living.

About 70% of the earth surface is covered with water, which amounts to 1400 million cubic kilometers. However, 97.5% of this water being sea water, it is salty. Fresh water availability is only 35 m km³ and only 40% of this can be used by human beings. Out of the total fresh water, 68.7% is frozen in ice caps, 30% is stored underground and only 0.3% water is available on the surface of the earth. Out of the surface water, 87% is stored in lakes, 11% in swamp and 2% in rivers (Anon. 2006)^[3]. According to the UN less than 1% of freshwater is usable for the ecosystem and human consumption. Agriculture uses about 68% of freshwater of rivers, lakes and other resources followed by industry at 7%. The water resources are not evenly distributed, across different continents; some countries have surplus water while many other countries are already facing scarcity of water. Skewed growth of population in different countries is further adding to the crisis. Among various continents, Asia has 36% of the available freshwater reserves, with over 60% of the world population where water is a scarce commodity. Compared to Asia, Africa is in a better situation but the top water deficit countries of the world are in Africa, where 13% of the population has access to 11% of the freshwater reserves. Australia and Oceania have plenty of water with 1% population owing 5% of the freshwater reserves, followed by North and Central America, with 8% population and 15% water reserves and South America with 6% global population and 26% freshwater reserves. Since generations, the pattern of water use in different countries is mostly dependent on the culture, lifestyle and industrial development (Gupta *et al.* 2013)^[4].

Water security in India

India is not a water poor country but due to growing human population, severe neglect and over-exploitation of the resource, water is becoming a scarce commodity. India is more vulnerable because of the growing population and indisciplined lifestyle. This calls for immediate attention by the stakeholders to make sustainable use of the available water resources.

At 2,518 billion m³, the total water resource base for India, including surface and groundwater, is substantial but highly variable as during the monsoon season 50% of the annual precipitation falls in less than one month and 90% of river flows occur in only 4 months of the year (NITI Aayog, 2018)^[5]. The ability of the current infrastructure to safeguard that variability is low, making it difficult for accessible, reliable supply to meet projected demand and thus putting water security of India at stake. With only 200 m³ of water storage capacity per person, compared to 2,200 m³ per person in China and some 6,000 m³ per person in the United States, India's accessible, reliable supply of water amounts to 744 billion m³, or 29 per cent of its total water resources (Govt. of India. 2009)^[3]. India's aggregate water demand is expected to double from the current level of about 700 billion cubic meters to 1498 billion cubic meters by 2040 (Wang, 2019)^[12]. With an estimated supply of about 744 billion cubic meters by then, the water gap is estimated to be 50 per cent. This gap would be driven by a rapid increase in demand for water for agriculture, coupled with a limited water supply and storage infrastructure. One key uncertain factor that may affect the size of this gap is climate change. Its most direct effect is likely to be an accelerated melting of the Himalayan glaciers upon which several of India's river systems depend, particularly the western rivers such as the Indus, which relies

on snowmelt for approximately 45 per cent of its flow. Though in the immediate future increased snowmelt should actually increase flow of these rivers, in the long run the impact is very likely to be a decrease of flow between 30 to 50 per cent.

Threats to water security

The common threat to water security can be water scarcity. There are several other causes to water scarcity including climate change, high population density, low rainfall, and over allocation of a water source.

Water crisis in India

India is the second most populated country in the world, with more than 1 billion citizens. More than 300 districts in 13 Indian states are grappling with water shortages. Nearly, 76 million people in India do not have access to safe drinking water, as polluted rivers and poor storage infrastructures over the years has created a water deficit which may become unmanageable in future. The World Bank estimated that 21 percent of communicable diseases in India are linked to unsafe water and the lack of hygiene practices. Further, more than 500 children under the age of five die each day from diarrhea in India alone.

The demand for water in India is steeply increasing because of the following reasons (Amarasinghet *al.*, 2007)^[2]:

- The primary reason is population as India's population which was 1.3 billion in 2005 is expected to rise to 1.66 billion in 2050.
- There is also going to be a major impact on development in the form of urbanization. In 2007, 28.2% of the Indian population was living in urban areas and the urban population is expected to increase to 55.2% by 2050.
- The per capita income of Indians will increase from \$468 in 2007 to \$6735 in 2050.
- Increased industrialization will demand more water as its contribution to GDP will increase from 29.1% in 2000 to 40% by 2050. Thus, the demand for water will increase from 30 billion m³ in 2000 to 161 billion m³ in 2050.
- The agriculture development will be more on water intensive cash crops and there will be 80% increase in the demand for water by 2050.

Most affected countries by water scarcity

According to the World Bank, by 2020, about 1.8 billion people in the world will face absolute water scarcity and 2/3rd of the world will have to deal with such conditions.

Top Water deficit Countries of the World are:

- Yemen
- Libya
- Jordan
- The Western Sahara
- Djibouti

Present water scarcity risk and projected risk in 2050

Water scarcity emerges from a combination of hydrological variability and high human use (Sadoff *et al.*, 2015) ^[7]. Between 2019 and 2050, the world population was expected to increase by 33%, growing from 8.0 billion to 9.3 billion (UNDESA, 2011), and food demand will rise by 60% in the same period (Alexandratos and Bruinsma, 2012) ^[1]. The OECD's 2012 ^[6] Global Environmental Outlook's Baseline Scenario (OECD, 2012) ^[6] projects increasing strains on freshwater availability through 2050, with an additional 2.3

billion people expected to be living in areas with severe water stress, especially in North and South Africa and South and Central Asia. Another report predicts the world could face a 40% global water deficit by 2030 under a business-as-usual (BAU) scenario (2030 WRG, 2009) ^[10]. An estimated 663 million people lack ready access to improved sources of drinking water, while the number of people without reliable access to water of good enough quality to be safe for human consumption is at least 1.8 billion (UNICEF/WHO, 2015) ^[9], and possibly significantly more.

Conclusion

Water underpins the very fabric of human life – our food and drink, the clothes we wear, the landscapes we enjoy, the societies we live in, the length and quality of our lives. The essential role that water plays in national life – in energy supply, infrastructure, economic growth, healthcare, education and culture – makes water a central concern for national policies. Because the water cycle is global, the availability, use and security of water transcend local, national and even continental boundaries. Water security is under severe pressure from many sources; a world population explosion, rapid shifts of people from rural to urban areas, the impact of dietary change as countries develop, increasing pollution of water resources, the over-abstraction of groundwater and the not insignificant issues created by climate change. The world is far from water secure. In many parts of the world the demand for water is already much greater than the available supply. This is not an issue that affects only developing countries, where water infrastructure is poor and where many people do not have access to safe drinking water, but also of the developed world, where burgeoning demand simply cannot continue to be met. Water for agriculture and, therefore, food is not given a sufficient attention on the global stage, where water supply and sanitation issues currently dominate. In order to move water for agriculture up the agenda on the global scene, water engineers, farmers, economists and policy makers will need to improve their communications with one another. Water has traditionally been regarded as a free resource. Any costs for water are usually associated with the cost of processing and delivery alone, rather than assigning any inherent value to the resource. Free, or greatly undervalued, water gives little incentive for water efficiency. There is growing interest internationally in the use of water pricing to reduce demand as well as to generate revenue to cover the cost of providing water supplies and maintaining infrastructure.

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