

Water for Life: Issues and Challenges

B. Suresh Lal, PhD

Professor of Economics, Department of Economics, Kakatiya University, Warangal, Telangana State-India

Abstract: *This paper analysis signification of water in the present day scenario, the human right to water and basic water requirements for sustainability of life. The issues and challenges involved in water in Global, South Asia, and India levels were emphasized. The water crisis in the world, its impact on women in developing countries is a serious issue. How to manage water resources for sustainable development is focused in this paper. The impact of water on health outcomes and faecal contamination of drinking water supplies affects adversely on health. Water scarcity, insecurity, and cost have been analyzed. How people and countries experiencing different levels of water stress was examined. India is suffering from the worst water crisis in its history and millions of lives and livelihoods are under threat. Currently, 600 million Indians face high to extreme water stress and about two lakh people die every year due to inadequate access to safe water. Top cities in India will run out of groundwater, impacting 100 million people and threatening crops and livestock. Thousands of villagers have abandoned their homes in a desperate search for water as the crisis has left village pumps and wells dry. The researcher provided suitable suggestions to save water.*

Keywords: Water, sustainable development, water crisis, water stress, save water

1. Introduction

Water is a foundation of life and livelihoods and is key to sustainable development. Successful water management will serve as a foundation for the achievement of many of the 17 Sustainable Development Goals (SDGs), as well as for SDG6- which is to 'Ensure availability and sustainable management of water and sanitation for all', Guppy (2017). The water has the power to transform people's lives: water is essential to human survival, the environment, and the global economy. Safe working conditions and a living wage can provide workers with sustainable income and pave the way for broader social and economic advancements.

Despite this, water is becoming a pressing societal and geopolitical issue in some regions, it is already of critical national concern. 'Business as usual' will mean the world will miss water-related SDGs by a wide margin; up to 40% of the world's population will be living in seriously water-stressed areas by 2035, and the ability of ecosystems to provide fresh water supplies will become increasingly compromised, Guppy(2017).

2.1 billion People live without safe water at home. One in four primary schools has no drinking water service, with pupils using unprotected sources or going thirsty. More than 700 children under five years of age die every day from diarrhoea linked to unsafe water and poor sanitation. Globally, 80% of the people who have to use unsafe and unprotected water sources live in rural areas. Women and girls are responsible for water collection in eight out of ten households with water off-premises. Over 800 women die every day from complications in pregnancy and childbirth. For the 68.5 million people who have been forced to flee their homes, accessing safe water services is highly problematic. Around 159 million people collect their drinking water from surface water, such as ponds and streams. Around 4 billion people- nearly two-thirds of the world's population - experience severe water scarcity during at least one month of the year. 700 million people worldwide could be displaced by intense water scarcity by 2030. The wealthier generally receive high levels of WASH services at

(often very) low cost, whereas the poor pay a much higher price for a service of similar or lesser quality, UNESCO (2019).

Globally, over 80% of the wastewater generated by society flows back into the ecosystem without being treated or reused. 1.8 billion People use a source of drinking water contaminated with faeces, putting them at risk of contracting cholera, dysentery, typhoid, and polio. Unsafe water, poor sanitation and hygiene cause around 842,000 deaths each year. 663 million people still lack improved drinking water sources. By 2050, close to 70% of the world's population will live in cities, compared to 50% today. Currently, most cities in developing countries do not have adequate infrastructure and resources to address wastewater management in an efficient and sustainable way. The opportunities from exploiting wastewater as a resource are enormous. Safely managed wastewater is an affordable and sustainable source of water, energy, nutrients, and other recoverable materials. The costs of wastewater management are greatly outweighed by the benefits to human health, economic development, and environmental sustainability- providing new business opportunities and creating more 'green' jobs, UNESCO (2017).

Global water challenges, like climate change, population growth, increasing urbanisation, and aging infrastructure, continue to intensify. The latest UN data estimates that 3.6 billion people - almost half the global population - live in areas that are potentially water-scarce at least one month per year and by 2050, more than 5 billion people could suffer water shortages due to climate change, increased demand and polluted supplies. Against this backdrop, water and wastewater utilities are turning to new and innovative solutions including digital technologies, to drive sustainable water management, IWA(2019).

2. The Human Right to Water

The human right to water entitles everyone, without discrimination, to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic

Volume 8 Issue 6, June 2019

www.ijsr.net

Licensed Under Creative Commons Attribution CC BY

use; which includes water for drinking, personal sanitation, washing of clothes, food preparation, and personal and household hygiene, same has been recognized by UNO in 2010 stated that “the right to safe and clean drinking water and sanitation as a human right that is essential for the full enjoyment of life and all human rights”.

3. Basic Water Requirements

All peoples, whatever their stage of development and their social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs.

This concept was strongly reaffirmed during the 1992 Earth Summit in Rio de Janeiro and expanded to include ecological water needs. In developing and using water resources, priority has to be given to the satisfaction of basic needs and the safeguarding of ecosystems, United Nations, (1992).

International organizations, national and local governments, and water providers adopt a basic water requirement standard for human needs of 50 liters per person per day (l/p/d) and guarantee access to it independently of an individual's economic, social, or political status. Unless this basic need is met, large-scale human misery and suffering will continue and grow in the future, contributing to the risk of social and military conflict. Ultimately, decisions about defining and applying a basic water requirement will depend on political and institutional factors, but the concept may prove useful in meeting basic water needs for the next century, Peter(1996).

4. Review of Literature

Several studies have dealt with the analysis of water supply, minimum water requirements and cost structure viewing it from different perspectives.

Brooks (1988) estimated in his studies the final component of a domestic basic water requirement is the water required for the preparation of food. While most detailed surveys of residential water use in industrialized countries do not provide separate estimates of water used for cooking, estimate that water use for food preparation in wealthy regions ranges from 10 to 50 liters per person per day, with a mean of 30 liters per person per day.

Water-borne communicable diseases like gastrointestinal disorders including acute diarrhoea are responsible for higher morbidity and mortality due to poor sanitation, unhygienic conditions and lack of safe drinking water in the tribal areas of the country. In a cross-sectional study conducted by RMRC, Bhubaneswar in 4 primitive tribes of Orissa, the diarrhoeal diseases including cholera was found to occur throughout the year attaining its peak during the rainy season, Lal(2011).

Contamination of water with human faeces causes the transmission of diseases such as typhoid. Poor health resulting from poor sanitation has a huge effect on economies, with money that could be used to purchase food

or education spent on medicines. National economies also feel the strain of providing medical treatment; people become too ill to work, their livelihoods being destroyed by preventable disease. In 2004, the World Health Organization estimated that about 1.8 million people die every year from diarrhoeal diseases (including cholera). About 90% of these deaths are of children under 5 years of age, Lal (2013).

These poor environmental conditions have severe ill effects on the health of affected people. They lead to the spread of diseases such as amoebiasis, cholera, diarrhoea, dysentery, malaria, schistosomiasis, typhoid fever as well as roundworm and guinea worm infections. It is estimated that diarrhoeal diseases, including dysentery, alone annually kill over 2 million children before their fifth birthday, Neumayer (2001).

Lal (2015), examine that Water-borne communicable diseases like gastrointestinal disorders including acute diarrhea are responsible for higher morbidity and mortality due to poor sanitation, unhygienic conditions and lack of safe drinking water in the Banjaras thandas. The acute diarrheal problem was basically due to poor environmental hygiene, lack of safe drinking water, improper disposal of human excreta which was further aggravated by low literacy, indiscriminate defecation in the open field, barefoot walking and lack of health awareness and hygiene, low socioeconomic status coupled with blind cultural belief, lack of access to medical facilities leading to serious public health problem encouraging faeco-oral transmission of enteric pathogens in most of the thandas in Andhra Pradesh.

A research study reveals that a hundred percent of students practicing hand wash. The material used for hand wash is soap for 48% and only water 52%. The hundred percent of students practicing hand wash before eating. A question was asked as to hand wash after toilet. 66% of students replied that yes and the remaining 34% said no. About the maintenance of clothes neat and clean, 85% of students replied yes and 15% said no. The table further reveals that 65% of students wash their clothes weekends and remaining 35% wash daily. Most of the students of the rural areas usually dry their clothes in the sunlight only, Lal (2016).

People may not know how their waste is treated, dispose of inappropriate types of waste that may damage treatment systems or the environment, or they may assume that wastewater is adequately treated before release into the environment even when it is not. Users may also value the perceived status of a particular system, such as a flush toilet, over interest in the sustainability of the systems, Moe(2006).

Currently, it is estimated that developing countries spend some US\$ 10-25 billion of public money annually combined with an additional US\$ 25 billion spread over the period 1990 to 1997 from private sector investments. From the official development assistance (ODA) only about 6.6% is earmarked for water and sanitation. Because of decreases in ODA in real terms over the last decade or so, this amounts to a mere US\$ 2.9 billion in 1996, UN Ecosoc (2000).

5. Objectives and Methods

- 1) To study the present water scenario of World and India
- 2) To identify issues and challenges associated with water and
- 3) To examine problems of water in terms of economic and health

The study is based on primary and secondary data, explored from various reports, documents, interviews, and experiences. This study is adopted purposive sample techniques method.

6. Discussion and Results

a) World Water Scenario

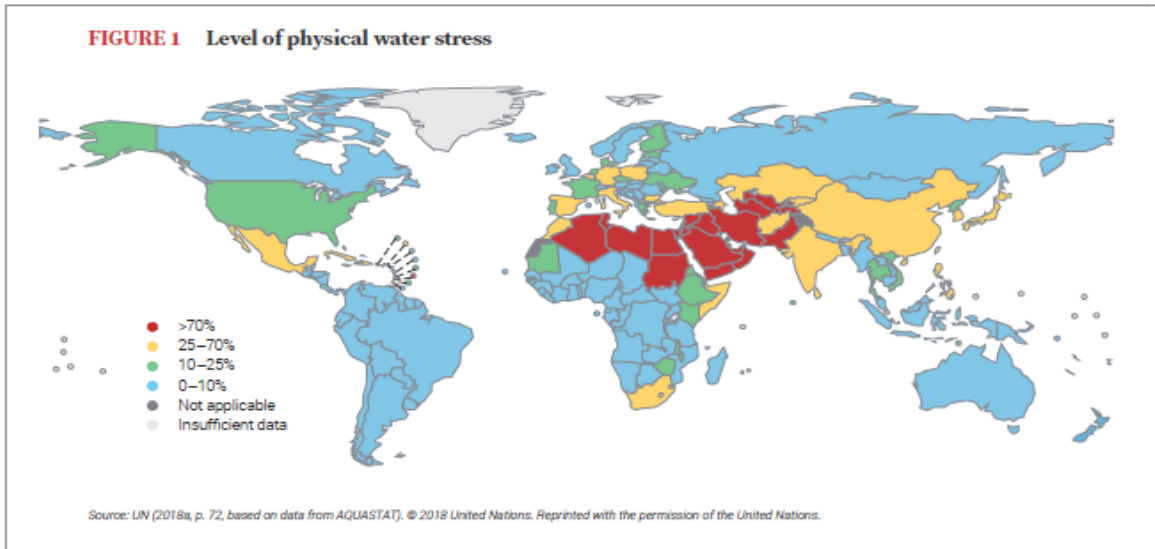


Figure 1 provides a global overview of countries experiencing different levels of water stress (the ratio of total freshwater withdrawn annually by all major sectors, including environmental water requirements, to the total amount of renewable freshwater resources, expressed as a percentage).

Over 2 billion people live in countries experiencing high water stress. Recent estimates show that 31 countries

experience water stress between 25% (which is defined as the minimum threshold of water stress) and 70%. Another 22 countries are above 70% and are therefore under serious water stress. Growing water stress indicates substantial use of water resources, with greater impacts on resource sustainability, and rising potential for conflicts among users, UN (2018).

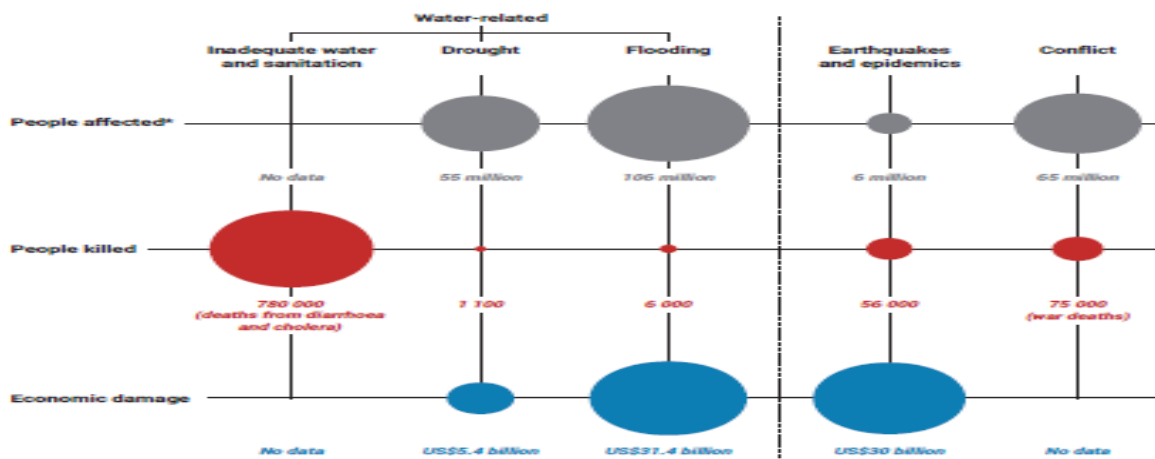


Figure 2: Average annual impact from inadequate drinking water and sanitation services, water-related disasters, epidemics and earthquakes, and conflicts

*People affected are defined as those requiring immediate assistance during a period of emergency; this may include displaced or evacuated people.

The water-related linkage between seemingly different trends is the relationship between rapid urbanization, increased vulnerability to floods and droughts, and the

increased risk of displacement (particularly in the case of informal settlements). However, in terms of the number of people affected and (especially) the number of people killed, the impacts of floods, droughts and conflicts are grossly outweighed by the number of those affected or killed by inadequate drinking water and sanitation services (Figure 2), UN(2019).

b) The South Asia Groundwater Situation

Droughts are frequent in South Asia; they impact large areas and devastate livelihoods. Arid and semi-arid areas of Afghanistan, Pakistan, and north-west India are the most vulnerable, but other parts of the region (including Sri Lanka), are also vulnerable. Arid/semi-arid and variable climates require storage and judicious use of water. About 80% of rain in much of South Asia falls from June to September, making seasonal storage of water critical (in dams, reservoirs, and tanks, as well as in aquifers, wetlands, and lakes) to provide reliable supply buffer for lean periods. The 2015-16 El Nino monsoon failure, coupled with soaring temperatures, affected 330 million people in India alone, with devastating socioeconomic impacts. In Sri Lanka, water for drinking, irrigation, livestock, and hydropower was affected, with significant livelihood consequences. This drought reinforced the learning that drought is not always caused solely by meteorological conditions, but can also partly be a result of failed water resources planning and management, Rafik(2017).

c) Indian Scenario

India is suffering from the worst water crisis in its history and millions of lives and livelihoods are under threat. Currently, 600 million Indians face high to extreme water stress and about two lakh people die every year due to inadequate access to safe water. The crisis is only going to get worse. By 2030, the country's water demand is projected to be twice the available supply, implying severe water scarcity for hundreds of millions of people and an eventual ~6% loss in the country's GDP. As per the report of National Commission for Integrated Water Resource Development of MoWR, the water requirement by 2050 in high use scenario is likely to be a milder 1,180 BCM, whereas the present-day availability is 695 BCM. The total availability of water possible in the country is still lower than this projected demand, at 1,137 BCM. Thus, there is an imminent need to deepen our understanding of our water resources and usage and put in place interventions that make our water use efficient and sustainable.

Villagers look to the monsoon rains to end the drought, but the rains are late this year. Some years they don't arrive at all or bring less rainfall than expected. By 2030, it's predicted that 40% of the population will have no access to drinking water and 21 cities, including Chennai and New Delhi, will run out of groundwater, impacting 100 million people and threatening crops and livestock. Thousands of villagers have abandoned their homes in a desperate search for water as the crisis has left village pumps and wells dry, NITI Aayog(2018).

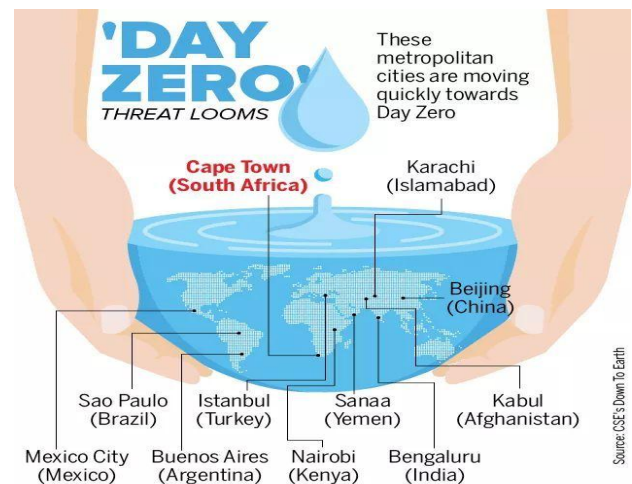
d) My Experiences in Cape Town, South Africa

I have been visited Cape Town, South Africa to present my paper in International Conference was held in the last week of March 2019. I stayed at Hotel Parliament is very nearly to Parliament buildings of South Africa at Cape Town. The story of Cape Town, South Africa is one that has been told countless times as a worst case scenario – a countdown to 'Day Zero,' the day a city runs out of water. As Cape Town continues to struggle to address its water shortage, similar challenges are arising across the globe. I could able to find

out sing boards and wall posters including washroom doors. Some of them given below.



Cape Town- South Africa, Sao Paulo- Brazil faces challenges in the water supply. Shenzhen- China faces challenges with untreated sewage discharges. Miami, United States, faces challenges with sea-level rise. Jakarta, Indonesia faces challenges with groundwater depletion. This list goes on and on, CSE's, Down to Earth(2019).



e) Water Crises in the World

In rural Sub-Saharan Africa, millions of people share their domestic water sources with animals or rely on unprotected wells that are breeding grounds for pathogens. The average distance that women in Africa and Asia walk to collect water is 6 kilometers. Average water use ranges from 200-300 liters a person a day in most countries in Europe to less than 10 liters in countries such as Mozambique. People lacking access to improved water in developing countries consume far less, partly because they have to carry it over long distances and water is heavy. For the 884 million people or so people in the world who live more than 1 kilometer from a water source, water use is often less than 5 liters a day of unsafe water.

The basic requirement for lactating women engaged in even moderate physical activity is 7.5 liters a day. At any one time, close to half of all people in developing countries are suffering from health problems caused by poor water and sanitation. Together, unclean water and poor sanitation are the world's second biggest killer of children. It has been calculated that 443 million school days are lost each year to water-related illness. In Tajikistan, nearly a third of the

population takes water from canals and irrigation ditches, with risks of exposure to polluted agricultural run-off.

A survey of 5000 schools in Senegal showed that over half had no water supply and almost half had no sanitation facilities. Of those schools with sanitation, only half had separate facilities for boys and girls. The result was that girls chose not to utilize these facilities, either because they did not want to risk being seen to use the toilet, or because they were warned that these facilities were not private or clean enough. Girls also avoided drinking water at school to avoid urination, thereby becoming dehydrated and unable to concentrate, UNO(2015). People living in the slums of Jakarta, Manila, and Nairobi pay 5 to 10 times more for water than those living in high-income areas in those same cities and more than consumers in London or New York. In Manila, the cost of connecting to the utility represents about three months' income for the poorest 20% of households, rising to six months' in urban Kenya. The water supply for each person must be sufficient and continuous for personal and domestic uses. These uses ordinarily include drinking, personal sanitation, washing of clothes, food preparation, personal and household hygiene. According to the World Health Organization (WHO), between 50 and 100 liters of water per person per day is needed to ensure that most basic needs are met and few health concerns arise.

The water required for each personal or domestic use must be safe, therefore free from micro-organisms, chemical substances and radiological hazards that constitute a threat to a person's health. Measures of drinking-water safety are usually defined by national and/or local standards for drinking-water quality. The World Health Organization (2011) Guidelines for drinking-water quality provide a basis for the development of national standards that, if properly implemented, will ensure the safety of drinking water. Water should be of acceptable colour, odour, and taste for each personal or domestic use. All water facilities and services must be culturally appropriate and sensitive to gender, lifecycle and privacy requirements. Everyone has the right to a water and sanitation service that is physically accessible within, or in the immediate vicinity of the household, educational institution, workplace or health institution. According to WHO, the water source has to be within 1,000 meters of the home and collection time should not exceed 30 minutes. Water and water facilities and services must be affordable for all, water costs should not exceed 3 percent of household income, WHO(2011).

f) How is the Water Crisis a Health Crisis?

Globally, 844 million people lack access to safe water and 2.3 billion people don't have a toilet. Nearly 1 million people die each year from water, sanitation and hygiene-related diseases which could be reduced with access to safe water or sanitation. Lack of access to safe water also affects the physical well-being of women and children who have no choice but to carry heavy vessels long distances. Safe drinking water is critical to the development of a healthy child. It means kids won't experience water-borne illnesses like typhoid. Diarrhea is one of the top three leading causes of child death and this is often triggered by consuming unclean water. Further, every 2 minutes a child dies from a water-borne disease. Whether they are consuming

contaminated water or suffering from dehydration due to diarrhea, a lack of access to safe water is responsible.

g) A Women's Health Crisis

A lack of access to safe water and sanitation significantly affects the health of women as well. Burdened daily by water collection and finding a place to go, women and girls spend large amounts of time carrying heavy vessels and walking long distances. The physical strain of these activities impacts their health and if pregnant, the health of their unborn children. One Million people killed by water, sanitation and hygiene-related disease each year.

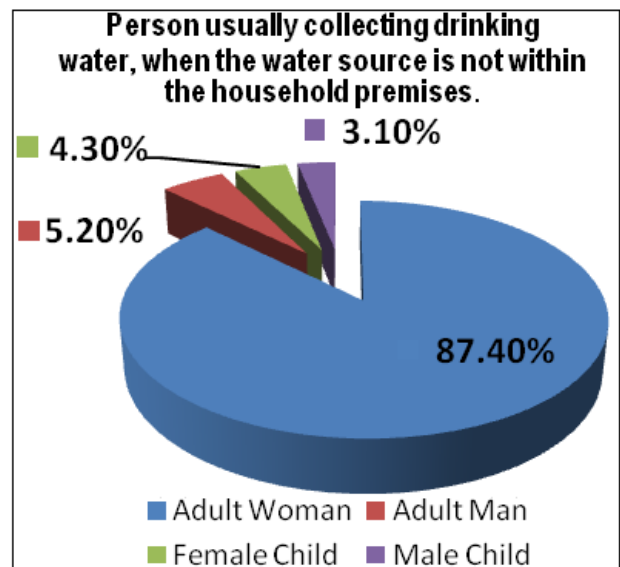


Figure 3: Person usually collecting drinking water, when the water source is not within the household premises.

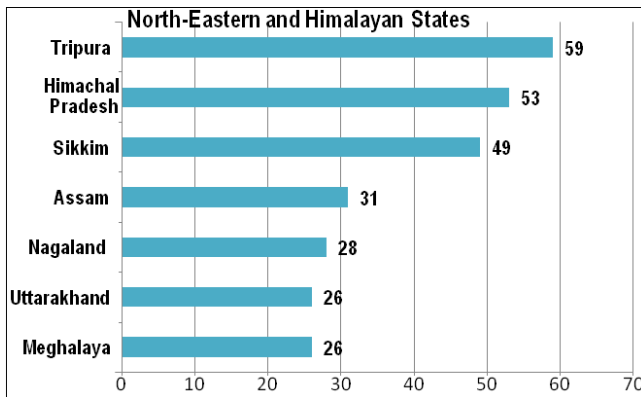
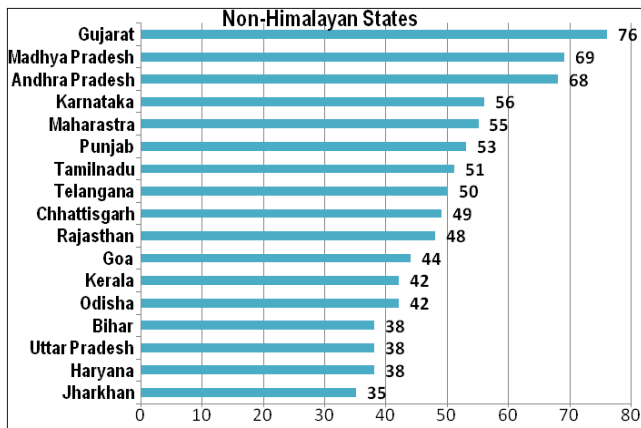


Figure 4: This situation is prevailing in Andhra Pradesh, India for water

h) Water Resource Management in India

Figure 5 & 6: State-level performance on water resource management,

Ranking of states according to Composite Water Index Scores (FY 16-17)



Water Index scores vary widely across states, but most states have achieved a score below 50% and could significantly improve their water resource management practices. The Water Index scores for FY 16-17 vary from 76 (Gujarat) to 26 (Meghalaya), with the median score being ~49 for Non-Himalayan states and ~31 for North-Eastern and Himalayan states (Figure 5). Gujarat is the highest performer, closely followed by other High performers such as Madhya Pradesh and Andhra Pradesh. Seven states have scores between ~50-65 (including two North-Eastern and Himalayan states) and have been classified as Medium performers. Alarming, ~60% of states (14 out of 24) have achieved scores below 50 and have been classified as Low performers (Figure 6). Low performers are concentrated across the populous agricultural belts of North and East India and among the North-Eastern and Himalayan states.

i) Water and Health Outcomes

Inadequate Water can cause various adverse health outcomes, through a number of different transmission pathways including:

- 1) Ingestion of water (e.g. diarrhoea, arsenicosis, fluorosis),
- 2) Lack of water linked to inadequate personal hygiene (e.g. diarrhoea, trachoma, scabies),
- 3) Poor personal, domestic or agricultural hygiene (e.g. diarrhoea, Japanese encephalitis),
- 4) Contact with contaminated water (e.g. schistosomiasis),
- 5) Vectors proliferating in water (e.g. malaria, dengue fever), and
- 6) Contaminated water systems (e.g. legionellosis).

The impact of Water on most of the diseases cannot be precisely enumerated, Prüss(2002).

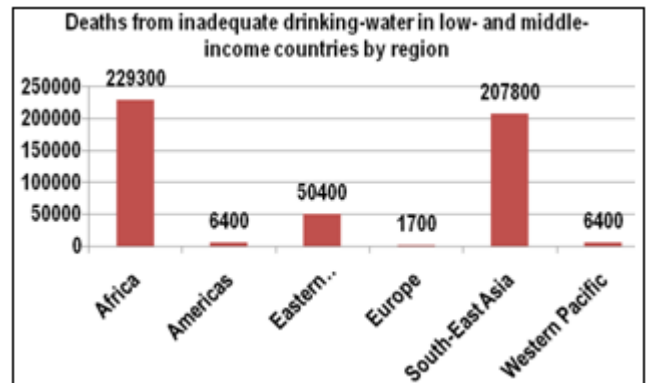


Figure 7: Deaths from Inadequate Drinking Water in Low- and Middle-Income Countries by Region, 2012

Based on the distribution of use of the different types of water sources and the associated risks of diarrhoea, outlined in the preceding sections, 502 000 diarrhoeal deaths in LMICs can be attributed to inadequate drinking- water. Of these deaths, 88% occur in Africa and South-East Asia (Figure 7). Estimates on a country-by-country were given in figure 7.

j) Faecal Contamination of Drinking Water Supplies

Drinking-water, even from an improved source, is not necessarily free of faecal pathogens and safe for health. In order to provide a comprehensive picture of water quality by country and type of water source, a systematic review and analysis were conducted. Coverage data from the Joint Monitoring Programme (JMP) were combined with 345 water quality studies and predictive models for the presence and level of microbial contamination of drinking-water supplies were developed. Water was considered as non-contaminated when complying with the guideline values for microbial quality, i.e. containing zero *E. coli* or thermotolerant coliforms in a 100 mL sample. Other potential drinking water contaminants such as chemicals have not been assessed here, WHO(2014).

k.) Some of the Key Facts of Water

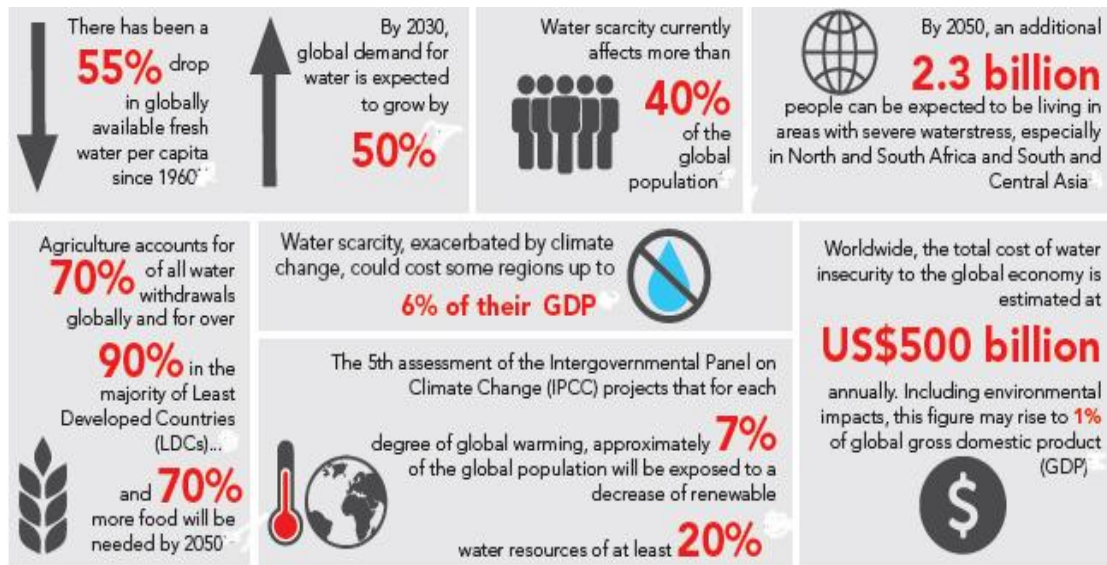
- 112 million people were affected by floods 2005-2015.
- 1.8 billion People now use a source of drinking water contaminated by faeces.
- 80% or more wastewater returns to the environment without adequate treatment.
- 30% of global water abstraction is lost through leakage.
- US\$114 billion per year or more than 3 times the current level of capital investment is needed to achieve the Sustainable Development Goal 6 targets on water supply, sanitation, and hygiene (6.1 and 6.2). The amount of money needed to meet the other targets of the "water goal" is currently unknown.
- 12.6 million deaths were attributable to the environment globally in 2012.
- 40% gap between water demand and water available by 2030.

l) Water Scarcity, Insecurity, and Cost

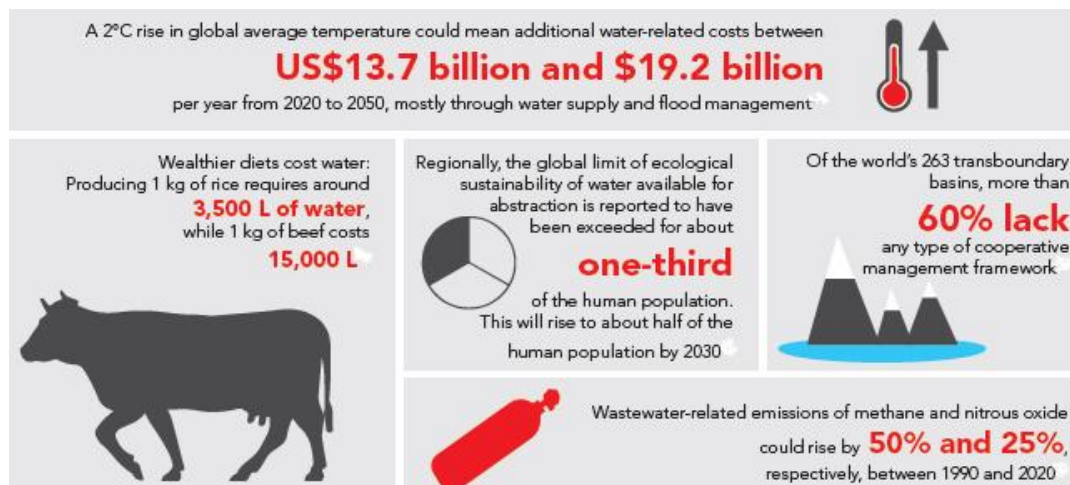
The notion that water is plentiful- it covers 70% of the planet is false, as only 2.5% of all water is fresh water. This limited resource will need to support a projected population of 9.7 billion in 2050; and by that date, an estimated 3.9

billion or over 40% of the world's population will live in severely water-stressed river basins, OECD (2012). Figure 8

below provides multi-level information of present and some are estimated.



Sources: WWP (2012), FAO (2011), FAO(2009), World Bank Group (2016), WWP(2016).



Sources: World Bank (2010), Hoekstra (2008), WWP(2012), UNEP (2002), UNEP (2011)

Figure 9 above focuses, the human activities often degrade water resources. 2 million tons of human waste is disposed of in watercourses every day; 15–18 billion m of freshwater resources are contaminated by fossil fuel production every year; and the food sector contributes 40 and 54% to the production of organic water pollutants in high-income and low-income countries respectively. Severe pathogenic pollution affects around one-third of all rivers, severe organic pollution around one-seventh of all rivers, and severe and moderate salinity pollution around one-tenth of all river stretches in Latin America, Africa, and Asia. A 2°C rise in global average temperature could mean additional water-related costs between US\$13.7 billion and \$19.2 billion. Wealthier diets cost water: Producing 1 kg of rice requires around 3,500 L of water, while 1 kg of beef costs 15,000 L. The global limit of ecological sustainability of water available for abstraction is reported to have been exceeded for about one-third of the human population. Wastewater-related emissions of methane and nitrous oxide could rise by 50% and 25%, respectively, between 1990 and 2020.

m) Some Suggestions to Save Water

The last few years have seen a remarkable change in the nature of the global discussion of issues of environment and development. Unfortunately, considerable debate and confusion surround both the terms “sustainable” and “development” and only modest forward progress has been made. This lack of progress is particularly disturbing in the area of water resources, which are vitally important for producing food, maintaining aquatic ecosystems, and protecting human health. Brushing teeth- Running tap 5 liters, whereas closed tap or bucket 0.75 liters. Shaving-running taps 5 liters, mug 0.5 liters. Bathing-shower running taps 100 liters where bucket uses 18 liters. Washing clothes-running tap 116 liters whereas bucket use 36 liters.

7. Conclusion

Recent efforts to integrate environmental issues and concerns with sustainable economic and social development have returned to the concept of meeting basic human needs first proposed nearly two decades ago. One of the most fundamental of those needs is access to clean water.

This paper presents the concept of water for life an economic analysis (WLEA) for human domestic needs and recommends that a WLEA for drinking, basic sanitation services, human hygiene, and food preparation be guaranteed to all humans. Specifically, 50 liters per person per day of protected water should now be considered a fundamental human right.

Hundreds of millions of people, especially in developing countries like India, currently lack access to water for life, resulting in enormous human suffering and tragedy. Furthermore, rapid population growth and inadequate efforts to improve access to water ensure that this problem will grow worse before it grows better. This problem should be a far higher priority for governments, water providers, and international aid organizations than it appears to be.

References

- [1] B. Suresh Lal, (2011); Economic Analysis of Health Care Services: A Study in Tribal Areas of Andhra Pradesh – India, International Journal of Health Management and Information (IJHMI), Volume 2, Number 2, pp. 119-131.
- [2] Brooks, D.B., and R. Peters, (1988); Water: The Potential for Demand Management in Canada. Science Council of Canada Discussion Paper, Ottawa, ON, Canada.
- [3] Down to Earth, (2019); Water Report of Centre for Science and Environment's Down to Earth-2019.
- [4] Eric Neumayer, (2001); Convergence in access to safe water and adequate sanitation: An analysis across countries and time, International Journal of Water, 1 (2), pp. 210-216.
- [5] FAO (Food and Agriculture Organization of the United Nations), (2011); The State of the World's Land and Water Resources for Food and Agriculture (SOLAW) – Managing systems at risk. FAO, Rome, and Earthscan, London.
<http://www.fao.org/docrep/017/i1688e/i1688e00.htm>
- [6] FAO (Food and Agriculture Organization of the United Nations), (2009); How to Feed the World in 2050. FAO, Rome.
<http://www.fao.org/wsfs/forum2050/wsfs-background-documents/wsfs-expert-papers/en/>
- [7] Guppy, L., Anderson, K.,(2017); Water Crisis Report. United Nations University Institute for Water, Environment and Health, Hamilton, Canada.
- [8] Hoekstra, A. & Chapagain, A. (2008); The Global Component of Freshwater Demand and Supply: an assessment of virtual water flows between nations as a result of trade in agricultural and industrial products. Water International, 33 (1), pp 19-32.
<http://www.tandfonline.com/doi/abs/10.1080/02508060801927812>.
- [9] IWA, (2019); Digital Water: Industry Leaders Chart the Transformation Journey, International Water Association, London.
<https://iwa-network.org/projects/digital-water-programme/>
- [10] Lal B Suresh & G. Kavitha, (2013): Economic Impact of Inadequate Sanitation on Women's Health: A Study in Warangal District, International Journal of Environment & Development, Vol.10, No-2, July-December,pp.217.
<https://www.researchgate.net/publication/276869279>
- [11] Lal B. Suresh & G. Kavitha, (2016); Assessment of Personal Hygiene Knowledge and Practices: An Empirical Study of Schooling Children in Warangal, International Journal of Science and Research (IJSR), Volume 5 Issue 8, August. www.ijsr.net
- [12] Lal B. Suresh, (2015): Socio-Economic and Health Issues of Banjaras in the Era of Globalization: A Study in Telangana Tribal Villages, International Journal of Physical and Social Sciences (IJPSS), Vol-5, Issue-6, June, pp. 207. "Retrieved from <https://www.researchgate.net/publication/277534999>"
- [13] Moe, C.L.; Rheingans, R.D, (2006); Global challenges in water, sanitation, and health. Journal of Water Health 2006, 4, 41–58. (PubMed0).
- [14] NITI Aayog, (2018); Composite Water Management Index, New Delhi. <https://water.org/our-impact/water-crisis/health-crisis/>
- [15] OECD, (2012); Environmental Outlook to 2050: the consequences of inaction. OECD 2012. <http://www.oecd.org/env/indicators-modelling-outlooks/oecd-environmental-outlook-1999155x.htm>
- [16] PBL, (2018); Netherlands Environmental Assessment Agency, Netherlands,pno.14.
- [17] Peter H. Gleick, M. IWRA, (1996): Basic Water Requirements for Human Activities: Meeting Basic Needs, Water International, Vol. 21, No. 2, USA.
- [18] Prüss A, Kay D, Fewtrell L, Bartram J, (2002); Estimating the burden of disease from water, sanitation, and hygiene at a global level. Environmental Health Perspectives. 2002; 110(5):537-42.
- [19] Rafik Hirji, Sushmita Mandal and Ganesh Pangare, (2017); Proceedings of the South Asia Groundwater Forum, South Asia Water Initiative.
- [20] The United Nations (UN); World Water Development Report 2018
- [21] The United Nations (UN); World Water Development Report 2019
- [22] The United Nations Office (2015); To Support the International Decade for Action 'Water for Life' 2005-2015/UN-Water Decade Programme on Advocacy and Communication (UNO-IDfA/UNW-DPAC).
- [23] UN Ecosoc (2000); Progress made in providing safe water supply and sanitation for all during the 1990s – Report of the Secretary-General, E/CN.17/2000/13, United Nations, Commission on Sustainable Development, New York.
- [24] UNEP (United Nations Environment Programme), (2002); The World's International Freshwater Agreements. UNEP Press, Nairobi.
<http://www.transboundarywaters.orst.edu/publications/atlas/>
- [25] UNEP (United Nations Environment Programme),(2011); Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication. UNEP Press, Nairobi.
<https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=126&menu=35>
- [26] UNESCO (2017); Waste Water the Untapped Resource, the United Nations World Water Development Report 2017, Paris.

- [27] UNESCO (2019): Leaving No One Behind, The United Nations World Water Development Report 2019, Paris.
- [28] United Nations, (1992); "Protection of the Quality and Supply of Freshwater Resources: Application of Integrated Approaches to the Development, Management and Use of Water Resources:' Agenda 21, Ch. 18, United Nations Publications, via Internet, 1992.
- [29] WHO (2011); Guidelines for drinking-water quality, 4th edition. Geneva: World Health Organization; 2011. http://www.who.int/water_sanitation_health/gbd_poor_water/en/
- [30] WHO/UNICEF,(2017a); Report on Safe Drinking Water and Access Services.
- [31] World Bank Group, (2016); High and Dry: Climate Change, Water, and the Economy. World Bank, Washington DC. <http://www.worldbank.org/>.
- [32] World Bank. (2010); Economics of adaptation to climate change - Synthesis report. World Bank, Washington DC. <http://www.worldbank.org/en/news/feature/2011/06/06/economics-adaptation-climate-change>
- [33] World Health Organization & UNICEF, (2017); Joint Monitoring Programme (JMP). Progress on Drinking Water and Sanitation, 2017 Update and MDG Assessment.
- [34] World Health Organization,(2014); Preventing diarrhoea through better water, sanitation, and hygiene: exposures and impacts in low- and middle-income countries, Geneva 27, Switzerland. www.who.int
- [35] WWAP (United Nations World Water Assessment Programme), (2016); The United Nations World Water Development Report 2016: Water and Jobs. Paris, UNESCO. <http://unesdoc.unesco.org/images/0024/002439/243938e.pdf>
- [36] WWAP (World Water Assessment Programme), (2012). The United Nations World Water Development Report 4: Managing Water Under Uncertainty and Risk. UNESCO, Paris. <http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/wwdr4-2012/>