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Water Security in Rural India

Babita[1]* Amit Kumar[2]

[1] Research Scholar, Department of Geography, MDU, Rohtak

[2] Assistant Professor, CDRJM College, Butana

Abstract – 'This paper is an attempt to describe the different levels of water security in major states of India. The study includes India as a whole and major states such as Haryana, Rajasthan, Utter Pradesh, West Bengal, Jharkhand Odisha, Madhya Pradesh, Gujrat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala, Bihar and Punjab.'

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1. INTRODUCTION

Human survival on earth is often regarded as the outcome of many unique features available on earth surface. All these unique features are very crucial to human survival and for their development. Among these many things water is a fundamental human need and a critical national asset. It determines the contours of socio-economic development and quality of life at all the places and in all the times in present and future. Adequate access to safe drinking water is often regarded as bench mark for all developmental activities. But in recent years because of pressures of population and economic activities converge on water requirement; the water sector will increasingly face the challenge of bridging the demand-supply gap. In India too serious water resource problem and as trends suggest, it is expected to become 'water stressed' by 2025 and 'water scarce' by 2050 (Eva Mia et al.2015). Fresh drinking water and its critical nature in the form of one of the basic necessities of life, it is even more critical to have water-security as it is critical for children, who are the most vulnerable to water-related diseases.

Now it is worldwide accepted that "Access to safe water and sanitation is now a fundamental human right. But water management also requires realistic ways of recovering delivery costs. An agreed definition of water security is vitally important in that context." And achieving water security has always been a societal priority, both in harnessing its support to sustain human life and reducing its destructive impact.

Water security captures the duality function of water as "the capacity of a population to safeguard access to adequate quantities of water of acceptable quality for sustaining human and ecosystem health on a watershed basis and to ensure efficient protection of life and property against water related hazards - floods, landslides, land subsidence, and droughts" (Bill and Malinda Gates Foundation, 2012).

Water security is not merely a theoretical understanding but it has huge practical utility which got reflected in UN declaration of Millennium Development Goals (MDGs). These MDGs were to be achieved by 2015 but even after passing of deadline nations are yet to achieve this MDGs and situation is even more critical in least developed countries like India. In UN declaration of MDGs, MDG number 7 says that "Target 7C: Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation."

In recent years this issue of water security has attained another dimension due to higher climatic and hydrological variability, with important consequences for societies. In one research study UN itself has briefly predicated that rainfall variability alone could push over 12 million people into absolute poverty and that climate change could increase global malnutrition by up to 25% by 2080 (UN, 2013). In the light of above present chapter of this dissertation is an attempt to look into the issues pertaining to water and sanitation in India.

2. DETERMINANTS AND STATUS OF WATER-SECURITY IN INDIA:

As it has been discussed earlier that water security is a status of any society when it has access to safe drinking water during all the seasons of the year. Access to safe water, not only for drinking but also for industrial and agriculture is very crucial for India. Lack of water security will not only hamper economic progress of the country but its poor quality will bring in more economic burden in the form of water borne diseases. Various studies suggest that there are great regional variations in

access to safe drinking water, sanitation facilities and hygiene related issues. Here, in this section an attempt has been made to analysis determinants of water security with reference to India. There are various determinants of water security and for the sake of convenience here in this chapter determinants are categorised as Physical determinants, socio-economic, cultural determinants, demographic determinants, technological determinants.

Present analysis of water security is based on four indicators i.e. per capita availability of water, main sources of water, and distance of water source from residence and rural-urban division in access to water. In terms of availability of water at macro level is concern with rapid increase in population per capita availability of water has decreased very rapidly at an alarming level.

In 1951 India had a population of 361 million and given the water available that time in India per capita availability of water was at satisfactory level with 5177 m3/year. Over time with the increase in population of India at water resource remained almost at previous levels per capita availability of water dropped rapidly. Table-1 reveals that there has been a continuous increase in population size in India and at the same time there has been corresponding fall in the per capita availability of water during same period. It is very informative comparison between decadal changes in population size and per capita availability of water. Comparison reveals rate of population increase had made corresponding fall in the availability of water. During 1971-81 when population recorded highest increase in census decade at the same time per capita change in water availability was also highest. This reveals that water security has direct relationship with population size. It is very heartening to note that India finds itself in a precarious position, in terms of water security. And this situation has already had sever impacts on the performance of several keys sectors of Indian economic such as from agriculture and food security to the economy and livelihood related issues are prime in this regard. Table-1. reveals decadal change in population and decadal change in per capita water availability in India during 1951 to 2011. Table shows that there has been a constant decline in water availability and there exists a close negative relation between population growth and per capita availability as water resources are either constant or declining in India. It is interesting to note that rapid decline in per capita water availability from 1981 to 2011 as during this period water intensive agricultural technology spread from core areas of green revolution to non-core areas of green revolution. Resultant India witnessed an increased demand for irrigation water, causing decline in per capita availability. Under the influence of increased use of fertilizers and pesticides in witnessed a fall in the quality of water due to mixing of agricultural waste to rivers and ponds. Situation seems even grimmer in times to come as still Indian agriculture and industry is highly dependent on extensive use of water.

Table-1. India: Decadal change in Population & Per Capita Water Availability

Census Year	Absolute Population (in Millions)	Decadal Per cent change in Population	Per Capita Water availability (M3/year)	Decadal Per cent Change in Per Capita Water Availability
1951	361.08	13.31	5177	----
1961	439.23	21.64	4987	-3.80
1971	548.16	24.8	4632	-7.66
1981	683.29	24.66	3498	-32.41
1991	846.38	23.85	2209	-58.35
2001	1028.61	21.54	1820	-21.37
2011	1210.19	17.62	1598	-13.89
2030*	1294.22	15.41	1341	-19.17
2050*	1640	12.76	1140	-17.63

Source: UNICEF (2010): An overview of status of drinking water and sanitation in schools in India.

Note: - *Estimated values.

In recent times per capita water availability in India has reached to below 1,730 cubic metres per person per year, dangerously close to the 1,700-mark declared by the World Bank to be 'water stressed'. By 2030, the per capita water availability is expected to decline to 1340 cubic metres per person per year. This means that by 2030, India will be extremely close to becoming 'water scarce', a condition that is defined by the World Bank to be when a country's per capita water availability reaches 1000 cubic metres (Chaudhuri and Roy, 2017). Table-2. shows per capita water availability in major state of India it is important to note that most of the northern state have high water availability as they have many perennial rivers which supply adequate water to meet the needs of millions. Rajasthan has lowest per capita availability of water coupled with lower availability of water under the influence to India Southern states such as Karnataka and Maharashtra also witnessed low availability of per capita as they have scares water resource as compare to their large base of population.

Table-2. Per Capita Water availability (M3/year) in Major Indian States

Country Region	Per Capita water availability (M3/year)
India	1598
Haryana	1764
Rajasthan	789
Uttar Pradesh	1162
West Bengal	1476
Jharkhand	1237
Odisha	1007
Madhya Pradesh	1236
Gujarat	900
Maharashtra	956

Andhra Pradesh	976
Karnataka	998
Tamil Nadu	1321
Kerala	1243
Punjab	1754
Bihar	1004

Source: Ministry of Statistics and Programme Implementation (2016): Swachhta Status Report, 2016

It is very heartening to note that in a country like India which is heavily dependent on agriculture for its performance water is rapidly declining. In the absence of adequate water security country will have 'Ripple Effect: on Food Security and Agricultural prosperity'. Demand supply mismatch in agriculture will severely undermine present food status of India and future prospect will be hampered.

3. MAJOR SOURCES OF DRINKING WATER

The main sources of drinking water were categories into – (1) Tap water, (2) Hand pump, (3) Tube well/Borehole, (4) Well, (5) Tank, Pond, Lake, (6) River, canal, (7) Spring and (8) Any other. Unto census 2001, tap water, hand pump and tube well were considered as safe sources of drinking water. Economic survey 2011-12 has published data on "Access to Safe Drinking Water in Households in India" of census 1981-2001. Following the same as sources of safe drinking water (Tap/Hand-pump/Tube well) for census 2011, data on access to safe drinking water in household has been created, collecting data from Provisional, Census of India, 2011, "Houses, Household Amenities and Assets – Drinking water data".

Table -3. shows India and major states along with the main sources of drinking water. Table reveals that in India around 40 percent of population is having access to tap water which is considered as safest water for drinking. Apart from tap water, hand pumps also serve demand for drinking water to nearly 40 per cent of Indian population. Hand pumps serve as chief source of water supply where piped water facility is not available. Vast rural areas are primarily dependent on this very source for their needs. In few pockets of Jharkhand and Kerala well is also a noteworthy source of drinking water. With reference to major states in India states have higher economic prosperity; high social development and low population base are performing remarkably well in terms of access to tap water. Here, southern states such as Tamil Nadu, Karnataka, Maharashtra, Gujarat and Andhra Pradesh are performing above par. Haryana is one exceptional state in north India which is performing remarkably well as compare to their north India counterparts. In Haryana Tap water serves the demand of nearly 70 of population followed by hand pumps and well is other important sources of drinking water.

Table 3. Percentage Main Source of Drinking Water in Major States of India, 2011

Region	Tap water	Well	Hand Pump	Other Sources
India	43.5	11	42	3.5
Haryana	68.8	3	22	6.7
Rajasthan	40.6	10.8	37.5	11.1
Uttar Pradesh	27.3	4	67.7	0.9
West Bengal	25.4	6	66.8	1.7
Jharkhand	12.9	36.6	47.3	3.4
Odisha	13.8	19.5	61.4	5.2
Madhya Pradesh	23.4	20	54.6	2
Gujarat	69	7.1	21.2	2.7
Maharashtra	67.9	14.4	15.5	2.1
Andhra Pradesh	69.9	14.4	15.5	2.1
Karnataka	66.1	9.1	21.5	3.5
Tamil Nadu	79.8	5.1	12.8	3.8
Kerala	29.3	62	4.2	4.5
Punjab	51	0.4	46.6	2
Bihar	4.4	4.3	89.9	0.9

Source: Census of India (2011): Houses, Household Amenities & Assets table on Drinking Water.

4. DISTANCE OF WATER SOURCE

In determination of water status of any region distance of water source is an important indicator to assess the access of people to safe drinking water. Data pertaining to distance of water source is also provided by census of India. In every Census, question regarding availability of drinking water source is asked from each household and responses are collected upon the distance at which it was available. Responses are categories into three-

(1) Within Premises: If the source was located within the premises where the household lived.

(2) Near the Premises: If the source was located within a range of 100 meters from the premises in urban areas and within a distance of 500 meters in case of rural areas.

(3) Away: If the source was located beyond 100meters from the premises in urban areas and beyond 500 meters in rural areas.

A household where water source is located within the premises is considered as best and any water a source which is available away from the residence is considered as not appropriate. With reference to percentage of population having access to safe drinking water data is available both for urban as well as rural areas. In terms of access to safe drinking in urban areas nearly 70 per cent have access within the premises and 20 per cent have safe drinking nearby house. Interestingly in urban areas access to safe drinking water within premises is far better as compare to rural areas. In urban areas most of the states have neatly 70 per cent households having water within the premises. States such as West Bengal, Bihar, Odisha,

Madhya Pradesh and Andhra Pradesh are not performing well as they have witnessed very low levels of water access within household. These states have large population and in the presence of abject poverty urban development in these states are poor in absence of adequate infrastructural facilities water access is poor.

In the access to safe drinking water in urban area Punjab, Haryana and Kerala have outperformed other states. In these states higher investment by states government in social sectors transformation has boosted the access of safe drinking water within premises. Increased education level created awareness among society about the importance of access to safe water has led this increased access. Here too newer urban schemes are rapidly showing results in transforming urban space.

Table-4. Percentage of Population Access to safe Drinking water Rural Areas

Region	Within the Premises	Near House	Away
India	35	42.9	22.1
Haryana	56.6	27.5	16.2
Rajasthan	21	47.1	31.9
Uttar Pradesh	44.1	41.9	14.1
West Bengal	30.4	37.9	31.5
Jharkhand	11.7	51.9	36.4
Odisha	16	45.5	36.5
Madhya Pradesh	13	50.9	36.1
Gujarat	48.3	33.2	18.5
Maharashtra	42.9	37.5	19.6
Andhra Pradesh	31.5	44.6	23.9
Karnataka	26.6	48.6	24.3
Tamil Nadu	17	74.7	5.2
Kerala	72.9	16.3	10.3
Punjab	81.5	12.7	5.7
Bihar	47	40.4	12.6

Source: Census of India (2011): Houses, Household Amenities & Drinking Water

Access to safe drinking water has great regional variation owning to various causes. In this segment an attempt has been made to analysis difference in access to safe drinking water between urban and rural areas. It is very interesting to know that in all the major states of India have given more thrust to develop urban areas as compare to rural areas. Table -6. shows that there is great difference in urban-rural water access, in all the state facility to drinking is more inclined towards urban areas. It is evident from table-6 that urban area has higher access to facility to drinking water within premises and rural area are mostly dependent on water supply from near or away from the residence. This difference in access to drinking water with in the premises is a phenomenon of all the states in India. The divide between these urban areas and rural is highly problematic and it has potential to cause unrest in rural areas. Higher dependency on water sources about side premises also cause problem to women as they have to devote a large time to carry water back home. And as women are already overburdened with household related works, water carrying will bring in addition burden on them.

5. OBJECTIVE

To describe the spatial pattern of water security in some selected state of India

6. DATA BASE AND METHODOLOGY

The study is based on secondary source of data. Most of the date has been collected from Census of India, 2011 To get a holistic picture of water security composite score ihas been calculated using Z-score method.

Z-score

$$Zi = \frac{(Xi - \vartheta)}{Standard\ Deviation}$$

Here,

Zi Z-score

Xi Value of observation

ϑ Mean of all values

Composite Score

$$CS = \frac{Zij}{N}$$

Here,

CS Composite Score

Zij Indicate Z score of an indicator J^{th} in district

N Number of variables

Indicators for Water Security

To analyse the level of water security following indicator has been taken.

X_1 Percentage of population having access to tap water

X_2 Percentage of population having water within premises in urban areas

X_3 Percentage of population having water within premises in rural areas

X_4 Per Capita Availability of water

X_5 Differentials in urban-rural access to safe drinking water

Description:

On the basic of selected indicators z-score was calculated and composite score is calculated. Analysis of Composite Development Score major states of India are divided into the categories namely highly developed region, medium developed region and low developed region (Table-5). Analysis of data reveals that there is clear demarcation between categories as highly developed category.

Table.5 Levels of Water Security, Sanitation and Hygiene

Sr. No.	Category Name	States
1	Highly Developed Region	Gujarat, Punjab, Haryana
2	Medium Developed Region	Uttar Pradesh, Rajasthan, Andhra Pradesh, Tamil Nadu, Maharashtra, Kerala, Karnataka
3	Low Developed Region	Odisha, Bihar, Jharkhand, Madhya Pradesh West Bengal

Source: Calculated using data obtained from Census of India, 2011.

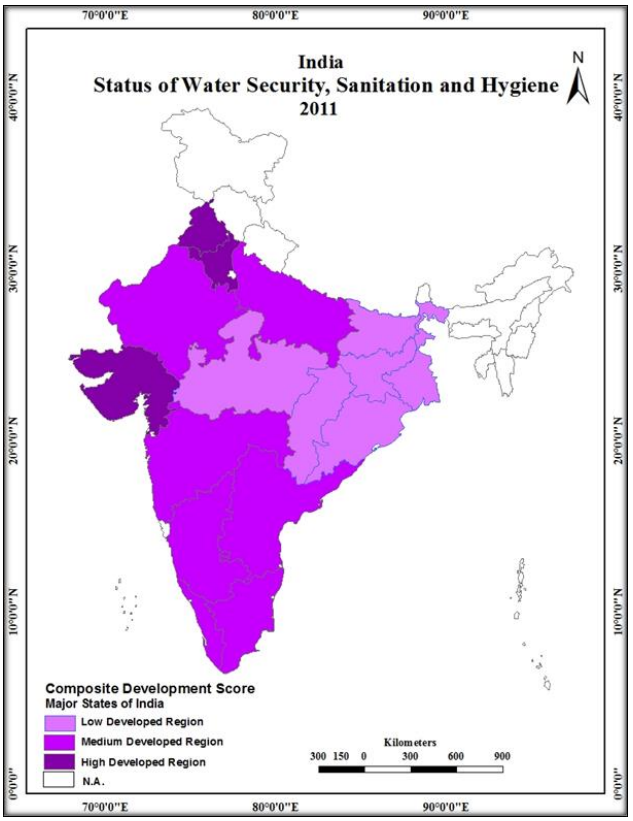
It constitutes sates such as Gujarat, Haryana and Punjab which are most prosperous states of India. Here higher per capita income has reflected in higher availability of basic services including water facility. Moreover, as economies of these states are performing better as compare to other states in India, state governments in these states are better equipped to invest more in basic services. In terms of social development states in developed category has higher level of literacy rate and more education this also has marked impact on the better performance of the states.

With reference to medium category states higher population pressure along with higher rate of urbanisation has dragged their score below. Like in Uttar Pradesh, Maharashtra, Tamil Nadu and Kerala population growth is seen as major problem. And due to increasing population civic facilities in the state has witness tremendous pressure. One other issue which as dragged the performance of these states below par is their economic performance in last few decades. Poor performance of economy has marked lower investment in social and sanitation society. In states with low level of development in Composite Score Index too high population pressure coupled with poor economic status has caused poor performance. As high population pressure with lower investment capacity of states has produced poor performance of all the social indicators too.

7. CONCLUSION

Extensive analysis of Water security, Sanitation and Hygiene is done to have fair information about status and trends in these issues at national and state level. As it is well known that trends of national and state level percolates at regional and village level. Given the information received from analysis that there is marked regional variation in status of water security. All these three phenomena should be looked in holistic manner and they have very high level of association and interdependence. With reference to water security it is found very crucial for food security and economic development of the country. In the analysis it was found that under the influence of increasing population and reducing water sources availability of per capita water is declining very rapidly. The decline is even more rapid in states where geo-climatic conditions are harsh.

Map 1 India: Composite Development Score for 'WaSH' in Major States of India



Source: Map is based on calculations on data obtained from Census of India, 2011.

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Corresponding Author

Babita*

Research Scholar, Department of Geography, MDU, Rohtak

bhuria2424@gmail.com