

# **Geographical study of Water Demand and availability in Suketi River Basin, Himachal Pradesh**

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## **Abstract**

### **Introduction**

Geography is a subject which deals with different aspects of the earth such as its composition, physiography, atmosphere etc. In today's world, exploitation rate of natural resources is very high due to increasing industrialization, urbanization. Water is one of the most important natural

resources which have no substitute on earth. The pressure on water resources is continuously increasing with increased population, however per capita water availability is continuously decreasing. The per capita availability of water varies from 8.5 litres per day in the Asian continent to 587 litres in the United States of America. The main reason for this uneven availability of water is population growth(Kumar, 2018). Different natural and human factors like physiography, geological structure, climate, economic structure, industrial set up etc. affect the pattern of water demand and utilization in any region.

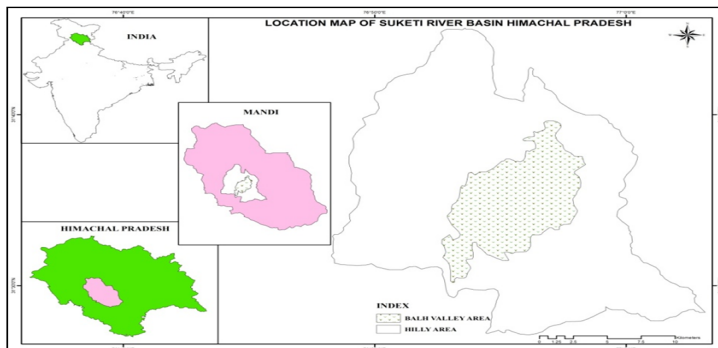
India is a country where every type of physiography can be seen. The northern most part of the country is covered with the Himalayan mountain ranges whereas southern, south-eastern and south-western parts are coastal land areas. Western region is covered with a vast desert called 'Thar' desert. Great alluvial plain is located in south of Himalayan region and peninsular plateau region is located in the south of great plain of north India. The population distribution, industrial development, availability of natural resources and economic developmental activities are varied in these regions. Buono et al (2015) studied the traditional water resources of India and reveals that the springs of India are under threat due to increased water demand, climate change and environmental pollution.

Himachal Pradesh is a hilly state located in the northern Himalayan region of India which provides water to various rivers like Satluj, Ravi, Beas, Yamuna and Chenab. In

this chapter the distribution of population and water demand for domestic and drinking purposes in Suketi river basin of Himachal Pradesh has been analysed geographically.

### Study Area

Suketi river basin is located in district Mandi of Himachal Pradesh which is subpart of Beas river drainage system. It is located between 76°48'30" East to 77° East longitudes and 31°29' North to 31°45' North latitudes. It encompasses an area of 426 sq. km. with an elevation of 754 m. above mean sea level at Beas Suketi confluence and 2052 m. above mean sea level at its highest peak Zoomdhar. The inter-montane valley called Balh valley surrounded by mountains is the unique characteristic of this basin. The area of Balh valley is about 80 Square Kilometres and as mountainous area is about 345 square kilometres. According to the census of India 2011, total population of the basin is 2,07, 378 out of which 52 percent population lives in Balh valley region.



Source: District Census Handbook and Administrative Atlas of

Himachal Pradesh, 2011.

### **Objectives of the Study**

1. To analyse the drinking and domestic water demand in Suketi river basin from 1991-2011.
2. To analyse the availability of water sources at village level in Suketi river basin.

### **Data Sources and Methodology**

The present study is based on secondary data which has been retrieved from District Census Hand Book of Mandi, Himachal Pradesh for 2011. Village wise distribution of population for the year 2011 has been displayed through maps. The water demand analysis has been done for the year 1991, 2001 and 2011.

### **Results and Discussion**

The results and findings of the study have been discussed under following headings:

1. Distribution of population in Suketi river basin.
2. Drinking and domestic water demand in Suketi river basin in 1991, 2001 and 2011.
3. Availability of surface and ground water sources in Suketi river basin.

#### **Distribution of Population in Suketi River Basin in 2011**

Total population of the basin in 1991 was approximately 1, 54,734 out of which 52 percent was residing in Balh block which is a valley area. In the year 2001 the total population of the basin was 1, 79,336 and slightly less (51 percent) was residing in Balh valley which means the proportion of the population in Balh valley reduced to a small extent. However

the total population in the basin in 2011 was 2, 07,378 and approximately 52.17 percent population was documented in Balh valley (Table 01). The valley comprises only the area of 18.82 percent of the total basin area however more than 52 percent population is residing in this valley. It indicates that the population density and pressure on natural resources such as land, forest and water is continuously increasing in the valley. The main reason of this increase is fertile soil, plain land surface, availability of sufficient surface and ground water sources. On the other hand approximately 81.18 percent area of the basin comes under hilly and mountainous terrain. Here less than 48 percent is residing. The main reason of this sparse distribution is uneven distribution of natural resources and lack of facilities in hilly areas.

In case of village wise distribution of population it is visible that almost all the highly populated villages are located in middle part of the basin which is valley region and remaining less populated villages are located in outer hilly and mountainous region (Figure 02).

**Table: 01 Block wise Population Distribution in Suketi River Basin from 1991 to 2011**

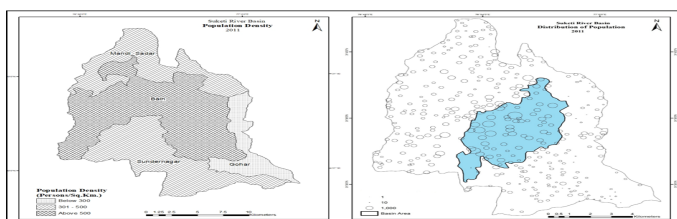
Sr. No.	Development Block Name	Population in 1991	Population in 2001	Population in 2011
1	Balh	80821	93038	108620
2	Gohar	10707	13095	15068
3	Mandi Sadar	22473	26625	30637

4	Sundarnagar	40733	46578	53053
Total		154734	179336	207378

Population density is also uneven in the basin within its hilly and valley region. Highest population density is found in Balh block and lowest is found in Gohar block. The Balh block is covered with maximum valley area therefore the population density is comparatively high in this region. In this block population density is above 500 persons per square kilometres. Mandi and Sundernagar blocks are recorded with moderate population density. These blocks covered with both hilly and mountainous region. Hence the population density is less in comparison to Balh block. The population density of Mandi and Sundernagar blocks is found between 301 to 500 persons per square kilometres (Figure 02).

The lowest density is found in Gohar Block where less than 300 persons per square kilometres are documented. This region is fully covered by high hills and mountains, due to the lack of basic facilities population is sparsely distributed in this block.

**Figure: 02**



Source: District Census Handbook, 2011.

## **Drinking and Domestic Water Demand in Suketi River Basin (1991-2011)**

Water is one of the most important substances on earth for the survival of life. It is vital for all living organisms. The drinking water is of much more importance than for other uses. The demand of drinking and domestic water is increasing with growing population. Now the situation is become worse and major cities all around the globe are facing water crisis in more or less extent. Every year thousands of people die due to lack of safe drinking water or unavailability of drinking water. All governments on national and international level are committed to provide safe drinking water to its entire population. But the growing population and its pressure on finite fresh water resources is the major issue. Gliek (1996) has estimated the per capita daily and annual drinking and domestic demand of water. He calculated the amount of water for drinking, sanitation and hygiene, bathing and for cooking. He concluded that humans need 50 Litres Per Capita per Day (LPCD) water for domestic use as minimum requirements and the water for food production is not included in this amount. Accelerated Rural Water Supply Programme (ARWSP) was started in the year 1972-73 by government of India. Its main objective was to help the states and union territories to increase the coverage of drinking water supply. According to its norms, 40 LPCD water is required for humans to meet the domestic demands (Table 02).

**Table: 02**

Basic demand of domestic water in LPCD (ARWSP)

Purpose	Quantity (LPCD)
Drinking	3
Cooking	5
Bathing	15
Washing Utensils and House	7
Ablution/ toilets	10
Total	40

ARWSP was upgraded into National Rural Drinking Water Programme (NRDWP) in 2009 and the norms were also upgraded. The criteria of minimum basic requirement of 40 LPCD exchanged with 55 LPCD. As ARWSP was focused to provide potable drinking water to rural population on the basis of 40 LPCD as basic needs but large segment of population was remained uncovered under water supply system. Therefore, with the beginning of 12<sup>th</sup> five year plan the focus shifted to providing piped water supply at household level. Major concentration was on providing safe drinking water to all rural households at the rate of 70 LPCD, but as a temporary measure the norm of 55 LPCD had been set for domestic water demand (table 03).



**Table: 03**

**Basic demand of domestic water in LPCD (NRDWP)**

Purpose	Quantity (LPCD)
Drinking	3
Cooking	5
Bathing	15
Washing Utensils and House	10
Ablution/ toilets	10
Washing Clothes and Other Uses	12
Total	55

Water demand for domestic and drinking purpose in the present study area has been calculated according to the norms of NRDWP i.e. 55 LPCD.

Per Capita Demand = 55 Litres

Per Capita Annual Demand =  $365 * 55 = 20075$  Litres

Total Population of Suketi River Basin (2011) = 2, 07, 378

Daily Domestic and Drinking Demand= Per Capita Demand \*  
Total Population

Daily Demand of the Basin =  $2, 07, 378 * 55 = 1, 14, 05, 790$   
litres or 11405.79 cubic meters.

(Here 1 cubic meter = 1000 litres)

Annual Domestic Demand of the Basin = Daily Demand of the  
Basin \* 365

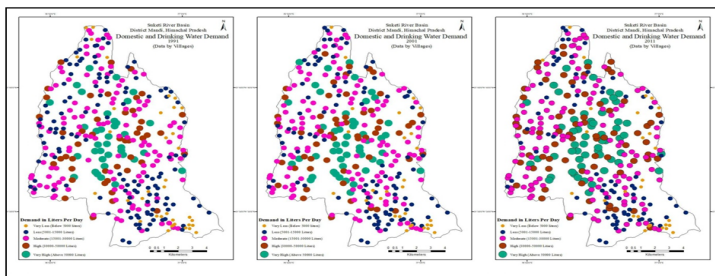
=  $1, 14, 05, 790 * 365 = 4, 16, 31, 13, 350$  or 41, 63, 113.35

cubic meters

As the basin comprises of valley and hilly regions, the demand is uneven in these areas. There are four blocks fully or partially comes under the basin. Total 387 villages are there in the basin and villages of valley areas have more population and hilly areas have comparatively less population. The water demand also follows the spatial pattern of population distribution (Figure 03).

**Figure: 03**

Suketi River Basin: Change in Drinking and Domestic Water Demand (1991-2011)



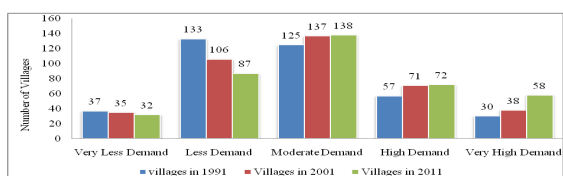
Source: Calculated according to NRDWP norms, 2009.

The twenty years' time period has been taken to analyse the change in domestic and drinking water demand in Suketi river basin. The demand has been calculated according to the norms of NRDWP guidelines for the year 1991, 2001 and 2011. The demand of domestic and drinking water in suketi river basin in 1991 was 85, 10, 370 litres per

day which increased to 98, 63, 480 litres per day in 2001 with decadal growth rate of 15.89 percent. This demand grows up to 1, 14, 05, 790 litres per day with slightly less rate which is 15.63 percent (Table 04).

**Figure: 04**

Suketi River Basin: Number of Villages by Water Demand (1991-2011)



In the year 1991, there were 37 villages recorded with very less water demand which reduced to 32 in 2011 and villages with less water demand reduced from 133 in 1991 to 87 in 2011. On the other hand villages with high demand increased from 57 in 1991 to 72 in 2011. The number of villages with very high demand is also increased in the basin from 30 villages in 1991 to 58 in 2011 (Figure 04).

**Table: 04**

**Block Wise Demand of Domestic and Drinking Water in Suketi River Basin from 1991 to 2011(Demand in Litres)**

Sr. No.	Development Block Name	Demand in 1991	Demand in 2001	Demand in 2011
1	Balh	4445155	5117090	5974100
2	Gohar	588885	720225	828740

3	Mandi Sadar	1236015	1464375	1685035
4	Sundarnagar	2240315	2561790	2917915
Tota l		8510370	9863480	11405790

### Availability of Water Sources in Suketi River Basin

Suketi river basin is gifted with enormous surface and ground water sources such as tap water whether treated or untreated, wells, hand pumps, tube wells, bore wells, springs, river, canal, tank, pond, lake and other sources like baories, ditches and khatries etc. These sources are unevenly distributed on the surface. As it has discussed that the basin comprises of hill and valley topography hence, the type of water sources also varies accordingly. According to Pophare et al (2014), most of the drinking and irrigation water supply depends on wells and tube wells in Balh valley and on the other hand hilly and mountainous terrain depends on spring and bore well sources. Village wise distribution of different sources is discussed in the following sections:

1. Treated/Untreated Tap Water: All 394 villages are equipped with treated/untreated tap water.
2. Well Water (Covered/Uncovered): Well water is available in 79 villages of the basin. And maximum well water sources are located in valley region (Figure 05).
3. Hand pump: Total 201 villages are equipped with hand pumps in the basin. Hand pumps are used both in valley and hill area of the basin (Figure 05).

**Table: 05**

Block Name	Number of Villages with Varied Water Sources in Suketi River Basin							
	Tap Water	Well Water	Hand Pump	Tube Well	Spring	River/ Canal	Tank/ Pond/ lake	Others
<b>Balh</b>	175	59	107	13	1	18	20	1
<b>Gohar</b>	35	1	19	0	0	0	0	9
<b>Mandi Sadar</b>	76	2	31	1	3	1	5	3
<b>Sundar nagar</b>	101	16	39	5	3	10	25	14
<b>Total</b>	387	78	196	19	7	29	50	27

Source: District Census Handbook, 2011.

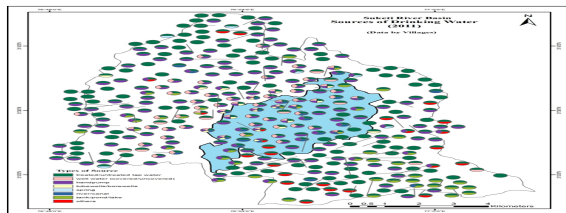
**Tube Well/Bore Well:** There are only 19 villages in the basin which have tube wells and bore wells. These are located in Balh valley because of shallow groundwater table.

**Springs:** Only 7 villages in the basin are using spring water. All these villages are located in hilly areas of the basin.

**River/Canal:** Rivers and canals also have influence on the sources of drinking water in the Suketi river basin. There are 31 villages in the basin which have access to river or canal water especially in the Balh valley.

Tank/Pond/Lake: These sources are available in 50 villages of the basin which are located in the southern hilly area of the basin.

Other Water Sources: Other sources like khatries, ditches and baories etc. are also available in the Basin. These sources of water are available in 28 villages of the basin. A small number of these sources are located in Balh valley and majority of these sources are located in hilly areas of the basin.



Source: District Census Handbook, 2011.

## Conclusion

Population and demand of water is continuously increasing rapidly in the basin. Population density is recorded high in Balh block whereas other three blocks such as Gohar, Mandi and Sundernagar recorded with less density. There is a huge variation in the availability of water sources in hilly and valley area of the basin. Hand pumps, well water, rivers and canals are the major sources of drinking water in Balh valley area whereas tank/pond/lake springs and other sources are available in hilly area. Around 115 villages of the basin in hilly areas are less populated and using only one source of water such as tap water and there is no other water source available in these villages. The villages having three or more sources are highly populated and located in Balh valley. The data

shows that there is a positive relationship between number of water sources and population size of the village. The villages with less population size have less number of available water sources, and highly populated villages have more water sources. It is also evident from the study that the number of the villages with less and very less water demand has been reduced and villages with high and very high water demand has increased from the year 1991 to 2011. There is a need to reduce the gap between water demand and supply in both hilly and valley areas of the basin which can be achieved through proper water conservation and management plan at micro watershed level.

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