



## **Water Crisis in the Hill Cities of Western Himalayas: A Startling Reality**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author AK designed the study, wrote the protocol and wrote the first draft. Author PKC managed the literature searches and references as well as corrected the first draft of the study. Author SK read and approved the final draft as well as finalize the topic of the manuscript.*

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### **ABSTRACT**

Water is the very basis for the existence of life in earth to the extent that the word life has almost become synonymous to it. But potable water is becoming a scarce resource despite the fact that the overall composition of water is about 70 % of the earth surface as the efforts for salvaging the usable water and using it in a sustainable way is an increasingly troublesome process. Over the years there are several instances of water shortages in various parts of the country, but the most intriguing instance is the water crisis in the Himalayan hill cities despite the fact that it is home to several big glaciers and vast river basins. In the recent years water crisis has been in high proportion in the various Himalayan hill cities. In the Leh district, during the last few years, there are multiple reports of the water shortages during the summer months. There are studies that despite these efforts, the gap between demand and supply of water is likely to double by 2050. Another important aspect is strengthening the governance and planning aspects of local administration for better identification,

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understanding, adaptation and mitigation efforts. Mountain-specific solutions with consideration for building local knowledge and database for futuristic planning are essential for a better future.

*Keywords: Western Himalayas; sustainable development goals; world's humanity; mitigation.*

## 1. INTRODUCTION

Water is the very basis for the existence of life in earth to the extent that the word life has almost become synonymous to it. But potable water is becoming a scarce resource despite the fact that the overall composition of water is about 70 % of the earth surface as the efforts for salvaging the usable water and using it in a sustainable way is an increasingly troublesome process. In September 2015, the UN adopted the 2030 Agenda for sustainable development with 17 Sustainable Development Goals (SDGs). Goal 6 is dedicated for ensuring access to water and sanitation for all.

India, where about 16 percent of the world's humanity resides, has just 4 percent of world's water resources and 2.45 percent of land area at its disposal. Thus, the nation has a far lower share of per capita availability of water [1]. Over the years there are several instances of water shortages in various parts of the country but the most intriguing instance is the water crisis in the Himalayan areas because the Himalayas are home to several big glaciers and vast river basins. Hence despite being the source of water to the Indian subcontinent there are several cities of the Himalayan region which see shortage of water particularly during the summers.

## 2. SITUATION IN MAJOR HILL CITIES

In the recent years water crisis has been in high proportion in the various Himalayan hill cities. In the Leh district, during the last few years, there are multiple reports of the water shortages during the summer months. [2,1] Further, with the summer just about to begin, the people in summer capital Srinagar of UT of J & K had already anguished with routine water scarcity in February, 2020. [3] Himachal Pradesh has been in news frequently in the last couple of years for taking stringent steps to combat water crisis in its famous tourist centres and cities, where the government was forced to request the tourists not to visit Shimla [4,5]. The situation is similar in the hill cities of Uttarakhand like Mussoorie, Nainital, Almora, Pithoragarh etc. where particularly during the summers there is need for

continuous rationing of water. It is ironic that the great rivers of Uttarakhand have quenched the thirst of millions while its residents face water shortage [6,7,8].

## 3. UNDERLYING REASONS

As the terrain and climatic conditions of the Himalayas is different from the rest of India, there may be several specific reasons that are plaguing this Himalayan crisis. Even within the Himalayan landscape, there is great amount of climatic diversity running from the west to east. Hence despite taking a holistic account of the possible reasons behind the crisis, there is need to do a region specific introspection of the problem for better understanding.

## 4. WESTERN HIMALAYAS

Important cities in Western Himalayas like Srinagar (J&K) are facing acute water shortage. Here the main reasons are drying up of the local wetlands which have been treated more as waste lands [9], rapid urbanization, environmental degradation, population growth, economic development and unhindered spatial expansion. There are reports which have hinted towards human pressure due to exploitation, encroachment and reclamation of many parts of the wetlands around the city for activities like agriculture, commercial and residential which has put extra pressure on the water resources. There are estimates to show that this city has increased more than 12 times in terms of population and 23 times in terms of area in the last just 100 years. And as per various newspaper reports, this problem has got extenuated during the summers as the prolonged dry spell of 2017 and 2018 along with this the continuous rising temperatures has added to this phenomenon [10].

In the western Himalayas of India next important city is Leh in the Laddaq Union territory region. This city is also representative of the different climatic conditions in Himalayas i.e. cold dry conditions. Here the shortage is more due to unregulated tourism which creates exponential population increase during the peak times

bringing too much pressure on the traditional sources of water. According to down to earth report in 2017, more people visited the city than the total population of the city and huge number of visitors not only put pressure on the scarce natural resources (including water) of the region. Further, just like Srinagar erratic rainfall / snow fall in the region, climate changes, temperature increase and over melting of glaciers during summers are also contributing factors to this issue. Other factors worth mentioning here are changing water use pattern in the city for example rise in the number of flush toilets, increase in the number of private bore wells, mismanagement and drying up of the natural water springs, etc which have contributed towards the water scarcity in the region [11].

Westwards is the state of Himachal which has great many rivers originating from this region. Despite this there have been several water related crisis in the various districts of the state within the last decade. Here the main hotspots of the water shortage areas are Shimla, Solan, Dharamshala and Spiti, while several areas also have the problem of contamination of drinking water. In the Shimla city, the problem has been acute in the last decade with very heavy tourist footfall during the summer months with estimates showing nearly 20,000 daily tourists visit to the hill station [12]. And this huge tourist spurt has sparked outrageous construction activities like theme restaurants, hotels / rest-houses, and other residential building which has spiked the demand for water. Therefore the lack of sustainable futuristic planning has plagued this city. Several other reasons like the climate change which has altered the winter precipitation in the region, drying up of the traditional natural water springs and almost non-existent rainwater harvesting strategy have also contributed toward this phenomenon. The summer of year 2018 offered a terrifying glimpse of what most of our cities could be facing in future. Situation became so dire that the residents of the city along with the state local authorities made an appeal to the tourists for not visiting the city, a strange paradox for the city which flourishes due to them [13].

Spiti is another case in this study where there is a crisis akin to the Laddaq union territory region. Retreating glaciers and inadequate snowfall during peak winter season is affecting not only the water security in the region but also threatening the livelihood and food security of this cold desert. Further the increased tourist inflow in the region has increased exponentially

leading to many residential houses turning into homestays along with the construction of new hotels. All this has put a lot of pressure on the per capita water availability in the region ([14]. Other cities of the state like Solan, Kasauli, Dharmshala have had their share in this crisis although not as acute as that of Shimla but these are sure heading this way. Unplanned residential, hotels, restaurants and holiday are major reasons here along with the rapidly rising local and tourist population [15].

The state of Uttarakhand is third region of the western Himalayas where there are several hill cities facing the potential water crisis. The problem is not new to Uttarakhand and as early as 2018, the United Nations Development Programme reported about an acute water crisis in the state. There were calls from several regions to boycott the 2019 elections until the issue of water crisis is not resolved in various regions like Pauri villages, Mussorie etc-. A report by NITI Aayog talks of the drying up of approximately 50% natural spring-based drinking water supply in the mountainous parts of Uttarakhand. As these natural springs are considered lifelines for people in the hills, the situation has worsened the problem of water shortage [16,17]. Over populated towns, lack of proper sustainable planning, poor maintenance and distribution has plunged mountain residents to severe water shortage, so much so that women and girl have to often walk kilometers for potable water. The districts like Almora, Pauri, Tehri, Pithoragarh and Chamoli are facing drinking water crisis, to the point that water scarcity is a major driving factor towards migration of villagers [18]. In Pauri, the areas like Jaiharikhal, Dwarikhal and Dugadda regions, whereas Jaunsar area of district TehriGarhwal, are the water scarcity hot stops which fall in the Garhwal region of Uttarakhand [19].

The city of Nainital is another paradox as this hill station is termed 'lake of district of India' but has been facing water woes over the years. Major reason for the increased stress on its water resources is the overdependence on the lake water resources but other factors too have their share in creating which are mainly anthropogenic in nature like surge population increase, excessive tourism, and sewage entering the lake etc. The other main factors that threaten the survival of this Himalayan lake include drying up of its source - Sukhatal, increasing siltation, constructions and encroachments on the slopes around the lake, eutrophication of the lake waters

due to the entry of solid waste, construction debris and other pollutants into the lake waters, climate change and comparative warming up of the Himalayas [20]. Due to rapid migration of the local villagers to the city of Pithoragarh water crisis has become perennial problem. This is coupled with new factors like construction activities, tourism, unplanned development and lack of long term planning.

## 5. REASONS IN A NUTSHELL

The crisis in the Kumaoni cities like Almora, Ranikhet, Nainital and Pithoragarh is mainly the result of unsustainable growth and unplanned development, growth in tourism, unregulated urbanization and the intensification of agriculture. Growth in the number of hotels and resorts has put a lot of pressure on the availability of water. Moreover deforestation has resulted into a high surface run-off and poor rainwater recharge, adversely affecting the feeding of mountain springs. The reduction in rain and the lack of rainwater recharge of natural springs has also adversely affected the flow of local rivers which are virtually reduced to a trickle during summers [21,22].

Despite having region specific reasons, there are certain commonalities among them. These include excessive population transfer from the villages to the urban centers, unregulated urbanization, climate change, poor future planning, excessive tourism, water mafia, lack of rain water / storm water management, poor sewage system, new life style (water use), construction activities, unregulated growth of Hotel / resort industry etc-. Loss of natural springs is one of the main reasons which is due to the deforestation leading to the drying up of springs, along with schemes like hydropower and construction of roads which disturb the underlying geology. Small aquifers get affected by reckless blasting works and other construction thus harming them. Water shortage is generally seen during summers. But at times some factors are responsible for the water shortages during the rainy and winter season. The shortage during rainy season is due to the clogging of the pipes and supply facility by the muddy water in the rivers and in winters there due to low temperature water freezes in the supply pipes.

## 6. GOVERNMENT INTERVENTIONS

The issue of water is listed in the state list as entry no. 17 as per the seventh schedule to the

constitution of India. Accordingly, there have been several government interventions in the wake of this crisis but generally these are of the nature of providing for more water supply to the target areas and are not wholesome enough to tackle the problem in a futuristic and sustainable manner. In the majority of the areas, the plan of the local administration is to increase the capacity by providing for water from new sources and reducing losses by replacing the yester year pipelines through the help of various financing agencies. Apart from it there are certain noteworthy steps to combat water crisis by the respective local government.

The government of Himachal Pradesh post 2018 crisis has initiated a three pronged strategy, which is a combination of short term, medium term and long term initiatives and plans. In the long term the plan is for bringing supply 104 MLD of water to the capital city through aRs 800 crore Kol Dam lift project, in the medium term the catchment areas local rivers are to be harvested along with the installation of an Ultra Violet water treatment plant to combat contamination. The short term measures include mapping the entire distribution network of British era system to plug the leakage. The local authorities in Uttarakhand cities are also the focusing mainly on plugging in leaks and increase water. Jal Jeevan Mission, a central government initiative under the Ministry of Jal Shakti, aims to ensure access of piped water for every household in rural India with safe and adequate water through individual household tap connections by 2024. The fund sharing pattern between Centre and State is 90:10 for Himalayan (Uttarakhand, Himachal Pradesh) and North-Eastern States. Apart from this, Project Paani a non-government effort to sensitize public and to combat water crisis are also some note worthy efforts in Uttarakhand [23,24,25].

## 7. WAY FORWARD

There are studies that despite these efforts, the gap between demand and supply of water is likely to double by 2050. This gap is more acute in the hill cities and towns with high dependence on natural springs [26]. Reasons to mitigate water shortages are: A) rejuvenate the natural springs (which is basically groundwater) and keep them running, as, like the glaciers, these springs also provide base-flow to the rivers. B) develop the database (with geospatial mapping) for these springs for the entire Himalayan region and understand the local hydrogeology. C) Then identifying areas where the recharge is taking place and then undertaking water conservation,

restoration works and recharge work in those sites. Very often, the recharge area of a spring can be on another side of the same mountain so this calls for a valley-to-valley approach where water conservation work may need to be undertaken from one valley to the next and treat both sides. This calls for a paradigm shift away from a watershed to a spring-shed approach. Also it is important to go for massive oak reforestation not only to arrest degradation of forests and also lead to water retention near these springs [27].

Another important aspect is strengthening the governance and planning aspects of local administration for better identification, understanding, adaptation and mitigation efforts. Growing urbanisation pressures of the nearby villages and increasing tourism activities must be efficiently regulated and if possible an upper limit must be set for tourism levels at least. This idea of creating records of tourist and pilgrim visit is putting excessive pressure on the scarce resources and is in turn a recipe for disaster. It is often mentioned that during the peak seasons there are at times more number of tourists than the residents.

## 8. CONCLUSION

Himalayas are a sacred and geologically sensitive landscape where unregulated activities are likely to bring bad news. Further despite heavy amount of precipitations during the monsoon season there is neither existing provision of rain water harvesting or storm water management nor any plans for future. There are times when excessive silt deposition and muddy waters clog the water stations and pipelines creating water shortage in the Cities and towns. During these times if all the buildings had the compulsory provision of rain water harvesting, this shortage could be easily addressed and would also save the exchequer a big amount of money. Hence to tackle this problem more efficient and empowered local bodies are required. Local solutions will be the key which needs to be augmented with the more and active participation of local women as they generally are at the frontlines for collecting water. Mountain-specific solutions with consideration for building local knowledge and database for futuristic planning are essential for a better future.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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