An Environmental Survey of Water Heritage and Source Sustainability along Maldevta route in Dehradun

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ABSTRACT

The state of Uttarakhand, covering an area of 735 square kilometres, is a mountainous region in India renowned for its rich cultural heritage and diverse natural biodiversity. The state's 238 glaciers are vital for sustaining North India's two major rivers, the Ganges and the Yamuna. Currently, Uttarakhand is experiencing significant climatic changes. The India Meteorological Department reports that the average annual rainfall has declined from 2,000 mm to 1,477.6 mm. As a result, the capital city, Dehradun, along with other areas, is facing a serious water crisis. The main factors contributing to groundwater depletion and pollution are mismanagement and overexploitation of water resources. The continuously growing need for water, sinking water tables and the loss of conventional scientific practices of water conservation and those based on local knowledge, have profoundly impacted these life-giving sources of water in Dehradun. Dehradun's people have traditionally relied on natural water resources and have had traditional ways of conservation. However, the situation has significantly deteriorated due to extensive tree cutting for various development projects. This work aims to document the current status of the Maldevta route in Dehradun, where numerous trees have been removed for the proposed construction of a dam on the Song River and to establish a dumping area associated with it. A study of the area was conducted to catalogue all natural water sources—including their location, type, status, and utility—to better understand the planning challenges and issues faced by the local community. Through surveys, observations, and discussions with local inhabitants, this study examines the current state of water sources along Maldevta Road. The primary objectives are to preserve these invaluable resources, utilize traditional knowledge, and improve the standard of living for local residents. Additionally, the research paper analyzes factors contributing to water-related issues to offer practical recommendations. The findings highlight the urgent need for sustainable practices and community engagement in resource management. By fostering collaboration among stakeholders, the study aims to create an awareness for conservation efforts that can benefit both the environment and the people who rely on these water sources.

Keywords*:* Dehradun, Maldevta road, Song dam, water resources, water conservation, indigenous practices.

INTRODUCTION

Water is fundamental to the existence of all living organisms on Earth and has been described as 'fons et origo', the source of all possible creation and existence (Eliade 1958). As a result, its importance in supporting human life is widely recognized around the world. This is why we notice that throughout history, various human civilizations developed several religious beliefs, practices, and rituals to honour this natural element. At the same time, they began developing a scientific approach and evolved water management systems, such as reservoirs, dams and levees, canals, tanks, and so on, in order to regulate natural water. Numerous traditions and rituals were developed to appease the water-providing powers, water structures were constructed worldwide and arrangements have been made to preserve, recharge, and minimize its use. (Singh, et al., 2020) Various studies have recognized the importance of hydro science and have sought to explore its historical development (Baker

and Horton, 1936; Biswas, 1969; Chow, 1964). Community customs, rituals, and festivals have been established to highlight the importance of water and raise awareness about its limited availability and restricted usage.

However, as human civilizations have progressed, urban areas have expanded, and scientific and technological advancements have occurred, the circumstances have significantly changed. According to reports, India consumes the highest volume of groundwater, comprising 24% of the global total and representing almost one-fourth of all groundwater extracted worldwide. (Mekonnan, M. and Hoekstra, A. 2011) Severe issues have arisen because of excessive groundwater consumption. The demand for water is rising quickly along with the population in most urban places, including Dehradun, the capital city of Uttarakhand. The groundwater table is constantly declining, and one of the most pressing and important problems facing Dehradun's policymakers and water supply agencies is how to provide enough water to meet societal demands and guarantee fair access to water. The problem is worsening with each passing day, and water conservation and sustainable management of fresh water are urgent needs of the hour.

Study Area

The hilly state of Uttarakhand, rich in natural wealth, consists of 238 glaciers covering an area of 735 km² (Acharya 2011). The glaciers of Uttarakhand serve as the main source for the sustenance of rivers like Ganga and Yamuna and thus help us to meet the water demand of North India. This region is rich in diverse natural resources and experiences substantial rainfall each year during the monsoon season. However, it is significant to note that due to human activities, the average annual rainfall has decreased from 2,000 mm to 1,477.6 mm. Because of the inaccessibility and variety of the mountain systems, residents of Uttarakhand display a great diversity of cultures, customs, resource usage, and stewardship practices with an emphasis on the interdependence of the ecosystem and humans. The present study is based on the Maldevta route in Dehradun. The area extends from Maharana Pratap Sports College Crossroad, Kandholi, Chironwali, to Sulphur Point of Haldwari Village, Maldevta Road. The area is important due to various shallow water aquifers, most of which are drinking water supplies. It is also worth mentioning that the Uttarakhand government is currently working on the Song Dam Project along this route. (Bhatt et al., 2018; Everard et al., 2020; Huddleston et al., 2003) However, several development initiatives, coupled with the rapid population growth in Dehradun, have led to a notable decline in the city's water level, resources, and availability. The area's inhabitants do not have enough water for cattle, irrigation, or daily needs. The goal of the current work is to address this problem. The purpose of this study is to investigate the connections between the expanding population, the urbanization process, project execution, and the health of the water sources along the path.

MATERIALS AND METHODOLOGY

Given the seriousness of the situation, a field-based study was conducted along Maldevta Road in Dehradun city. In May 2024, field surveys were carried out in the following locations: Kandholī, Chironwāli village, Maldevta, Asthal, Serki, Dwara, Muni, Bhilang, Kund Dwara, Akhandwali Bhilang, Saundaḍā, Sera, Rangaḍ, and Haldwari. The information was collected through field surveys, observations, and interviews with residents, shopkeepers, nomads, and construction site workers. Additional information was gathered from books and journals, as well as through meetings with officials from Jal Nigam and Jal Sansthan Dehradun. Reports and study materials available on the websites and in the libraries of the Forest Research Institute, Indian Institute of Soil and Water Conservation, Survey of India, and Anthropological Survey of India in Dehradun, Uttarakhand, India, were also consulted. Data obtained from various sources was reviewed and analyzed to provide recommendations to the different agencies involved in the Song dam project at various stages, from policy formulation to implementation, with the aim of assisting them in making informed decisions.

Objective

Identification of all the natural water resources and study of their current status is the prime focus of the study in order to have a better understanding of the difficulties of the area and the general condition of the natural water sources there. The study aims to make a list of all the functional, semi-functional and non-functional water

sources of the Maldevta route. The objective is to provide recommendations to address the challenge of water scarcity and suggest the areas where there is feasibility to apply ancient water conservation practices based on observation and scientific techniques.

Water Resources along the Maldevta Route: Types, Location, Status & Observations

Surveys of this trail were conducted in May of 2024, which discovered nine springs, three rivers, and two canals that supply water to the region and neighbouring Dehradun villages. The map (figure 1) given below shows the location and type of these water resources.

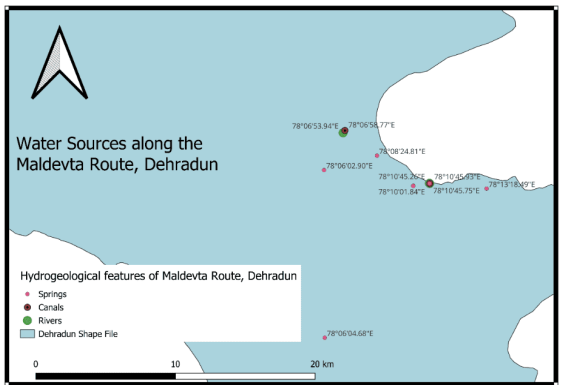

Figure 1: Water Resources along the Maldevta Route using Google Earth and QGIS

The data gathered from this survey shows that there was little care taken to maintain and safeguard the water sources that are situated along the path, and that a significant number of trees were removed from the path. Figure 2 shows the current state of the water resources which are the lifeline of residents of the area and passerby.

(R1) (R4)

(R5) (R8)

(R11) (R14)

Figure 2: Picture Plates (some significant WR referred in table of NWR)

Every water source along this path has had a big drop in water volume. Consequently, residents, passerby and livestock in the area are facing difficulties. Below, Table 1 provides details of each water source, including its utility, current status, observations, and recommendations.

Table 1: Details of Natural Water Resources along the Maldevta Route

Sr. No.	Type of Source	Location Dehradun, Uttarakhand	Status	Utility & Consumption	Remarks & Suggestions
R-1	Spring	Maharana Pratap Sports college Crossroad, Kandholī, Chironwāli Village	Functional, Water volume is good. here is seasonal change in the steady flow of water. Summertime flow is at its lowest, and during rainy seasons it is at its highest. (little drop in flow).	There is pure, drinkable water. In addition to being used for drinking and bathing by locals in the nearby villages and bystanders, water is also carried by a number of institutions.	Developing a large recharging pit, injection would be great here. Building a water tank, next to the source is also advisable in order to store additional water. (see Pl. 1c) The source must be preserved, adequately maintained and cleaned because it is a valuable resource. It is highly advised that no commercial or tourism-related activities be conducted there.
R -2	Baldi River	Searaki, ward Asthal, Maldevtā Road	Semi-functional, The source is dry at the location of survey.	The river is dry for a considerable distance.	The dry patch is a major worry. The community and the government should work together to conserve the source.
R -3	Canal	Thewa, ward Asthal, Maldevtā Road	Functional, Sufficient volume of water (a slight decrease in flow)	Garhwal Jal Sansthan supplies filtered canal water to different areas of Dehradun. Residents rely on this water for washing and other activities, and it is also essential for local cattle.	Cleaning and maintenance of the canal and surroundings is necessary.
R -4	Spring	Dwārā, Village, Mahendrapur from hilly forest	Functional, Sufficient volume of water (a slight decrease in flow)	Visitors and locals alike use the water for drinking. The nearby area is clean.	Because of widespread tree cutting for the purpose of disposing of construction site detritus, there has been a decline in water flow. The management of excess water at the location is also essential.
R -5	Spring	Muni Village	Non functional	10-12 families of Muni Village depend this water source. Now	Because of construction debris that was dumped near the water source, the source is no longer

				residents come down 1.5 kilometers to get water for their daily needs.	functioning. Cleaning up construction trash and reviving the spring are urgently needed.
R -6	Spring	Bhilang Village	Non functional	-	We couldn't reach to the exact location of the source due to its height. As told by the residents source is significant as they depend on it. It is critical to identify and address the cause of its drying out.
R -7	Spring	Kund Dwara Hilly Forest	Functional, Sufficient volume of water (a slight decrease in flow)	Passersby and 12–13 families use it.	The primary reason of the decline in water supply, which is the main concern of the public, has been found to be deforestation. In order to meet their water needs, the local community has worked to install pipelines in the region.
R -8	Spring	Akhndawānī Bhilang Valley	Functional, (little drop in flow and diversion in route)	40 to 50 families use the water; the canal water next to it is used for irrigation and cattle.	Pipeline constructed by the government. People face the problem when there is damage in pipeline which happens quite often.
R -9	Song River, (tributary of Ganga)	Saundaḍā Village, Hellas Valley	Functional, Sufficient volume of water (a slight decrease in flow)	Water is used by 20–25 families. Pipelines and canals provide the supply.	Song River has sufficient water to supply areas nearby. In the rainy season when pipelines are damaged, there is a crisis of water. A well-planned policy and its execution are essential for proper maintenance of the water source.
R -10	Chifalti River	Saundaḍā Village, Hellas Valley	Functional, A noticeable decrease in water volume.	People do not use Chifalti river water. The water of the Song River fulfils local needs.	For the construction of the dam, numerous trees were removed in the surrounding area, affecting the river's water flow. It is essential to halt any further tree cutting and establish guidelines to ensure the river's sustainability.

R - 11	Spring	Near Serā Village, Thano Range	Functional, A good amount of water	Passengers use the source's water for drinking and washing their cars and scooters.	It is advisable to build a tank to stop the water waste.
R - 12	Spring	Near Rāngaḍ Village, Thano Range	Functional, Sufficient volume of water (a slight decrease in flow)	For drinking purposes, 9–10 families use water.	The source is protected by a wall, however it is in poor condition. It urgently needs to be repaired.
R - 13	Canal	Near Rāngaḍ Village, Thano Range	Functional, sufficient water (reduction in volume)	The canal's water is used by 9 to 10 families. River water is supplied to surrounding communities via canal.	Cleaning and maintenance of the surroundings is necessary.
R - 14	Spring (Sulphur Pond)	Haldwari	Functional A considerable volume of water, and the reduction is not evident.	Tourists utilize the water from this stream to treat skin diseases or just for enjoyment. (Not drinkable)	Severe flash floods on September 17, 2025, significantly impacted the water source. Maldevta experienced approximately 41.5 mm of rainfall that day. Consequently, a surge of water and debris severely affected the approach and surroundings of the pond. Essential protective measures are needed. The site has been developed as a tourist attraction and has potential for further expansion.

RESULTS AND ANALYSIS

The study conducted along Song Dam path, Maldevta Road, Dehradun suggests that the selected area has a good number of natural water sources and an adequate water volume to meet the daily needs of the local population, irrigation, and livestock rearing. In the research area fourteen natural water sources comprising nine springs, three river belts and two canals are identified. It has been observed that the volume of water in eight of the fourteen natural sources has decreased.

The springs in Muni and Bhilang Villages are currently non-functional, while the Baldi River is only partially functional due to dry conditions at the time of the survey in Asthal of Maldevta Road. The only spring with almost continuous water flow is at Kandholī Village, Dehradun. Figure 3 illustrates the percentages of different types of water resources along the Maldevta route, along with their current status.

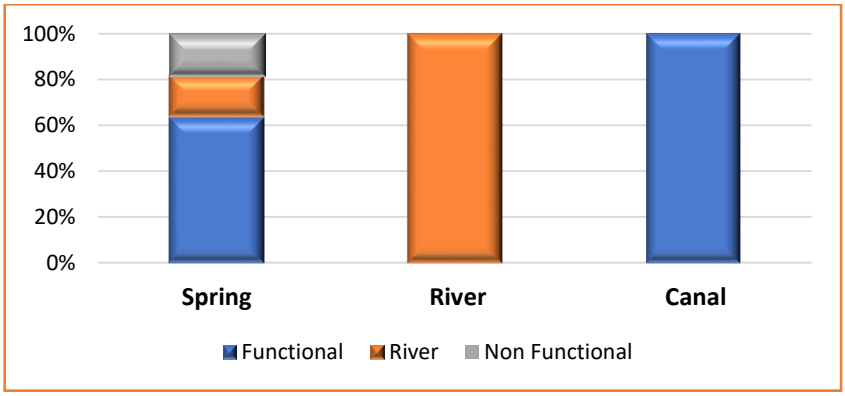

Figure 3: Water Resources along song dam path: (a)Types(b) Current Status

WR 1 is discovered to be in outstanding condition across all sources. In addition to providing water to institutions, it feeds thousands of people. A small amount of hygiene is necessary. With minor seasonal variations, the flow of water remains constant. The flow is at its highest during rainy seasons and at its lowest during the summer. This is the perfect location for the large recharging pit and injection well. The construction of a water tank will help reduce water wastage and regulate its usage. The area around the source needs to be properly cleaned and maintained. It is highly advised that any business or tourism-related activities should be avoided there. The area's ongoing dam construction, urbanization, and the carelessness of the general public have all had an impact on other sources of the trail.

Spring located in Muni Village is no longer operational after construction debris was deposited near the water source. This is the only source of water supply to the village families; therefore, residents travel 1.5 kilometres to obtain water for their daily needs. Restoring the spring and cleaning up the construction trash are critical needs. Another spring is currently inoperable following the construction of a road along this route. Determining the cause of its drying out and fixing it are crucial.

The Chifalti, Song, and Baldi rivers flow through the research area. Currently, the only river from which people are using water is the Song. When the survey was conducted, the Baldi River was dry. The locals claim that because the Chifalti River is contaminated, they have discarded the water. Investigating and addressing the reason of the Baldi River's drying up at the spotted point is essential. The Song and Chifalti rivers require upkeep of their cleanliness and flow.

All of the water sources that are now accessible need to have their surrounds properly maintained and cleaned, according to research study. It is also important to note that 16,500 trees—many of which have already fallen—will be chopped down for the Song Dam Project. Tree cutting has been identified as the primary cause of the area's declining water supply. It is suggested to avoid it wherever alternative option is available. For example, dumping ground can be shifted to some other suitable place.

CONCLUSION

Dehradun city is primarily dependent on groundwater sources for its water needs; it is critical to ensure sustainable resource management considering the city's expanding water demand. According to research, a variety of ecological and human problems are caused by a lack of understanding of the local environment, poor access to freshwater resources, and improper management of those resources. There are convincing signs that the government-approved development initiatives meant to enhance the socio-economic standing of the locals instead contributed significantly to the devastation of the region's native flora, fauna, and water sources. To exacerbate the situation, there has been a sharp rise in soil erosion, the obstruction of rivers, tributaries, and springs, as well as tree cutting, or deforestation.

In Dehradun, the vast majority of residents rely on the city's natural water supplies to survive. These sources have traditionally been revered and protected by the local community. This reverence is reflected in the numerous

places throughout the city named after water sources, such as Nalapani, Tibbanala Pani, Gucchupani, Jharipani, Khattapani, Nalipani, Bhopalpani, Sahastra Dhara, East Canal, Jakhan, and many others. Additionally, there are various celebrations and customs that emphasize the appreciation and respect for water. Sadly, however, historic customs were disregarded and outmoded during the capital city's urbanization and infrastructure development processes. Ordinary citizens of the city have abandoned their civic duties in favour of government organizations managing and conserving the city's resources. This led to water shortages and the neglect of available water resources; in order to address the issue, focus has been placed on locating new or alternative water supplies through the use of traditional, centralized methods. The present study clearly indicates that to facilitate further economic development and guarantee the supply of fresh water to meet projected demand, it is imperative that the natural water sources along this route be maintained and preserved. The region also requires to develop gravity dams and reservoirs which will help to reduce our dependency on ground water. However, it is equally critical to consider the surrounding and local ecology. There is an urgent need to maintain and preserve the natural water sources along this route to enable increased economic development and assure the supply of fresh water to fulfil anticipated demand.

The development and preservation of the ecology along the Maldevta route, Dehradun, depend heavily on the sustainable management of the area's natural water resources. High river flow usually damages pipelines, leading to water shortages in many areas during the rainy season. Another issue threatening water sources is mining and deforestation in Dehradun. The water level of every resource has been reduced. Proper management of water and the cleanliness of the water source's surrounding area are a must. It is also necessary to understand the significance of natural resources. The region can improve its water security, encourage sustainable agriculture, and increase its resilience to climate change by resurrecting and combining traditional water conservation techniques with contemporary approaches. The successful implementation of these initiatives requires the active involvement of the community and the backing of policy. Engaging local stakeholders in educational programs can foster a deeper appreciation for these resources and encourage collective responsibility. By promoting awareness and collaboration, the community can create a sustainable framework that not only secures water resources but also enhances overall environmental health.

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