GEOGRAPHICAL ANALYSIS

ORIGINAL ARTICLE

Role of Local Community in Conservation of Himalayan Natural Water Springs: A Case Study of Kharahal Region in Kullu District

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Abstract

Natural springs are the primary source of water for the rural households in the Himalayan region. For many people, springs are the sole source of water. For example, a major proportion of drinking water supply in the mountainous parts of Himachal Pradesh is spring based. This research paper is based on the role of local community in the conservation of natural water springs in Kharahal region of Kullu district of Himachal Pradesh. The main objectives of this research paper are to identify the natural water springs, to study the significance of natural water springs and study the role of the local community in the conservation of natural water springs in the study area. This research paper utilizes both primary and secondary data sources. Primary data was meticulously gathered through an extensive field survey encompassing the entire study region, while secondary data was sourced from authoritative reports such as the Niti Aayog report, Indian Census, and Panchayat office documents. Following data acquisition, a rigorous process of tabulation, compilation, and analysis was conducted using advanced statistical methods, complemented by the creation of maps and diagrams. The maps were developed using Q-GIS software, and diagrams were generated with Microsoft Excel. The study's findings reveal the existence of 71 natural water springs across 10 panchayats within the study area. These springs are integral to the region's economic activities, cultural practices, and essential for drinking and domestic purposes. As such, local communities are pivotal in the conservation, maintenance, and revitalization of these natural springs.

Keywords: Local community; Kharahal region; Himalaya; Natural springs; Conservation; Q-GIS

1 Introduction

Natural water springs are vital sources of freshwater that emerge from the Earth's surface, resulting from the discharge of groundwater from subterranean aquifers. These springs occur across diverse landscapes, from mountainous terrains to coastal regions, and are often enriched with minerals, offering a pristine and uncontaminated water supply. Historically, natural springs have served multiple purposes, including drinking, bathing, irrigation, and medicinal applications,

highlighting their significance in human civilization [1]. Many springs have also become popular tourist destinations, highlighting their cultural and historical significance. Natural water springs originate from the natural discharge of groundwater through joints, pores, fissures, and fractures when an aquifer or water-bearing stratum intersects with the Earth's surface. The point where water emerges is referred to as the spring orifice [2]. The human settlements in the mountainous regions of India are dominantly dependent on springs for drinking water, domestic usage, and agricultural needs. Springs are the lifeline of water supplies for mountainous regions. They have been called different names in different parts of our country like Zhara in Maharashtra, Jhora in West Bengal, Dhara in Sikkim, Naula, Baori, Bai and Dhara in Himachal Pradesh, and Uttarakhand, Kuiphir in Mizoram, Ephut in Manipur, Chhimik in Leh-Ladakh and Jharna in Odisha. Springs hold significant cultural and religious value, often serving as sacred sites for worship and prayer. Beyond their spiritual importance, they provide essential ecosystem services by sustaining base flows that feed numerous rivers, support vital wetlands, and regulate dry-season water levels in lakes. Springs are natural discharge points where groundwater emerges and flows to the surface. Most originate from aquifers—rock formations that store and transmit water to both springs and wells. In the Himalayan region, springs serve as the primary source of high-quality freshwater, playing a crucial role in the sustenance of local communities [3]. More than 60–70% of the population in the Indian Himalayas relies directly on springs for domestic use and livelihood needs [4]. Springs hold immense religious and cultural significance for local communities. Despite limited access to piped water supply, many residents directly consume untreated spring water, occasionally boiling it during winter [5]. Despite the region's abundant water resources, Himalayan communities are experiencing an escalating water crisis, characterized by frequent shortages and pollution. Unregulated agricultural expansion, deforestation, mining, poorly planned urbanization, and tourism have created significant challenges for the region's water resources. The excessive use of agricultural chemicals and inadequate waste management have further deteriorated water quality [6]. Unpredictable rainfall patterns, rapid climate change, and increasing extreme weather events are expected to exacerbate the water crisis in the Himalayan mountains. The neglect of springs in mainstream water policies, resource planning, and developmental projects has severely threatened their sustainability [7]. In recent years, civil society organizations (CSOs) and government agencies, with support from research institutions, have initiated efforts to restore these vital water sources. Effective implementation and upscaling of spring revival programs can enhance water availability, improve livelihoods, and contribute to achieving several Sustainable Development Goals (SDGs) [8]. There is growing evidence that springs across the Himalayan region are drying up or experiencing reduced discharge. The fragile Himalayan ecosystem is highly susceptible to both natural processes and human-induced changes. Irregular rainfall, ecological degradation, and seismic activity—coupled with land-use and land-cover changes driven by infrastructure development—are placing immense strain on mountainous aquifer systems. Reports indicate that nearly 50% of perennial springs have already dried up or become seasonal, leading to severe water shortages for drinking and domestic use in hundreds of Himalayan villages. A prolonged crisis will inevitably impact the lives of millions residing in mountainous regions [3].

2 Objectives

1. To identify the natural water springs in the study area.
2. To study the significance of natural water springs in the study area.
3. To study the role of local community in conserving the natural water springs.

3 Study Area

The Kharahal region is a significant area within Kullu district, Himachal Pradesh. Geographically, it is situated between latitudes 31°90′ and 32°00′ North and longitudes 77°11′ and 77°17′ East. The region is bordered by Kais village to the north, Kashawri village to the east, Bhrain village to the southeast, Jia village to the south, and the Beas River to the west. Covering a geographical area of 32.24 square kilometers, Kharahal has a total population of 15,609, encompassing 2,585 families [9].

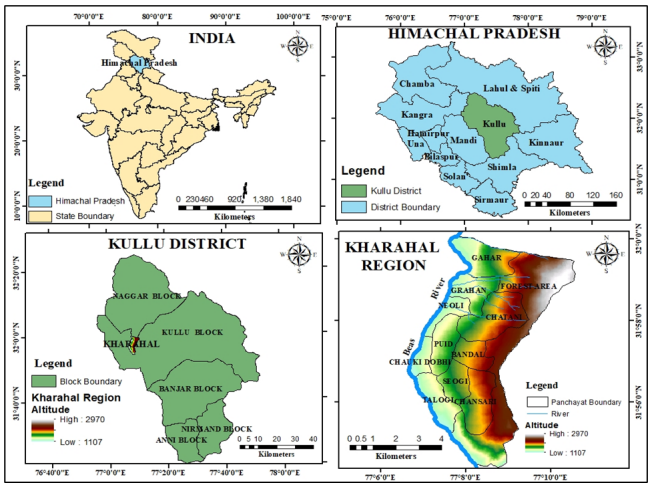

Fig. 1. Location map of study area

4 Database and Methodology

Selection of the problem

The natural water springs within the study area constitute the principal sources of uncontaminated drinking water. Despite their significance, these springs have remained largely unexamined. Therefore, the researcher has selected this topic to carry out a comprehensive study and to emphasize the importance of protecting and preserving these vital resources.

Data collection

Secondary data was obtained from various government sources, including the Digital Elevation Model (DEM) data from the Carto-DEM Bhuvan Portal and Himalayan Spring data from the NITI Aayog Report of 2017. Relevant demographic and geographical information about the study area was extracted from the District Census Handbook (2011) and records maintained by the Panchayat Office. The data related to the springs in the study area was meticulously collected through a comprehensive regional survey.

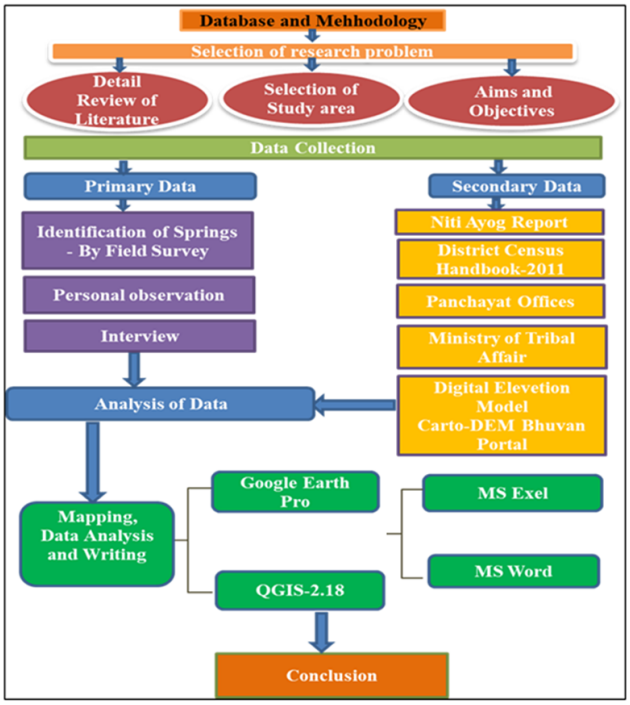

Fig. 2. Database and methodology

Data analysis and representation

After data collection, analysis was performed using maps and diagrams. The data was processed and analyzed with Microsoft Excel, while mapping was done using Q-GIS 2.18 software. In preparing this research paper, the researcher has heavily relied on a range of government reports, academic books, and scholarly articles for reference and guidance.

5 Result and Discussion

1. Natural Water Springs in Himalayas

The Himalayas, often referred to as the ”water tower of the earth,” are a vast and vital source of freshwater for the Indian subcontinent. Perennial rivers such as the Indus, Ganga, and Brahmaputra, along with their numerous tributaries, originate in these majestic mountains and provide water to millions of people[8,10]. However, the role and contribution of springs, which are the main source of water for many mountain communities, are often overlooked and poorly understood[11]. Springs are essential for meeting the drinking, domestic, and agricultural water needs of both rural and urban populations in the Himalayas[8].

Table 1. Springs of entire Indian Himalayan states

S. No.	Name of State	Total No. of Villages	No. of Villages with Spring	Percentage of Villages Which Report Having Springs
1	Arunachal Pradesh	5589	2086	37.3
2	Assam	26395	2997	11.35
3	Manipur	2581	1405	54.43
4	Meghalaya	6839	3810	55.7
5	Mizoram	830	453	54.57
6	Nagaland	1428	639	44.74
7	Sikkim	451	425	94.23
8	Tripura	875	141	16.11
9	West Bengal (Darjeeling)	688	221	32.12
10	Himachal Pradesh	20690	2597	12.55
11	Jammu Kashmir	6553	3313	50.55
12	Uttarakhand	16793	594	3.53
All Himalayan States		**89712**	**18681**	**20.82**

Source - Inventory and Revival of Springs in Himalayas for Water Security, NITI Ayog Report-2017

Out of a total of 89,712 villages in the Himalayan region, 18,681 villages are endowed with natural water springs. Among these, Meghalaya has the highest number, with 3,810 villages, while Tripura has the fewest, with only 141 villages featuring natural springs. Additionally, Jammu and Kashmir account for 3,310 such villages, followed by Assam with 2,997, Himachal Pradesh with 2,597, Arunachal Pradesh with 2,086, Manipur with 1,405, Nagaland with 639, Uttarakhand with 594, Mizoram with 453, Sikkim with 425, and Darjeeling with

221 villages. Sikkim exhibits the highest proportion of villages with water sources, at 94.23%, while Uttarakhand has the lowest, at just 3.53% (Table 1 & Figure 3).

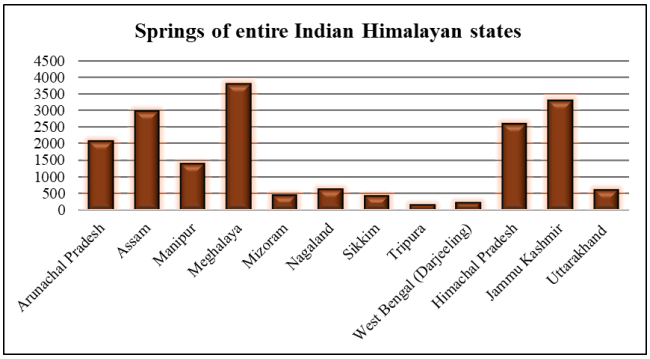

Fig. 3. Number of Villages with Spring in Himalaya

2. Identification of Natural Water Springs in the Kharahal Region

In the study area, the researcher has identified a total of 71 natural water springs, which are unevenly distributed across the region. The largest concentration is found in Chatani Panchayat, where 25 springs have been recorded. This is followed by 15 springs located in forested areas, 8 springs in Gahar Panchayat, 5 springs in Chansari Panchayat, and 4 springs each in Grahan and Seogi Panchayats. Additionally, 3 springs are situated in Chowki Dobhi Panchayat, while Talogi, Neoli, and Puid Panchayats each host 2 springs, and 1 spring is found in Bandal Panchayat. Among the 71 identified springs, 60 are classified as perennial, consistently providing water throughout the year. Conversely, 6 springs are seasonal, offering water only during the rainy season and experiencing shortages in the dry season. Furthermore, 5 springs that were previously perennial have completely dried up, no longer supplying water in any season (Figure 4).

The distribution of natural water springs is more concentrated in the northern and northwestern regions of the study area, while there is a complete absence of springs in the southern and southeastern parts. In contrast, the western and southwestern regions exhibit a lower number of water springs compared to their northern and northwestern counterparts.

The average density of natural water springs in this region is 2.2 springs per square kilometer. The highest density is found in Chatani Panchayat, which boasts a remarkable density of 6.67 springs per square kilometer. This is followed by Chauki Dobhi with 2.94 springs, Gahar with 2.78 springs, and Seogi with 2.47 springs per square kilometer. Other notable densities include 1.94 springs in Grahan, 1.79 springs in Chansari, and 1.71 springs in Neoli. The forested area exhibits a density of 1.34 springs, while Puid and Talogi each have a density of 0.93 springs. Bandal records the lowest

Table 2. Gram Panchayat Wise Spring Distribution and Density in Kharahal Region

S. No.	Name of Gram Pan-chayat	Number of Springs	Spring Density (Number of Springs Per Square KM)	Name of Springs
1	Gahar	8	2.78	Gahar, Gahar-1, Gahar-2, Gahar-3, Banki, Seobagh, Sarudu, Sarudu-1
2	Grahan	4	1.94	Grahan, Jagot, Shad-hara, Disco
3	Neoli	2	1.71	Neoli, Juani
4	Puid	2	0.93	Puid, Bhaunbai
5	Chauki Dobhi	3	2.94	Chanjar, Chanjar-1, Hargundhar
6	Talogi	2	0.93	Talogi, Trambli
7	Seogi	4	2.47	Seogi, Beogi, Bari Padru, Jhaul
8	Chansari	5	1.79	Dharth, Pechha,Mahish,Tharku Lower, Tharku
9	Bandal	1	0.65	Nagoni
10	Chatani	25	6.67	Kuhadi, Dhaunsi Paut, Mankhadi, Bargo, Manari, Kufri, Lari, Dee-man, Kotaseri, Kot, Koshnala, Badhayi, Badhayi-1, Tundi Ra Nala, Chhanga, Chhanga-1, Shilu, Chatani, Badlogi, Kochhan Pani, Bhakhal, Narantni, Dhaunsi Nala,Thaig Nala, Malanbai
11	Forest area	15	1.34	Aahni Thach, Aahni Thach-1, Aahni Thach-2, Aahni Thach-3, Gobha, Khunti Ruadi, Khunti Ruadi-1, Sanyara Thach, Khadak Nala, Saru-maru, Deemnu Pani, Mahut, Mahut-1, Mahut-2, Soilang
Total		**71**	**2.2**	

Source – Primary field survey, 2022-23

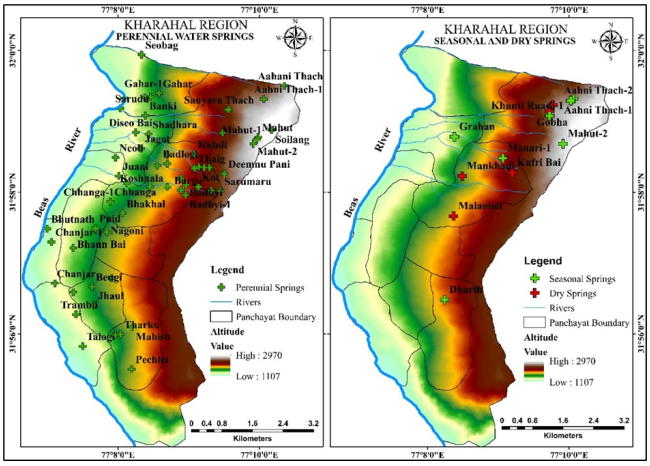

Fig. 4. Perennial, seasonal and dry natural water springs

density among the surveyed areas, with just 0.65 springs per square kilometer (Table 2 and Figure 5).

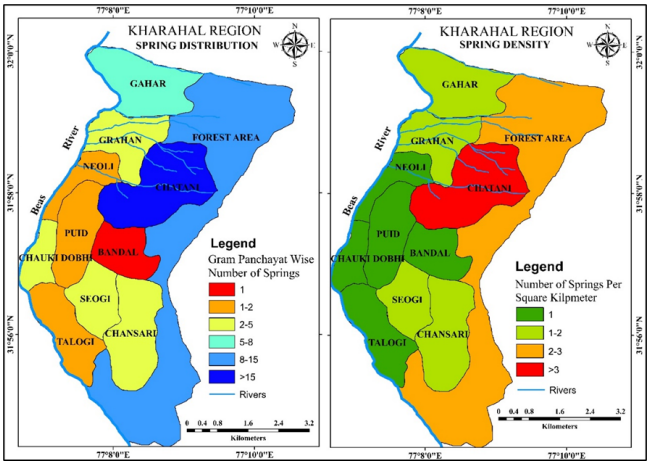

Fig. 5. Gram panchayat wise springs distribution and density

3. Significance of Water Springs in Study Area

Natural water springs also serve as significant cultural and religious symbols for humans, with many spring sites recognized as places of worship and prayer. They play a crucial role in providing ecosystem services, particularly in maintaining base flows that nourish both small and large rivers, sustain important wetlands, and help regulate water levels in lakes during dry seasons. Springs represent points on the Earth's surface where groundwater naturally emerges and flows, contributing to the hydrological balance of the region.

Ecological Significance of Natural Water Springs

Water springs play a vital ecological role in the environment, acting as key sources of fresh water for a diverse range of plant and animal species. They offer a steady flow of water essential for maintaining wetland ecosystems, which support a rich variety of flora and fauna. Additionally, water springs play a significant role in regulating water temperature, a crucial factor for the survival of many aquatic organisms. They also provide essential nutrients and minerals that are crucial for the growth and survival of both plants and animals. Additionally, water springs support a rich community of microorganisms that are integral to nutrient cycling and soil health. Overall, these springs are fundamental to maintaining healthy ecosystems and fostering biodiversity. The researcher observed that natural vegetation has developed around nearly all the perennial and seasonal water springs in the study area. Notably, 15 springs are located within forested regions, adequately meeting the water needs of local flora and fauna. Moreover, vegetation has also flourished around springs situated near agricultural areas and human settlements, underscoring the important role that natural springs play in maintaining ecological balance.

Fig. 6. Photographs of the springs captured during the field survey

Socio-Economic Significance of Natural Water Springs

Water springs play a crucial socio-economic role in many communities worldwide. They provide a reliable source of water for irrigation, enabling farmers to cultivate crops and raise livestock in areas where water is scarce. This access to water enhances food security and creates economic opportunities for agricultural producers. Additionally, many water springs are situated in picturesque locations, attracting tourists who come to swim, hike, or appreciate the area's natural beauty. This influx of visitors can generate jobs and boost revenue for local businesses. Moreover, water springs often serve as a source of clean, fresh drinking water for surrounding communities, which can improve public health and mitigate the incidence of waterborne diseases. In the

study area, residents of five panchayats—Chatani, Gahar, Seogi, Chansari, and Bandal—are entirely dependent on these natural springs for their drinking water needs and the irrigation of agricultural and horticultural crops.

Cultural Significance of Natural Water Springs

Water springs are often regarded as sacred in numerous cultures and religions, believed to possess healing powers, and associated with various deities or spirits. Many communities conduct rituals and ceremonies at these springs to honor their spiritual significance. The cultural importance of water springs is profound in societies around the world, often viewed as sacred sites intertwined with stories, myths, and legends. For instance, in religions such as Christianity and Hinduism, holy water springs are considered sacred and are believed to possess healing properties. In the Kullu district, springs such as Beas Kund, Manikaran, and Bashisht are revered as sacred, with many people believing that bathing in these waters can cleanse them of their sins. In many indigenous cultures, water springs symbolize the source of life and are associated with fertility and abundance. These springs are often thought to be inhabited by spirits or deities who govern the flow of water and can be appeased through offerings or rituals. Water springs frequently become focal points for cultural practices and celebrations. In the study area, the cultural significance of water springs is particularly noteworthy. Out of a total of 71 springs identified, 49 are considered culturally important. Local communities revere these springs as deities, utilizing their waters in various rituals, including worship, marriage ceremonies, mundan rites, and death rites.

4. Role of local community in the conservation of natural water springs

The local community plays a crucial role in the conservation of natural water springs in Kharahal Region. Their active involvement is essential for safeguarding these vital resources for future generations. Through collaborative efforts, the community can effectively protect these springs. Residents of the Kharahal region are undertaking the following measures to preserve these natural springs:

1. The local community in the Kharahal region takes full responsibility for protecting the falls by preventing any activities that might harm them, such as dumping garbage, overgrazing, or construction of nearby springs.
2. The community can regularly check the water quality of the springs and report any changes to the relevant authorities so they can take appropriate action.
3. The community can raise awareness among people about the importance of conserving water and promote sustainable water use practices, such as rainwater harvesting, water conservation in agriculture, and the use of water-efficient technologies.
4. The local community in the Kharahal region engages in afforestation activities to prevent soil erosion and support the maintenance of water levels in the springs.
5. The local community creates eco-tourism activities around the springs to encourage conservation and provide job opportunities. This can involve activities like nature walks, birdwatching, and eco-friendly camping.
6. There are 49 springs in the study area that hold cultural significance. The local community worships these springs as deities and uses their water for drinking, irrigation, worship, marriage rituals, and other cultural practices, which leads them to protect these springs diligently.
7. The populations of the Chatani, Bandal, Chansasari, Gahar, Seugi, and Beugi panchayats in the study area are entirely dependent on these springs for water, so they make every possible effort to conserve them.
8. There are 15 springs located in the forest area, but their condition is significantly poorer compared to springs in other community-managed regions. This suggests that the forest springs may suffer from neglect or lack of proper care, leading to issues such as reduced water quality and flow. In contrast, the springs in other areas likely receive more attention and conservation efforts, resulting in healthier conditions.

6 Conclusion

Natural water sources in the Himalayan region are essential for providing fresh water to meet the needs of the local community. A total of 71 natural water springs have been identified in the study area, of which 60 are perennial, 6 are seasonal, and 5 are currently dry. The local community relies entirely on these springs for their water needs, using the water for drinking, cooking, bathing, and irrigation. These springs hold significant socio-economic, cultural, and ecological importance. The community reveres these natural springs as deities and incorporates their water into various cultural ceremonies. Additionally, these springs contribute to maintaining ecological balance by supporting diverse plant and animal life in their vicinity. However, due to various human activities, the water levels in these springs are declining, leading to potential water crises in the future. Therefore, it is crucial to implement conservation efforts to preserve these vital resources for future generations. The local community actively works to preserve the springs by planting trees in their vicinity. This afforestation helps protect the springs from soil erosion and contributes to the overall health of the ecosystem. In addition to planting trees, the community takes responsibility for the maintenance and cleaning of the springs. Regular cleaning helps prevent pollution and ensures

that the water remains pure and safe for use. The community also focuses on proper water discharge, which is essential for maintaining the springs' health and sustainability.

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