JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

# Community participatory approach to revive and restore springs and streams in the Indian Himalaya

**Dharm Singh Meena**[1]
[1]Uttarakhand Forest Department
mail id: dharmifs09@gmail.com

**Abstract**

Springs and streams play an important role in sustaining Himalayan ecosystem. Most of the population residing in the Himalaya are dependent on these springs and streams for drinking, irrigation and other domestic purposes. Major rivers flowing from the Himalayas depends a lot on springs and streams and are spring fed. In an attempt to save and protect springs and streams, the project aims to build a climate resilient community by providing them access to water in all seasons of the year. Heval river rejuvenation programme is a step towards a resourceful and a resilient community. Heval River is one of the tributaries of river Ganga which originates as name of Khuret gad near Surkanda Devi temple at an altitude of over 2690m above the msl in Narendranagar Forest Division in district Tehri Garhwal. It is the main river of the district Tehri Garhwal and is spring fed.

The local community are dependent on the source for drinking water purposes and for agricultural uses. There is a huge threat on the sustainability of the river due to the ongoing construction activities around the springs. The feeding springs and streams are drying up due to climate change and other anthropogenic activity in the recharge areas. To contribute towards enhancing the adaptive capacities and climate resilience of local and vulnerable communities, the we took up the initiate to revive the river (Heval) and targeted 16000 hectares of Heval sub-watershed including 66 springsheds and 17 streams. Baseline surveys and feasibility analysis was conducted in the preliminary phase of the project which was followed by detailed hydrogeological implementation seeking the advice of subject experts.

Keywords: Springs, Himalaya, Recharge area, Climate resilience, Hydrogeology

## 1. Introduction

India's 75.52% forest area is covered by the states of Indian Himalayan Region (IHR**).** The Indian Himalayas holds key to India's ecological security and is the major supplier of forest goods and hydropower. These forests are rich in diversity and hence their economic viability is also very high. Further, the Himalayan forests are very important in terms of capturing essential atmospheric moisture mainly in the form of snow, to regulate river flow and to reduce erosions and sedimentation downstream (Negi and Agarwal, 2006).

The change in area and forest cover varies from the state to state, with the eastern extension of Himalaya to the western Himalayan states. On this basis, IHR can be broadly divided into two categories. First category represents to the Western and Central Himalayas including Jammu & Kashmir, Himachal Pradesh and Uttarakhand and the second category includes the Eastern Himalayas. Himachal Pradesh and Uttarakhand are two neighbouring Himalayan states, share their boundary and collectively cover 20.45% of geographical area in the IHR. They are alike with respect to various characteristics, such as topography, demography, socio-economic development pattern and are very much similar in respect of geographical area, forest cover, and climate.

Links between forests and water are complicated and vary with geography, weather patterns and management. Healthy forest has many positive impacts on the hydrological cycle and can offer many ecosystem services related to water provision and regulation. The interactions between forests and water provide an extensive range of products and services that are of vital importance to the functioning of the ecosystem, society and human well-being.

Forest departments, other implementing and decision-making authorities are strategically optimizing water related ecosystem services, including issues related to quality, quantity and timing. There is a continued demand for upgraded and enhanced knowledge, based on forest and water interactions at multiple scales, including interactions in small and large watersheds. This calls for multisectoral collaboration between forestry, land management and water resource management to develop adaptive practices which address forest, water and land resources. These practices need to be shared and adopted to benefit more people.

A recent report by NITI AAYOG states that nearly 30% of the springs in the Himalayan region are dying while 50% are discharging less water than a few years ago. Traditionally, villagers in Uttarakhand are dependent on springs to meet their water needs but in the last few decades, several springs have either dried up or their discharges have reduced, causing acute water scarcity in summer months. To contribute towards enhancing the adaptive capacities and climate resilience of local and vulnerable communities, we took up the initiate to revive the river (Heval) and targeted 16000 hectares of Heval sub-watershed including 66 springsheds and 17 streams. The goal of the project was to rejuvenate and revive the existing springs and river in sub watershed of the river.

## 2. Methodology

### 2.1 Description of the study site

Heval River is one of the tributary of river Ganga which originates as name of Khuret gad near Surkanda Devi temple at an altitude of 2690 m in Narendra Nagar Forest Division in district Tehri Garhwal of Uttarakhand. It lies between 30°25'1.71''N Latitude and 78°17'57.70''E longitude and travels 4.49 km. before joining the Pujaldi gad and Sour gad at same place (30°23'23.80''N, 78°19'29.11''E). River Havel from the confluence of these three-sub streams. It is the main river of the district Tehri Garhwal and is spring fed. The local communities are dependent on the river, springs and streams for drinking, agriculture and other domestic purposes.

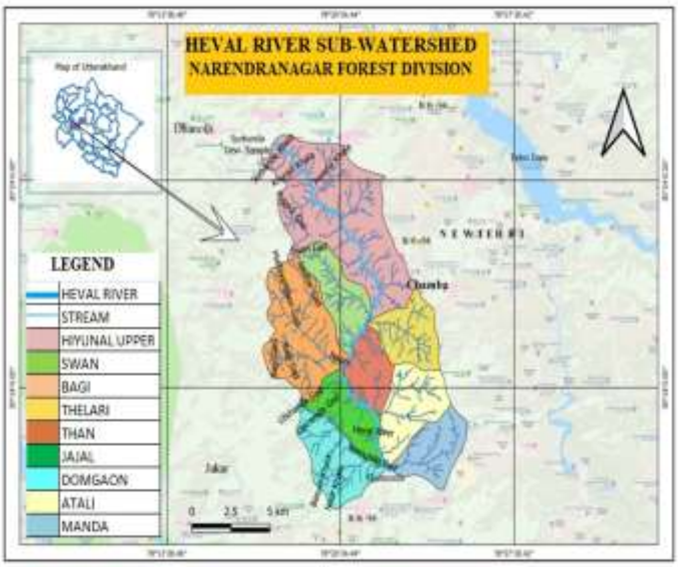


Fig. 1: Study site

### 2.2 Approach

Landscape based approach was taken to rejuvenate the river. The approach was divided into two phases: Phase 1: Springshed treatment, Streamshed treatment, afforestation, community mobilisation and convergence with other organisations; Phase 2: River front management and river front development

Three-pronged approach was applied.

1. Comprehensive: Include all the aspects of river landscape rejuvenation. Provide solutions in a scientific manner that mimic natural systems of restoring water.
2. Sustainable: Solve immediate needs and create convergence systems that ensure reliable supplies in the future.
3. Community-driven: Empower local communities through capacity building frameworks.

**Measures undertaken**

- Scientific measures: A scientific understanding of ground water was developed by doing a detailed hydrological mapping of springs, streams and watershed area identification of the river.
- Mechanical measures: The action plan included some mechanical interventions in identified the identified recharge area for spring shed, stream shed management and reduction of siltation in the river.
- Vegetative measures: Afforestation was done parallel to riverbed and particular watershed to hold

the soil and help in water retention. Local plants suitable to the biophysical settings of the area, were given priority in plantation activities.

- Social measures: Awareness through multiple transact walks, capacity building trainings, meetings with officials of other departments and other awareness campaigns were conducted to create proper understanding of the initiative.

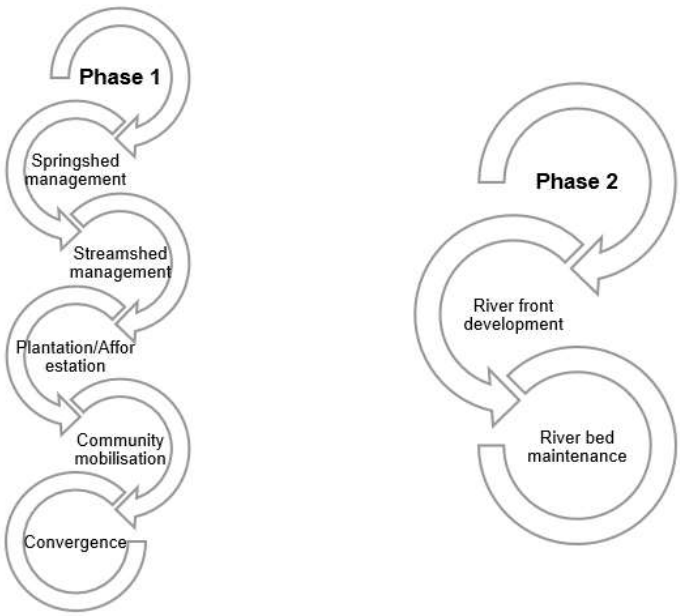


Fig. 2: Approach for landscape-based management

### 2.2.1 Springshed and Streamshed management approach

For better understanding of springshed and streamshed approach, hydrogeology of spring systems and their management including recharge and conservation at landscape scale was taken into account. This adapted approach aims to the improve groundwater availability on the basis of a scientific and systematic assessment of water storage and water quality for drinking and agricultural purposes. The science of groundwater known as 'hydrogeology' can lead us to a better understanding of aquifers, thus providing ways and means for its proper sustainable management. In the mountain areas like the Himalaya, high relief and the complex geological structure plays a vital role in formation of these mountain aquifers. Hydrogeological mapping of the springs and streams often reveals that the recharge area and the area of protection of the springs show a very site- specific relationship. The extent and location of these areas are completely governed by local geology and the rock structure, often irrespective of administrative boundaries or type of land viz., private, common, agricultural, forest etc., many of which are "anthropogenic" divisions that are not always coherent with boundaries of natural resources such as groundwater. Hydrogeological mapping involves detailed study of rocks, streams and springs in the springshed. The type of rock(s) in an area, their attitude, openings present and the different structural features are the components that control the accumulation and movement of groundwater. In case of the Himalaya, the complexity of these components makes this study more important. The dip and strike of rocks form the basis of geological mapping. Any study of groundwater remains incomplete without a proper understanding of aquifers hence for sustainability of springs was studied with a strong hydrogeological context especially relevant to the conservation, protection and land treatment measures in order to adapt to various fluxes imposed by the overarching climate change phenomenon. Springs and streams in the project area represents a typical hydrogeological framework with a large degree of variability and complexity, attributed by the geology, terrain and hydrogeological factors. Detailed step by step revival methodology was adopted for the revival of springs and streams.

### 2.2.2 Ten step methodology for spring revival

*Step 1: Feasibility & Baseline Survey*

The methodology followed a base line survey of individual household and communities. Thereafter structural setting of the area and its spring's catchment, the study included preliminary survey, Geological, Hydrogeological study and preparation of hydro-geological cross section/maps and data analysis. Pilot survey was conducted in the villages which were dependent on the river Havel, springs and streams. The major criteria of selection of springs were based on human consumption (drinking and domestic), hydro-geological characteristics, land use, slope and community participation.

*Step 2: Comprehensive mapping*

The second step is to collect background information of the identified recharge area of spring. Conduct a reconnaissance survey to collect brief information about spring which includes local geology, land use, and land cover type, settlements, dependency of water users, location of springs measurement of discharge. This comprehensive survey helps to comprehensive mapping of spring and helps to understand the local hydrogeology, and social, governance issues and conflicts (Shrestha et al. 2017).

*Step 3: Setting up Data Monitoring System*

The third step is setting up a data monitoring system at the spring site, which consists of data collection, storage, and analysis, and dissemination to the community. It is also important to evaluate the present situation of the communities control system. Monitoring system of spring discharge and daily rainfall data provide the information of the total recharge and discharge variations which will be helpful to understand the exact situation of the spring. For monitoring od spring generally, select the spring with a high dependency of population. Also, monitor the drinking water quality of a spring.

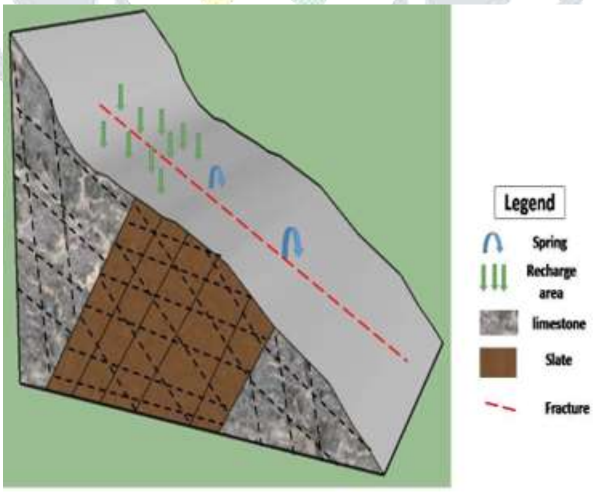


Fig. 3: Spring catchment & recharge zone mapping

*Step 4: Socio-economic Governance of Springs*

The step was undertaken through questionnaire survey/ group discussions with the local habitants and administration for collecting the real management situation. To find the information related to communities' water sources, how they manage the water distributions? What is the current situation? Is there water scarcity? Any society or NGO are working for better development and management. Such questions were addressed in this step of the methodology.

*Step 5: Geo-Hydrological Mapping*

Geo-hydrological map of the region was prepared based on the collected data such as spring location, elevation, latitude and longitude, and other geological observations collected by field team.


Fig. 4: Geo-hydrological mapping

*Step 6: Landscape management & Treatment Protocol*

A treatment protocol was developed for landscape-based management approach mentioning details of the treatment parameters and the methodology adopted.

*Step 7: Implementation*

After successive training exercise and based on the collected data and map of the recharge area, customised implementation was done for each spring and stream. The trenches design and type was selected based on the nature of rock and the underlying geology beneath it.

*Step 8: Advocacy & Awareness*

For better sustainability and conservation of recharge areas, awareness campaign was done in each villages to avoid exploitation and prevent open defecation in the recharge area.

*Step 9: Maintenance & Sustainability*

Developing hydrogeological inventory of springs along with a maintenance guideline of springshed such as recharge and discharge measures, conservation of forest or land use and land cover, institutional mechanism. Involving community in the implementation phase helped in ensuring sustainability of the project.

Step 10: Monitoring & Impact Assessment

The impact of revival programe on spring discharge, water availability, and socio- economic was assessed and continuous monitoring for further study for proposed for a long term data.

## 3. Impact of the study

### 3.1 Direct Impact on People

Setting up of monitoring system has clearly raised awareness amongst the community and provided evidences of water quality and quantity. The water is now considered potable. The practice has helped in the generation of livelihood for local communities. Over 96,085 man-days across 34 Van Panchayats/Gram Panchayats were created by involving local communities. The increased discharge of springs and streams has reduced women drudgery. The involvement of local community in planning and implementation has empowered the communities and created ownership. Water is now available to the local communities for irrigation throughout the year.

### 3.2 Impact on Ecosystem

Increase in discharge rate of springs and streams provided direct impact on ecosystem. Rejuvenated potential in the catchment area was increased and there was reduced sediment load in river and its sub-streams. The soil erosion was arrested thereby regulating the flood in the region. Improved water quality along with improvement of habitat for wildlife was observed. The overall exercise would lead to increase in biodiversity and carbon storage in the forests.

## 4. Discussions and lesson learnt

The Himalayan region receives good rainfall, but major portion of it is in monsoon season and the recharge of groundwater gets hampered by huge surface runoff. The recharge of groundwater plays an important role in the sustenance of local community, these recharge helps in good spring water during dry season. Due to erratic weather patterns and increased anthropogenic pressure majority of the springs across Himalaya have shown drastic decline in their discharge. The climate change impacts, manifested in the form of rising temperatures, more intense precipitation patterns, and longer winter droughts, have further reduced the natural groundwater recharge (Tambe et al 2011). This pattern of a shrinking monsoon season and the resulting drying up of natural springs and declining base flow of streams has been recently documented in the western Himalaya as well (Rawat et al 2011). The present study also confirms the impact of both climate change and anthropogenic pressure on spring discharge and community perception of declining spring discharge in the dry seasons is increasing at an alarming rate.

Reviving of springs and streams is a challenging task and the most important part of this exercise is to correctly identify the exact recharge zone. The multidimensional landscape-based approach involving different departments and empowering local communities through trainings helped in successful implementation of the project. Crop intensification method has reduced the demand of water for irrigation. Benefit sharing mechanism sharing of resources i.e. fodder encouraged the communities to participate in conservation activities. Social measures through awareness has created responsible and informed practices i.e reduction in open defecation and grazing control in critical areas.

### Conclusion and ways forward

Abundant water is available in the Himalayas, as the rain is plentiful but it is an irony the inhabitants still deprived of water even for drinking and other allied domestic need because of their uncomfortable access to these sources. Now, it has been well recognized that by reviving and enhancing the water yield of traditional water sources like springs, we could meet the water demand of the rural population residing in remote and inaccessible terrain of Himalaya. Such a strategy, when implemented successfully, would solve the water associated problem to the people permanently. The results of this study to revive springs and streams show that it is possible to supplement the natural recharge of the spring aquifer by taking up artificial rainwater harvesting works in the recharge (springshed) area. The lean period spring discharge can be increased, resulting in enhanced rural water security of the local community in the dry season, thereby building resilience against climate change impacts. Considering the vital role springs play in ensuring rural water security in the Himalaya and their declining status, further action research studies need to be taken up to advance the lessons learned from this experiment. We recommend mainstreaming springshed development in programs related to watershed development, rural water supply, and climate change adaptation, especially in the Himalayan region.

## Acknowledgements

The author is thankful to the PCCF (Head of Forest Department) Uttarakhand, CEO CAMPA Uttarakhand, M.S. Bisht (S.D.O Narendra Nagar, Uttarakhand), Ankit Rana for survey & field work. The author is thankful to District Magistrate Tehri for his financial support. Last, but not the least, the author is grateful to the generous support provided by different government department and funding sources without them the project implementation would not have been possible.

## References

Negi, G. C., & Agrawal, D. K. (2006). MEETING REPORT: Measuring and valuing ecosystem services: Himalayan mountain context. Current Science, 91(5), 573-575.

NITI Aayog. (2018). Report of Working Group I Inventory and Revival of Springs in the Himalayas for Water Security. New Delhi, India: NITI Aayog (Shrestha et al. 2017).

Tambe S, Arrawatia ML, Bhutia NT, Swaroop B. (2011). Rapid, cost effective and high resolution assessment of climate-related vulnerability of rural communities of Sikkim Himalaya, India. Current Science 101(2):165–173.

Rawat PK, Tiwari PC, Pant CC. (2011). Climate change accelerating hydrological hazards and risks in Himalaya: A case study through remote sensing and GIS modelling. International Journal of Geomatics and Geosciences 1(4):687–699.