RESOURCE BOOK ON SPRINGSHED MANAGEMENT IN THE INDIAN HIMALAYAN REGION

Guidelines for Policy Makers and Development Practitioners

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

सत्यमेव जयते
NITI Aayog

IWMI
International Water Management Institute

AUTHORS

INTERNATIONAL WATER MANAGEMENT INSTITUTE

Ms. Roshan Rathod
Mr. Manish Kumar
Dr. Aditi Mukherji
Dr. Alok Sikka
Dr. K.K. Satapathy, Independent Consultant.

NITI AAYOG GOVERNMENT OF INDIA

Shri. Avinash Mishra
Ms. Saloni Goel

SWISS AGENCY FOR DEVELOPMENT AND COOPERATION

Dr. Mustafa Khan

Rathod, R.; Kumar, M.; Mukherji, A.; Sikka, A.; Satapathy, K. K.; Mishra, A.; Goel, S.; Khan, M. 2021. *Resource book on springshed management in the Indian Himalayan Region: guidelines for policy makers and development practitioners.* New Delhi, India: International Water Management Institute (IWMI); New Delhi, India: NITI Aayog, Government of India; New Delhi, India: Swiss Agency for Development and Cooperation (SDC). 40p. doi: https://doi.org/10.5337/2021.230

KEY STAKEHOLDERS CONSULTED

Government Agencies

Compensatory Afforestation Fund Management and Planning Authority, Uttarakhand.
Directorate of Soil and Water Conservation, Govt. of Meghalaya.
Department Of Panchayats & Rural Development, Govt. of West Bengal.
Department of Land Resources, Govt. of India.
Department of Land Resources, Govt. of Nagaland.
Himachal Pradesh Forest Department.
Uttarakhand Forest Department.
Meghalaya Basin Development Authority, Govt. of Meghalaya.
Ministry of Environment, Forest and Climate Change, Govt. of India.
Rural Development Department, Govt. of Sikkim.

Civil Society Organizations

Advanced Center for Water Resources Development and Management, Pune.
BAIF Development Research Foundation, Pune.
Centre for Ecology Development and Research, Dehradun.
Central Himalayan Rural Action Group, Dehradun.
Himmothan Society, Dehradun.
International Centre for Integrated Mountain Development, Kathmandu, Nepal.
North East Initiative Development Agency, Kohima.
Rajarhat Prasari, Kolkata.
People's Science Institute, Dehradun.

Research and Academic Organizations

G.B. Pant National Institute of Himalayan Environment, Uttarakhand.
Indian Institute of Technology, Roorkee.
University of Kashmir, Jammu and Kashmir.

Funding Agencies

Arghyam, India
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), India
Swiss Agency for Development and Cooperation (SDC), India.

DESIGN & ILLUSTRATION

4POINT3, New Delhi.

COVER PHOTO

Chawa Khola, Village – Upper Burmick, Kalimpong -II, West Bengal.
By Roshan Rathod, IWMI.

CONTENTS

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

NITI Aayog

IWMI International Water Management Institute

ACRONYMS and ABBREVIATIONS

ACWADAM	Advanced Center for Water Resources Development and Management
ATREE	Ashoka Trust for Research in Ecology and the Environment
BAIF	BAIF Development Research Foundation
BARC	Bhaba Atomic Research Center
BP	Best Practice
BRLF	Bharat Rural Livelihoods Foundation
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CEDAR	Centre for Ecology Development and Research
CHIRAG	Central Himalayan Rural Action Group
CSOs	Civil Society Organizations
DoLR	Department of Land Resources
DPR	Detailed Project Report
DST	Department of Science and Technology
DSWC	Department of Soil and Water Conservation
DWP	Detailed Work Plan
ECS	Eleutherian Christian Society
GBPNIHE	G.B. Pant National Institute of Himalayan Environment
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoI	Government of India
GSI	Geological Survey of India
HKH	Hindu Kush Himalaya
HSS	Himalayan Seva Sangh
ICIMOD	International Centre for Integrated Mountain Development
IHCAP	Indian Himalayas Climate Adaptation Programme
IHR	Indian Himalayan Region
IIT-Roorkee	Indian Institute of Technology, Roorkee
JJM	Jal Jeevan Mission
LULC	Land-use and Land cover
MBDA	Meghalaya Basin Development Authority
MCLLMP	Meghalaya Community Led Landscape Management Project
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MoEF&CC	Ministry of Environment, Forest and Climate Change
MoES	Ministry of Earth Sciences
MoWR	Ministry of Water Resources
NABARD	National Bank for Agriculture and Rural Development
NEIDA	Northeast Initiative Development Agency
NGOs	Non-Governmental Organizations
NIH	National Institute of Hydrology
NMHS	National Mission on Himalayan Studies
NMSHE	National Mission for Sustaining Himalayan Ecosystem
NRDWP	National Rural Drinking Water Programme
NRLM	National Rural Livelihoods Mission
O&M	Operation and Maintenance
PES	Payment for Ecosystem Services
PGWM	Participatory Groundwater Management
PHED	Public Health Engineering Department
PRA	Participatory Rural Appraisal
PRI	Panchayati Raj Institution
PSI	People's Science Institute
RDD	Rural Development Department
SCI	System of Crop Intensification
SDC	Swiss Agency for Development and Cooperation
SDGs	Sustainable Development Goals
SHC	Spring Health Card
SM	Springshed Management
SWI	System of Wheat Intensification
UNDP	United Nations Development Programme
VLIs	Village Level Institutions
VWSPs	Village Water Security Plans
WASH	Water, Sanitation and Hygiene Committees
WIHG	Wadia Institute of Himalayan Geology
WWF	World Wildlife Fund
WUA	Water User Associations
WUG	Water User Group

INTRODUCTION

Photo by Roshan Rathod
Spring source in Kalsi, Dehradun (PSI)

Springs are groundwater discharge points in the mountains where the water-bearing layers (aquifer) intersects with the ground surface, and water seeps out of rock pores, fissures, fractures, or depressions. Springs are the primary water source for millions of people in the mid-hills of the Hindu Kush Himalayas (HKH) and supply over 90% of water needs for domestic uses. Over the past decade or so, there has been increasing concern that springs are drying up or becoming seasonal, and their discharge is reducing over the years, even though quantitative evidence is still relatively sparse. The seasonal and overall decline in springs has affected both domestic water availability in remote villages as well as agricultural productivity, as springs are an essential source of irrigation in the Himalaya. Thus, the decline of Himalayan springs and the larger Himalayan groundwater systems threaten the water security of the hill populations and the entire Indo-Gangetic plains. In the past decade or so, spring revival efforts using the principles of hydrogeology has become the most widely accepted model of springshed management (SM) by several non-governmental organisations (NGOs) and governmental agencies in the Himalaya.

Given that spring revival efforts have now been undertaken in three countries in South Asia, namely India, Nepal, and Bhutan, it is now time to undertake a stocktake of the initiatives and existing learnings to document the best practices for spring revival. Furthermore, with almost a decade of spring revival by different civil society organizations and government agencies, it is the right opportunity to reflect on the processes, practices, and policies surrounding springshed management. It will facilitate the efficient execution of a national mission on springshed management that encapsulates learnings from the past decade.

This Resource Book is a summarised guiding document on best practices in springshed management in the IHR. For a detailed understanding of best practices and case studies of implementation of best practices, practitioners are recommended to look at this document along with the other vital reports on springshed management, including Siddique et al. (2019), NITI Aayog (2018), and Shreshtha et al. (2018). Together, these documents will provide the practitioners with an in-depth understanding of springshed management in the Himalaya.

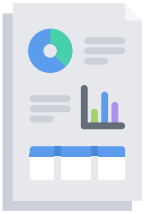
METHODOLOGY

This Resource Book is a result of

Expert Interviews with key stakeholders.

Online survey with experts.

Community interactions.



Scientific literature review.

This best practices listed in the document are distilled from information gathered through expert interviews (61 experts from 30 organisations) and online surveys (32 experts), and community interactions (27 springs in six states). The 25 best practices identified from the expert interviews were divided into six major components of springshed management. These were further evaluated based on five criteria of Replicability, Sustainability, Capacity Building, Knowledge Creation, and Scalability. The participants also helped identify the most suitable stakeholder to lead/anchor the best practice and what would be the preferred sources of funding for implementation and scaling up. The best practices were field validated with community interactions across the IHR states to understand different models and their impact on the social, hydrological, institutional, and other aspects of springshed management. Finally, the results from the study were shared with stakeholders (66 participants) in a consultation workshop held on 27th August 2021 where the BPs were shared, discussed, and critical feedback gathered. This Resource Book is an amalgamation of all these processes and provides concise information on the Best Practices of Springshed Management in the IHR under the different aspects of:

1. Major Activities to be undertaken
2. Advantages of the Best practice
3. Key stakeholders who have implemented the Best Practice
4. Potential sources of funding for scaling the Best Practice
5. Major Challenges
6. FAQs that the Best Practice aims to address

Each of the best practices have also been further categorised as technological, financial, institutional, and training and capacity building.

Technological – If the practice uses an existing technology or promotes new technology to ease implementation of springshed management.

Financial – If the practice denotes aspects of financing springshed management in different forms like cash or kind.

Institutional – If the practice requires institutional mechanisms and processes or promotes institutionalising via the government or the community.

Training and Capacity Building – the execution of the practice requires the building of capacities of different stakeholders.

Please note that each practice could be categorised under more than one category.

SUMMARY OF 25 BEST PRACTICES

Summary table of the 25 Best Practices identified from the entire study process from expert interviews, online survey and field-based community interactions under different aspects of springshed management contributed by different partner organisations.

Springshed Management Components	Best Practices
A. Needs Assessment Identifying the needs and the willingness of the community is the first step in the springshed management projects followed by technical feasibility surveys to assess the possibility of undertaking the initiative and preparation of detailed work plans (DWPs).	**A.1** Social and technical feasibility surveys. **A.2** Village water security plans (VWSPs) using participatory water budget assessments.
B. Spring Inventory Spring inventory is the mapping and collation of basic information on a set of springs of interest in a geographical area. The information is useful for prioritizingcritical springs for revival and short- and long-term monitoring, based on the needs of the communities.	**B.1** A standard format and easy-to-use mobile apps for spring inventory. **B.2** Build capacities of and incentivize VLIs for spring inventory and monitoring using a citizen science model. **B.3** Enumeration of springs as a part of national sample surveys and censuses. **B.4** Use of Remote Sensing (RS) and GIS technologies such as LiDAR for spring inventories. **B.5** A publicly accessible state and national level repository.
C. Data Monitoring Hydrological monitoring of springs along with hydrogeological mapping, is crucial for quantifying the size and ability of the underlying spring aquifer to provide steady discharge in the lean season. The discharge and quality monitoring are being carried out manually by staff, para-hydrogeologists, or automated instruments. Periodic documentation of spring discharge and water quality also improves the community's understanding of their resources and helps develop better management practices.	**C.1** Long term spring monitoring protocols for selected springs. **C.2** Institutional arrangements of spring database management.
D. Community Mobilization, Livelihood Creation And Capacity Building Community mobilization is a central strategy for creating awareness about water security and nature-based solutions among local communities. In addition, it facilitates the inclusion of local and traditional knowledge in the planning and implementation of springshed management.	**D.1** Community awareness and mobilization activities. **D.2** Formation and capacity building of WUGs/VLIs. **D.3** Gender Equality and Social Inclusion (GESI) approach in springshed management. **D.4** Train para-hydrogeologists for springshed management. **D.5** Springshed management curricula for schools and colleges for awareness generation. **D.6** Science-practice-policy network/consortiums at state and national level to facilitate action and research on springs. **D.7** Simple to use operations and maintenance protocol for WUGs. **D.8** Water management practices that support allied livelihood activities.
E. Hydrogeological Assessments and Recharge Interventions Fine-scale and accurate mapping of the underlying geology and groundwater forms the backbone of the current springshed management programme. It involves undertaking a detailed mapping of rocks and their structures to delineate aquifer boundaries and their properties in the spring-shed, ultimately helping in the identification of potential recharge areas and then proposing suitable recharge measures.	**E.1** Simple handbooks documenting a standard methodology of field-based hydrogeological mapping and recharge area identification. **E.2** A technical manual/guideline on recharge measures for optimal recharge and reduced soil erosion. **E.3** Use of hydrological data and isotope techniques to supplement hydrogeological mapping for accurate recharge area identification and impact assessment. **E.4** Combining hydrogeological mapping, isotope techniques and hydrological instrumentation to create regional aquifer maps.
F. Funding Sources and Convergence Currently, the springshed programmes are funded by several discrete sources, including government grants and CSR funds. Leveraging other existing funding resources to complement and supplement components of springshed management is critical for achieving scalability. Simultaneously, creation of community-led funds through voluntary contributions by the user-group can improve the longevity of the recharge measures and ensure sustainability of the initiative.	**F.1** Convergence with existing government programs. **F.2** Community contribution as a source of funding for O&M. **F.3** Payment for Ecosystem Services as a funding mechanism for springshed management. **F.4** A national mission on springshed management with directives for funding and implementation for the IHR states.

MAPPING 6 STEPS METHODOLOGY WITH 25 BEST PRACTICES

Summary table of the 25 Best Practices identified out from the entire study process from expert interviews, online survey and field-based community interactions corresponding to the 6-Step methodology for springshed management as mentioned in the 2018 NITI Aayog report contributed by different partner organisations.

Steps	Best Practices
I Comprehensive mapping/Spring Inventory	B.1 - A standard format and easy-to-use mobile apps for spring inventory.
	B.2 - Build capacities of and incentivize VLIs for spring inventory and monitoring using a citizen science model.
	B.3 - Enumeration of springs as a part of national sample surveys and censuses.
	B.4 - Use of Remote Sensing (RS) and GIS technologies such as LiDAR for spring inventories.
	B.5 - A publicly accessible state and national level repository.
II Data monitoring system	C.1 - Long term spring monitoring protocols for selected springs.
	C.2 - Institutional arrangements of spring database management.
III Social, Gender and Governance aspects	D.2 - Formation and capacity building of WUGs/VLIs.
	D.3 - Gender Equality and Social Inclusion (GESI) approach in springshed management.
	F.2 - Community contribution as a source of funding for O&M.
	F.3 - Payment for Ecosystem Services as a funding mechanism for springhsed management.
IV-A Hydrogeological assessments and recharge area identification	E.4 - Combining hydrogeological mapping, isotope techniques and hydrological instrumentation to create regional aquifer maps.
	D.4 - Train para-hydrogeologists for springshed management.
	E.1 - Simple handbooks documenting a standard methodology of field -based hydrogeological mapping and recharge area identification.
	E.3 - Use of hydrological data and isotope techniques to supplement hydrogeological mapping for accurate recharge area identification and impact assessment.
V Springshed implementation Protocol and Implementation	A.1 - Social and technical feasibility surveys.
	D.1 - Community awareness and mobilization activities.
	A.2 - Village water security plans (VWSPs) using participatory water budget assessments.
	E.2 - A technical manual/guideline on recharge measures for optimal recharge and reduced soil erosion.
	F.1 - Convergence with existing government programs.
	D.7 - Simple to use operations and maintenance protocol for WUGs.
	F.4 - A national mission on springshed management with directives for funding and implementation for the IHR states.
VI Measuring impacts – hydrological and socio-economic	D.6 - Science-practice-policy network/consortiums at state and national level to facilitate action and research on springs.
	D.5 - Springshed management curricula for schools and colleges for awareness generation.
	D.8 - Water management practices that support allied livelihood activities.

SUMMARY OF FAQs

Summary table of the 25 Best Practices identified and the corresponding frequently asked questions on springshed management that they help address.

Springshed Management Components		FAQs
A	**Needs Assessment**	A1 1. What are the benefits of pre-feasibility surveys in springshed management? 2. What are the secondary sources of information for springs? 3. What are the tools for undertaking feasibility surveys and water budgeting exercises with communities? 4. What are the secondary sources of information for springs? A2 1. What are the critical springs for prioritized interventions from a community's perspective? 2. What are the tools for undertaking feasibility surveys and water budgeting exercises with communities?
B	**Spring Inventory**	B1 1. How many springs are present in the IHR? 2. What are the key parameters of interest for spring inventory? 3. How have mobile-based apps been used for spring inventory? 4. What are the estimated numbers of declining or dried up springs in the Himalaya? B2 1. What are the critical springs for prioritised interventions from a community's perspective? 2. How many springs are used by local communities in the Himalaya? 3. What are the estimated numbers of declining or dried up springs in the Himalaya? 4. What is the trend of spring discharge, rainfall and water quality of springs in the IHR? B3 1. How many springs are present in the IHR? 2. How many springs are used by local communities in the Himalaya? 3. What are the estimated numbers of declining or dried up springs in the Himalaya? B4 1. How many springs have been mapped with basic information in the IHR? 2. How do differnet land-use, including forest and human habitation, and local geology affect spring behaviour across different typologies? B5 1. How many springs have been mapped with basic information in the IHR? 2. What are the parameters on which spring inventory data is collected? 3. What are the estimated numbers of declining or dried up springs in the Himalaya?
C	**Data Monitoring**	C1 1. For how many springs is data available already in the IHR? 2. What are the parameters on which spring monitoring data is collected? 3. What are the estimated numbers of declining or dried up springs in the Himalaya? C2 1. What are the key academic institutions involoved in the inventory and research on springs in the IHR?
D	**Community Mobilization, Livelihood Creation And Capacity Building**	D1 1. What are the best tools for creating awareness and enhance community participation? 2. How to build ownership and sustainability in springshed management projects with communities? D2 1. How strengthening of institutional mechanisms at the grassroots-level can ensure the sustainability of springshed management? 2. Which are the existing VLIs that can be strengthened to undertake springshed management? D3 1. How to identify community leaders for spearheading projects? 2. How can communities be encouraged to lead SM? D4 1. What aspects of springshed management can para workers be trained in? 2. What other government programs can training of para workers be converged with? D5 1. How can springshed management be integrated in school and college curriculum? D6 1. What are the advantages of state and national-level consortiums on SM? 2. What are some of the examples of state-level consortiums for springshed management? D7 1. What management protocol should be followed for springshed management? D8 1. What are the different water management practices that can introduced as a part of springshed management? 2. How to link livelihood activities with SM in the IHR?
E	**Hydrogeological Assessments and Recharge Interventions**	E1 1. Which handbooks can be consulted for learning field-based hydrogeological assessments? E2 1. What kinds of interventions are needed for integrated water management in the Himalaya? 2. What are the recharge interventions suitable for different Land-use and land-cover (LULC) types, topographies, elevation, hydrogeology, etc? E3 1. What is the role of forests, agriculture and other land-use on spring discharge and quality? 2. What are the connections between springs across local-watershed-basin scales? E4 1. What does isotope analysis help analyze?
F	**Funding Sources and Convergence**	F1 1. Which are the different sources of funding available through convergence? 2. Which are some of the examples where convergence has helped scale up springshed management? 3. Which departments can be approached for convergence? F2 1. How can communities be encouraged to lead SM? 2. How can communities support SM initiatives financiially? F3 1. How can PES be leveraged in SM? 2. What are the different models of PES in SM? F4 1. Which are some of the examples where convergence has helped scale up springshed management? 2. Which departments can be approached for convergence?

BEST PRACTICES IN SPRINGSHED MANAGEMENT ACROSS THE INDIAN HIMALAYAN REGION

A standard dictionary definition of the word "best practice" is any action or procedure in any given field that is accepted or prescribed as being correct or most effective in delivering the desired outcomes. Based on stakeholder interviews, field visits and an online survey with experts, we have identified a set of 25 "best practices", which are divided into six major components of a typical springshed management program in the IHR:

A. Needs Assessment
B. Spring Inventory
C. Data Monitoring
D. Community Mobilization, Livelihood Creation and Capacity Building
E. Hydrogeological Assessments and Recharge Interventions
F. Funding Sources and Convergence

The following are the criteria on which these best practices were selected

Replicability

Is the practice replicable at different geographical locations and within different socio-economic-cultural contexts?

Sustainability

Does the practice support the long-term sustainability of the springshed programme after intervention from three key perspectives:

- Sustenance of the spring discharge and quality,
- Stability of the (community) institutions managing the springs, and
- The ability of the implementing organisations (CSO/Govt. dept. etc.) to continue or scale the programme in different regions?

Capacity Building

Does the practice contribute to capacity building of the implementing organisation and the local communities through participatory knowledge transfers?

Knowledge Creation

Does the practice facilitate experimentation, innovation, adoption, and documentation of knowledge by the implementing organizations and the local communities?

Scalability

Is the practice appropriate for scaling of the springshed programme by the implementation agency?

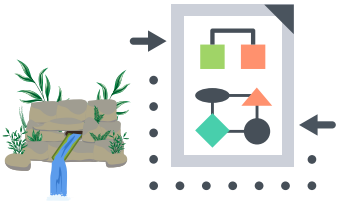
A. Needs Assessment

A.1 Social and technical feasibility surveys.

Main Activities

Participatory resource assessment.

Collation of secondary data on springs, land-use and demographic dependence.



Preparation of DWP by the implementation team (CSOs/government agency, para-hydrogeologists and the community).

Advantages

Prioritisation of critical springs.

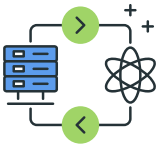
Helps in gauging community willingness to ensure sustainability of the initiative.

A detailed technical plan helps in coordinated implementation.

Key stakeholders who have implemented this practice

CSOs	ACWADAM, PSI, CHIRAG, Prasari, Himmothan Society, NEIDA, BAIF
Government Departments	DoLR (Nagaland), MBDA, RDD (Sikkim), PHED (Mizoram), Forest Department (UK), Forest Department (HP)

Major challenges



Digitization of relevant data for scientific analysis.

Ensuring participation of women and socioeconomically-marginalised communities like Dalits and tribals.

Potential funding sources for scaling

MGNREGA, Watershed Development and Ministry of Jal Shakti funds allocated to PRIs.

FAQs that the Best Practice aims to address

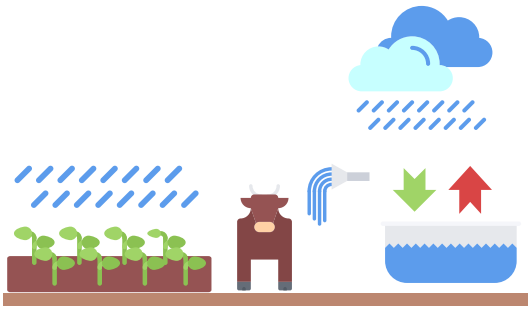
- What are the benefits of pre-feasibility surveys in springshed management?
- What are the secondary sources of information for springs?
- What are the tools for undertaking feasibility surveys and water budgeting exercises with communities?
- What are the secondary sources of information for springs?

A

A.2 Village water security plans (VWSPs) using participatory water budget assessments.

Main Activities

Conduct village meetings and PRA with the community, especially with women , elders and socioeconomically-marginalised communities like Dalits and tribals.



Carry out seasonal water budgeting exercises of spring water for different uses.

Advantages

Provides detailed information on available water resources and their supply and demand estimates.

Helps prioritise critical springs and plan for appropriate interventions.

Acts as an entry point activity to mobilise and involve the community.

Helps in demand management.

Key stakeholders who have implemented this practice

CSOs

ACWADAM | PSI | CHIRAG | Himmothan Society | GIZ | NRDWP | NEIDA | BAIF

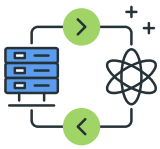
Have made VWSPs for more than 1500 springs across the IHR.

Government Departments

DoLR (Nagaland) | MBDA | MCLLMP | PHED (Mizoram) | Uttarakhand Forest Department | RDD (Sikkim)

Have made WSPs for more than 300 springs across the IHR.

Major challenges



Digitization of relevant data for scientific analysis.

Technical knowledge dissemination to the community.

Mainstreaming demand management with supply augmentation.

Potential funding sources for scaling

CAMPA, MGNREGA, and Watershed Development.

This practice has been funded by NAPCC, NRDWP and funding agencies such as GIZ, in the past.

FAQs that the Best Practice aims to address

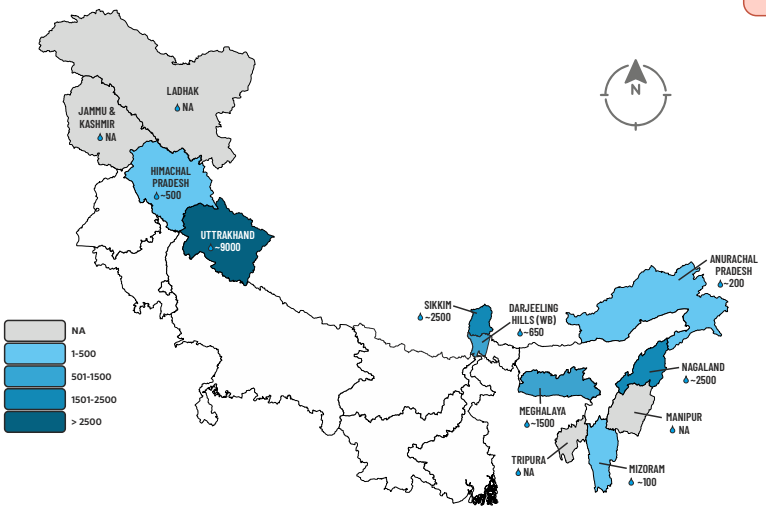
- What are the critical springs for prioritized interventions from a community's perspective?
- What are the tools for undertaking feasibility surveys and water budgeting exercises with communities?

B. Spring Inventory

B.1 A standard format and easy-to-use mobile apps for spring inventory.

TOTAL SPRING INVENTORIES USING A STANDARD FORMAT ACROSS THE IHR

~15000



Main Activities

- Geographical location of the springs.
- Ownership of recharge area.
- Land cover and land use patterns in the catchment area.
- Spring discharge and water quality.

Advantages

- Standardized inventory information.
- Lead to a central repository.
- Enable scaling up spring inventory.
- Reduction in costs for data collection.

Key stakeholders who have implemented this practice

CSOs	ACWADAM, PSI, CHIRAG, Himmothan, Prasari
Government Departments	GBPNIHE, NEIDA, DoLR (Nagaland), RDD (Sikkim), DSWC (Meghalaya)

The RDD uses a customised application developed for them by the Centre for Development of Advanced Computing (C-DAC), Pune for preparing spring inventory.

Major challenges

- Applicability of technology in remote mountain areas.
- Local and traditional knowledge inclusion in standard formats.

Potential funding sources for scaling

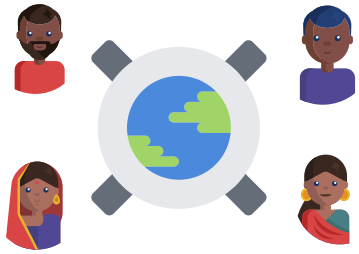
The Ministry of Jal Shakti has emerged as the preferred source followed by MGNREGA, CAMPA and the JJM. This practice has been funded by SDC and GIZ, in the past.

FAQs that the Best Practice aims to address

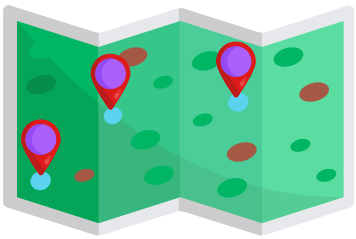
- How many springs are present in the IHR?
- What are the key parameters of interest for spring inventory?
- How have mobile-based apps been used for spring inventory?
- What are the estimated numbers of declining or dried up springs in the Himalaya?

B.2 Build capacities of and incentivize VLIs for spring inventory and monitoring using a citizen science model.

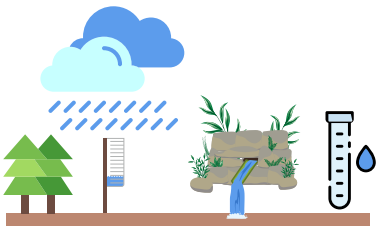
Main Activities



Technical capacity building of VLIs like the Gram Panchayat, WUGs on data collection.

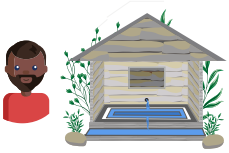


Geo-tagging and documentation of land-use, ownership, and demographic information on springs.



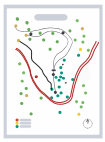
Systematic data monitoring of rainfall, spring discharge, and water quality.

Advantages



Captures local and traditional knowledge.

Entry point activity to engage the community.



Participatory resource mapping creates ownership.

Allows for scaling spring inventory and monitoring at marginal costs.

Key stakeholders who have implemented this practice

The Govt. of West Bengal, Prasari and ACWADAM built capacities of 675 Dhara Sevaks nominated by the Gram Panchayat on spring inventory and the preparation of DWPs on an incentive- basis of INR 1500/DPR under the Jharna Dhara program supported by SDC.

The RDD, Sikkim trained community personal for spring inventory on an incentive-basis (Rs 50-100/spring) and mapped 2500 springs across Sikkim with support from SDC.

CSOs like PSI, CHIRAG, Himmothan, NEIDA, WWF etc. across the IHR have trained members of the VLIs on monitoring spring discharge.

Major challenges

Financial constraints.

Avoid duplication of data.

Lack of centralized training resources.

Potential funding sources for scaling

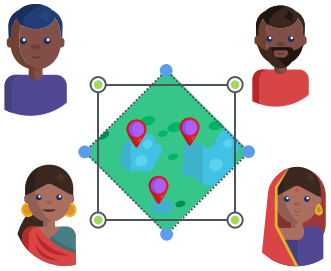
NMHS, JJM, CAMPA and Watershed Development funds.

FAQs that the Best Practice aims to address

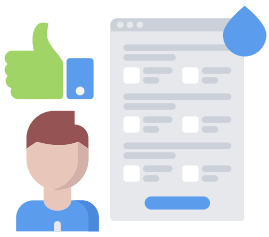
- What are the critical springs for prioritised interventions from a community's perspective?
- How many springs are used by local communities in the Himalaya?
- What are the estimated numbers of declining or dried up springs in the Himalaya?
- What is the trend of spring discharge, rainfall and water quality of springs in the IHR?

B.3 Enumeration of springs as a part of national sample surveys and censuses.

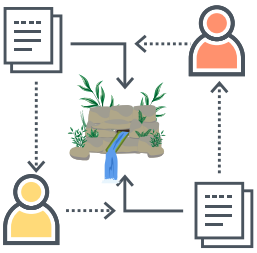
Main Activities



Build capacities of PRIs to administer representative spring surveys.



Advocacy and lobbying for the inclusion of spring inventory under National census.



Share spring enumeration data with the community.

Advantages

Collection of ground-truthed spring information at village/block/district level.

Building of water resource asset registers for local dissemination.

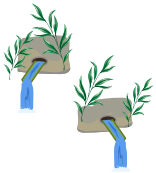
Replicable and scalable practice that will contribute to the comprehensive database on springs.

Key stakeholders who have implemented this practice

ACWADAM (2019) derived the number of spring-dependent villages from the District Census Handbook, 2011 for each district in the IHR states and the 4th Minor Irrigation Census by the Ministry of Water Resources.
They also highlighted that the spring numbers are extensively underreported and recommended the inclusion of spring inventory as part of the district census handbook.

Major challenges

Avoiding duplication of data.



Unique numbering of springs with multiple access points.

Spring data security for the communities.

Verified ground truthed data.

Potential funding sources for scaling

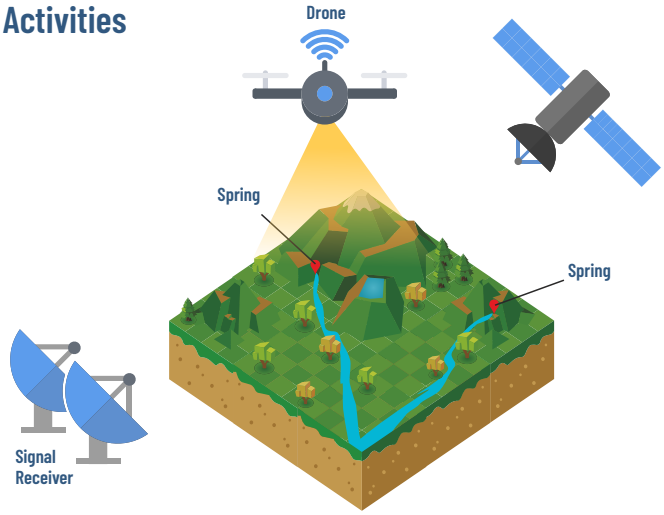
Census funds under relevant GoI ministries (Ministry of Home Affairs), Ministry of Jal Shakti (Minor irrigation Census).

FAQs that the Best Practice aims to address

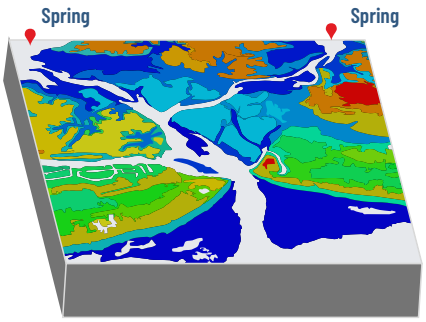
- How many springs are present in the IHR?
- How many springs are used by local communities in the Himalaya?
- What are the estimated numbers of declining or dried up springs in the Himalaya?

B.4 Use of Remote Sensing (RS) and GIS technologies such as LiDAR for spring inventories.

Main Activities



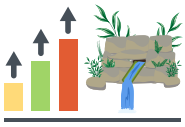
Regional mapping of springs using LiDAR-based sensor technology and ground-truthing.



Developing spring potential maps by combining LiDAR data with other RS-GIS sources.

Advantages

3D terrain mapping at higher accuracy.



Enabling scaling up at a landscape level.

Reducing costs and supplements manual mapping.

Key stakeholders who have implemented this practice

Survey of India, and NITI Aayog have undertaken a pilot project to map springs using the LiDAR technology in the Tehri Garhwal district of Uttarakhand.

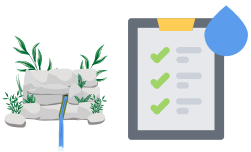
DoLR Nagaland has delineated the state into 3543 micro watersheds (~500 hectares each) with the help from NSAC Nordic Space Application Centre, the GIS department of DoLR. They arrived at an ~ number of 20 springs/micro watershed, and hence the estimation of ~71,000 springs in the state.

GBPNIHE uses remote sensing through the overlay technique, using GIS for mapping the spring zone, which is conducive for recharge.

Major challenges

Steep slopes unable to capture data.

Laser penetration through canopy cover.



Ground truthing with on-ground spring inventory data

Potential funding sources for scaling

NMHS, JJM, MoEFCC, Ministry of Earth Sciences and DST.

FAQs that the Best Practice aims to address

- How many springs have been mapped with basic information in the IHR?
- How do differnet land-use, including forest and human habitation, and local geology affect spring behaviour across different typologies?

B.5 A publicly accessible state and national level repository.

Main Activities

Creating an online portal to enable crowdsourcing of validated inventory data.

State level spring inventory initiatives with a state nodal agency.

Advantages

Avoiding duplication of data.

Enable better project planning in ecologically fragile areas.

Improve data quality.

Facilitate sharing and research on springs.

Key stakeholders who have implemented this practice

CHIRAG	Uttarakhand	Spring Atlas of 1000 springs.
MGNREGA,Prasari & Govt of WB	West Bengal	An online portal with information of 667 springs across 4 districts.
LRD	Nagaland	Spring Atlas of 2394 springs.
RDD	Sikkim	Spring inventory information on 1600 springs. (https://sikkim-springs.gov.in)
ACWADAM supported by SDC	IHR	Preparation of a geotagged database for springs which is in public domain. (www.themountainsprings.in)

Major challenges

Data credits and security.

Inter-agency/organisation data sharing.

Financial support for long-term maintenance of the portal.

Avoiding duplication of data from multiple sources.

Potential funding sources for scaling

NMHS, CAMPA and JJM.

This practice has been funded by SDC in the past.

FAQs that the Best Practice aims to address

- How many springs have been mapped with basic information in the IHR?
- What are the parameters on which spring inventory data is collected?
- What are the estimated numbers of declining or dried up springs in the Himalaya?

Community interaction at Lolay, Kalimpong. The WUG is led by women and all documentation is maintained by them including their account books.

Recharge structures in the 40 acre forest land of Tendong hills. The forest landscape approach springshed revival works.

Large cardomom planted in the recharge area as incentive for the private land holder in 16 acre village, Darjeeling district.

Innovative irrigation methods implemented under the WRIDD funded irrigation project in Kalimpong.

Innovative irrigation methods implemented under the WRIDD funded irrigation project in Kalimpong.

Rejuvenation of springs revives old lakes in Gangolihaat, Uttarakhand.

Wall paintings help disseminate complex hydrogeological concepts in simplified messages.

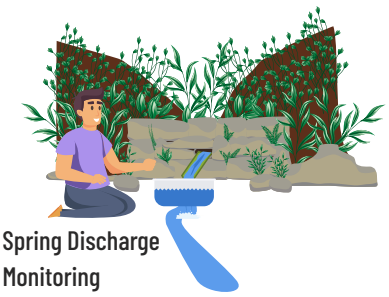
C. Data Monitoring

C.1 Long term spring monitoring protocols for selected springs.

Main Activities

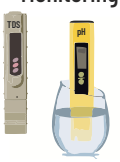
Train local communities and field staff in manual monitoring of spring discharge, rainfall and water quality.

Installing automatic data collection instruments for high-resolution monitoring of spring discharge, rainfall and water quality.



Spring Discharge Monitoring

Water Quality Monitoring



Automatic Weather Station

Advantages

Helps in scientific impact assessment of springshed revival projects.

Community-based data monitoring creates ownership and aids decision-making at the local level.

Facilitates collaborations of science and practice.

Key stakeholders who have implemented this practice

CHIRAG	Uttarakhand	40-45 springs since 2008 through manual monitoring and instrumentation by local staff and the community.
PSI	Himachal Pradesh & Uttarakhand	Long term monitoring of 40-45 springs through instrumentation and manually.
IIT-Roorkee, ATREE, CHIRAG and RDD	Uttarakhand & Sikkim	Instrumentation of 15 springs on a long-term basis for research purposes.
GBPNIHE	Uttarakhand	4 centers in the Himalayan region for long- term monitoring of springs through manual and instrumented methods.
DoLR	Nagaland	Installed 8 Customised Automated Weather stations across the state since 2019 on a pilot basis.

Major challenges

Long-term financial support for instruments and human resources, including para hydrogeologists.

Maintenance and ownership of field instruments.

Data access and site management post withdrawal or project ending.

Potential funding sources for scaling

NMHS, JJM and Watershed Development programme, PRI funds, MoEFCC, DST, MOES.

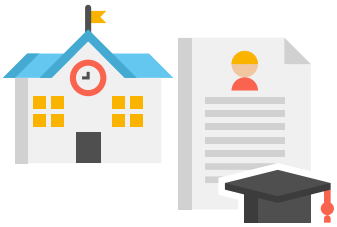
FAQs that the Best Practice aims to address

- For how many springs is data available already in the IHR?
- What are the parameters on which spring monitoring data is collected?
- What are the estimated numbers of declining or dried up springs in the Himalaya?

C.2 Institutional arrangements of spring database management.

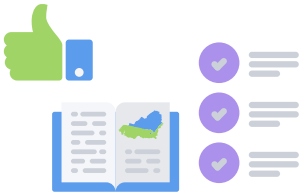
Main Activities

Identify key academic institutions across the IHR to undertake actionable research.



Capacity building of Masters and PhD researching on SM.

Advantages



Encourages action research to inform policy and practice.

Supplementing existing literature on springs in the IHR.

Key stakeholders who have implemented this practice

Academia and Research Institutions

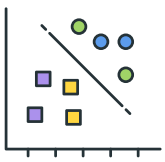
IIT Roorkee | GBPNIHE | NIH | WIHG | BARC | Kumaon University | ATREE | Kohima University

Major challenges

Long term inter-agency collaboration.

Demystifying technical knowledge and it's dissemination.

Long term financial support.



Ensuring scientific analysis of the data for knowledge dissemination.

Potential funding sources for scaling

NMHS, BARC, and the Namami Gange Programme (NMCG), can be significant funding sources for this practice.
GBPHIESD has been selected as a nodal agency to maintain a comprehensive decision support system by the NITI Aayog.

FAQs that the Best Practice aims to address

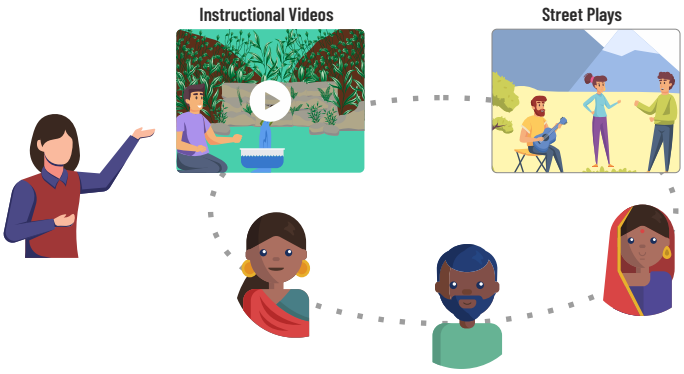
- What are the key academic institutions involoved in the inventory and research on springs in the IHR?

D. Community Mobilization, Livelihood Creation and Capacity Building

D1. Community awareness and mobilization activities.

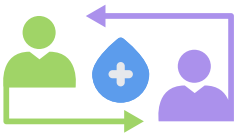
Main Activities

- Identify context -specific and interactive mobilization tools to create awareness.
- Simplyfying scientific concepts in local language.
- Use 3D models/visual aids to better explain the concept to the community.
- Peer-to-peer learning through exposure visits to successful case studies.

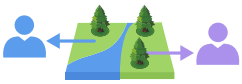


Advantages

Helps communities to visualise the concept.



Sharing and learning through lived experiences between communities from diverse contexts.



Developing conflict resolution mechanisms.

Key stakeholders who have implemented this practice

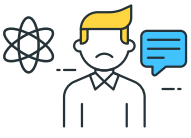
Most CSOs like PSI, CHIRAG, Himmothan, etc. use street plays combining water issues with local folklore as an effective tool of mobilization. Exposure visits to successful intervention sites enable peer-to-peer learning and experience sharing.

CHIRAG and DoLR (Nagaland) have used publicly displayed 3D models of the springshed in the village to practically explain the concepts of springshed management to the community.

RDD, Sikkim uses the Dhara Vikas graphical handbook supported by SDC and GIZ in local language for better awareness generation.

Major challenges

Ensuring technical knowledge dissemination.



Simplifying scientific concepts in local languages.

Improving coordination between communities sharing common springs.

Potential funding sources for scaling

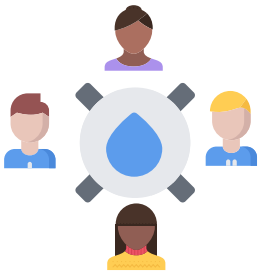
NRLM community mobilization funds, 'CSOs' project funding, JJM.
This practice has been funded by agencies such as Arghyam, SDC and GIZ in the past.

FAQs that the Best Practice aims to address

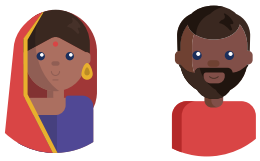
- What are the best tools for creating awareness and enhance community participation?
- How to build ownership and sustainability in springshed management projects with communities?

D.2 Formation and capacity building of WUGs/VLIs.

Main Activities



Identify existing institutional mechanisms.



Ensure inclusive and equitable participation from all social strata, including socioeconomically marginalized communities like Dalits and tribals.

Build capacities of VLI members on springshed management.

Create and strengthen financial, operational, and documentation systems.

Advantages

Enables a robust decentralized governance structure.

Helps in building the youth's skills for future employment and take ownership.

Conflict resolution mechanisms for communities.

A long-term data monitoring protocol with community involvement.

Key stakeholders who have implemented this practice

CSOs like PSI, Himmothan, CHIRAG, NEIDA, Prasari form water user groups with dependent households as members, especially women. This process is followed by capacity building before actual implementation begins. Their roles include regular monitoring of springs, cleaning of recharge and discharge area, operations and maintenance funded by the community, and bottom-up decision-making process.

Department of Soil and Water Conservation, Meghalaya, helped formation of dedicated village committees called Village Darbar to oversee spring revival activities. Each SM activity was undertaken after due consultations by the respective Village Darbars.

Major challenges

Equitable participation of women and marginalised groups like Dalits and tribals.

Institutionalising WUGs with government schemes/bodies.

Decentralising decision making and implementation.

Maintenance and sustainability of the WUG post project completion.

Potential funding sources for scaling

JJM and Watershed Development programmes.

FAQs that the Best Practice aims to address

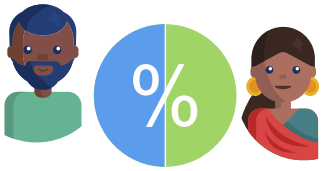
- How strengthening of institutional mechanisms at the grassroots-level can ensure the sustainability of springshed management?
- Which are the existing VLIs that can be strengthened to undertake springshed management?

D.3 Gender Equality and Social Inclusion (GESI) approach in springshed management.

Main Activities

Identify and train women and representatives from marginalised groups like Dalits and tribals leaders from VLIs on SM.

Ensure active participation of women and marginalised groups like Dalits and tribals leaders in the decision-making process.



Ensure equitable representation of women members and marginalised groups like Dalits and tribals as part of the WUG.

Advantages

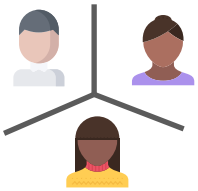
Creates an inclusive approach that will lead to the sustainability.

Promotes gender mainstreaming and social inclusion.

Key stakeholders who have implemented this practice

ACWADAM, CHIRAG, PSI, Himmothan, Prasari among other CSOs actively engage women as part of their springshed management initiatives across the IHR. They emphasise on training women para-hydrogeologists as women are the primary collectors of water in rural mountain communities, as a result of their gendered roles in the society.

Major challenges



Cultural barriers for women in accessing public spaces.

Additonal burden of work to the already existing daily chores.

Low literacy levels among women and marginalised groups.

Addressing caste based differential access to water resources.

Potential funding sources for scaling

Awareness & Training funding for changing social attitutdes and norms from MGNREGA, Watershed Management programmes and NAFCC.

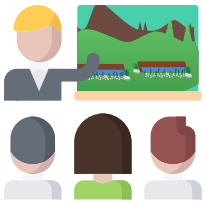
FAQs that the Best Practice aims to address

- How to identify community leaders for spearheading projects?
- How can communities be encouraged to lead SM?

D.4 Train para-hydrogeologists for springshed management.

Main Activities

Identify and select potential para-hydrogeologists from the community.



Build capacities on components of springshed management through field schools and training centers.

Converging with skill development programmes like Skill India Mission for capacity building and certification.

Advantages

Helps in long-term data monitoring and mobilization of the community.

Creates community ownership by involving the youth and securing future livelihoods.

Helps in scaling up the initiative creating a ripple effect with trained professionals.

Key stakeholders who have implemented this practice

CSOs

ACWADAM | PSI | CHIRAG | Prasari | Himmothan Society

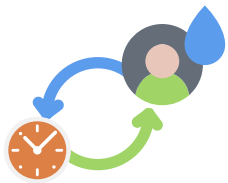
Trained thousands representatives of the community, CSOs and Government departments on hydrogeology, social and governance aspects, and data monitoring across the IHR.

Government Departments

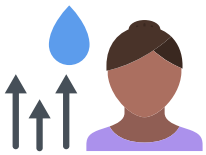
RDD (Sikkim) | DoLR (Nagaland) | MBDA | MCLLMP

Trained staff and village data collectors on hydrogeology, social and governance aspects, and data monitoring.

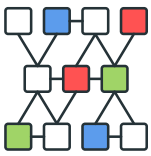
Major challenges



Financial and livelihood security of para hydogeologists post project completion.



Ensuring training and building capacities of women para hydrogeologists.



Uniform training and capacity building across diverse lithologies.

Potential funding sources for scaling

MGNREGA, Watershed Development, CAMPA.

This practice has been funded by GIZ, SDC, Arghyam, Tata Trusts and WWF, in the past.

FAQs that the Best Practice aims to address

- What aspects of springshed management can para workers be trained in?
- What other government programs can training of para workers be converged with?

D.5 Springshed management curricula for schools and colleges for awareness generation.

Main Activities

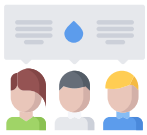
Design simplified curricula on the basics of springshed management.

Introducing SM as an elective subject for students of Hydrology or Water Resources in collaboration with schools and colleges in the IHR.

Create Eco-clubs in schools and colleges to promote springshed management activities.

On-field discharge and water quality monitoring with the help of schools and colleges.

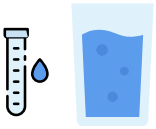
Advantages



Simplyfies scientific concepts for early adoption.

Sensitises and develops interests in critical issues such as impacts of development and climate change on water security in the Himalaya.

Will create water-conscious schools and colleges through training.



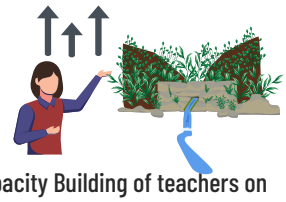
Help in understanding drinking water quality issues and come up with innovative nature-based solutions to address them.

Key stakeholders who have implemented this practice

CSOs like CHIRAG, PSI, and Himmothan Society conduct awareness workshops and training on the importance of springs for school and college students as a part of their awareness-building exercise in the villages where SM is being implemented.

Major challenges

Simplified curricula created in multiple languages.



Capacity Building of teachers on Springshed Management.

Institutionalising partnerships with incentives.

Potential funding sources for scaling

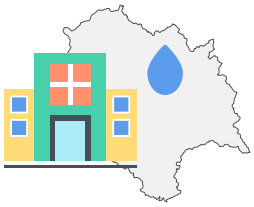
Funds from JJM and NMHS can be utilized for this practice as well as from University grants & state education departments.

FAQs that the Best Practice aims to address

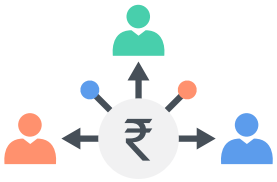
- How can springshed management be integrated in school and college curriculum?

D.6 Science-practice-policy network/consortiums at state and national level to facilitate action and research on springs.

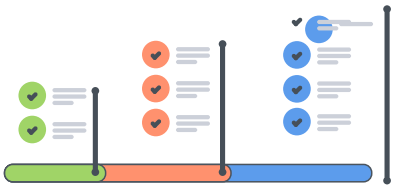
Main Activities



Identify key organizations and departments at the state level.



Identify a nodal agency to anchor the network/consortium process with dedicated funding sources.



Identify long and short-term objectives for developing a comprehensive knowledge base on the Himalayan springs to support implementation and policy changes.

Advantages

Allows stakeholders to leverage cross-sectoral resources and expertise to scale up.

Help create participative policy and practice discussions leading to knowledge creation.

Supports cross-learning and mainstream a scientific approach to groundwater management.

Enable making springs a national policy focus and creates scalable models through advocacy.

Key stakeholders who have implemented this practice

The Springs Initiative (Arghyam and ACWADAM)	ACWADAM, PSI, CHIRAG, Keystone Foundation, Grampari, HSS, Govt. of Sikkim, Govt. of Meghalaya, among others.	Arghyam facilitated and funded the Springs Initiative between 2014-2019, which was participated by 15+ CSOs and five state governments. The initiative focussed on mainstreaming participatory community-based springshed management approaches in the mountain communities across India through action research , capacity building, policy and advocacy, and field facilitation.
The Springshed Management Consortium (Forest Department, Uttarakhand)	Headed by the PCCF, this consortium has officials of the forest department and other concerned departments and CSOs like Himmothan Society, PSI, BAIF.	The state-level consortium enables an efficient springshed management initiative in the forest jurisdiction based on the recommendations of the NITI Aayog. It leverages CAMPA funds for springshed management by the UK Forest Department with technical and field support from CSOs members including Himmothan Society, PSI and BAIF. In the future, the SMC plans to engage with the Van Panchayats for the execution of works.
North-Eastern States Springshed Consortium	Nagaland government departments of Land Resources and Rural Development, NEIDA, Tata Trusts, ACWADAM, and PSI.	This is a multi-stakeholder consortium that is working towards enhancing recharge of spring aquifers in the local ecosystem and augmenting drinking water security for the local communities in Nagaland.

Major challenges

Financial constraints are restricting sustainability of the networks.

Moving from project driven consortiums.

Potential funding sources for scaling

MGNREGA and CAMPA component of training and capacity building and from different state ministries to create scalable models at the state level.

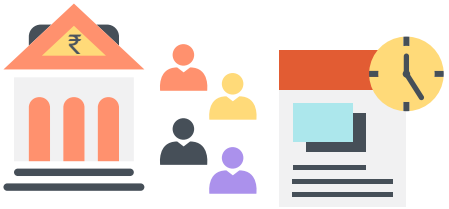
FAQs that the Best Practice aims to address

- What are the advantages of state and national-level consortiums on SM?
- What are some of the examples of state-level consortiums for springshed management?

D.7 Simple to use operations and maintenance protocol manual for WUGs.

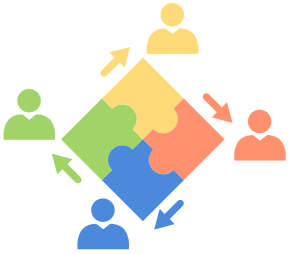
Main Activities

Identifying water-use priorities, recharge, and discharge area protection protocol, benefit-sharing norms, financial transparency, etc. for the WUG .



Set up an operations and maintenance fund for the WUG.

Advantages



Maintenance and sustainability of SM works post-withdrawal through shared and collective responsibility of the community.

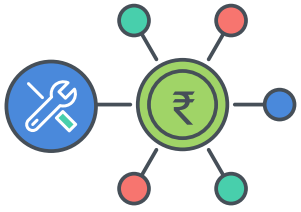
Maintained recharge structures and vegetative measures improve spring recharge and water quality.

Key stakeholders who have implemented this practice

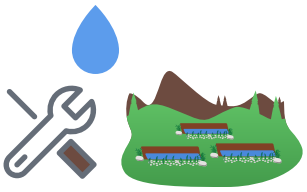
CSOs	PSI, CHIRAG, Prasari, Himmothan Society
Government Departments	RDD (Sikkim), MGNREGA (West Bengal), MBDA and MCLLMP (Meghalaya)

Major challenges

Compliance by all community members.



Financial constraints due to smaller fund sizes.



Ensuring maintenance of spring recharge works post livelihood benefits accrue.

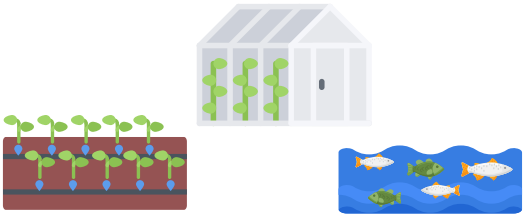
FAQs that the Best Practice aims to address

- What management protocol should be followed for springshed management?

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Agency for Development and Cooperation SDC
NITI Aayog
IWMI International Water Management Institute

D.8 Water management practices that support allied livelihood activities.

Main Activities



Introduce livelihood activities like System of Crop Intensification (SCI), innovative irrigation techniques, fisheries, horticulture, etc. by training farmer groups.

Link SM activities with individual beneficiary schemes, such as NRLM, through convergence.

Advantages

Promotes the one water (multiple uses of water) concept.

Creates monetary incentives for the communities which leads to sustainability through a holistic approach.

Key stakeholders who have implemented this practice

PSI	Introduced SCI along with springshed management as a water saving farming practice for maize, wheat, and vegetable farming.
Himmothan Society	Introduced the concept of one water as a part of all their livelihood programs while linking them to springshed management.
Prasari	Drip irrigation, SCI for vegetable farming were introduced as water-management practices for farming by using increased spring discharge, optimally.
NABARD	NABARD launched an integrated springshed-based participatory watershed development programme in the NER, including Sikkim, on a pilot basis with financial support under WDF since January 2017 which is now extended to other hilly areas of states. As of March 31, 2021, 82 springshed development projects have been sanctioned.
LRD, Nagaland	Upscaling and implementing the springshed management programme through NABARD to introduce livelihood interventions along with springshed management.

Major challenges

Equitable participation and benefits for all social strata, especially marginalised groups.

Adoption of improved water management practices by the community.

Lack of knowledge of schemes and programs to leverage.

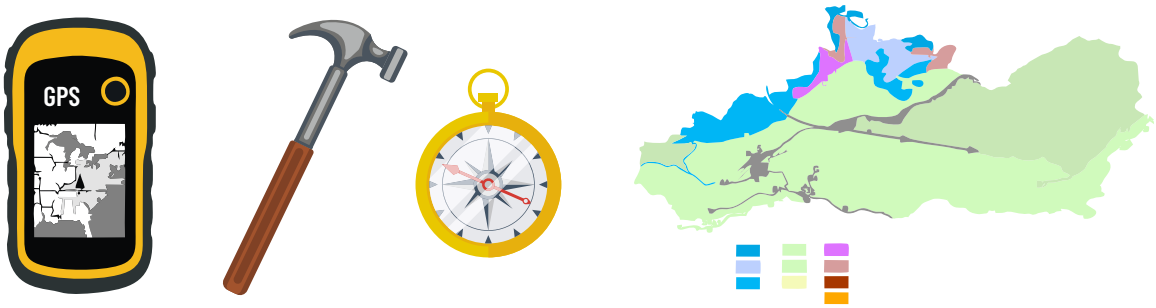
FAQs that the Best Practice aims to address

- What are the different water management practices that can be introduced as a part of springshed management?
- How to link livelihood activities with SM in the IHR?

E. Hydrogeological Assessments and Recharge Interventions

E.1 Simple handbooks documenting a standard methodology of field-based hydrogeological mapping and recharge area identification.

Main Activities



Designing a graphical handbook on field-based hydrogeological mapping and recharge area identification in local languages.

Advantages

Enables the inclusion of local and traditional knowledge.

Standardization in training para-hydrogeologists.

Simplyfying scientific concepts in local languages.

Supports the training and capacity building of field staff.

Key stakeholders who have implemented this practice

Currently Dhara Vikas Manual is a very easy-to-use handbook curated by RDD Sikkim in collaboration with GIZ, UNDP, ACWADAM, and its partners like PSI, CHIRAG, etc. which covers aspects of hydrogeological mapping and recharge area identification. This handbook needs to further be improvised by including more innovative techniques and learnings from the past few years in the field.

Major challenges

Standardisation across diverse and complex terrains.

Incorporating regional geological, cultural and social diversities.

Potential funding sources for scaling

Funds can be utlised from the CGWB and the Ministry of Jal Shakti, GoI.
This activity has been funded by GIZ, SDC and UNDP, in the past.

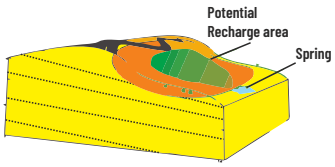
FAQs that the Best Practice aims to address

- Which handbooks can be consulted for learning field-based hydrogeological assessments?

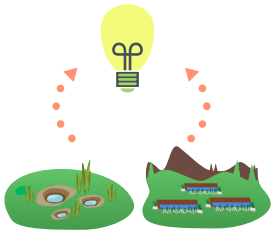
E.2 A technical manual/guideline on recharge measures for optimal recharge and reduced soil erosion.

Main Activities

Review existing recharge intervention manuals.



Devising appropriate recharge measures based on spring type, LULC, slope, and topography.



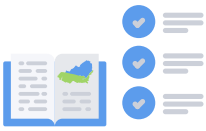
Trial and innovation of different recharge measures across the IHR.

Promoting vegetative and nature-based measures.

Advantages

Manual suggesting appropriate recharge measures suitable for given conditions.

Simplified document for help to scale-up across the IHR.



Improved recharge structures will help in impact assessment.

Key stakeholders who have implemented this practice

RDD (Sikkim) in collaboration with GIZ and its other partners like ACWADAM, PSI, CHIRAG, GBPIHESD (Sikkim), DST, TMI among others published a user manual (3 editions) to help other agencies use the concept to help revive their dying springs. It has detailed information on hydrogeology, recharge interventions, social and governance aspects, data monitoring, impact assessment, etc.

SDC SCA-Himalayas project in partnership with ICIMOD is preparing a training manual for springshed management in the IHR.

Major challenges

Incorporating regional geological, cultural and social diversities.

Lack of rigorous empirical knowledge on the efficacy of the existing measures in SM context.

Potential funding sources for scaling

Rural Development Departments of different states and Central Ground Water Board.
This practice has been funded by funding agencies like GIZ, UNDP, SDC, ICIMOD, in the past.

FAQs that the Best Practice aims to address

- What kinds of interventions are needed for integrated water management in the Himalaya?
- What are the recharge interventions suitable for different Land-use and land-cover (LULC) types, topographies, elevation, hydrogeology, etc?

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Agency for Development and Cooperation SDC

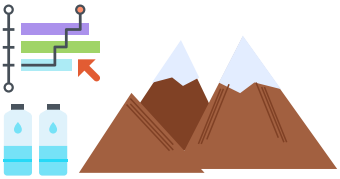
NITI Aayog

IWMI International Water Management Institute

E.3 Use of hydrological data and isotope techniques to supplement hydrogeological mapping for accurate recharge area identification and impact assessment.

Main Activities

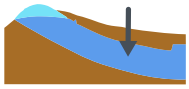
Identifying suitable springs for sample collection and isotope analysis



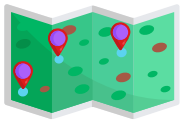
Analyse and collect the water samples of rainfall, snowfall, surface and groundwater bodies.

Identifying labs for isotope analysis.

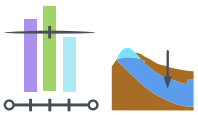
Advantages



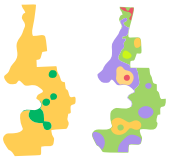
Helps delineate the aquifer boundaries and recharge area.



Helps in the identification of the origin of groundwater, age, flow velocity and direction, connections between different aquifers, local porosity, transmissivity, and dispersity of an aquifer.



Used to estimate the mean elevation of the contributing catchment.



Helps to understand the spatial distribution of potential source waters.

Useful in impact assessment and quantification of hydro-socio-ecological impact.

Key stakeholders who have implemented this practice

BARC has been undertaking isotope studies for understanding spring aquifer properties and recharge zone identification.

RDD (Sikkim) did an isotope study with BARC using natural isotopes to understand aquifers and the geohydrology of Sikkim Himalaya. The study found that the 15 instrumented springs were all recharged from three specific recharge points across the elevation gradient. And the natural isotope fingerprint of all the springs was the same which implied that they were sharing that aquifer.

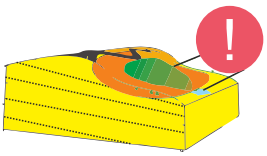
Studies conducted by University of Kashmir, Department of Earth Sciences funded by BARC using isotopes in the Western Himalaya.

GBPNIHE in collaboration with the NIH and IAEA has published studies on understanding spring and stream water responses in headwaters of the Indian Lesser Himalaya using stable isotopes, conductivity, and temperature as tracers.

Major challenges

Limited field studies on isotope analysis of springs.

Financial and technical capacity building constraints.



Lack of easily accessible and high- resolution geological maps.

Potential funding sources for scaling

NMHS as well as through internal funding available to research organisations.

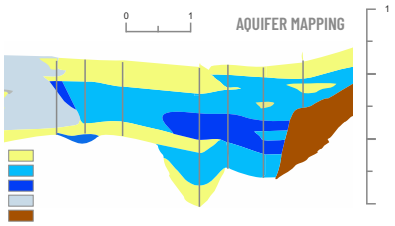
This practice has been funded by BARC, in the past.

FAQs that the Best Practice aims to address

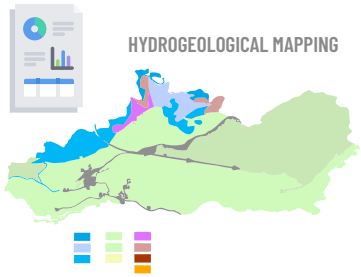
- What are the likely impacts of climate change on the Himalayan springs?
- What is the role of forests, agriculture and other land-use on spring discharge and quality?
- What are the connections between springs across local-watershed-basin scales?

E.4 Combining hydrogeological mapping, isotope techniques and hydrological instrumentation to create regional aquifer maps.

Main Activities



Multi-disciplinary action research aimed at modelling spring behaviour, aquifer mapping, and recharge area delineation.



Combining hydrological discharge analysis with hydrogeological mapping and isotope analysis.

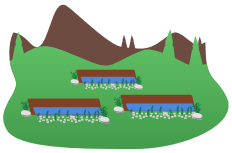
Vulnerability assessment and predicting the changes in spring behaviour with climate change impacts.

Advantages

Regional understanding of climate change impacts on springs.

Developing scientific knowledge base.

Identifying the most vulnerable type of springs for prioritised conservation.



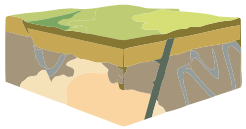
Improvement in recharge measures based on inputs from action-based research.

Key stakeholders who have implemented this practice

Science-practice collaborations between institutions like ATREE, IIT-Roorkee, GBPNIHE, CHIRAG, RDD and PSI have led to multiple research stations where detailed research is being undertaken for enhancing scientific understanding of the Himalayan springs.

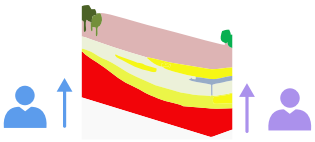
Department of Earth Sciences at the University of Kashmir has undertaken isotope studies to understand spring behaviour in the Western Himalaya.

Major challenges



Lack of rock exposure.

Limited availability of geological maps.



Capacity building for undertaking regional aquifer mapping.

Potential funding sources for scaling

Govt. departments like MoEFCC, DBT, DST, NMHS, MoES.

FAQs that the Best Practice aims to address

- What does isotope analysis help analyze?
- What are the examples of isotope analysis currently?

F. Funding Sources and Convergence

F.1 Convergence with existing government programs.

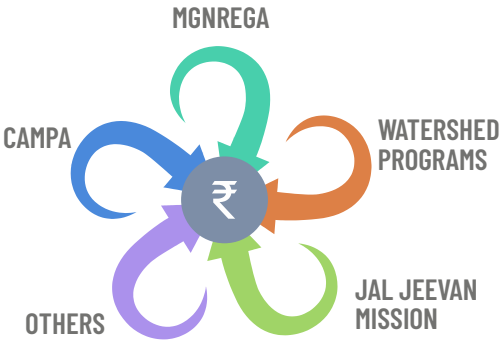
Main Activities

Many state governments have been utilising the MGNREGA funds for springshed management, including components requiring earthen works such as check dam, renovation of traditional water bodies, plantations, contour trenches, etc., and training and capacity-building of VLIs.

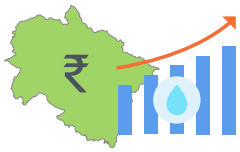
State and National-level CAMPA funds are recommended for SM works including activities such as afforestation and regeneration, and Soil and Water Conservation.

Springshed Management is also added as one of the components of the watershed development guidelines where funds in tune of Rs 28000 Ha-1 for hilly areas and Rs 22000 Ha-1 for plains are allocated for Soil and Water conservation activities.

With its focus on source sustainability through recharge structures and rainwater harvesting, JJMis recommended to adopt SM practices in convergence with other schemes such as MGNREGA, IWMP, CSR, etc.



Advantages



Enables the scaling up of the intervention and creates durable assets.

Aids in bringing synergies between different government programmes/schemes in planning and implementation.

Planning and convergence at the grassroots level will lead to ownership of projects.

Key stakeholders who have implemented this practice

In a pioneering initiative under the Dhara Vikas programme, RDD (Sikkim) used MGNREGA funds for springshed management in West Sikkim and South Sikkim districts. In each gram panchayat, the Dhara Vikas proposal was approved by the respective Gram Sabha after a feasibility survey followed by technical report preparation by the local para-hydrogeologist.

The Govt. of West Bengal and Prasari works with trained Dhara Sevaks (local village youth) to prepare DPRs, and then implementation activities are undertaken through convergence with MGNREGA. The DPR preparation was financially supported by SDC, BRLF and Arghyam under Jharna Dhara program led by the State MGNREGA cell.

The UK forest department has utilized CAMPA funds for designing and implementation of spring recharge actitivites in forest areas under their jurisdiction.

As per the guidelines of JJM, restoration of springs should be done through CAMPA funds with support from local CSOs in preparation of work plans and implementation by the respective forest departments.

Major challenges

Inter-departmental collaboration and knowledge/data sharing.

Lack of knowledge on available schemes and programs to be leveraged.

Streamlining the process of convergence at state and national-levels.

FAQs that the Best Practice aims to address

- Which are the different sources of funding available through convergence?
- Which are some of the examples where convergence has helped scale up springshed management?
- Which departments can be approached for convergence?

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Agency for Development and Cooperation SDC

NITI Aayog

IWMI International Water Management Institute

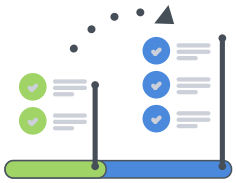
F.2 Community contribution as a source of funding for O&M.

Main Activities

Interact with the community to gauge their willingness to contribute.

Community contribution mechanisms and amount decided by community members.

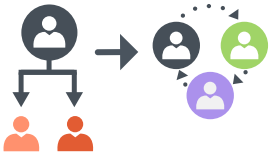
Explore options of community contributions through labour, material, or in-cash.



Utilisation of collected funds for operations and maintenance.

Advantages

Improves ownership as part of a robust exit strategy.



Reduces over-reliance on external funds for minor requirements.

Help sustain the initiative and helps in decentralized decision-making.

Key stakeholders who have implemented this practice

PSI - Uttarakhand and Himachal Pradesh	20%-25% of the implementation costs are borne by the community in labour, material, or in-cash. Monthly contributions of Rs 10-Rs 100/HH are collected by each HH under the operations and maintenance fund.
CHIRAG, Uttarakhand	Contribution is up to 40% and 20%-25% in activities undertaken on individual land and community land respectively.
LRD, Nagaland	Community-contributed local material for pipeline work undertaken under the NABARD springshed program across many villages.

Major challenges

Equitable and timely contribution by community members.

Sustenance of community fund post-project completion.

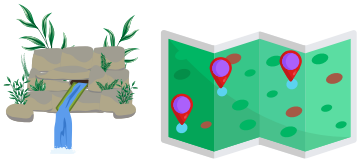
FAQs that the Best Practice aims to address

- How can communities be encouraged to lead SM?
- How can communities support SM initiatives financially?

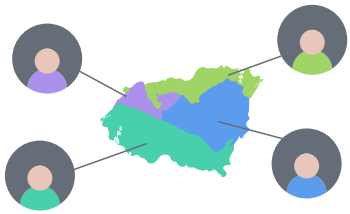
F

F.3 Payment for Ecosystem Services as a funding mechanism for springshed management.

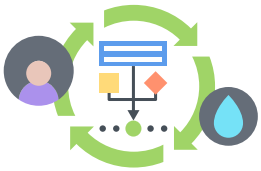
Main Activities



Identify upstream-downstream linkages w.r.t springs.

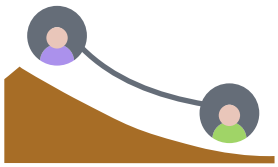


Devising mutually agreed monetary/in-kind payments mechanisms between upstream and downstream communities.



Documentation and operationalization of PES mechanism though periodic meetings between the stakeholders.

Advantages



Incentivizes upstream communities to provide ecological services to downstream communities and improves urban-rural equity.

Ensures a sustainable model of incentivization as well as conflict- resolution.

Creates ownership and shared benefits among the both communities.

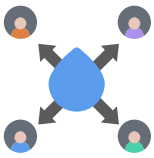
Potential opportunity to leverage resources from tourism industry for SM.

Key stakeholders who have implemented this practice

In 2010, a 20-year PES agreement was constituted between the Palampur Municipal Corporation (PMC) and the Bohal Forest Development Committee (BFDC) under the Palampur Water Governance Initiative (PWGI) supported by GIZ and Himachal Pradesh Forest Department. The BFDC comprised village communities, especially the women, from Bohal, Mandai, and Kodi villages in the Bandla Gram Panchayat in Kangra district, HP. In the arrangement, the PMC will be paying Rs. 10000 annually to BFDC protect and conserve the forests in the recharge area of the Bohal spring and streams, which provide water supply to the Palampur township.

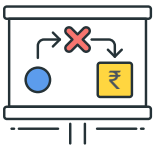
CSOs like PRASARI, PSI, CHIRAG have also used PES in different forms to convince individual landowners or communities in different watershed to provide their land on a voluntary basis through planting of income generating horticulture plants like apples, peach, plum etc. or cash crops like large cardamom in the recharge area, linking landowners to individual beneficiary schemes like fishponds, poultry farming, livestock rearing among others to incentivise them.

Major challenges



Conflict resolution between communities sharing water resources.

Benefit sharing between communities.



Financial Incentives may not be substantial enough to be lucrative for upstream communities.

Potential funding sources for scaling

Watershed Development programmers, Individual Beneficiary schemes, NRLM and CAMPA.

FAQs that the Best Practice aims to address

- How can PES be leveraged in SM?
- What are the different models of PES in SM?

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

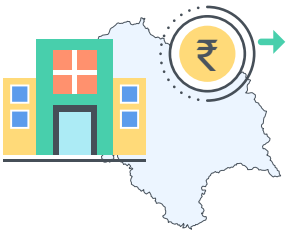
Swiss Agency for Development and Cooperation SDC

NITI Aayog

IWMI International Water Management Institute

F.4 A national mission on springshed management with directives for funding and implementation for the IHR states.

Main Activities

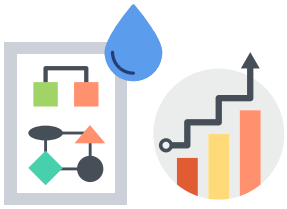


Identify a nodal agency under an appropriate ministry a central source of funding.

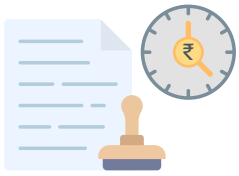
Fund allocation to CSOs as well as state governments.

Establishing a National Training Centre to execute a standard program on SM.

Advantages



A dedicated program will get the scale that we need to treat the millions of springs in the IHR.



Timesaving in terms of facilitating convergence as a steady source of funding at central-level.

CSOs will be better equipped with resources to undertake springshed management holistically.

Key stakeholders who have implemented this practice who can be involved

This is recommendation emerged from the consultation with different stakeholders and has not been implemented yet.
The following stakeholders can be involved under an appropriate ministry or NITI Aayog.

Ministry of Jal Shakti | MoEF&CC | Ministry of Rural Development | JJM | Namami Gange

Major challenges

Flexibility for fund expenditure.

Appointment of a nodal agency to spearhead the national mission.

Identifying a clear mandate with specificities to execute at the state level.

FAQs that the Best Practice aims to address

- Which are some of the examples where convergence has helped scale up springshed management?
- Which departments can be approached for convergence?

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

NITI Aayog

IWMI International Water Management Institute

KEY RECOMMENDATIONS

Though the task of revival of the Himalayan springs is gigantic, it can be achieved through a systematically coordinated, combined national, state and local level initiatives involving all possible stakeholders and partners including governments, community and people at large. These actions may be divided into the 4 main categories of

Technical

A nodal agency-led decision support system that leverages technology for spring-related data integration, management and seamless sharing.

Use of field-validated RS-GIS technologies for spring inventory is recommended after due consultations before scaling up.

Mainstreaming technical knowledge on hydrogeological mapping, identification of recharge areas, and suitable measures.

Institutional

A National springs mission (NSM) involving state-level Nodal Agencies (SLNA) is recommended for better coordination, improved efficiency and scaling up of SM works.

A Gender-Equity-Socially Inclusive (GESI) approach should be included in SM implementation for improved benefit sharing and sustainability.

State and national level science-policy-practice consortiums are essential for experience sharing, complementary knowledge generation and transfer, and capacity building of all stakeholders.

Financial

Creation of a National Spring Mission with directives for convergence is essential for long-term and sustainable resource mobilization.

Community contribution for Operations and Maintenance funds is recommended while undertaking springshed works to ensure ownership and sustainability.

Exploring PES mechanisms (cash/kind) between upstream and downstream communities for funding SM activities.

Capacity Building

Identification of state-level nodal agencies with infrastructure for facilitating capacity building Key stakeholders who have implemented this practice including government agencies.

Instutionalisation and livelihood security for para-hydrogeologists for expanding the reach and sustenance of delivery mechanisms under SM.

Development of tailored capacity building material on SM suitable for different stakeholders.

ACKNOWLEDGMENTS

This Resource Book is a combined product of efforts from the International Water Management Institute (IWMI), India, the NITI Aayog, Government of India, and the Swiss Agency for Development and Cooperation (SDC), India.

We would like to thank all the listed key stakeholders that kindly gave access to project documents and provided field support. The authors would like to thank People's Science Institute, Central Himalayan Rural Action Group, Himmothan Society, Rural Development Department (Government of Sikkim), Land Resources Department, Government of Nagaland, Prasari, and Gramya (Uttarakhand) for providing field support and facilitating interactions with the local communities. We would also like to thank all the experts and panelists who participated in the expert interviews, online consultation, and online survey and shared their experiences and perspectives. Their valuable feedback helped ensure that this resource book is comprehensive and representative of the springshed management in the Indian Himalayan Region. We are grateful to IWMI-India team colleagues at the International Water Management Institute, who provided valuable feedback and support during the making of this knowledge product.

The authors benefited from exchanges with Shri Ashok Jain and Shri Umakant ji from the Department of Land Resources, Government of India. The authors also received useful information and perspectives from conversations held with officials from the Forest Department of Uttarakhand and Himachal Pradesh, Rural Development Department of Sikkim, Land Resources Department of Nagaland, Meghalaya Basin Development Authority, and MGNREGA cell of West Bengal.

The authors are particularly thankful to the women, men, and youth of the various springshed sites that were visited during the making of this resource book. We thank them for their support, time, and hospitality.

Last but not least, we acknowledge the support from the Swiss Agency for Development and Cooperation (SDC), India, through the project "Documenting Best Practices in Springshed Management" sanctioned under the "Strengthening Climate Change Adaptation in Himalayas (SCA-Himalayas)" programme.

FURTHER READING

CHIRAG. (2019). Spring Atlas of Uttarakhand, http://chirag.org/wp-content/uploads/2019/07/SPRING-ATLAS-CHIRAG.pdf

Dhawan, H. (2015). Improving the Practice and Policy of Springshed Management in India. 7th World Water Forum 2015, April, 1–4. http://lib.icimod.org/record/30289

Kresic, N., & Stevanovic, Z. (2009). Groundwater hydrology of springs: Engineering, theory, management and sustainability. In Butterworth-Heinemann. https://doi.org/10.1016/B978-1-85617-502-9.00025-6

Kulkarni, H., & Mahamuni, K. (2013). Regional hydrogeology of the Tendong hills and a Rapid hydrogeological assessment for Kitam. http://www.acwadam.org/index.php?option=com_rsform&formId=4&tmpl=component&linkfrom=2013%20/Technical%20report%20/Mountain%20System%20/South%20Sikkim/Sikkim/India/Regional%20hydrogeology%20of%20the%20Tendong%20hills%20and%20a%20Rapid%20hydrogeological%20assessment%20for%20Kitam&linkname=TR47&ml=1&iframe=1

Kumar, V., & Sen, S. (2018). Analysis of Spring Discharge in the Lesser Himalayas: A Case Study of Mathamali Spring, Aglar Watershed, Uttarakhand. 321–338. https://doi.org/10.1007/978-981-10-5711-3_22

Negi, G. C. S., & Joshi, V. (2002). Drinking water Issues and Development of Spring Sanctuaries in a Mountain Watershed in the Indian Himalaya. Mountain Research and Development, 22(1), 29–31. https://doi.org/10.1659/0276-4741(2002)022[0029:dwiado]2.0.co;2

NITI Aayog. (2018). Inventory and Revival of Springs in the Himalayas for Water Security: Report of Working Group I. http://www.niti.gov.in/writereaddata/files/document_publication/doc1.pdf

Panwar, S. (2020). Vulnerability of Himalayan springs to climate change and anthropogenic impact: a review. Journal of Mountain Science, 17(1), 117–132. https://doi.org/10.1007/s11629-018-5308-4

Rural Management and Development Department. (2014). DHARA VIKAS HANDBOOK A User Manual for Springshed Development. Government of Sikkim. https://sikkim-springs.gov.in/researchStudiesFiles/1605857199830_Dhara%20Vikas%20Handbook-%203%20EDITION%20English%20version.pdf

Scott, C. A., Zhang, F., Mukherji, A., Immerzeel, W., Mustafa, D., & Bharati, L. (2019). Water in the Hindu Kush Himalaya. In Wester, P., A. Mishra, A. Mukherji, & A. B. Shrestha (Eds.), The Hindu Kush Himalaya Assessment (pp. 257–299). Springer International Publishing. https://doi.org/10.1007/978-3-319-92288-1

Sharma, G., Pradhan, N., Sharma, D. P., Luitel, M., Barola, Y., Luitel, K. K., & Nyima, K. (2019). Conserving springs as climate change adaptation action Lessons from Chibo – Pashyor Watershed , Teesta River (Issue October). https://lib.icimod.org/record/34553

Shrestha, R. B., Desai, J., Mukherji, A., Dhakal, M., Kulkarni, H., Mahamuni, K., Bhuchar, S., &, & Bajracharya, S. (2018). Protocol for Reviving Springs in the Hindu Kush Himalayas: A Practitioner's Manual (Issue September). https://lib.icimod.org/record/34040

Siddique, M. I., Desai, J., Kulkarni, H., & Mahamuni, K. (2019). Comprehensive report on Springs in the Indian Himalayan Region: status of springs, emerging issues and responses. ACWADAM Report ACWA/ Hydro/201 9/H88. https://www.researchgate.net/publication/337869758_Comprehensive_report_on_Springs_in_the_Indian_Himalayan_Region

Tambe, S., Kharel, G., Arrawatia, M. L., Kulkarni, H., Mahamuni, K., & Ganeriwala, A. K. (2012). Reviving dying springs: Climate change adaptation experiments from the Sikkim Himalaya. Mountain Research and Development, 32(1), 62–72. https://doi.org/10.1659/MRD-JOURNAL-D-11-00079.1

Valdiya, K. S., & Bartarya, S. K. (1991). Hydrogeological Studies of Springs in the Catchment of the Gaula River, Kumaun Lesser Himalaya, India. Mountain Research and Development, 11(3), 239. https://doi.org/10.2307/3673618

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

Swiss Agency for Development and Cooperation
Embassy of Switzerland
New Delhi - 110 021
Website: www.eda.admin.ch/newdelhi

NITI Aayog

NITI AAYOG Sansad Marg,
New Delhi, 110001
Fax 91-11-23096764 & 23096779
EPABX 23096620
Reception Ext. 2001, 2002
Website: http://niti.gov.in

International Water Management Institute

CGIAR
IWMI is a CGIAR Research Center

International Water Management Institute
2nd Floor, CG Block C, NASC Complex,
DPS Marg, Pusa, Opp Todapur,
New Delhi 110 012, India
Telephone: +91 11 25840811, 25840812 and 25843536
Email: iwmi-delhi@cgiar.org
Website: www.iwmi.org