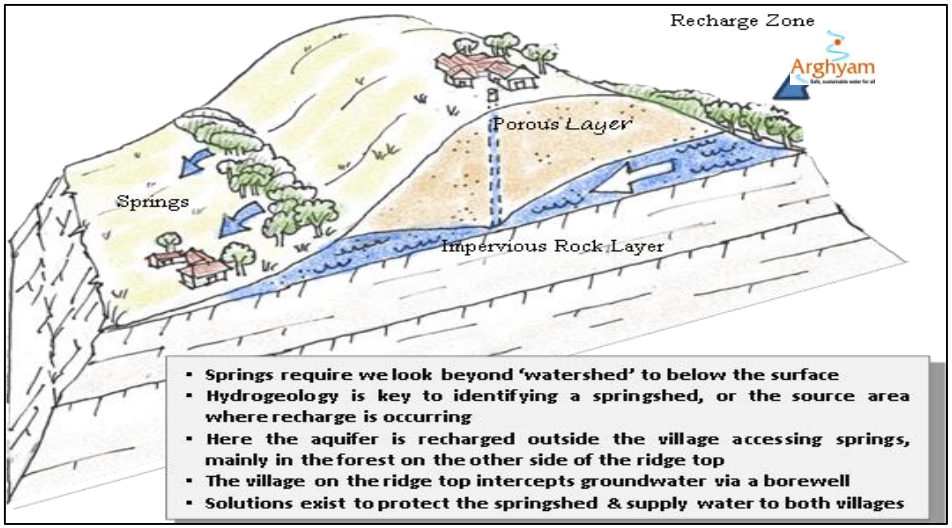
Understanding the Impacts from Springshed Development across the Himalayan Region

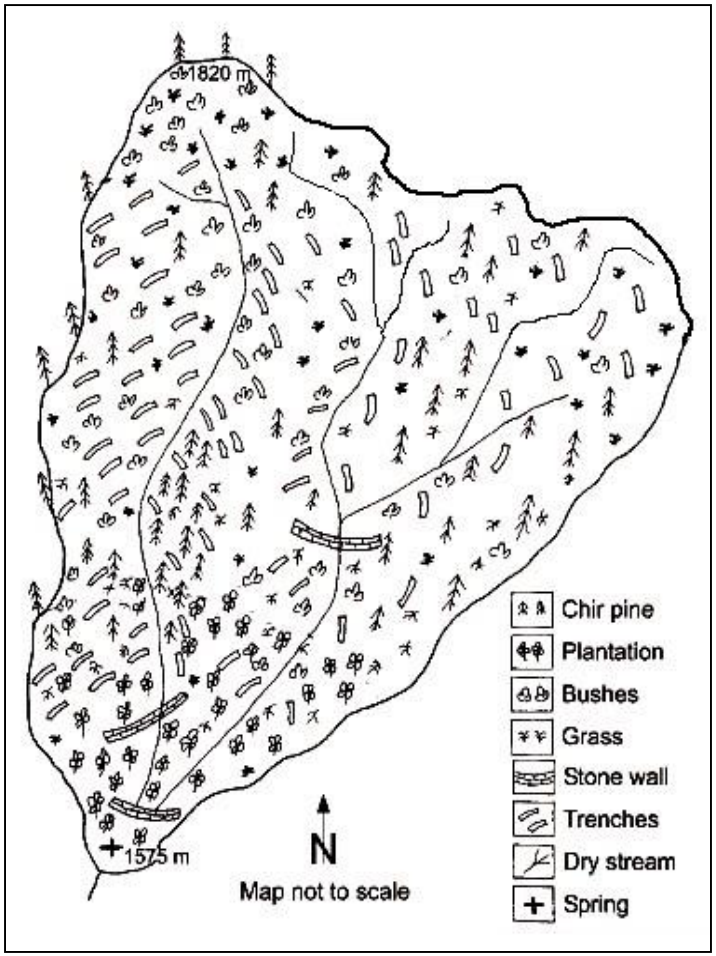
Debashish Sen, Rajesh Kumar and Anita Sharma
People's Science Institute, Dehradun

Springshed Development - Concept & Practices

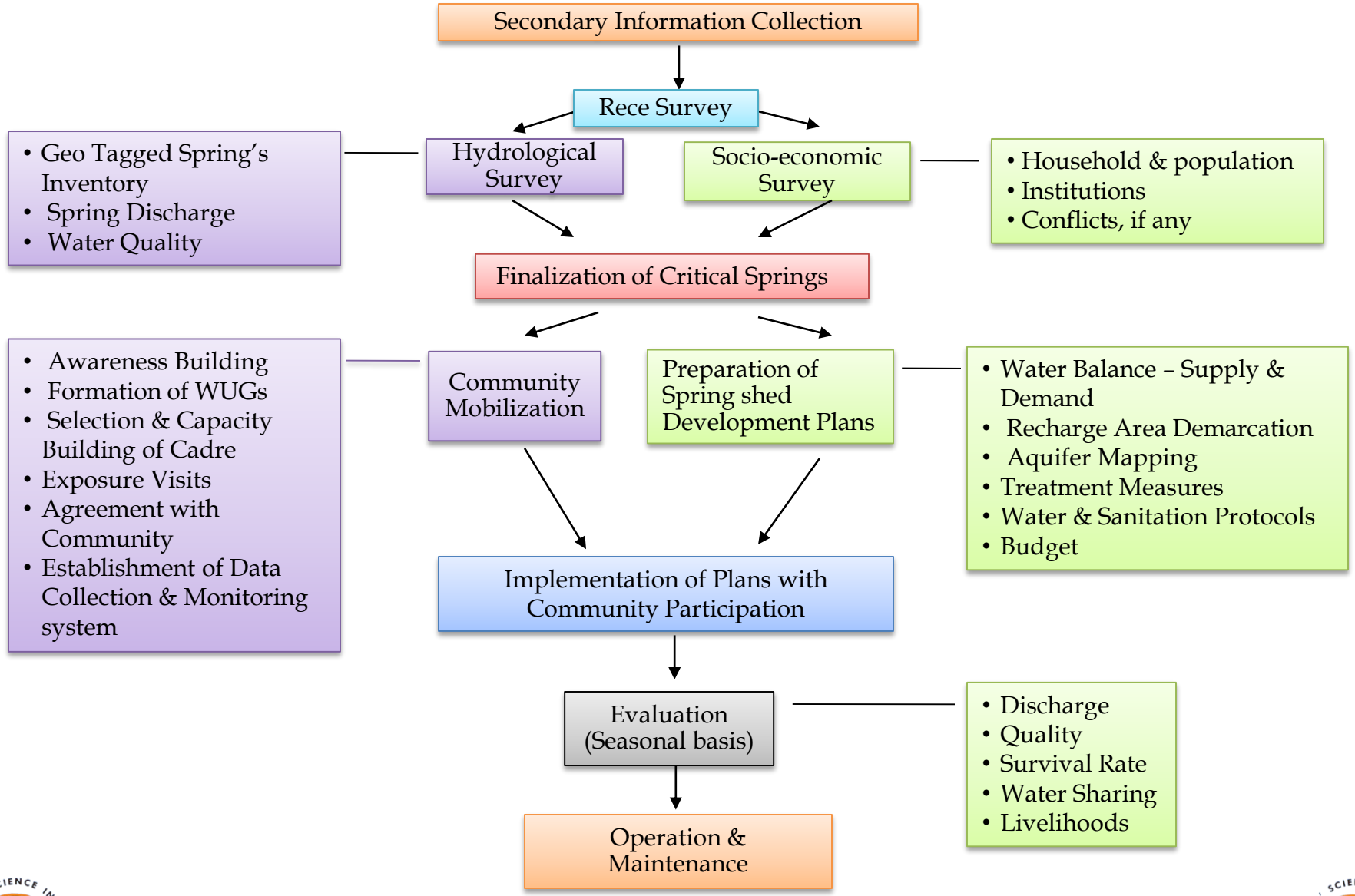
Regenerating underground seepage through engineering, vegetative and social measures like :

- Trenching (SCT and CCT)
- Small check dams/gully plugs
- Recharge pits
- Plantation of fuelwood, fodder, fruit trees and grass
- Social fencing



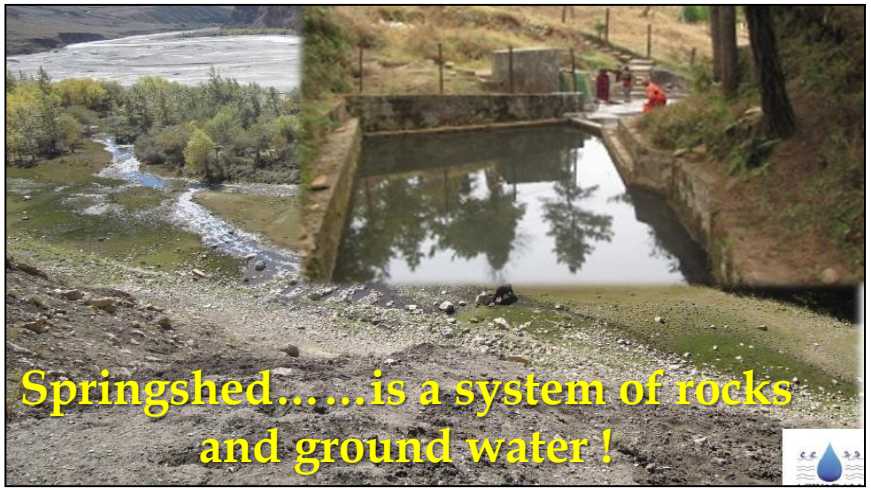


Steps for Springshed Development



Benefits of Springshed Development

- Reduced Peak Flow
- Increased Base Flow
- Reduced Lean Flow Period
- Household Water Security
- Higher Plant Survival Rate
- Increased biomass production
- Increased Fodder Availability
- Improved Water Quality
- Increased Life of Downstream Storage Structures



PSI's Major Springs' Rejuvenation Programs

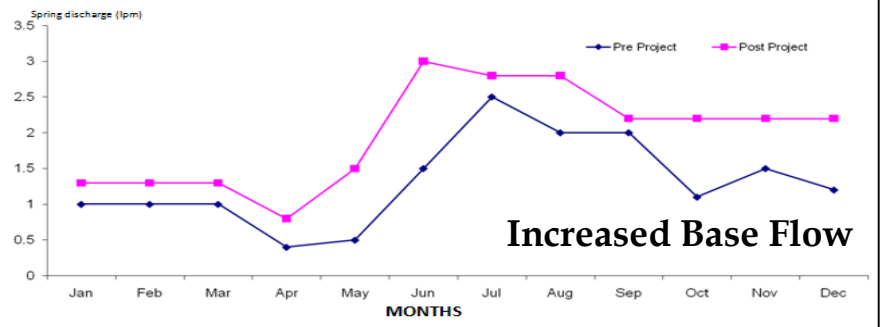
Year	Spring Rejuvenation Work
2002-2006	Uttarakhand and Himachal Pradesh - (18 springs) under Watershed Development Programs
2009-2011	South, West and East districts of Sikkim – (12 springs) through Rural Management and Development Department
2012-2016	Thanakasoga GP, district Sirmour, HP – (5 springs) under Arghyam's Participatory Ground Water Management (PGWM) Program
2016-2017	Pilots in 11 districts of Nagaland – (11 springs) with support of Land Resources Department (LRD), Nagaland
2017-2020	Community based springshed development in Uttarakhand – 50 springs in five districts of Uttarakhand, through BAL
	Inventorization of 300 springs in Uttarakhand, Nagaland and Arunachal Pradesh along with revival of springs on watershed basis (in partnership with LRD Nagaland, IIT-Roorkee, WWF-India & Arghyam) under National Mission on Himalayan Studies (NMHS) supported by MoEF & CC.

I. Revival Of Springs Creating Water Sanctuaries In Uttarakhand & Himachal Pradesh (2002-06)

S. No.	State	Area Treated (Ha)	Water Storage Capacity Created (KL)	Soil Retained (Tons)
1.	Uttarakhand –6 watersheds	416	5,647	318
2.	Himachal Pradesh –5 watersheds	301	10,867	573
	TOTAL	**717**	**16,514**	**891**

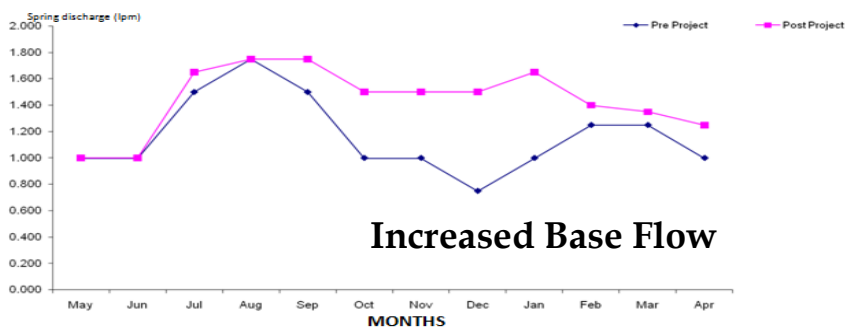
Impacts of Springshed Development Works

Impact on Spring Flow
(a) Maakri Bawri, Bilaspur (HP)

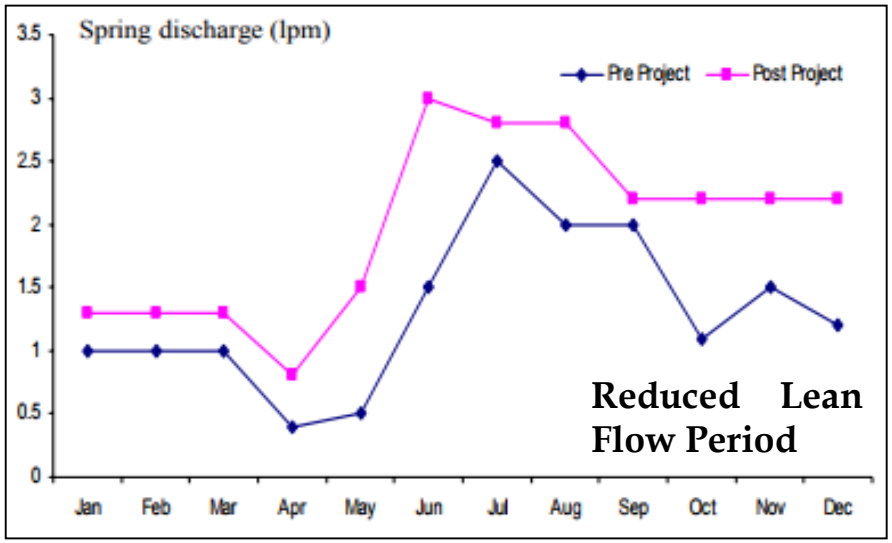


0.9 ha of staggered trenches and 1,000 plants (*Bauhinia* and *Acacia*)

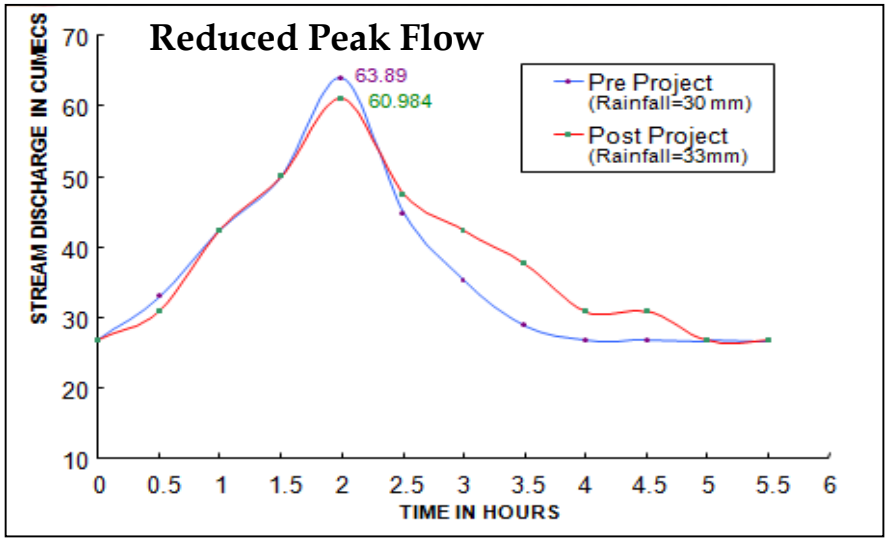
Impact on Spring Flow
(b) Basantu Dhara, Tehri Garhwal (UKD)



2 community ponds and 6,000 plants (*Quercus*, *Bauhinia*, *Morus* and *Grewia*).
Treated area 4.5 ha



Impact in the Silh Nala watershed in Bilaspur district, Himachal Pradesh

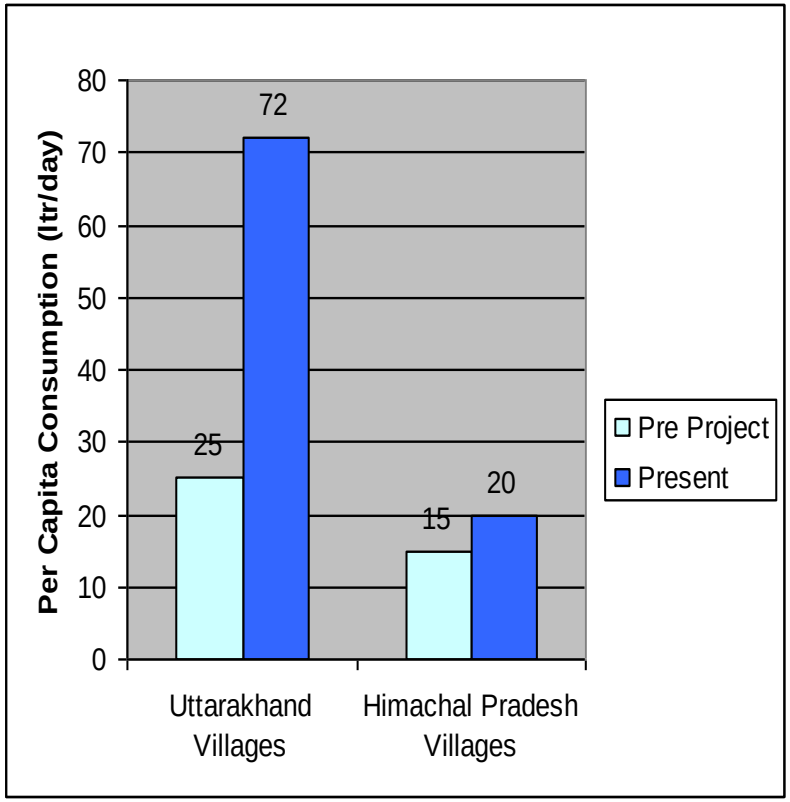


Impact on Stream Discharge (Flood Hydrograph of Bhanaj Gad), Kangra District, HP

Outcomes of Springshed Development Works

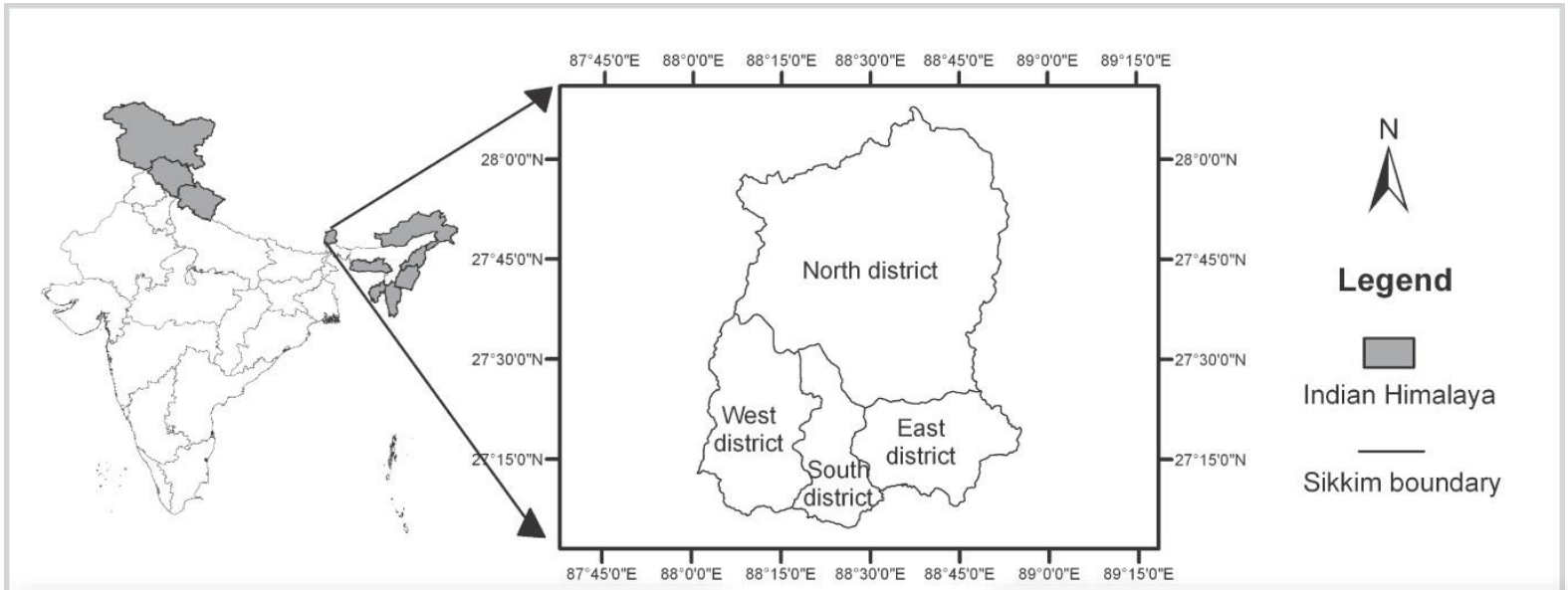
The springshed development activities led to

- Generation of water storage capacity of 16,514 KL leading to GW recharge
- Retaining 891 T of top soil annually from recharge areas of concerned springs
- Increase in spring discharges (see figures overleaf).
- Reduced lean flow period and increased base flows
- Increased per capita water availability for 436 households of 18 villages
- Increased fodder availability



PSI was invited by Sikkim Government to demonstrate similar pilots in Sikkim

II. Sikkim Dhara Vikas Program



Program Approach

Developing a cadre of in-house trained para-hydro-goelogists in coordination with NGO partners. Simultaneously, climate change related vulnerability assessment of the villages was conducted

Resource mapping and preparation of village spring atlas conducted. In the process, recharge areas of various springs and streams were identified based on local geohydrology

Laying of contour trenches and preparing for rainwater harvesting of various lakes and springs.

Source: Rural Management and Development Department, Government of Sikkim, and OneWorld Foundation India, 2014

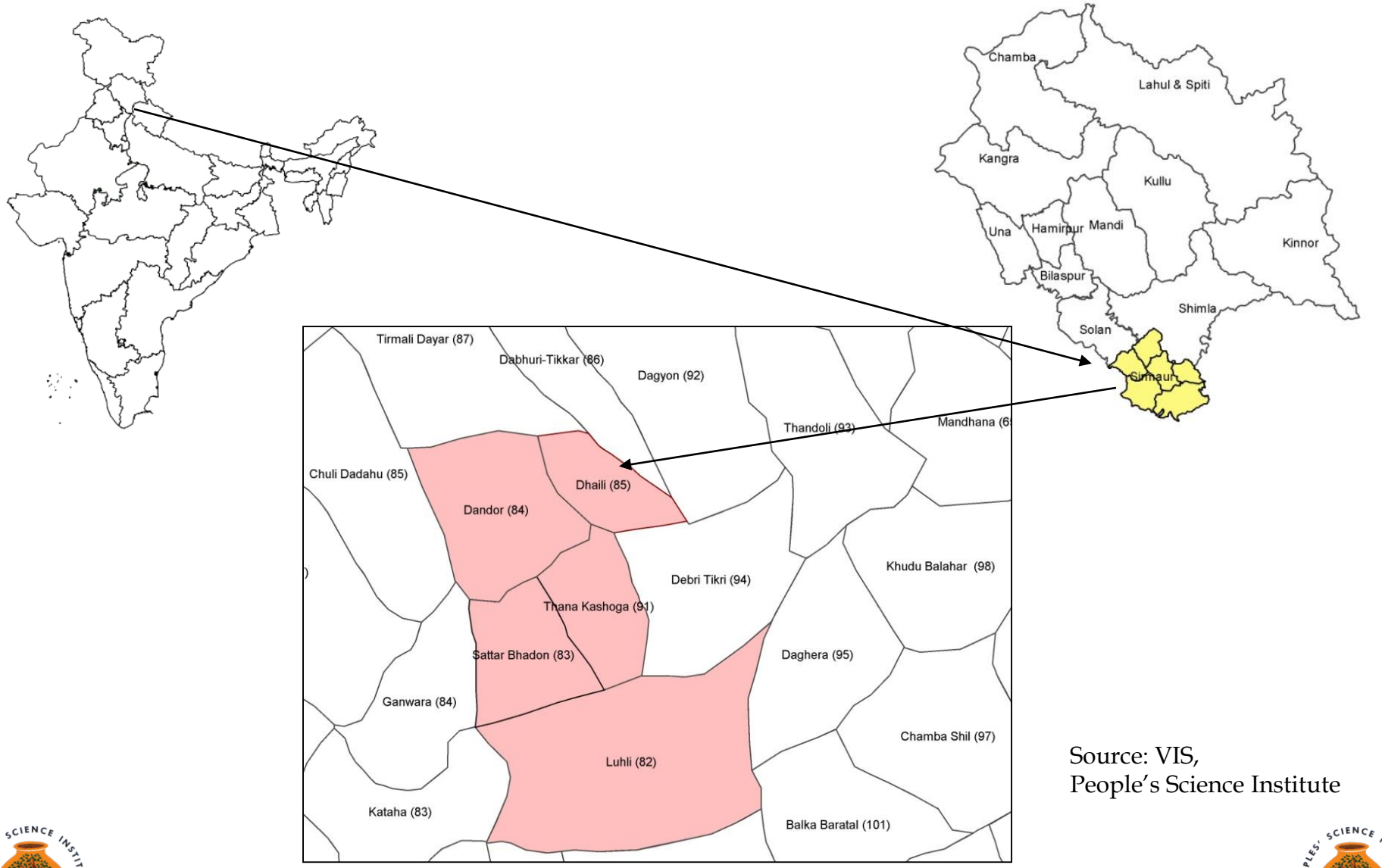
Technical support provided by PSI, ACWADAM, Arghyam, and WWF-India and other State Government Departments

Impacts of Dhara Vikas Program

Name of spring	Discharge in March 2010	Discharge in March 2011
Malagiri Dhara, Lungchok Kamarey GPU, Sumbuk	7.5 lpm	15 lpm (2 times)
Aitbarey Dhara, Deythang GPU, Kaluk	2 lpm	6 lpm (3 times)
Dokung Dhara, Takuthang GPU, Kaluk	8 lpm	30 lpm (3.5 times)
Nunthaley Dhara, Deythang GPU, Kaluk	2 lpm	10 lpm (5 times)
Kharkharey Dhara, Deythang GPU, Kaluk	1 lpm	5 lpm (5 times)
Chukudum Dhara, Kewzing Bakhim GPU, Ravangla	45 lpm	60 lpm (1.3 times)

- Springshed development work was taken up as a state programme called *Dhara Vikas* by the Sikkim Government
- Creation of resource inventory of springs for the state
- Preparation of village springs atlas (700 springs)
- Cadre of trained para hydrogeologists
- Revival of 50 springs and 5 lakes.
- 900 million litres of annual ground water recharge
- Improving domestic water availability and enhanced farm productivities

III. Thanakasoga GP, District Sirmour, H.P



Source: VIS,
People's Science Institute

Highlights of PGWM in Thanakasoga

Profile

Households - 156

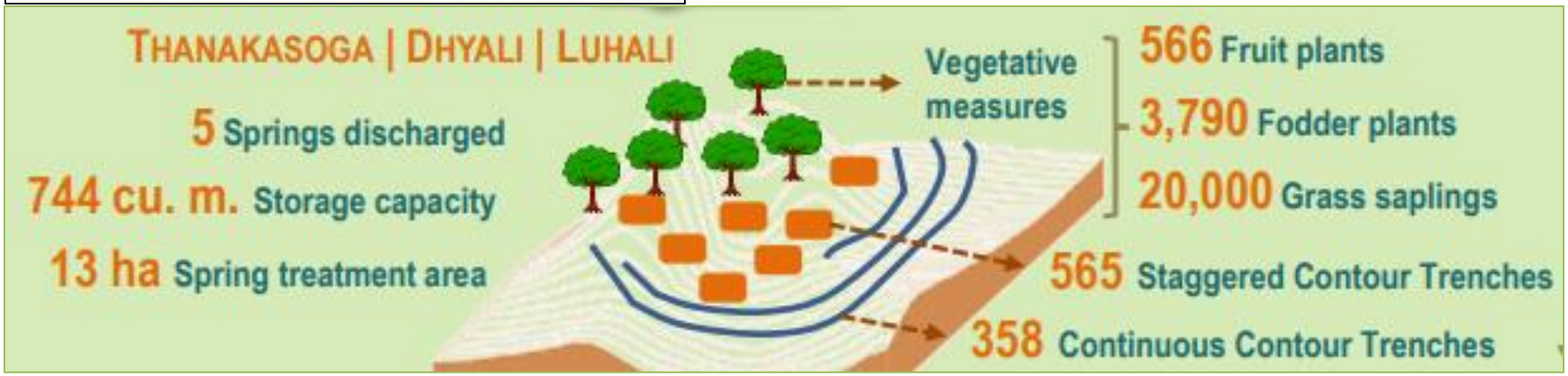
Population - 1024 Avg.

Annual Rainfall - 1206 mm

Critical Issues

- Fluctuations in rainfall
- High water scarcity
- Lack of irrigation
- Reduced crop yields
- Reduced fodder & water for livestock
- Economical loss

Major SSD Activities



Community Mobilization

Village Meetings

Interactions with School Children

Nukkad Nataks for Awareness

Formation of Water User Group

Springs Profile: Thanakasoga

Springs	Thana-1	Thana-2	Dhyali-1	Dhyali-2	Luhali-3
Co-ordinates	N 30 35'12.1" E077 24'30.7"	N 30 35'00.8" E077 24'36.0"	N 30 35'06.3" E077 24'52.0"	N 30 35'04.3" E077 25'10.4"	N 30 35'30.9" E077 23'18.0"
Lithology (Rock Type)	Highly weathered Ferruginous Phyllite and Quartzite	Weathered ferruginous Phyllite weathered	Weathered Phyllite	Phyllite	Quartzite
Spring Typology	Fracture and Depression	Fracture and Depression	Depression	Fracture	Fracture
Seasonality	Seasonal	Seasonal	Perennial	Perennial	Perennial
Usage	Drinking and Domestic	Drinking and Domestic	Drinking and Domestic	Drinking and Domestic	Drinking and Domestic
Recharge area (Ha)	2.5 ha	2 ha	3 ha	2 ha	3 ha

Capacity Building Activities

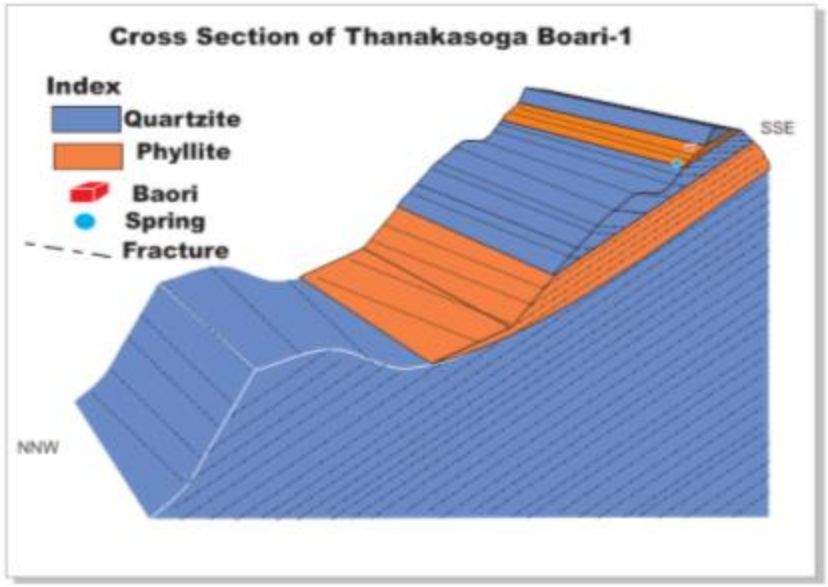
Training of Water User Groups

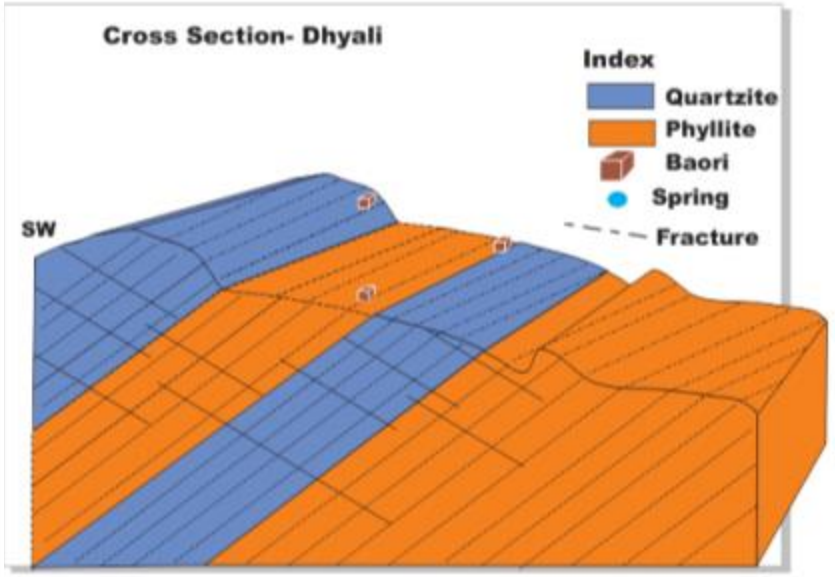
Field Exposure

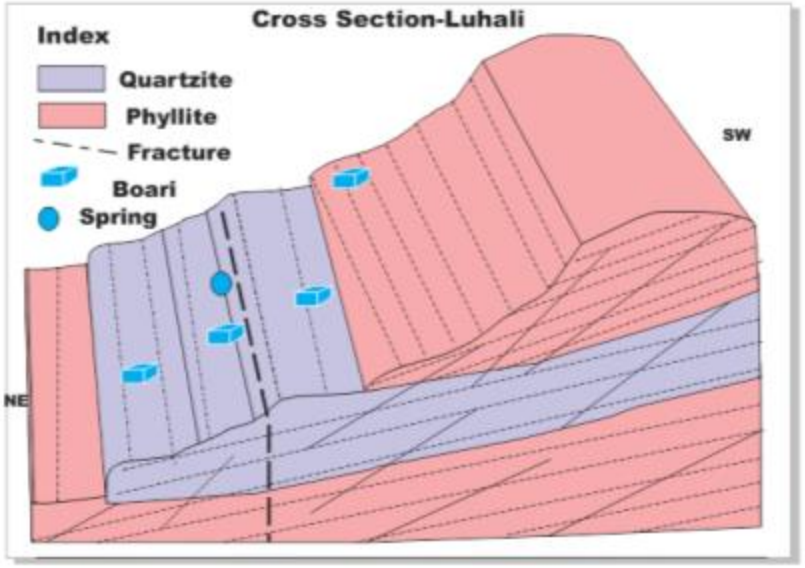
Training on Water Quality

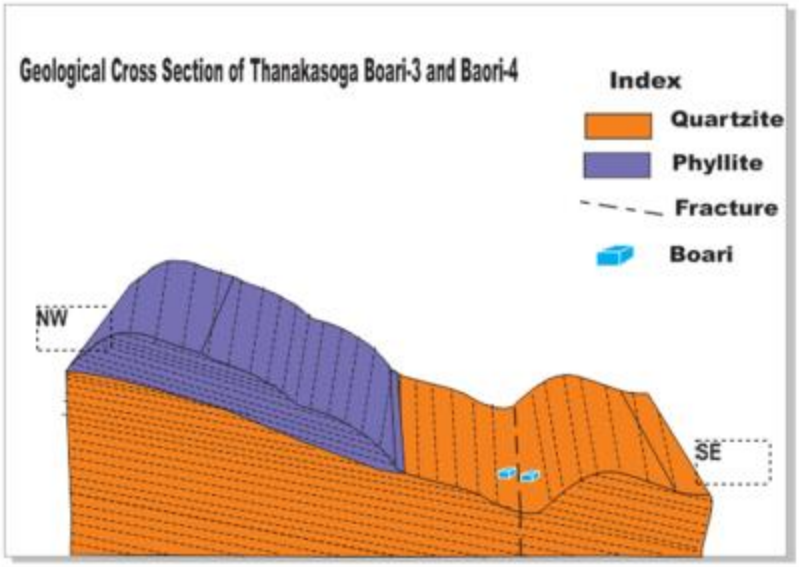
Training on Layout of Trenches

Hyrogeological Mapping of Springs







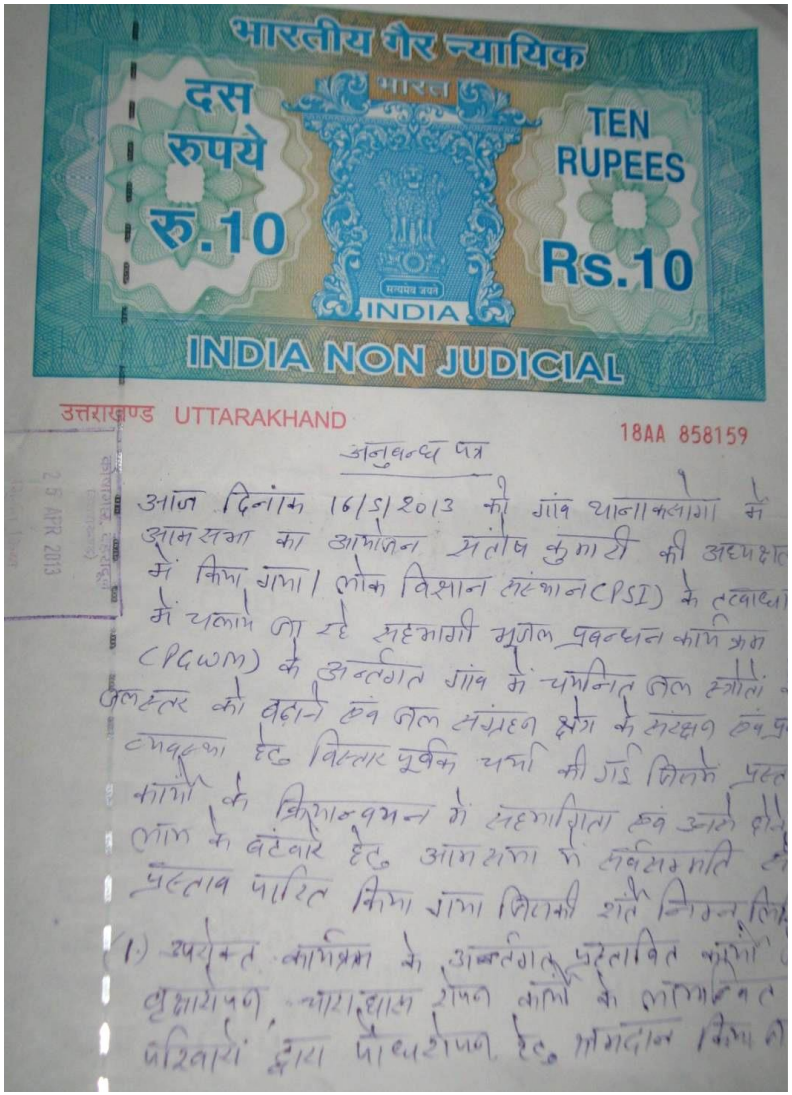


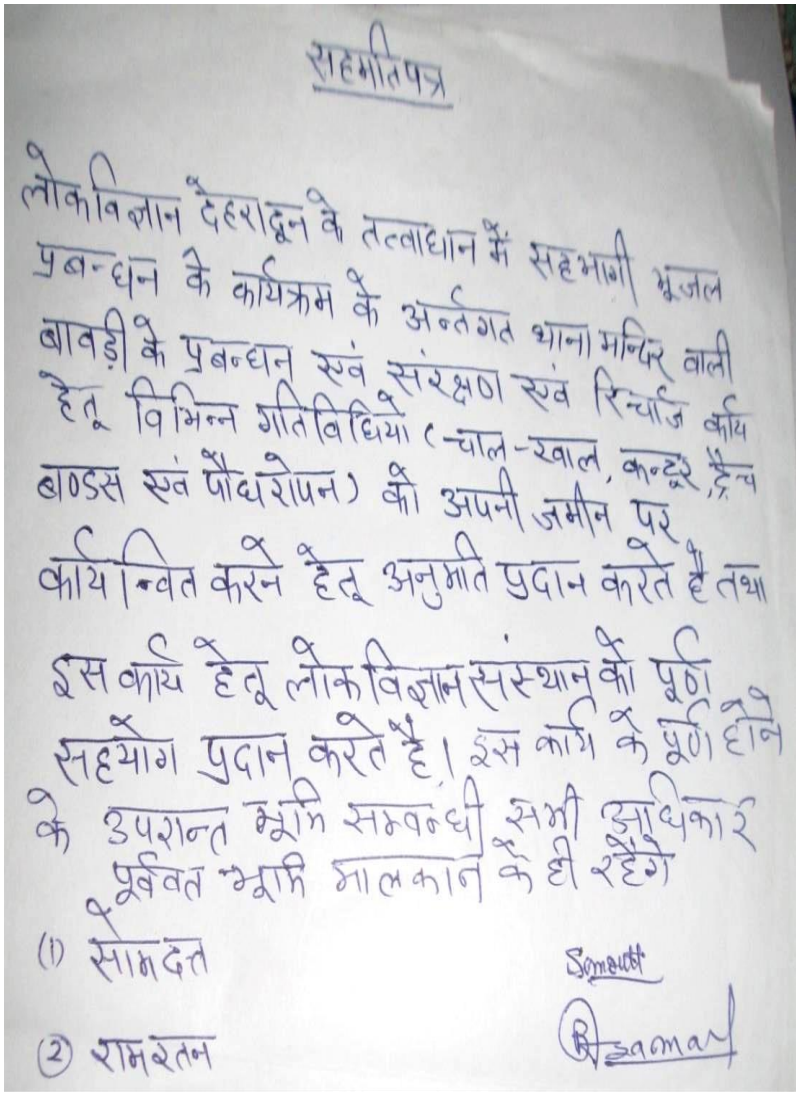
Components of Springshed Development Plans

S. No.	Site	Treated Area (ha)	Number of Staggered Contour Trenches	Number of Continuous Contour Trenches	Storage Capacity Created (volume in cubic meters)	No. of fruit plants	No. of fodder plants	No. of grass saplings
1	Thana-1	2.3	144	106	190	148	900	4000
2	Thana-2	2.5	129	45	151	105	800	4000
3	Dhayali-1	3	112	-	120	98	830	4000
4	Dhayali-2	2.7	75	-	86	80	560	4000
5	Luhali-3	2.5	105	207	197	135	700	4000
Total		**13**	**565**	**358**	**744**	**566**	**3790**	**20000**

Total cost of recharge area treatment activities: Rs.12,25,452 ~ 2.5 lakhs per spring

Springs Protocols





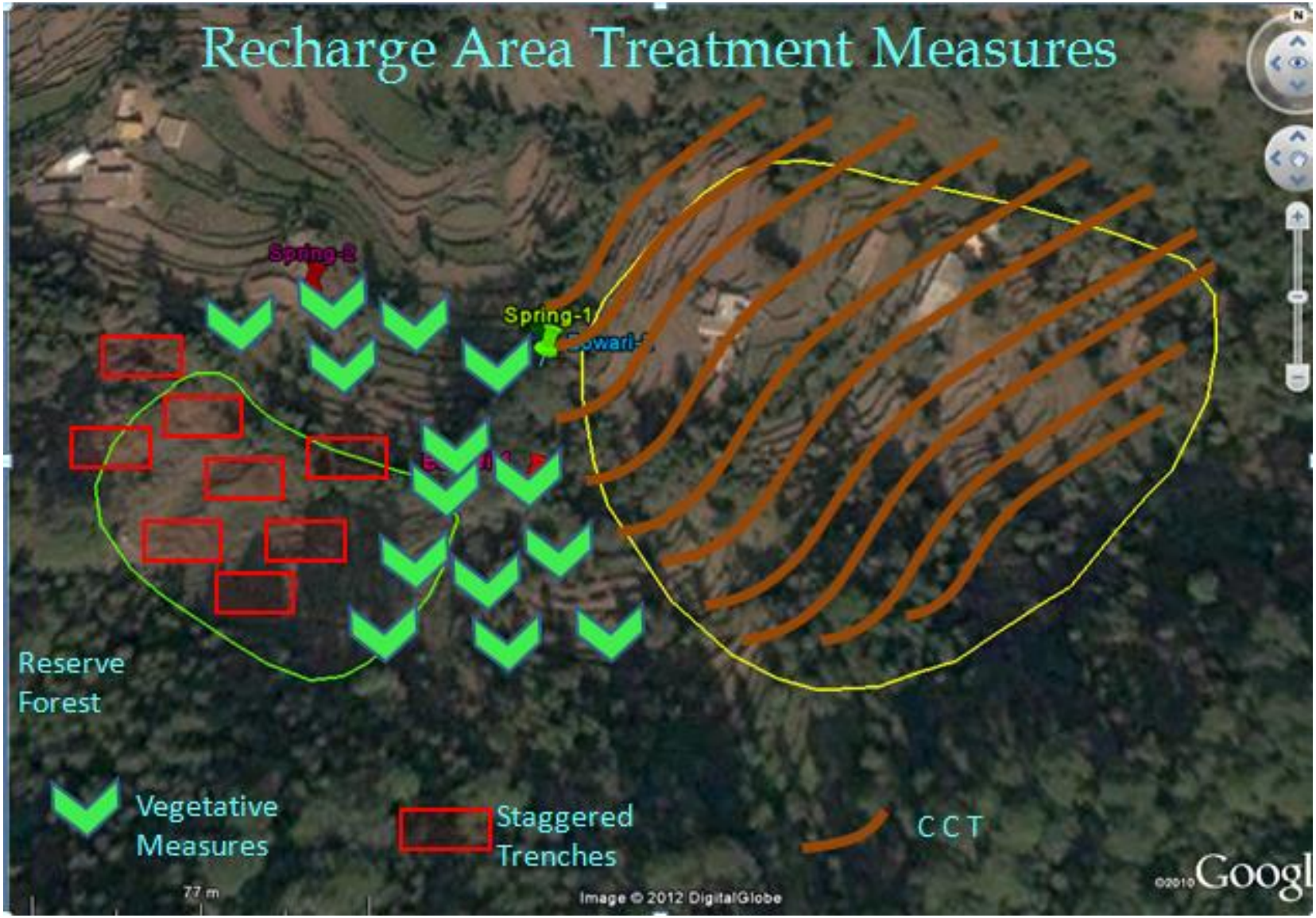
Implementation of Recharge Area Treatment Plans

Establishment of Nurseries

Laying out of Trenches

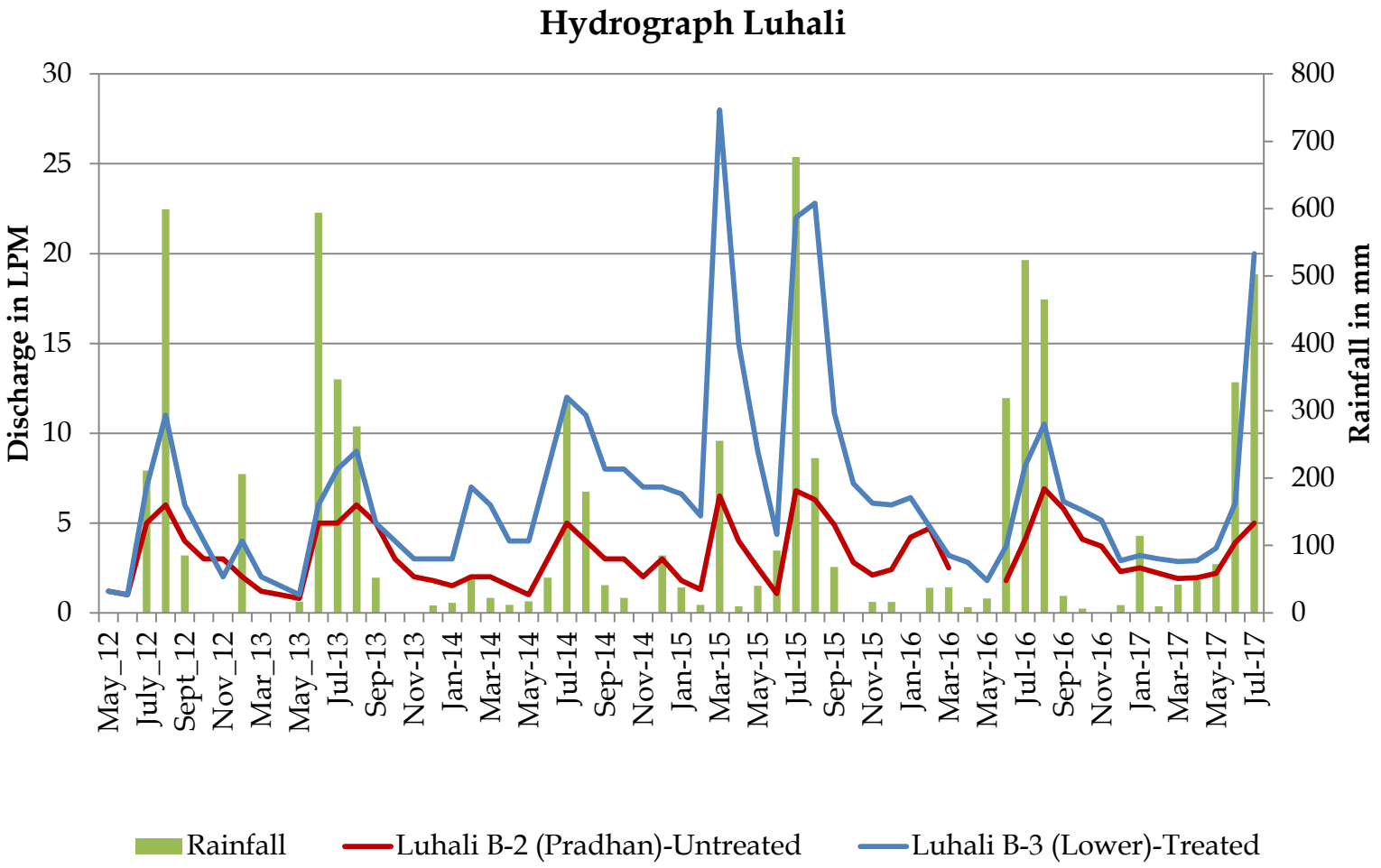
Dug out SCTs and CCTs

Plantation in Recharge Area


Recharge Area Treatment Measures
Spring-2
Spring-1
Reserve
Forest
Vegetative
Measures
Staggered
Trenches
C C T
77 m
Image © 2012 DigitalGlobe
©2010 Google

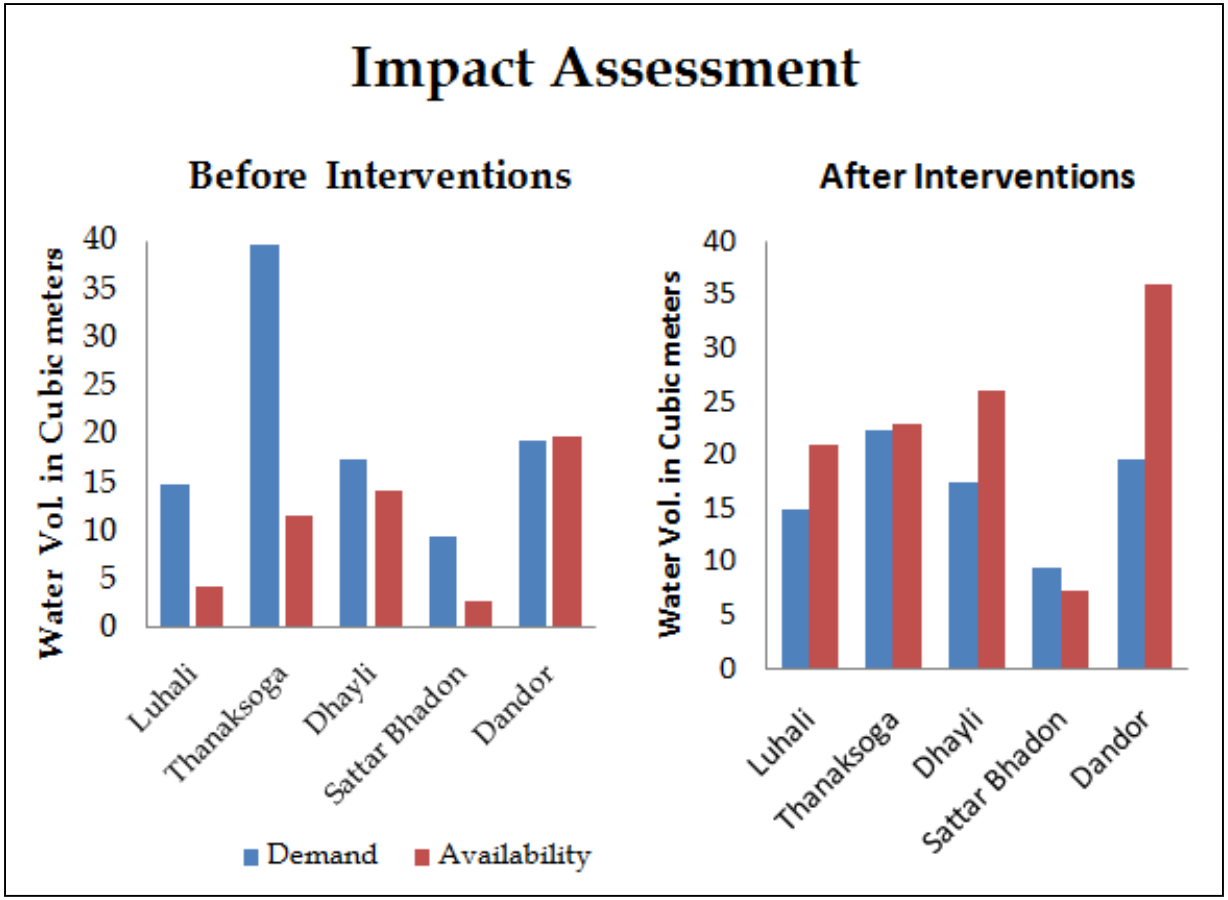
Increased Spring Discharge

Impact on Spring Discharge: The Case of Luhali

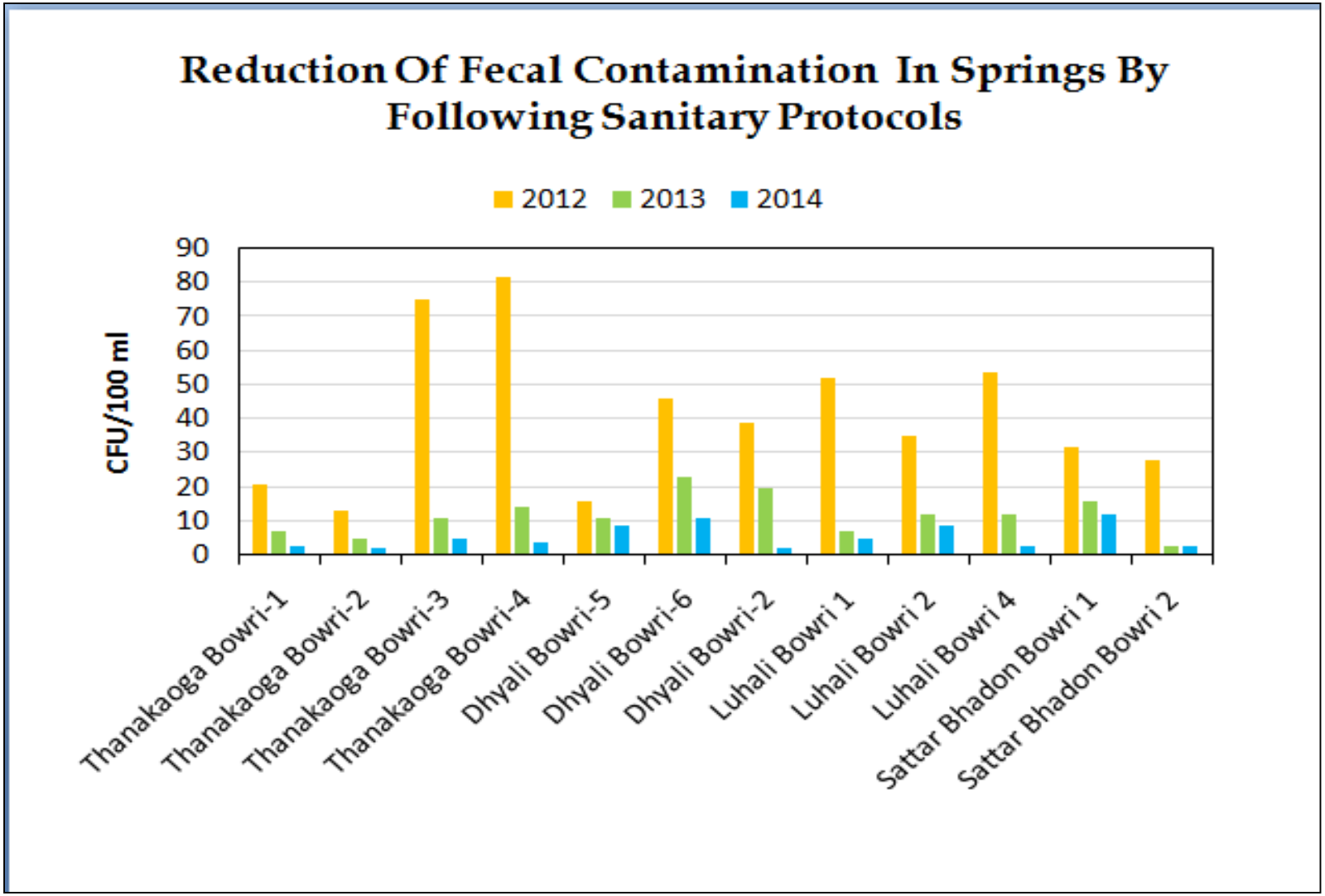


Increase In Water Availability

Availability of water before and after interventions

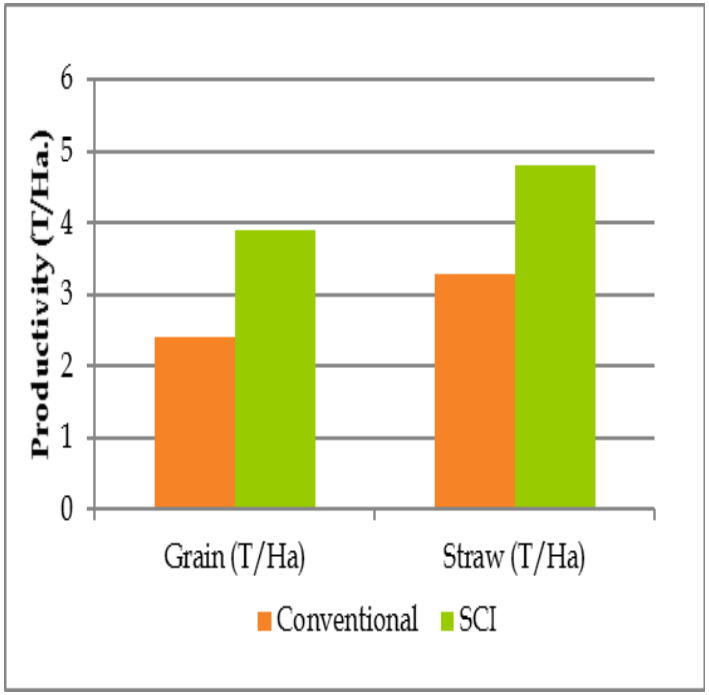


Reduced Bacteriological Contamination in Spring Water



Improvement in Irrigation Based Livelihoods

- With SWI technique, the average productivity of wheat went up from 2.42 tons/ha to 3.9 tons/ha for grains
- The straw yield increased from 3.3 ton/ha to 4.8 ton/ha.
- Introducing SCI for grains, vegetables and spices helped farmers (58 out of 152 households in 3 villages) earn additional income.



Success achieved in Thanakasoga helped PSI to establish new collaborations in North-Eastern states, particularly in Nagaland, Meghalaya, and Mizoram for springshed development programs.

Outcomes of Thanakasoga

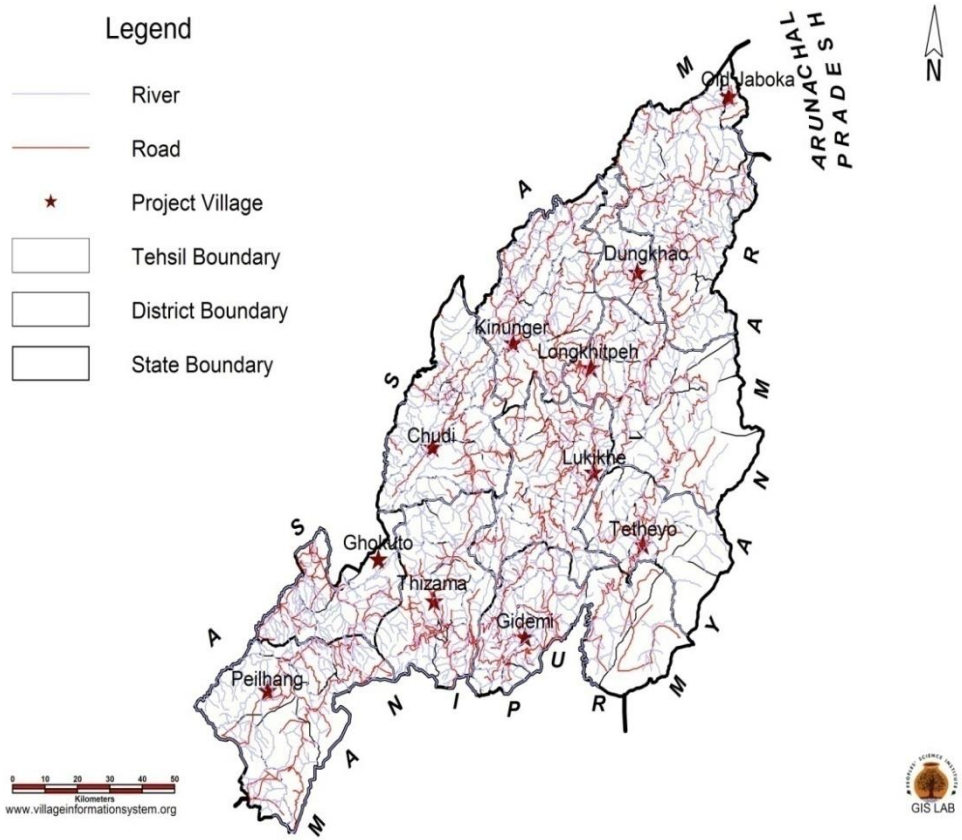
- Increased spring discharge (up to 3-5 times in 1.5 years depending upon the spring hydrogeology) leading to enhanced per capita water availability
- Community access to water extended to drier months (extension of 2 to 4 months in a year)
- Reduction in drudgery of women. They have to travel less distances to collect water which save their time for doing more productive work.
- Increase in biomass availability form vegetative measures in the recharge area leading to enhanced fodder availability.
- Treatment activities in recharge area of Thana-1 baori increased flow in the Sattarbhadon *gadera*.
- Availability of safe drinking water (reduction in contamination by 80 - 100 %) through sanitary protocols leading to reduced health risks
- Strengthened village level institutions for managing water in a sustainable and equitable manner.
- Enhanced spring discharge enabled increased water availability for irrigation leading to introduction of SCI techniques yielding more grain.
- New collaborations in North-Eastern states, particularly in Nagaland, Meghalaya, and Mizoram for spring shed development programs.

Community's involvement helps managing groundwater (springs) as a common pool resource

IV. Participatory Springshed Development in 11 District of Nagaland

Objectives

- Regeneration of 11 springs (1 spring each in 11 districts)
- Involvement of local communities especially women in planning and recharge works, maintaining and sharing of water sources
- Strengthening of VLIs for conflict management and O & M
- Knowledge dissemination and communication to ensure sustainability of the programme.



List of Selected Villages

S. No.	District	Block	Village	Total no. of Households	No. of beneficiaries
1	Zunheboto	Tokiye	*Lukikhe*	86	86
2	Wokha	Sanis	*Chudi*	108	35
3	Tuensang	Chare	*Longkhitpeh*	87	87
4	Phek	Pfutsero	*Gidemi*	62	20
5	Peren	Athibung	*Peilhang*	113	60
6	Mon	Tizit	*Old Jaboka*	52	15
7	Mokokchung	Ongpankong South	*Kinunger*	66	40
8	Longleng	Longleng	*Dungkhao*	71	45
9	Kohima	Chiephobozhu	*Thizama*	127	207
10	Kiphire	Longmatar	*Tethuyo*	96	72
11	Dimapur	Nuiland	*Ghokuto*	52	40
Total				920	707

Nagaland: Selected Springs

Amungru kikhi, Puensang district

Khotnu, Mon district

Johjung Jong, Longleng district

Sebtsu Psudu, Mok district

Methodology

Class Room Training

Field Training

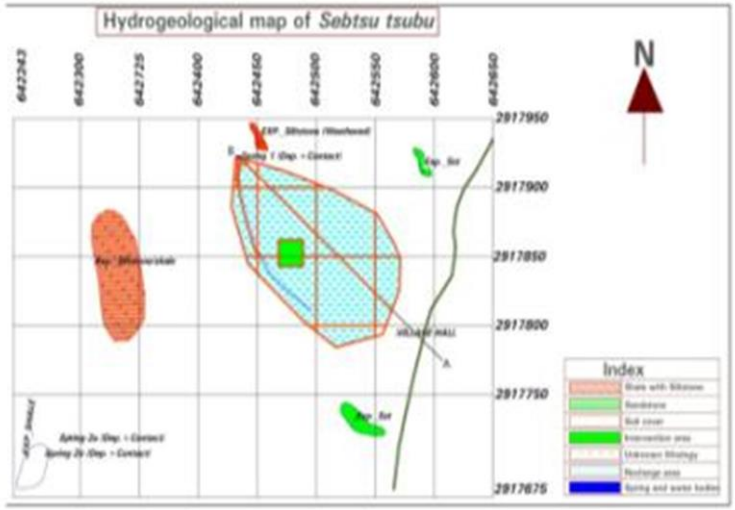
Transect Walk of the Village

Interaction with Communities

Major Activities

Creation of Spring Inventory

Geological Mapping of Exposed Area



Hydrogeological Map of Spring

Specific Recharge Area (hectare)	0.75
Size of Trenches (m)	2 X 0.6 X 0.45 (40-50% slope)
No. of Trenches	52
Vertical interval (contour)	8-10 m
Proposed Area of grass on bund	720 sq.m.
Proposed no. of saplings	200

Springshed Treatment Activities

Major Activities Contd……

Capacity Building Spring WUG

Layout of Treatment Activities

Dugout Trenches

Monitoring of Discharge & Water Quality

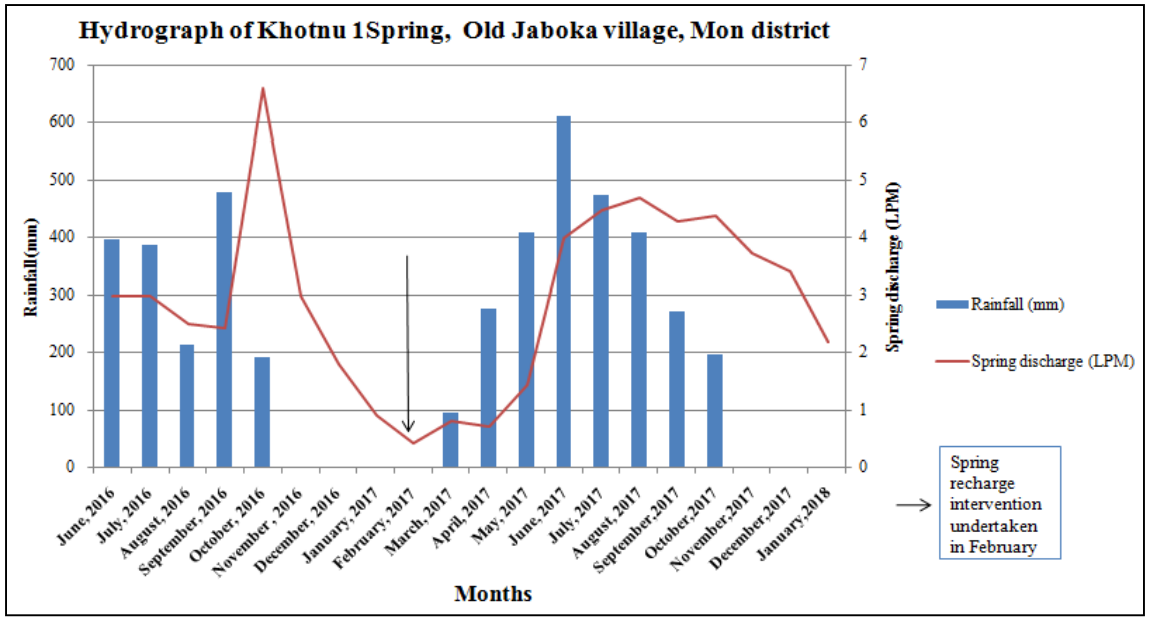
Springshed Treatment Measures

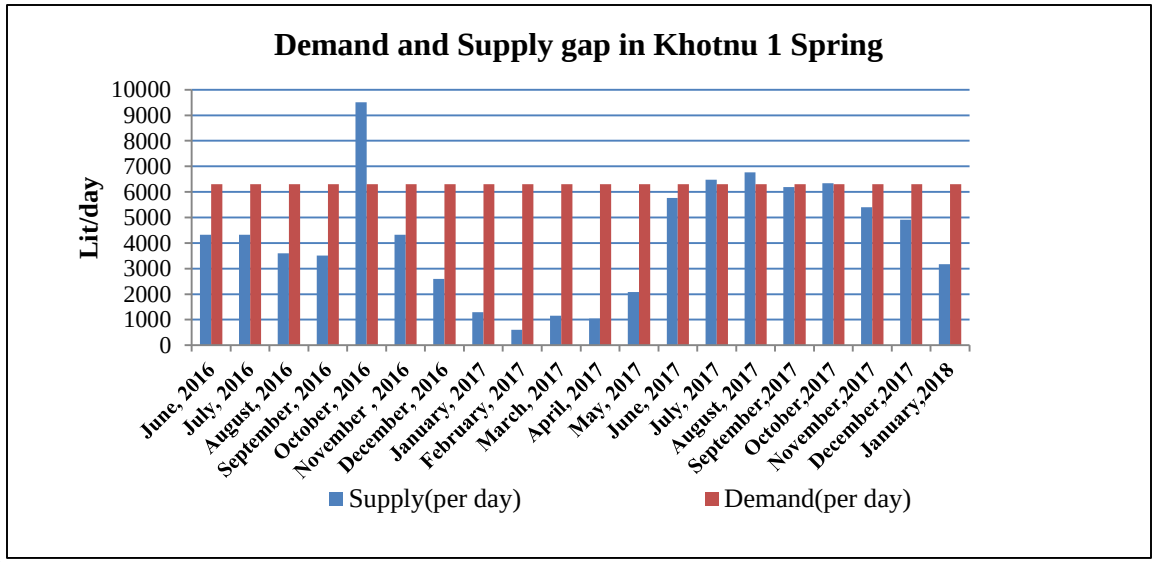
District	Zunheboto	Wokha	Tuensang	Phek	Peren	Mon
Village	Lukikhe	Chudi	Longkhitpeh	Gidemi	Pielhang	Old Jaboka
Spring Name	Kili Ghoki	Ratchu	Amungru Khikha	Ruzaru	Canaan	Khoatnu
Spring type	Depression	Depression	Depression & Contact	Fracture & Contact	Depression	Fracture & Contact
Seasonality	Perennial	Perennial	Perennial	Perennial	Perennial	Perennial
Specific Recharge area (hectares)	0.9	0.6	0.6	0.9	0.9	0.9
Size of Trenches (SCT)	2 X 0.6 X 0.45 (40-50% slope)	2 × 0.45 × 0.45 (30-50% slope)	2 × 0.45 × 0.45 (30-50% slope)	2 × 0.45 × 0.45 (30-40% slope)	`2 × 0.6 × 45 (30-50% slope)	2 X 0.6 X 0.45 (40-50% slope)
No. of trenches	200	60	35	160	150	4
Vertical interval (contour)	8-10 m	8-10 m	8-10 m	8-10 m	8-10 m	8-10 m
Proposed no. of Saplings/tree plantation	700	55	270	600	-	-

Springshed Treatment Measures (contd..)

District	Mokokchung	Longleng	Kohima	Kiphire	Dimapur
Village	Kinunger	Dungkhao	Thizama	Tethuyo	Ghokuto
Spring Name	Sebtsu tsubu	Johjong yung	Peso Dzukhou	Aseriite	Aphu Ghoki
Spring type	Depression & Contact	Depression	Depression & Contact	Fracture & Contact	Fracture & Contact
Seasonality	Perennial	Seasonal	Perennial	Perennial	Perennial
Specific Rcharge area (hectares)	0.6	0.9	0.6	0.9	0.9
Size of Trenches (SCT)	2 × 0.45 × 0.45 (30-50% slope)	2.5 × 0.6 × 0.6 (20-30% slope), 2 × 0.6 × 0.45 (30-40% slope), 2 × 0.45 × 0.45 (40-50% slope)	2 × 0.45 × 0.45 (30-50% slope)	2 × 0.45 × 0.45 (30-40% slope)	`2 × 0.6 × 45 (30-50% slope)
No. of trenches	60	120	35	160	150
Vertical interval (contour)	8-10 m	5-12 m	8-10 m	8-10 m	8-10 m
Proposed no. of saplings/tree plantation	200	120	100	400	-

Impact: Case of Khotnu 1 Spring, Old Jakoba Village





Increased Spring Discharge

Reduced Peak Flow

Increased Base Flow

Reduced Lean Period

Increased Water Availability

Additional Outputs:

Inventory of 11 springs

Cadre of trained personnel

Strong Village Level Institutions

Model being upscaled

Impacts of Springshed Development

Environmental Impact:
- Soil and water conservation and increased biomass production.
- Communities better informed about hydrogeology leading to more rational GW use.
- Sanitation protocol reduce bacterial contamination of water and lead to better health.

Social Impact:
- Participatory approach enhances unity and local governance in selected communities
- Sustainable and Equitable use of water
- Reduced health risks due to waterborne diseases

Economic Impact:
- Increased flows and extension of availability of water further into the drier seasons.
- Opportunity to cultivate more crops which may increase income of the people.
- Improved water and biomass availability for domestic use and livelihoods (irrigation).

Technological Impact:
- Availability of data in the form of springs discharge, groundwater quality and the correlation of rainfall as well as aquifer mapping will have a larger pedagogical impact.
- Documentation of sci. database useful for planning springshed dev. in other areas.

Development of Resilience to Climate Change

Impacts: Indicators & Means of Verification

Desirable Impacts	Indicators	Means of Verification
• Reduced Peak Flow • Increased Base Flow • Reduced Lean Flow Period	• Spring Discharge	• Rainfall Measurement • Discharge Measurement
• Improved Water Quality	• Fecal Coliform	• Water Quality Testing
• Increased Household Water Security	• Per Capita Water Consumption	• Household Survey
• Improved Fodder Availability	• Plant Survival Rate • Biomass Production • Milk Production	• Biomass Survey • Household Survey
• Soil Conservation	• Soil Erosion	• Downstream Silt Load
• Improved Livelihoods	• Enhanced Income • Reduced Drudgery • Water Borne Diseases	• Household Survey

Participatory Impact Assessment of Springshed Dev.

Measuring Rainfall

Discharge Measurement

Water Quality Monitoring

Sharing and Decision Making

Stakeholders Involvement especially Local Communities in Monitoring the Impacts leads to Ownership & Sustainability

PSI

Thank You

Web : www.peoplesscienceinstitute.org
Mail : psiddoon@gmail.com
Phone : +91 135 2763649
Fax : +91 135 2763368

653, Indira Nagar
Dehra Doon - 248 006
Uttarakhand
INDIA