Dhara Vikas Initiative

Reviving Himalayan Springs

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Government of Sikkim

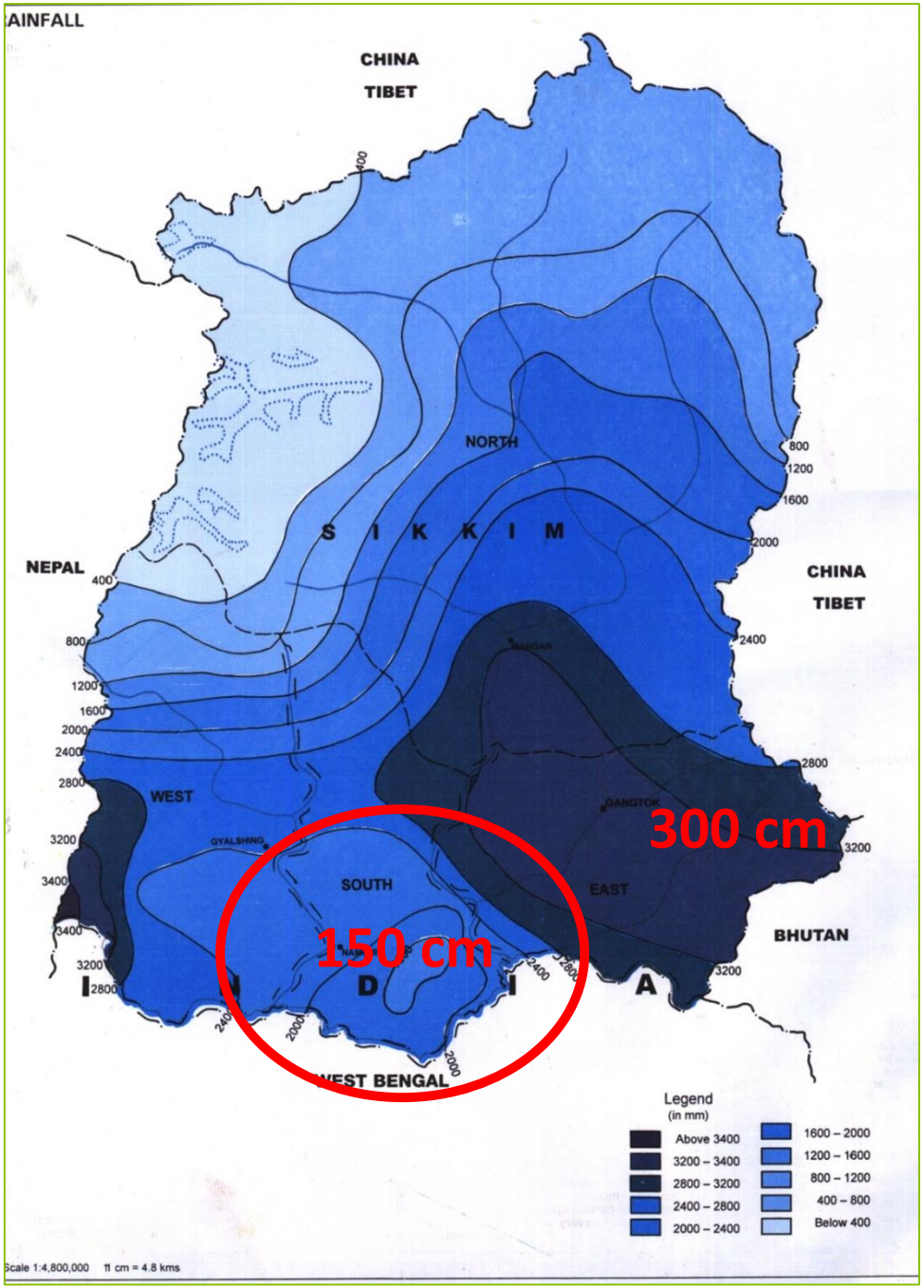
Research Questions

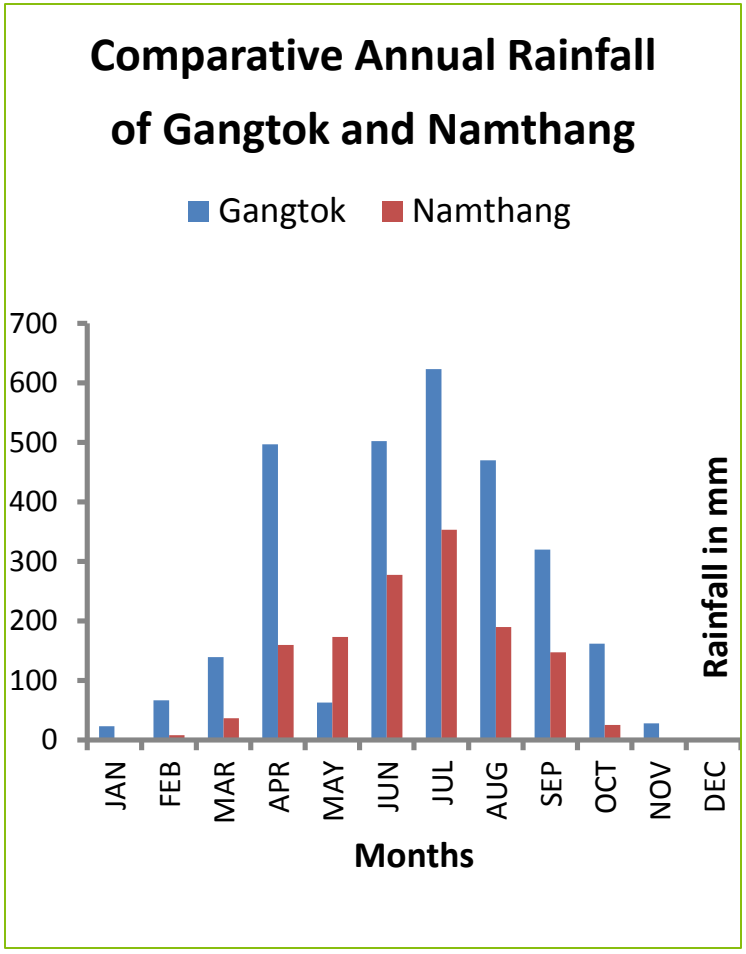
- Adaptive experiments in Sikkim
- Methodology adopted in the field
- Some success stories
- Challenges faced
- On going projects
- Partners who made possible

Research questions

- Can Himalayan springs be revived?
- Where is the recharge area?
- How much area will be needed, is land available?
- How much will the spring discharge increase?
- The discharge will increase in which season?
- How much investment will be needed?
- What is the expected benefit to the farmers?
- How do we attribute the impact to our initiative?
- Is this increase in discharge sustainable?

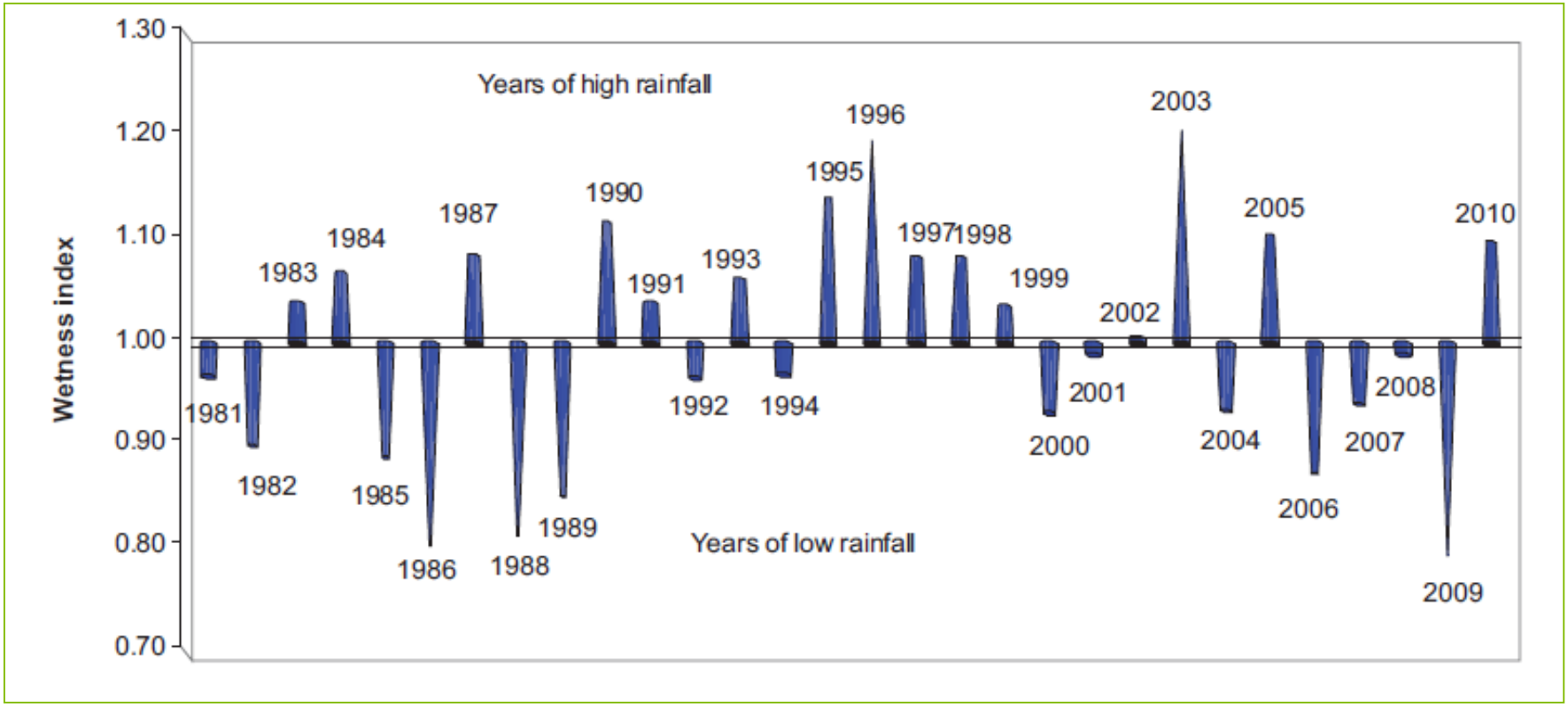
Rainfall variation





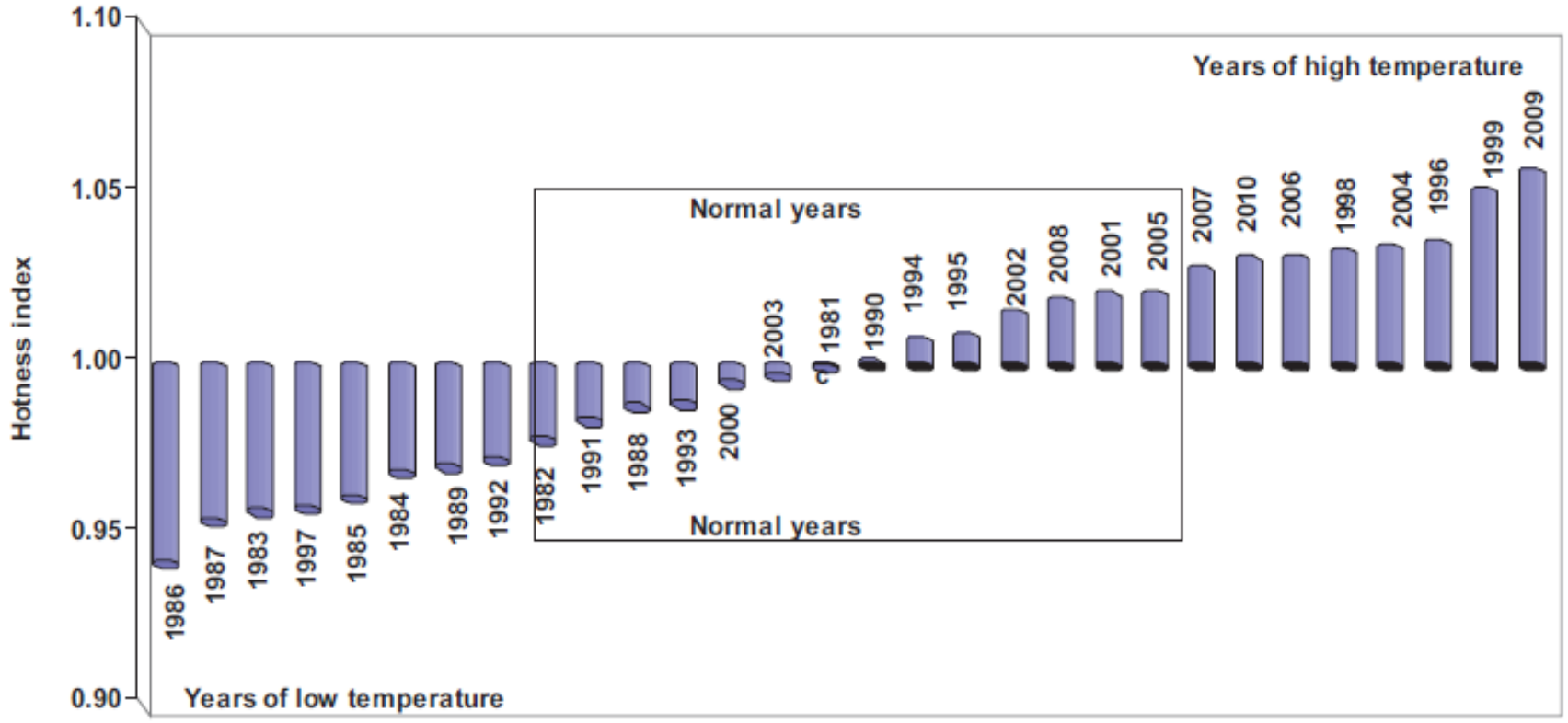
Decrease in number of rainy days

(H. Rahman et.al, 2012)



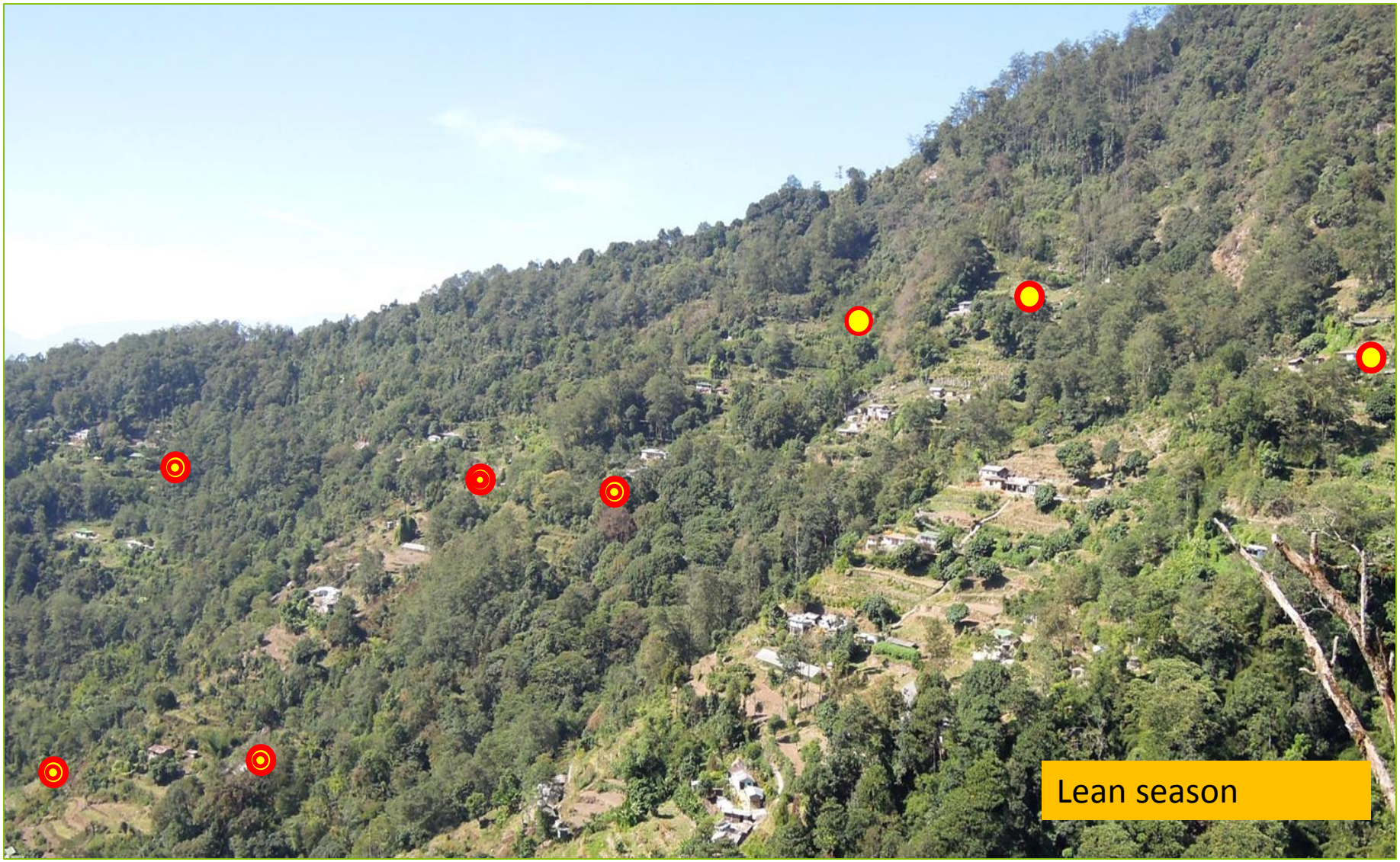
1991-2010 data for Tadong area shows that the total number of rainy days has come down by 72 days, total annual rainfall has decreased at the rate of 17.77 mm /Year

Increase in mean minimum temperature (H. Rahman. et .al,2012)



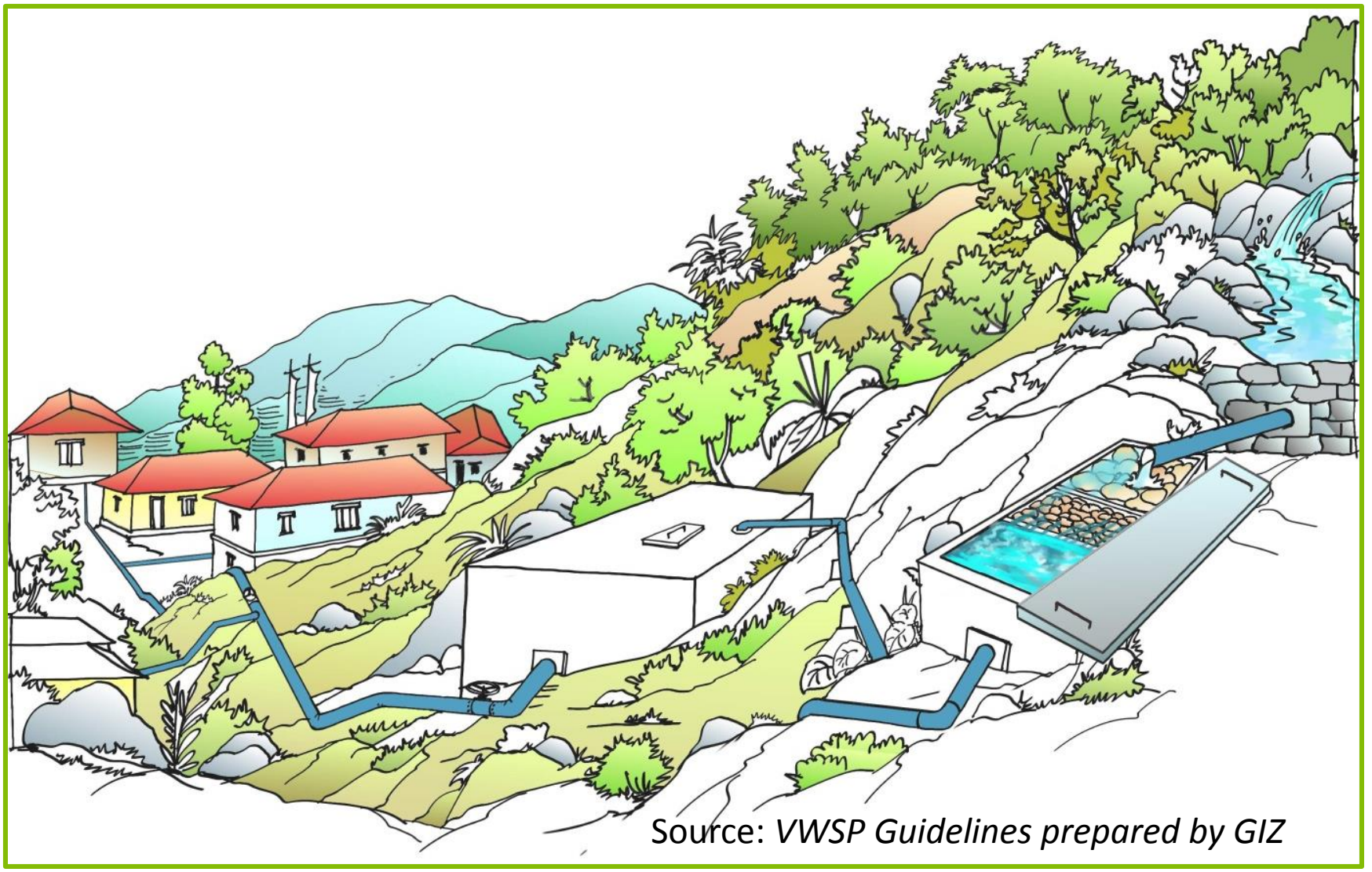
1991 to 2010 data for Tadong area shows increase in the mean minimum temperature by 0.80°C/Decade

The dynamic problem



Drying up of the springs

The existing water supply system became defunct



Source: *VWSP Guidelines prepared by GIZ*

Implication of drying springs

- Water scarcity during lean season were the most pressing needs in most of the village
- Women & children spent best part of their time fetching water for household need

- Mostly women and children carry water from downstream springs
- Agriculture and livestock suffered due to shortage of water

Provide us water, we will take care of agriculture and livestock

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Overview

Dhara Vikas Initiative in Sikkim

2008-2011:

- Conceptualized the programme
- Developed human resource
- Prepared spring atlas
- Better understanding of springs
- Vulnerability assessment of gram panchayats
- Initiated pilots focusing on individual springs

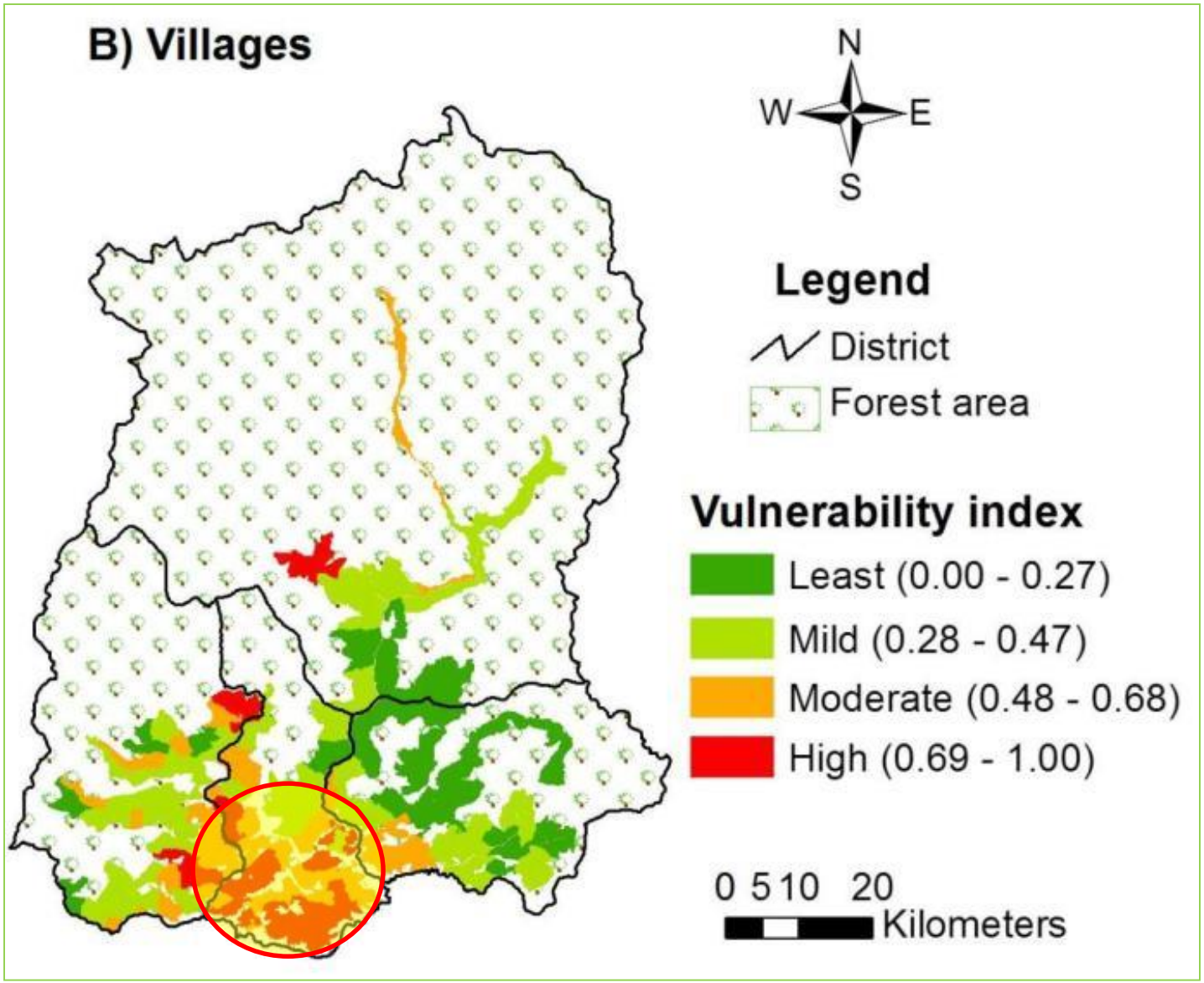
2012 onwards:

- Shifted from springshed to landscape projects
- Executed bigger projects
- Improved understanding
- Knowledge management and sharing
- BARC isotope fingerprinting study
- CDAC hydro-geologic modeling study

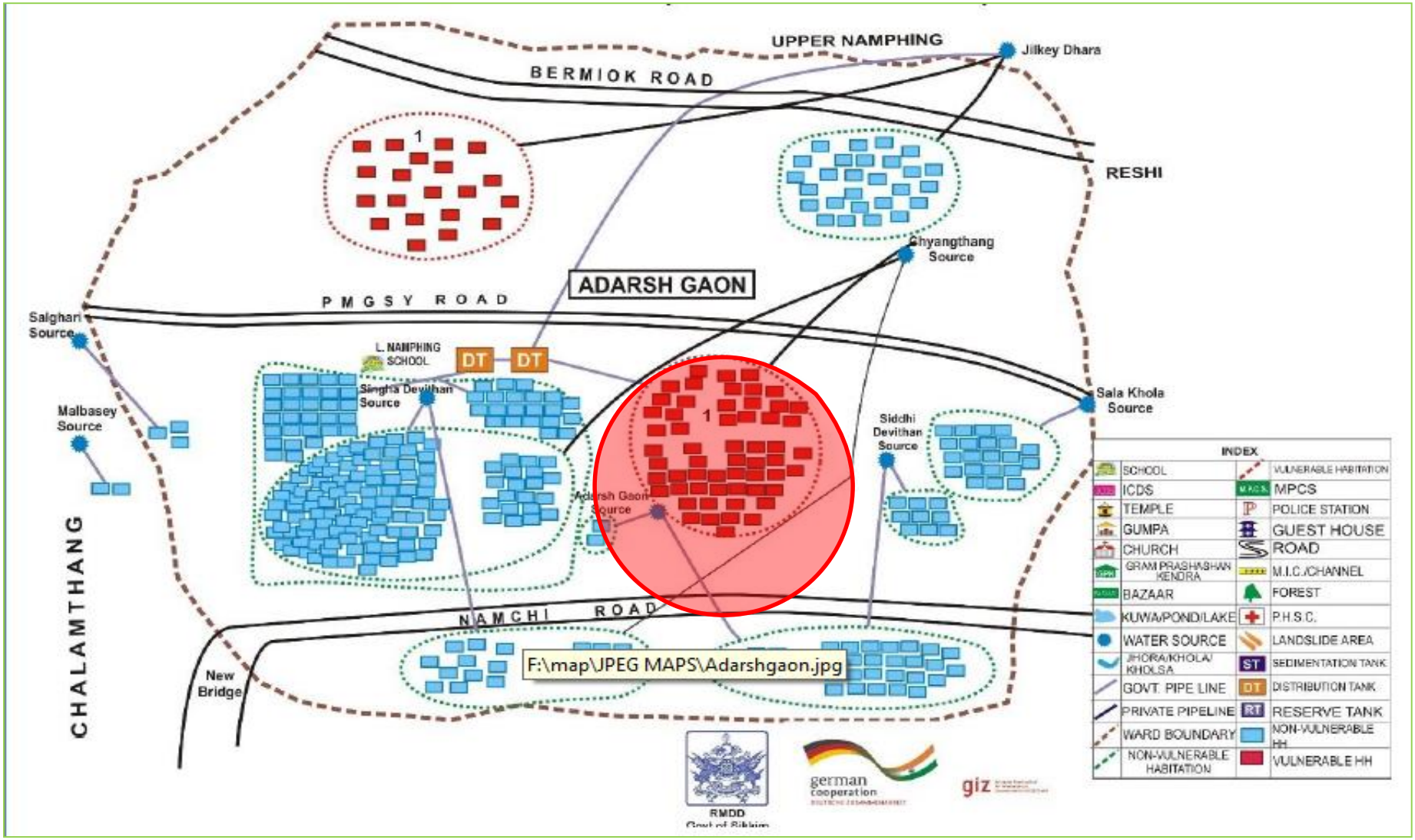
Develop local capacity

Para-hydro-geologists

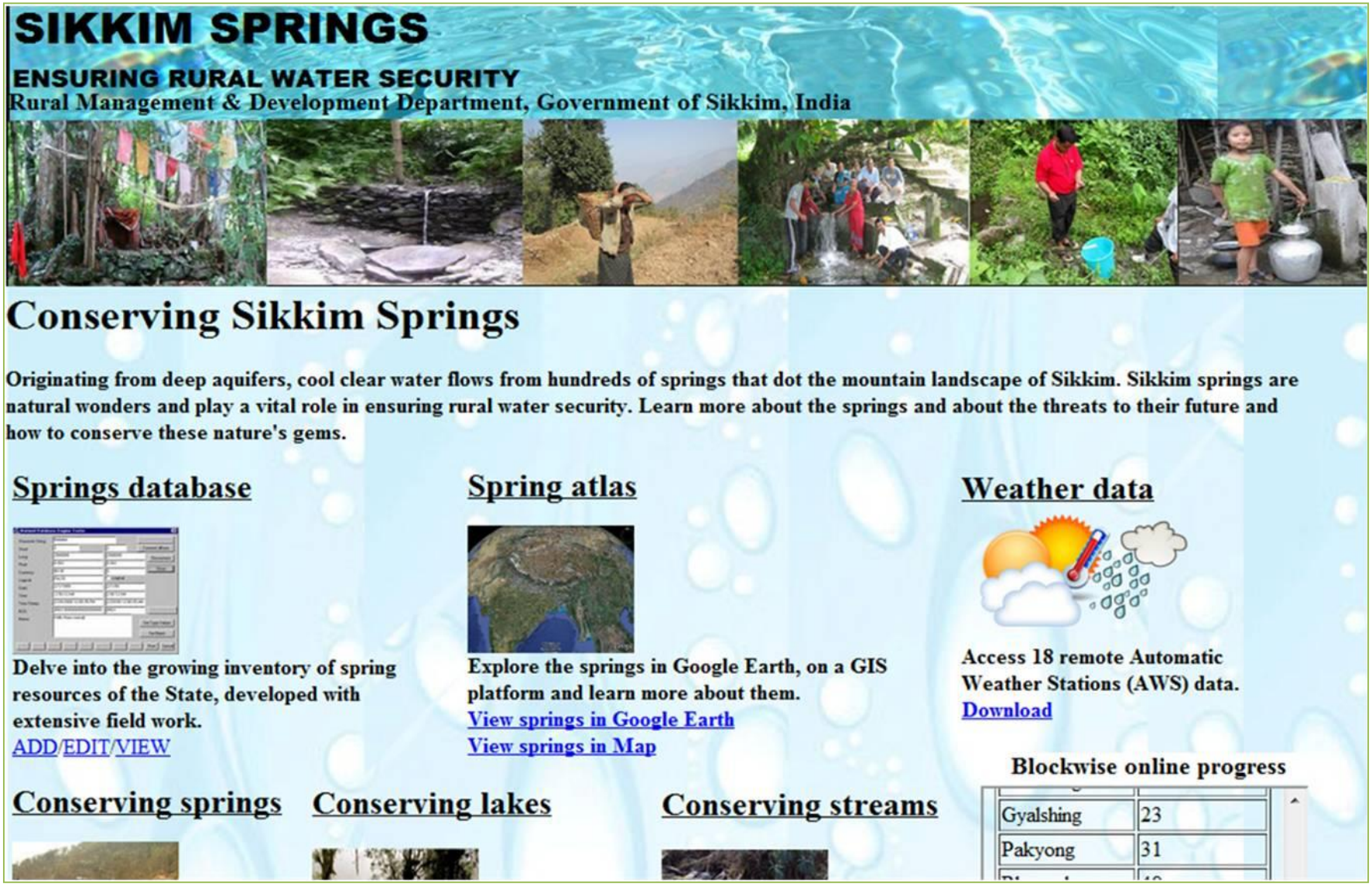
Identify vulnerable villages



Identify critical springs (VWSP)



www.sikkimsprings.org
Preparation of Village Spring Atlas



Get strong baselines of spring discharge and rainfall

Focus on source (springs)

Focus on resource (aquifer)

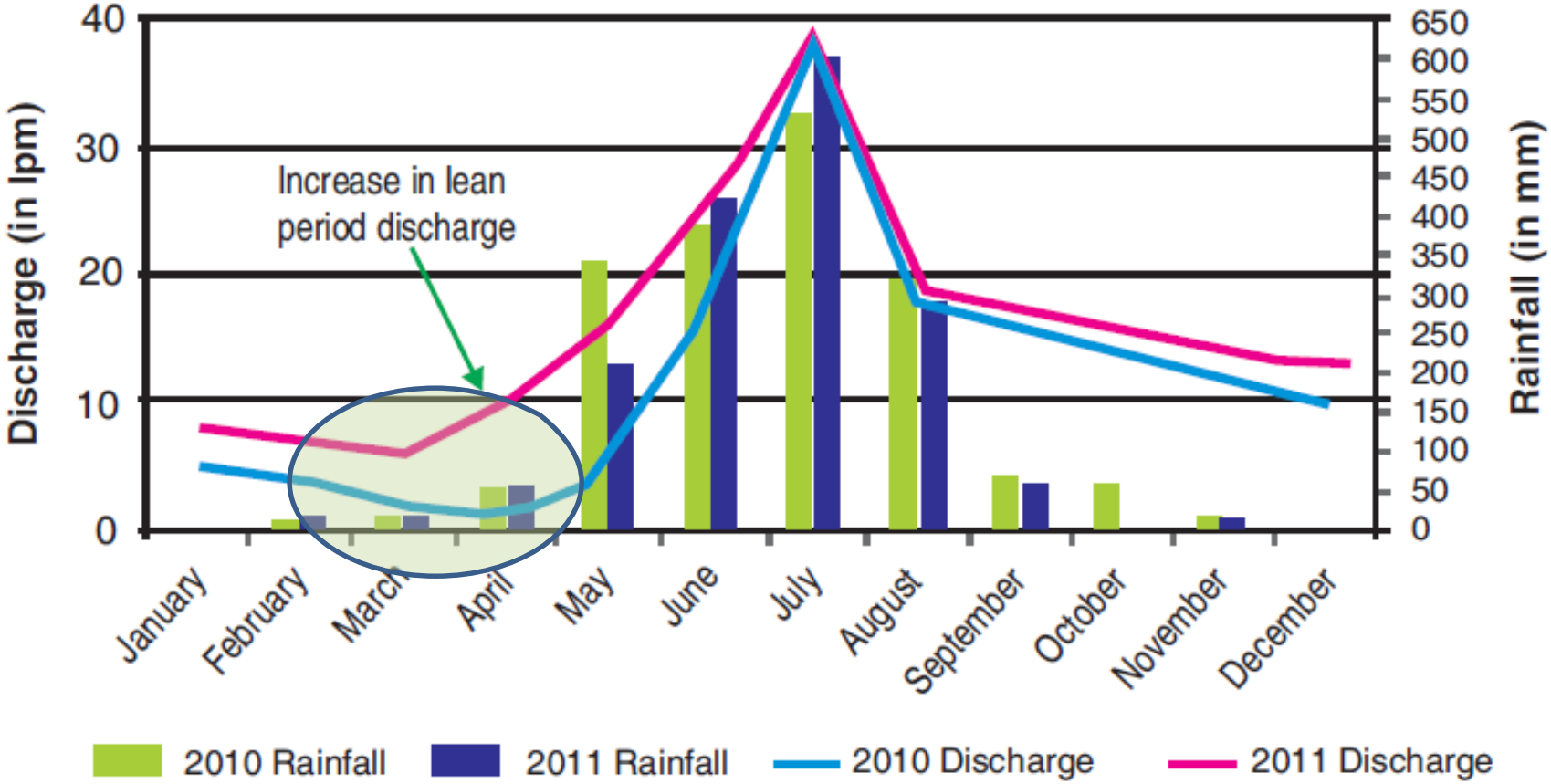
Tendong hill in South Sikkim

120 ha out of 1000 ha taken up at recharge areas in 2013-14

Effectiveness

Hydrograph of a spring

Hydrograph of a spring, showing the impact of artificial recharge on spring discharge along with rainfall pattern.



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Steps adopted in Dhara-Vikas Planning

Eight step action plan of dhara vikas

Step 1: Resource mapping of the village water resources (springs, streams and lakes), their location, land tenure, dependency of water users, recharge area, measurement of discharge etc

Step 2: Baseline study of the springs to measure the discharge, understand the geo-hydrology, type of spring, land tenure, dependency of water users, recharge area etc

Step 3: Prepare the Springshed Development Plan showing the spring, aquifer, recharge area, Google map etc

Step 4: Prepare the lake revival plan

Step 5: Prepare the plan to enhance the ground water recharge contribution of hill top forests

Step 6: Estimation, technical and financial sanctions

Step 7: Follow best practices in implementation

Step 8: Monitoring and evaluation

Source Survey

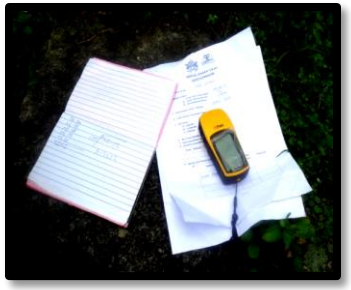
Interaction with the water users

Survey of recharge area by technical team, Panchayats and water users

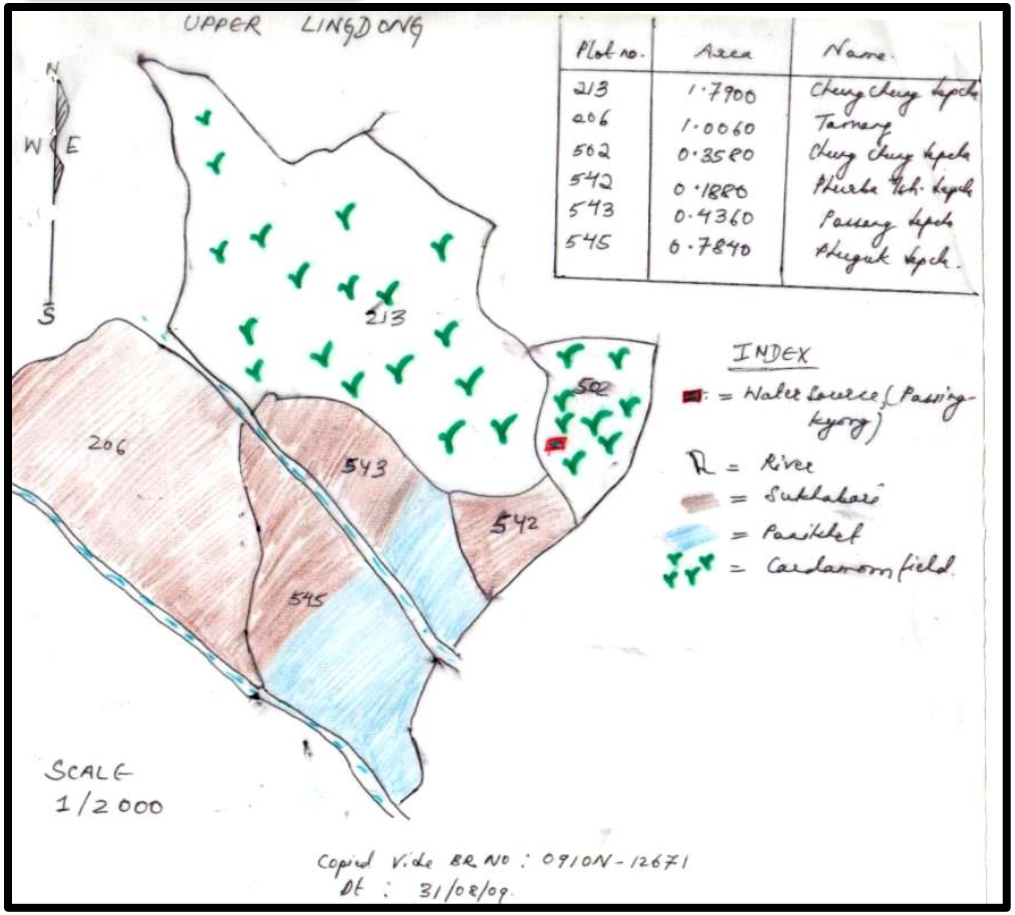
Geological Assessment

Geology- Important aspect of spring-shed development

Spring-shed Development Plan



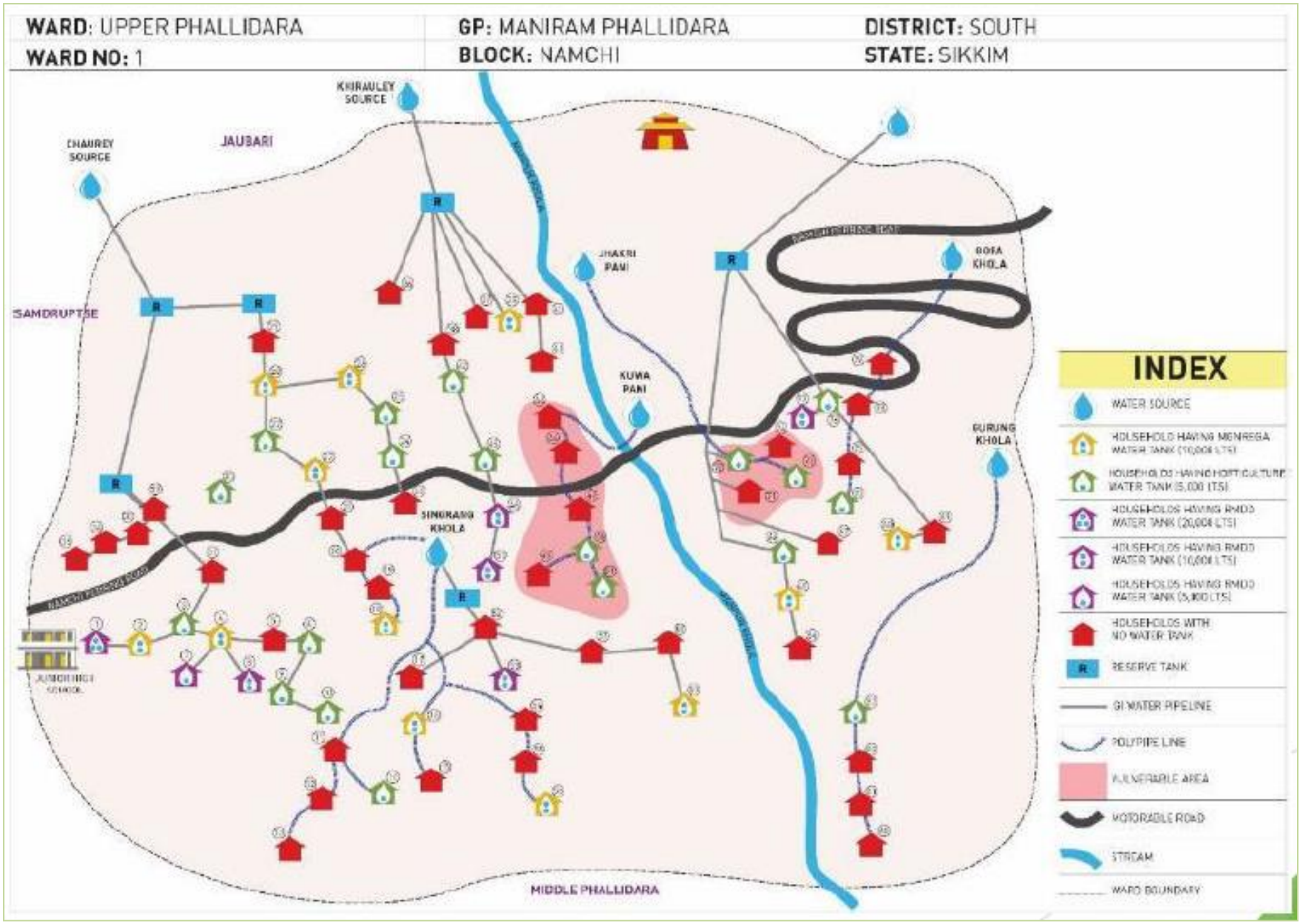
Cadastral Maps



- ✓5 – 10 hec area of spring-shed is being mapped
- ✓Who are the owners?
- ✓What are the plot nos?
- ✓What is the area?
- ✓What is the landuse?

-sukhabari, panikhet, banjo, Khasmal, RF etc.

Resource map



IMPLEMENTATION GUIDELINES

1. The wage payment is on piece rate basis so ONE workers need to dug out TWO nos of 6 feet X 3 feet X 2 feet trenches in a day to met their wages OR THREE workers need to dug out ONE nos of 10 feet X 10 feet X 2 feet percolation pond
2. It is always preferable to dug out the pond or trenches where surface run off take place during rainy season, so that a trenches or pond get full in each rainy day.

ENVIROMENTAL SAFEGUARDS

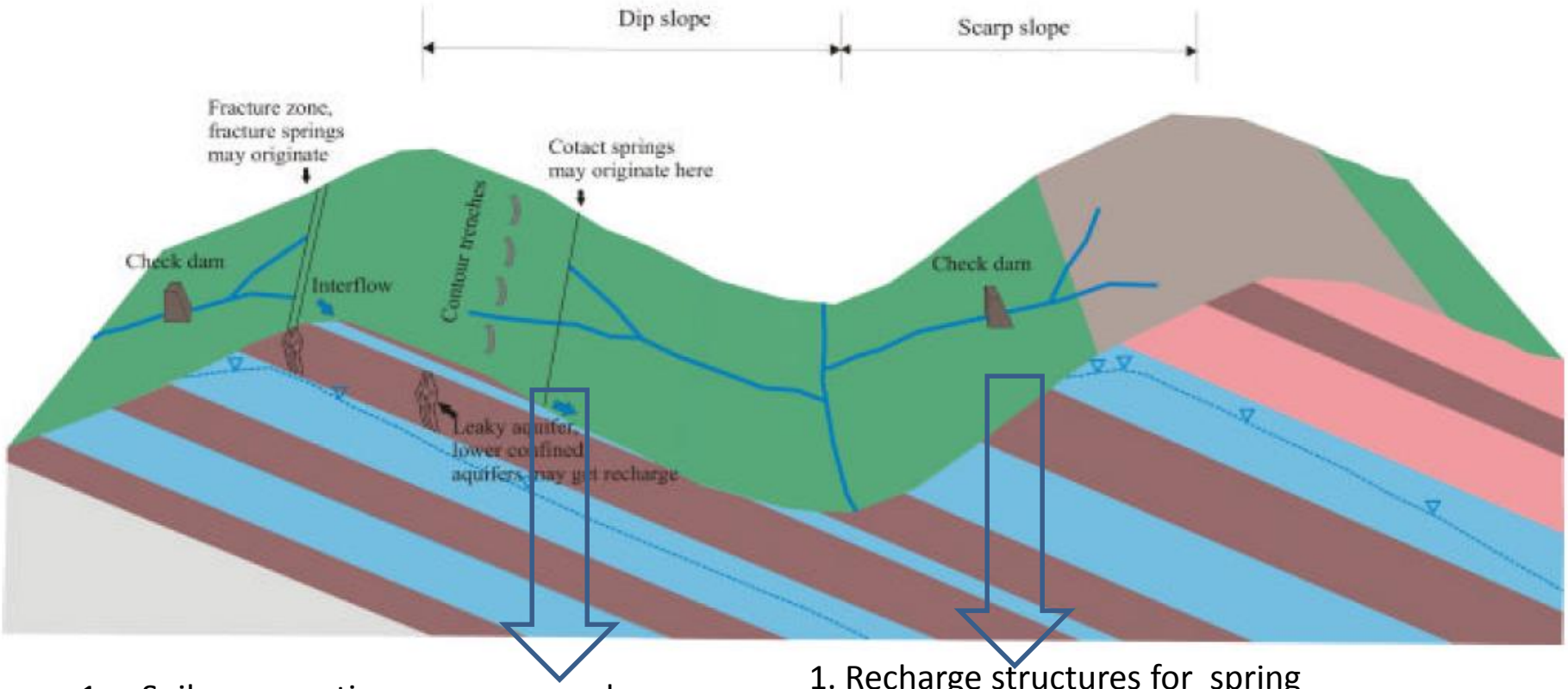
1. Fulltime presence and supervision of Forest staff during the whole operation is mandatory
2. Need to ensure that Forest wing provides briefing on code of conduct to labourers beforehand

4. Dry toilet has to be set up and later on hygienically filled up

5. All non-degradable solid waste needs to be brought back in sacks to be disposed after returning

6. Convergence with forest department to take up plantations in the same area

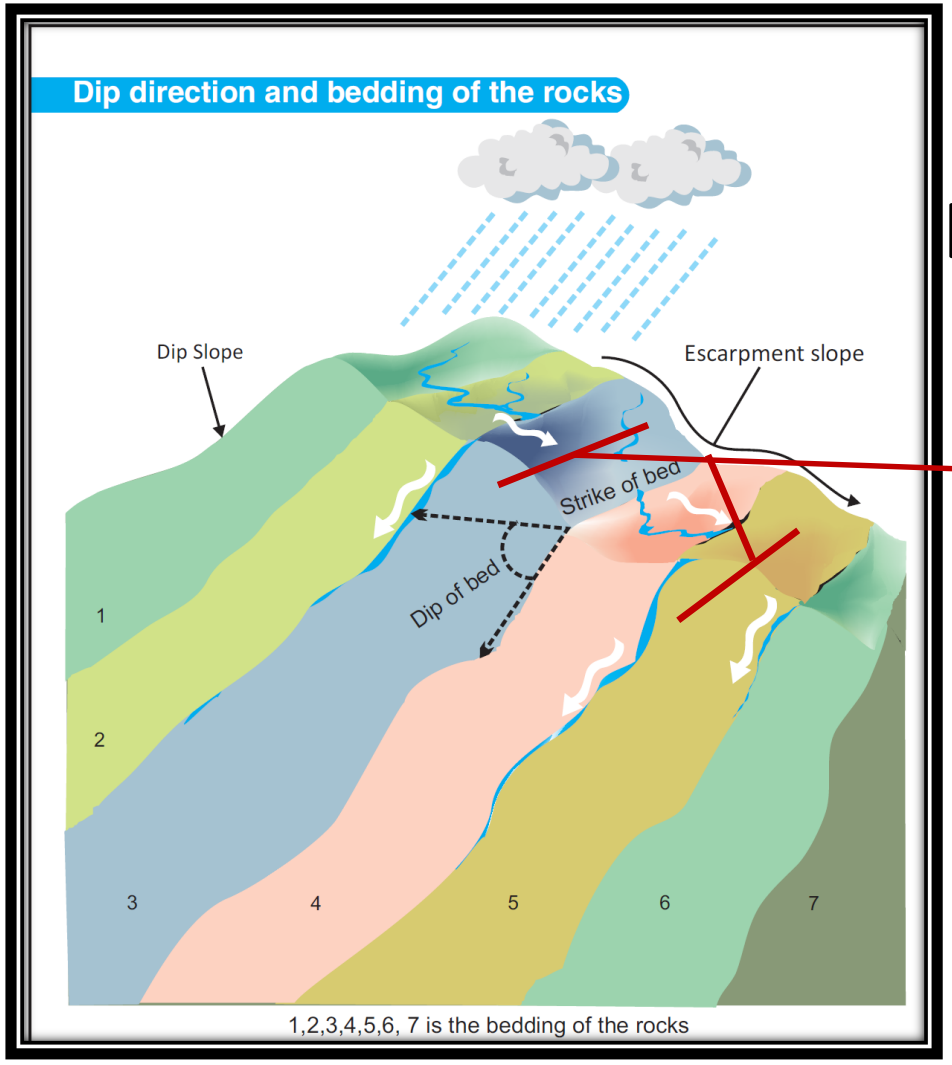
Understanding the recharge area



1. Soil conservation measures such as terracing
2. Plantation
3. Jora training for gully erosion etc.

1. Recharge structures for spring development along the fracture/soft rock interface. (micro placement of percolation pit, ponds, check dams with due consideration of slope and geology by trained field facilitators in geo-hydrology known as para-geohydrologists)

Identification of recharge area



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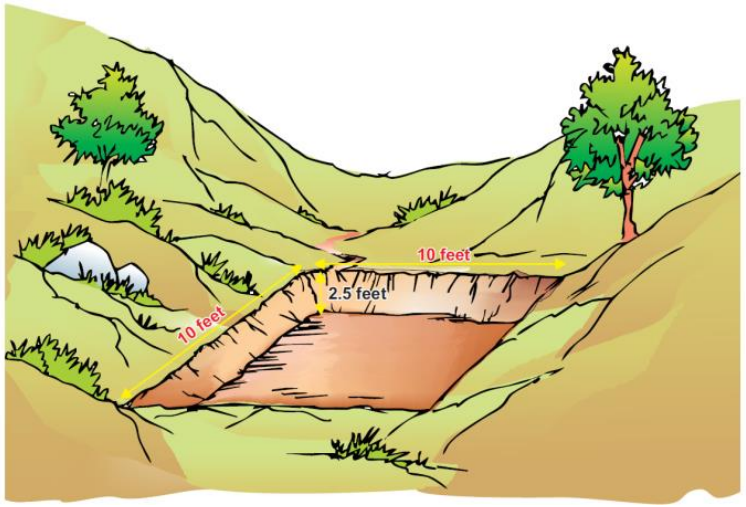
If incoming water abuts against opposite dipping strata then there is more chance of percolation

How to do the Recharge works?

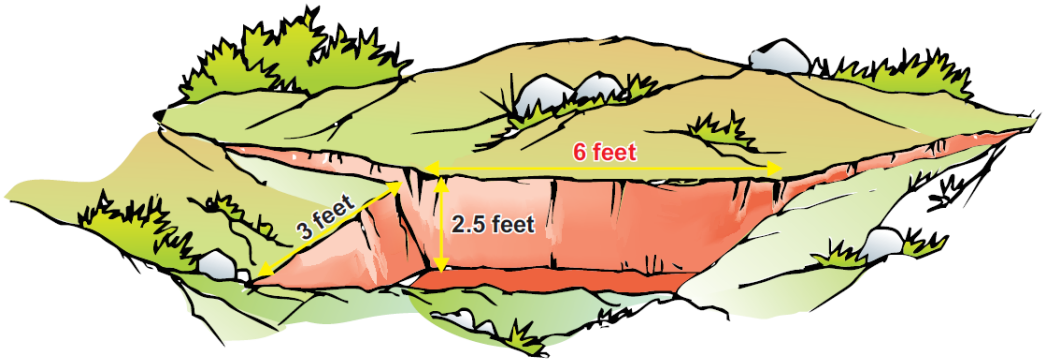


PONDS

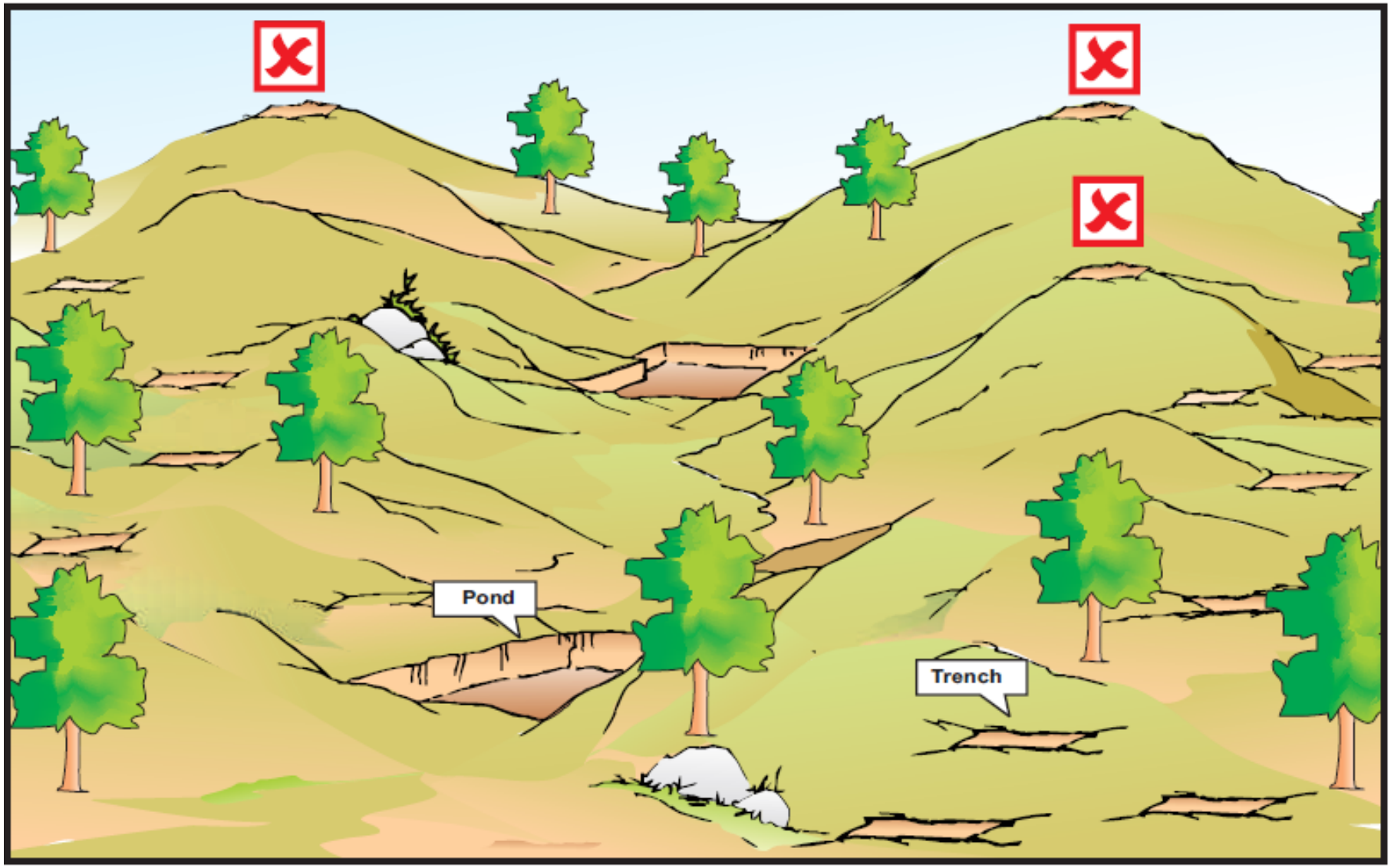
TRENCHES

Design of the trenches on sloping lands

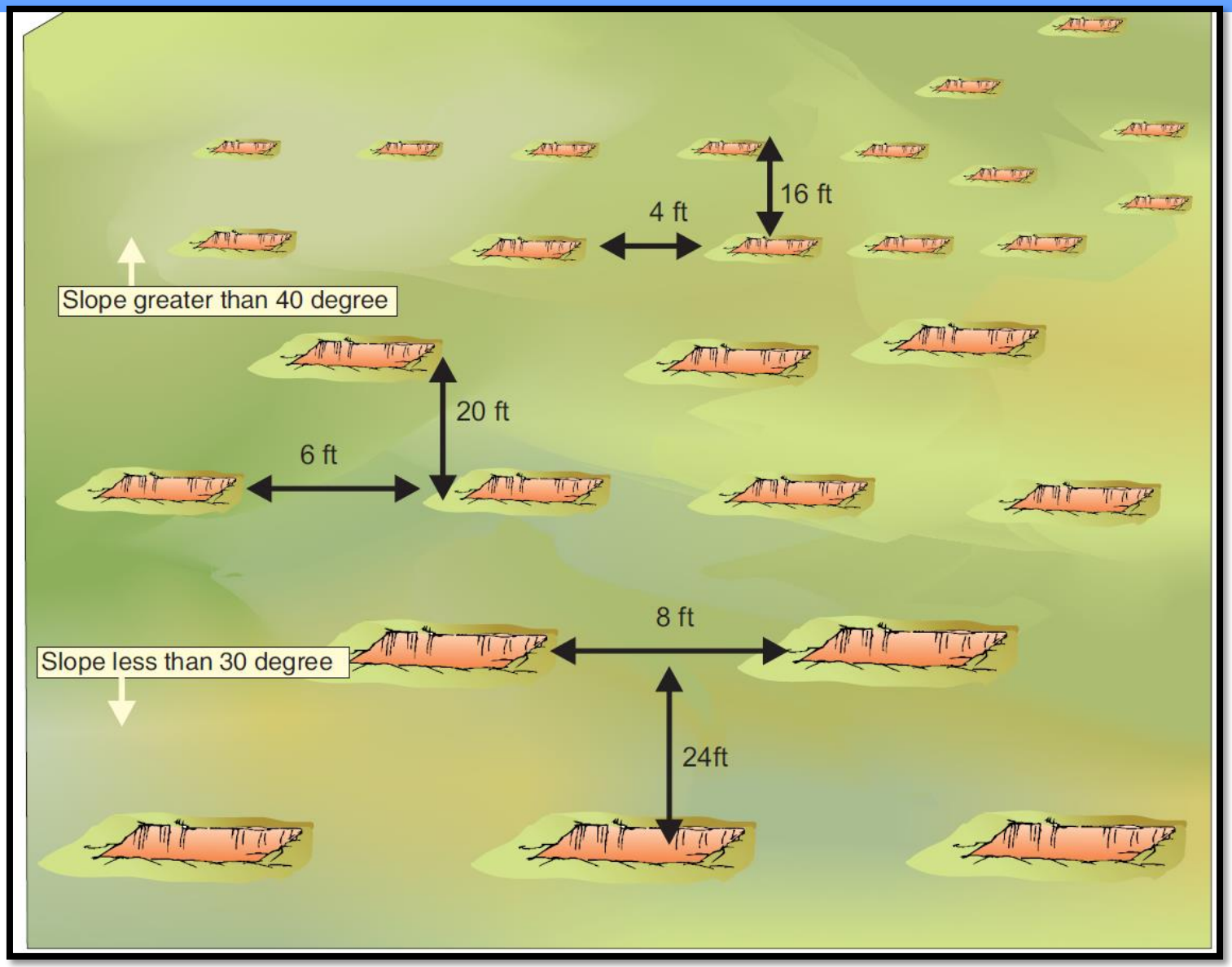
Slope	Size of the trench			Volume of trench	Total trenches per ha	Storage of water per ha*
	Length	Width	Depth			
%	m	m	m	cum	nos.	cum
<30	2.00	1.00	0.60	0.90	150	135
30-40	2.00	0.60	0.60	0.55	180	100
40-50	2.00	0.60	0.45	0.40	200	80



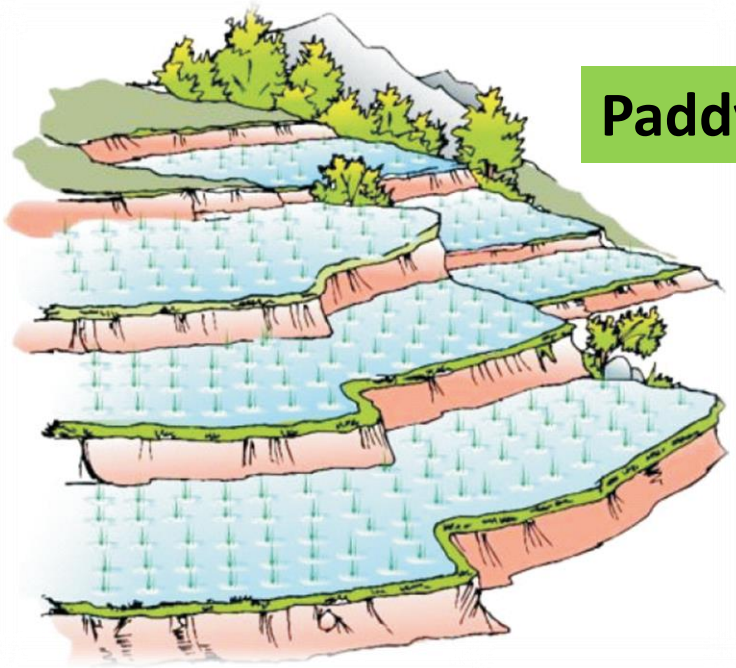
Location of Ponds and Trenches



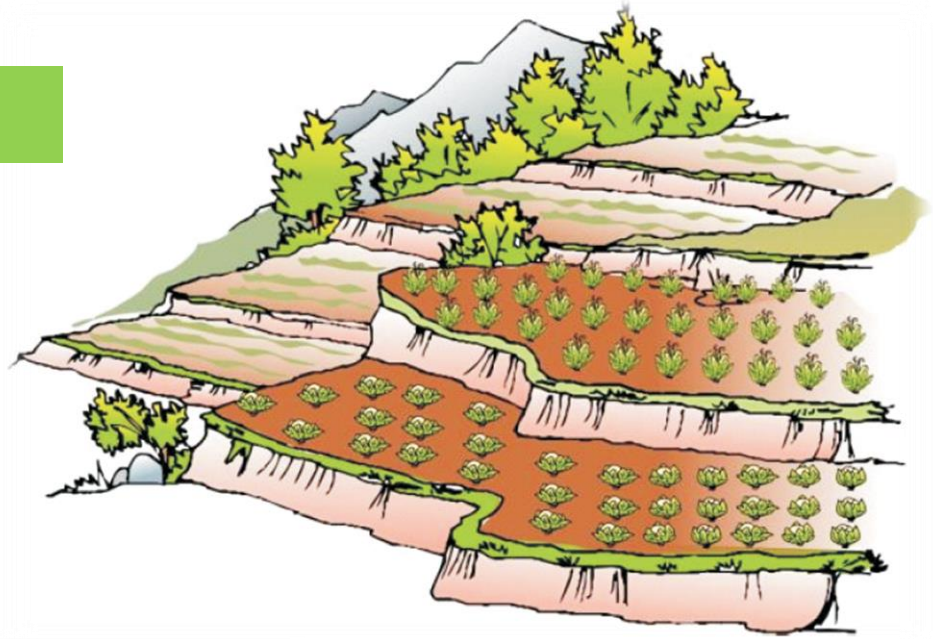
Design of trenches



Land use structures aiding natural ground water recharge



Paddy Fields



Terrace Fields

Sink-holes

Role of Forest in Natural Recharge

Can opy

Under growth

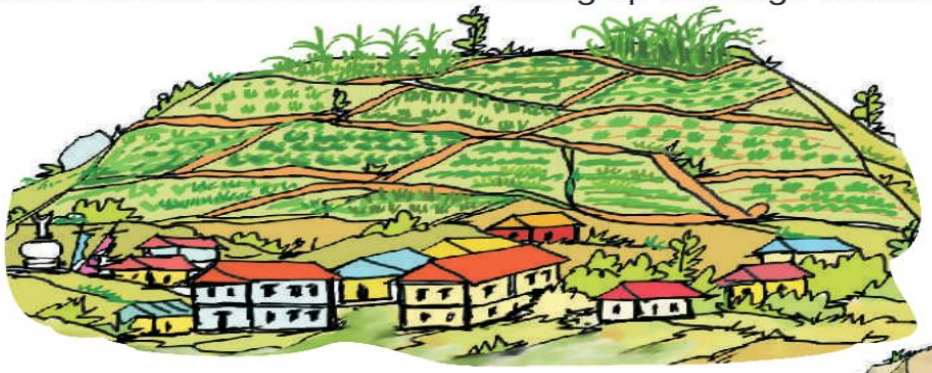
Forest floor

Litter layer/

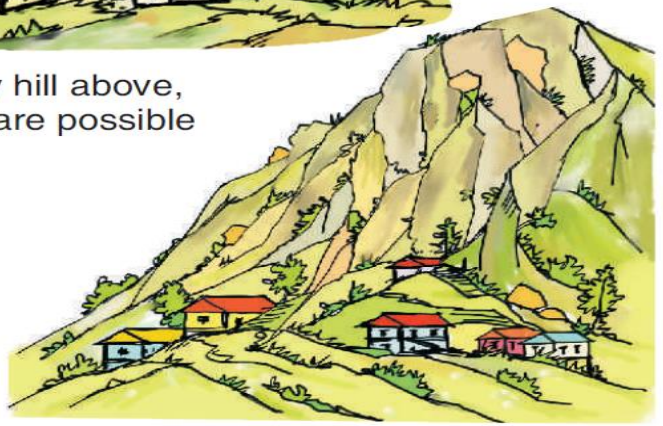
Setting where reviving springs is not possible

1. Village is located on the top of the hill with no forests above the village. All the springs are located below the village

2. The land above the village is used for agriculture and no fallow land or forests are available for taking up recharge activities



3. The village has steep or rocky hill above, where no recharge activities are possible



4. High rainfall area with landslide prone zones

A feasibility study need to be carried out and only if the area is found feasible, then eight step action plan can be adopted

Research questions

Adaptive experiments in Sikkim

Methodology adopted in the field

Some success stories

Challenges faced

On going projects

Learning from mistakes

Case Study of Seti-Khola Source Namthang

Seti Khola (stream), a major source of water for Palitam, Kateng and Phamphok villages of South Sikkim had completely dried up in lean Season. Dhara Vikas initiative and conversion of hill top Nagi lake into recharge structure revived major springs supplying water to these villages.

Key Spring	Dependent Village	Lean Period Discharge 2010	Lean Period Discharge 2013
Seti Khola Source 1	Palitam, Pamphok and Nalam	0.5 LPM	2.0 LPM
Seti Khola source 2	Middle Palitam	1.6 LPM	2.8 LPM
Seti Khola source 3	Lower Palitam and Upper Kateng	2.6 LPM	5.2 LPM
Waiba Dhara	Lower Kateng	1.1 LPM	2.1 LPM
Hittey Dhara	Namthang Bazar	3.8 LPM	5.4 LPM

Case Study of Seti-Khola Source Namthang

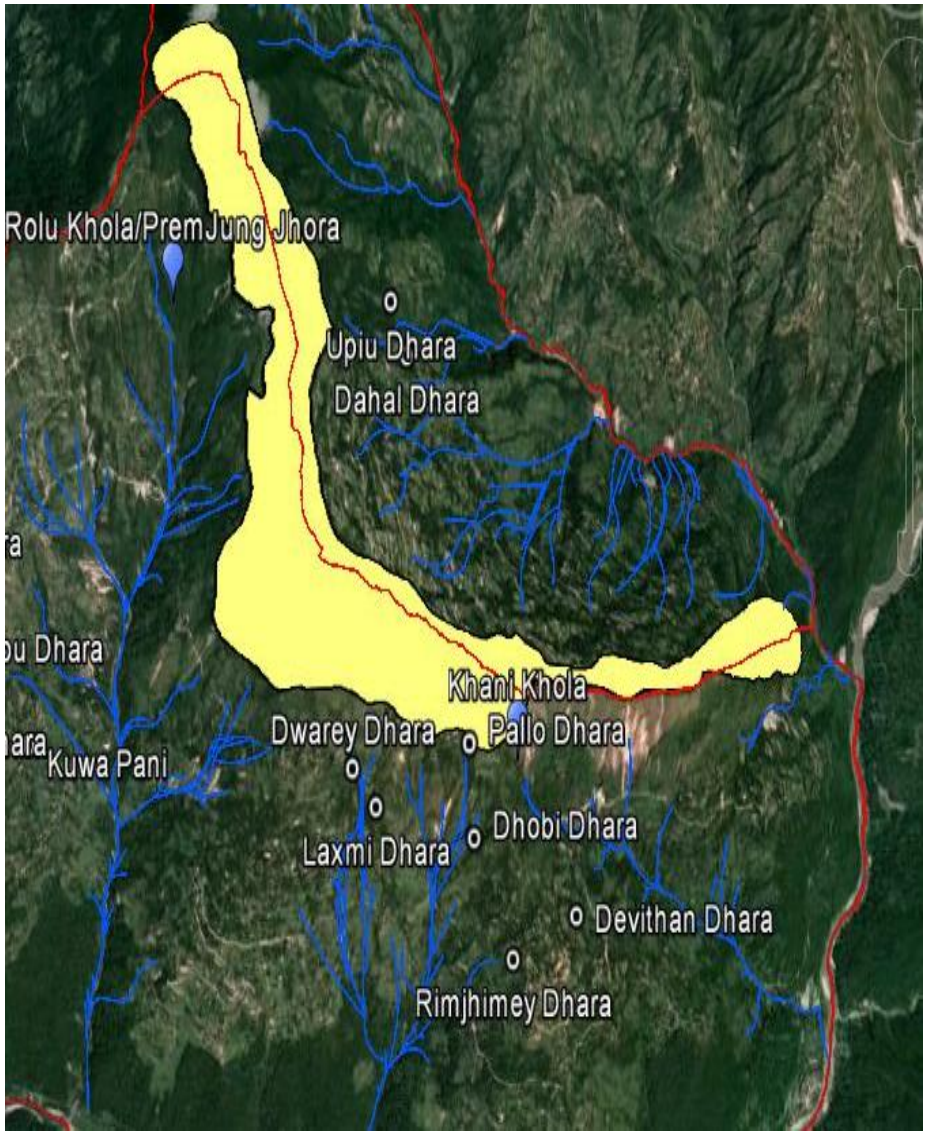
Impact Assessment

The revival of the Stream has brought green revolution in the downstream villages

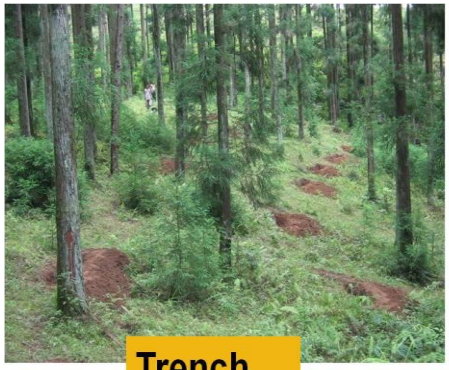
1. The villagers of Kateng Phampok started producing offseason vegetables and today produces 1500 kg per household which is sold in the local markets- Namthang and Rangpo bazars.

2. This has resulted in additional income of Rs. 5.58 lakhs (on average Rs. 18000/- per household) for 31 families of lower Kateng village.

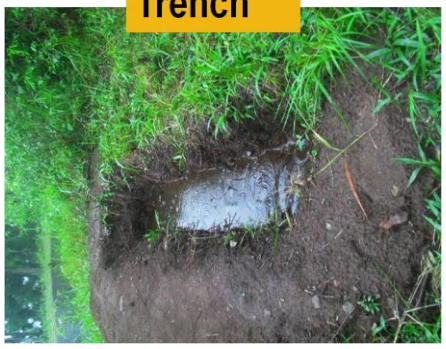
Sadam Ground water Recharge Project Project



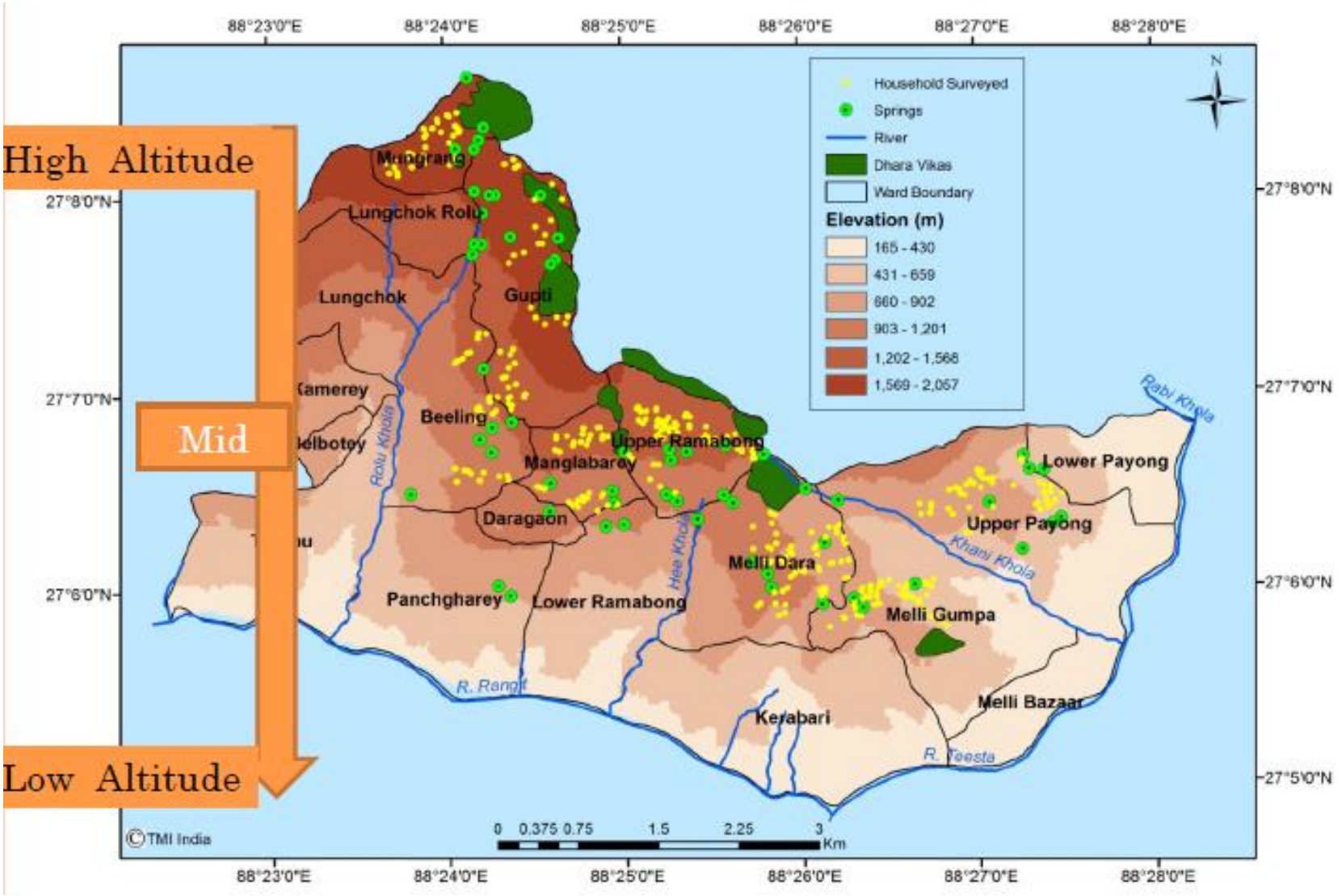
Sadam , Melli dara and Lungchok , Tamle chaur (100 ha)


Trench


Pond



Sadam landscape project



Socio-economic study taken up by The Mountain Institute, India, 2015

Sadam Ground water Recharge Project Project

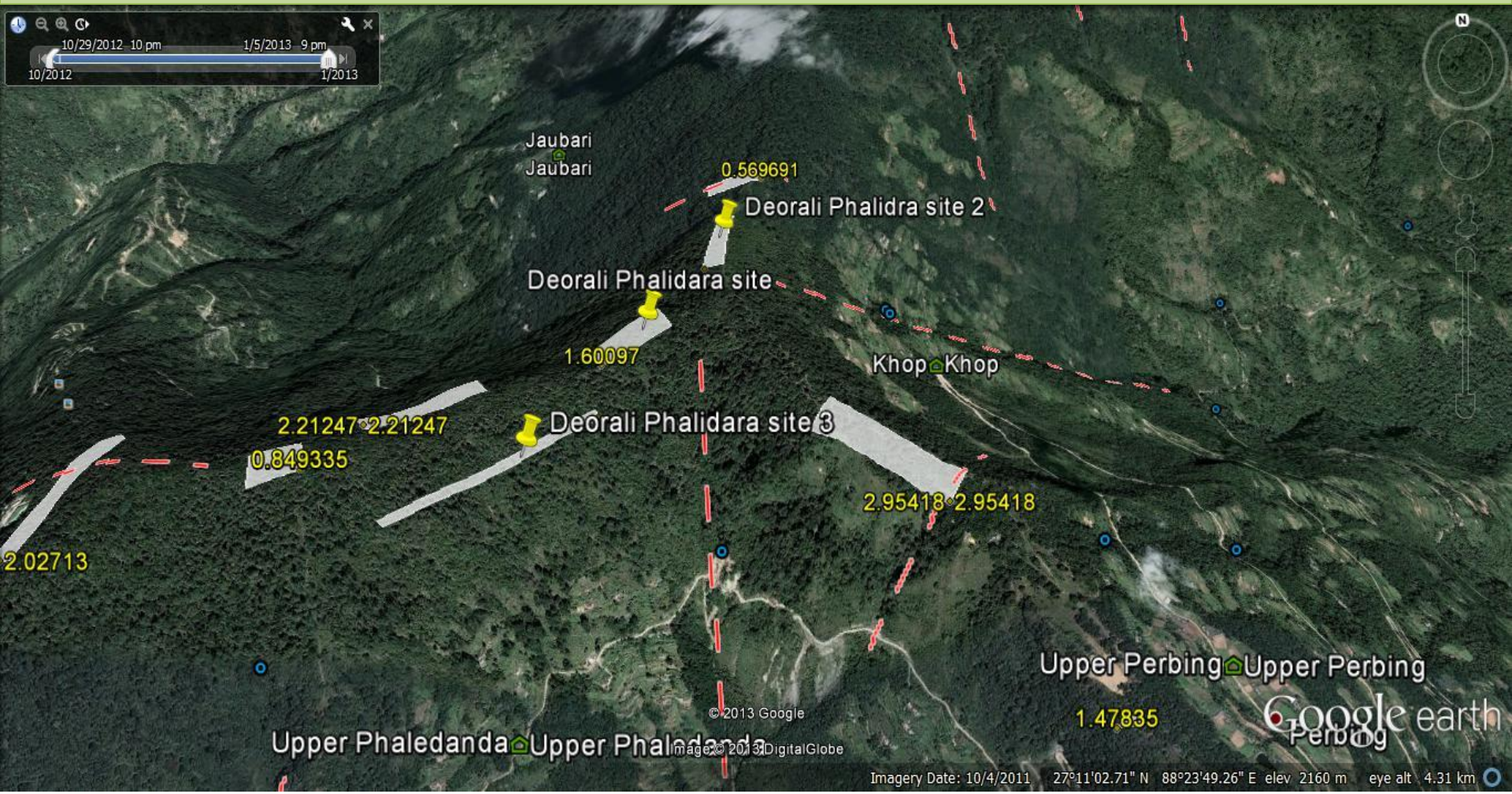
Before

- ❖ Households located in upper belt faced acute crises of water during lean season
- ❖ Transported 4000 liters of water twice a week from river downstream with average household cost of Rs. 3200 per month.

After

- ➢ Springs in upper Melli dara has revived and become perennial which has helped the villagers to save Rs. 1.28 lakhs per month.
- ➢ Today there are more than 60 poultry farms producing 58000 poulty in the span of 45-50 days
- ➢ Dairy farming has come up in the large scale in the village.

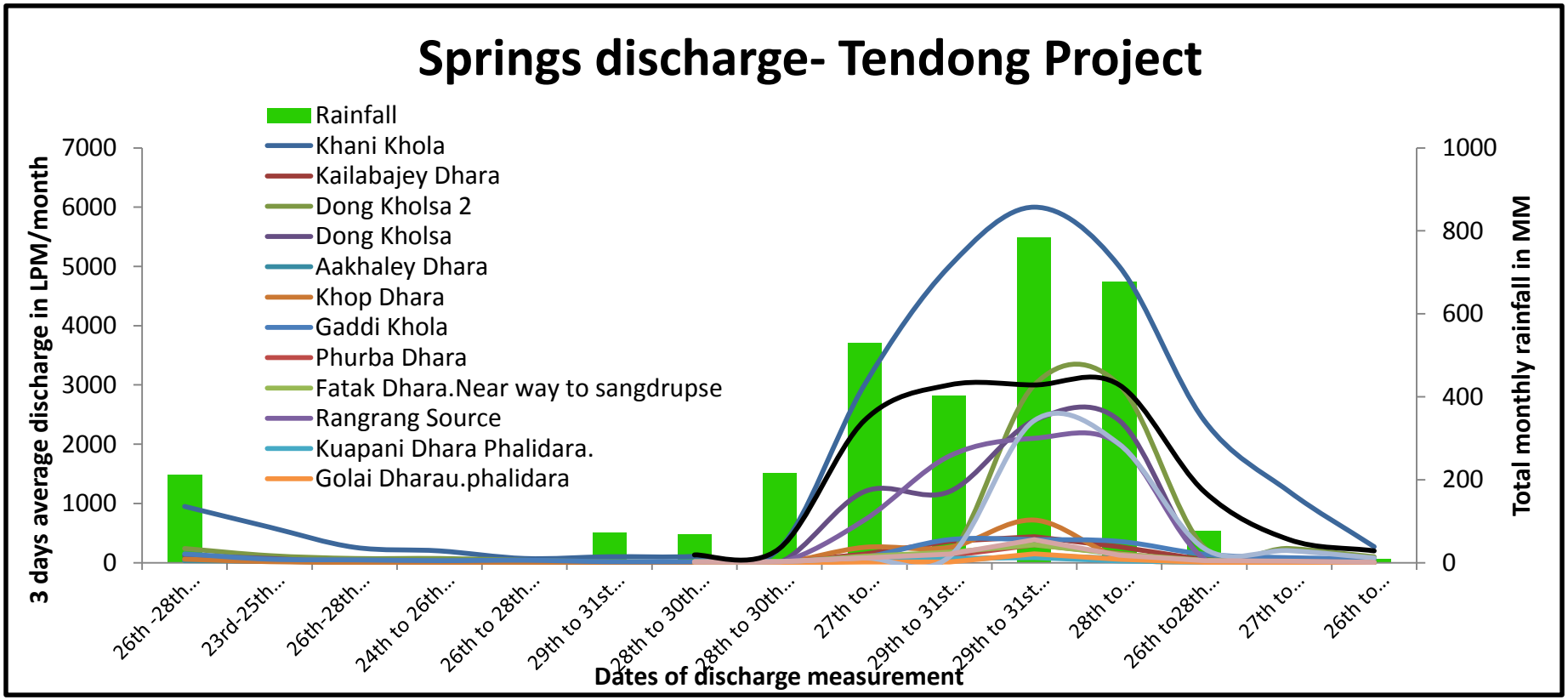
Tendong-hill in South Sikkim



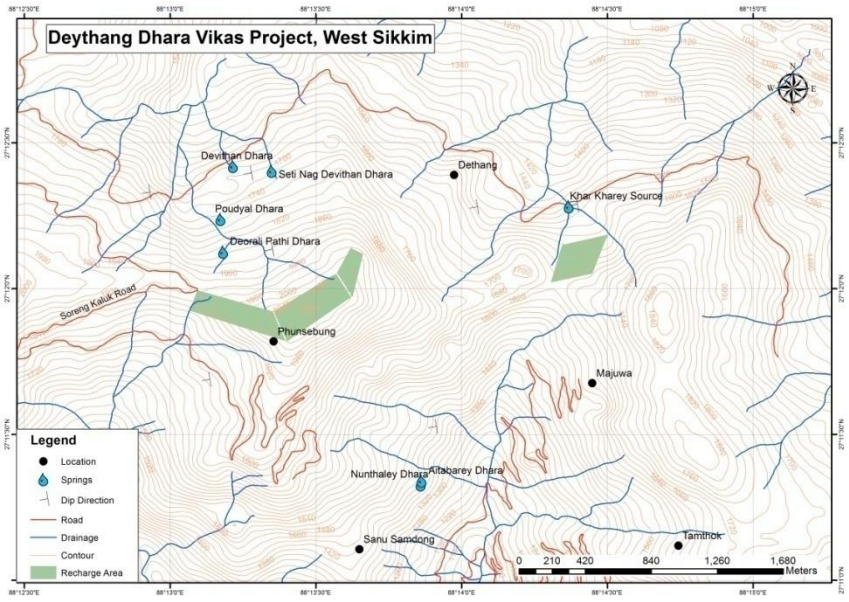
Total 120 Hecs out of 1000 Hecs was found as recharge zone. Cost optimization and target based planning

Tendong-hill Project in South Sikkim

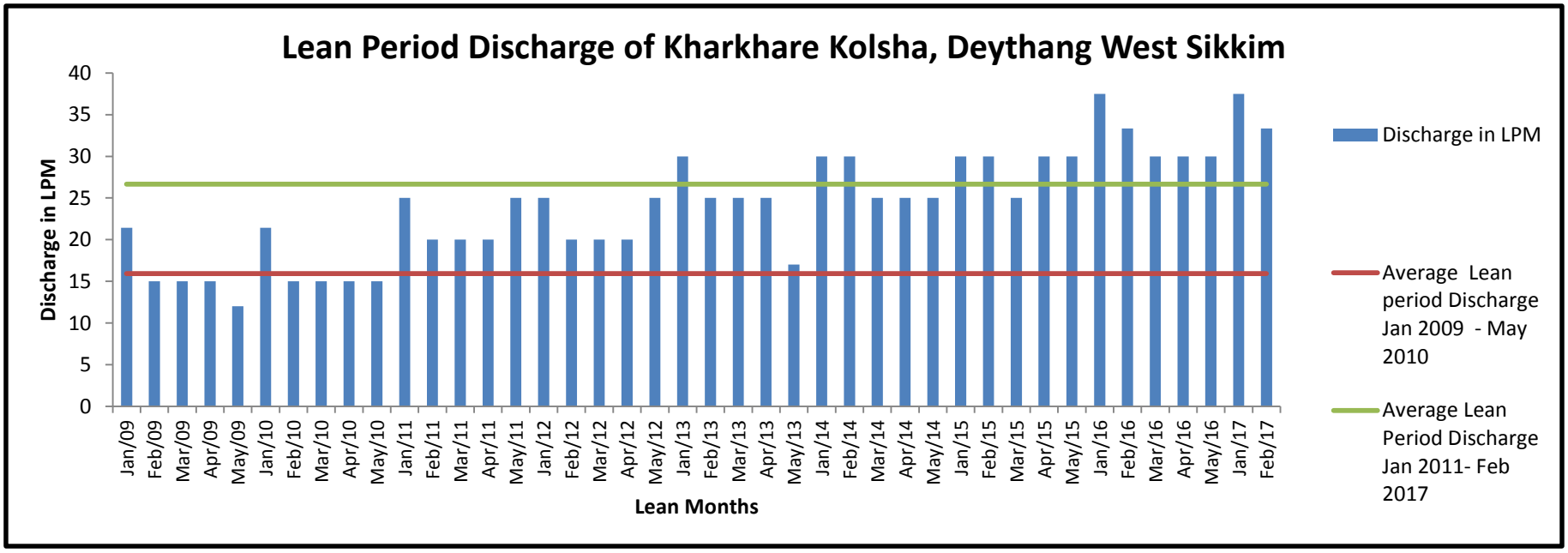
The Project has helped to increase the discharge of spring abutting Tendong Hills. It has helped in off-season vegetable cultivation in a big way. Jaubari, Perbing, Chuba , Phong Villages are now the major suppliers of vegetables. It is evident from many way side vegetable shops along Namchi-Damthang and Namchi-Singtam Via Phongla and Perbing roads.



Deythang Dharavikas Project



Three critical fracture springs namely Nunthaley Dhara, Aitabarey Dhara and Kharkharey Kholsa has been revived. Earlier the discharge barely sufficed 4-5 households and villagers use to carry water. Now the dependency has increased to more then 50 households.



Reviving Dolling lake

2008

2011

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On going projects and future plans

Learning from mistakes

Technical know-how

Lack of technical know-how at the local level to prepare scientific spring-shed development plans by understanding the Hydro-Geology and identifying the recharge zone

Several rounds of specialized knowledge and skills in the fields of rainwater harvesting, geo-hydrology, spring discharge measurement, use of GPS and laying of contour trenches, the whole of 2009 was utilized in organizing more than 20 capacity building programs to train the existing manpower (Field Facilitators, ACFs) with the help of SIRD in coordination with various NGOs like WWF-India, Peoples Science Institute – Dehradun, ACWADAM – Pune, ARGHYAM – Bangalore, TMI-India, Department of Science and Technology and Department of Mines and Geology, Government of Sikkim.

standardization of spring-shed development Strategy

Several rounds of meetings and workshops with Engineers, hydrologist and experts and partner organisations to standardise the spring-shed development strategy

Step 1: Resource mapping of the village water resources (springs, streams and lakes), their location, land tenure, dependency of water users, recharge area, measurement of discharge etc

Step 2: Baseline study of the springs to measure the discharge, understand the geo-hydrology, type of spring, land tenure, dependency of water users, recharge area etc

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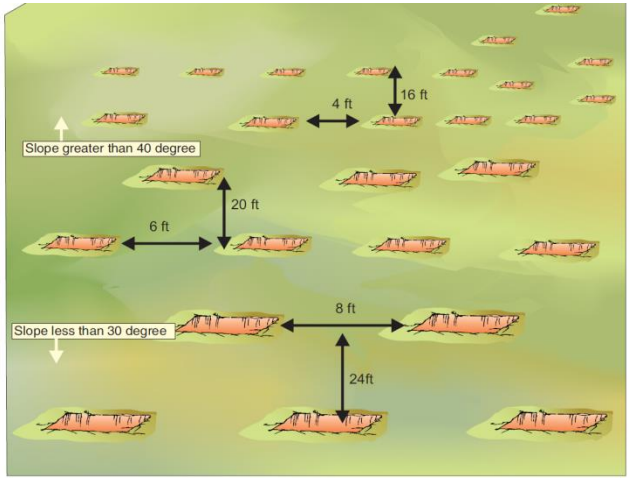

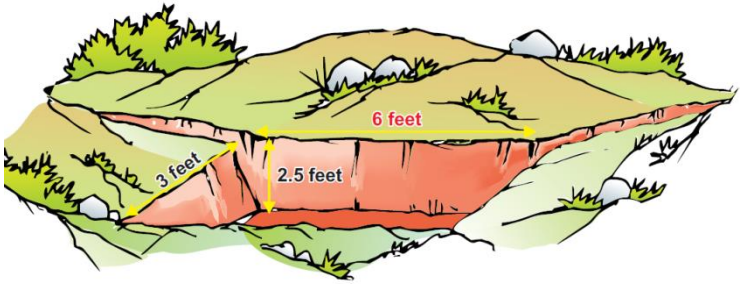

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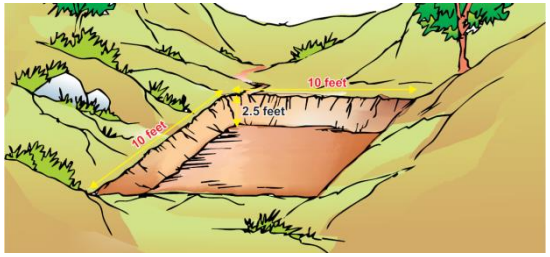
40-50	2.00	0.60	0.45	0.40	200	80

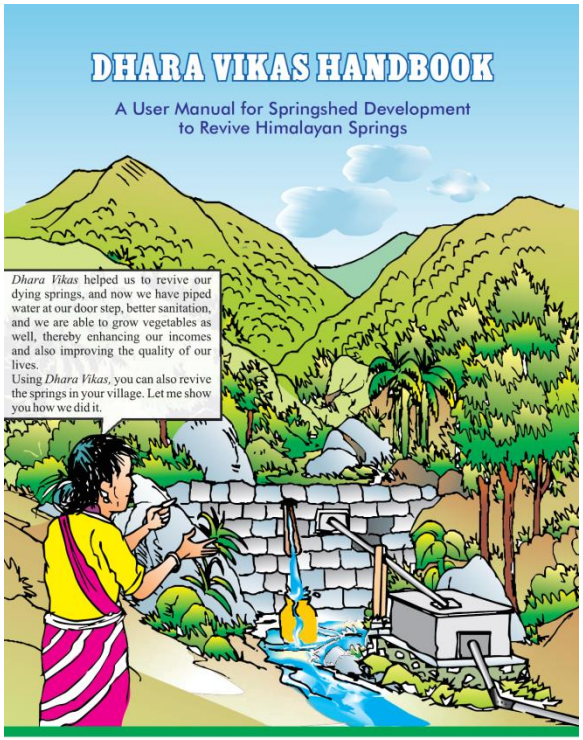


Mobilization of Fund

Getting recognition of planning commission Government of India

Based on these successful pilots, springs-shed development was added in the list of permissible works of the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) national flagship programme in 2012.

dissemination and acceptance of these new technologies



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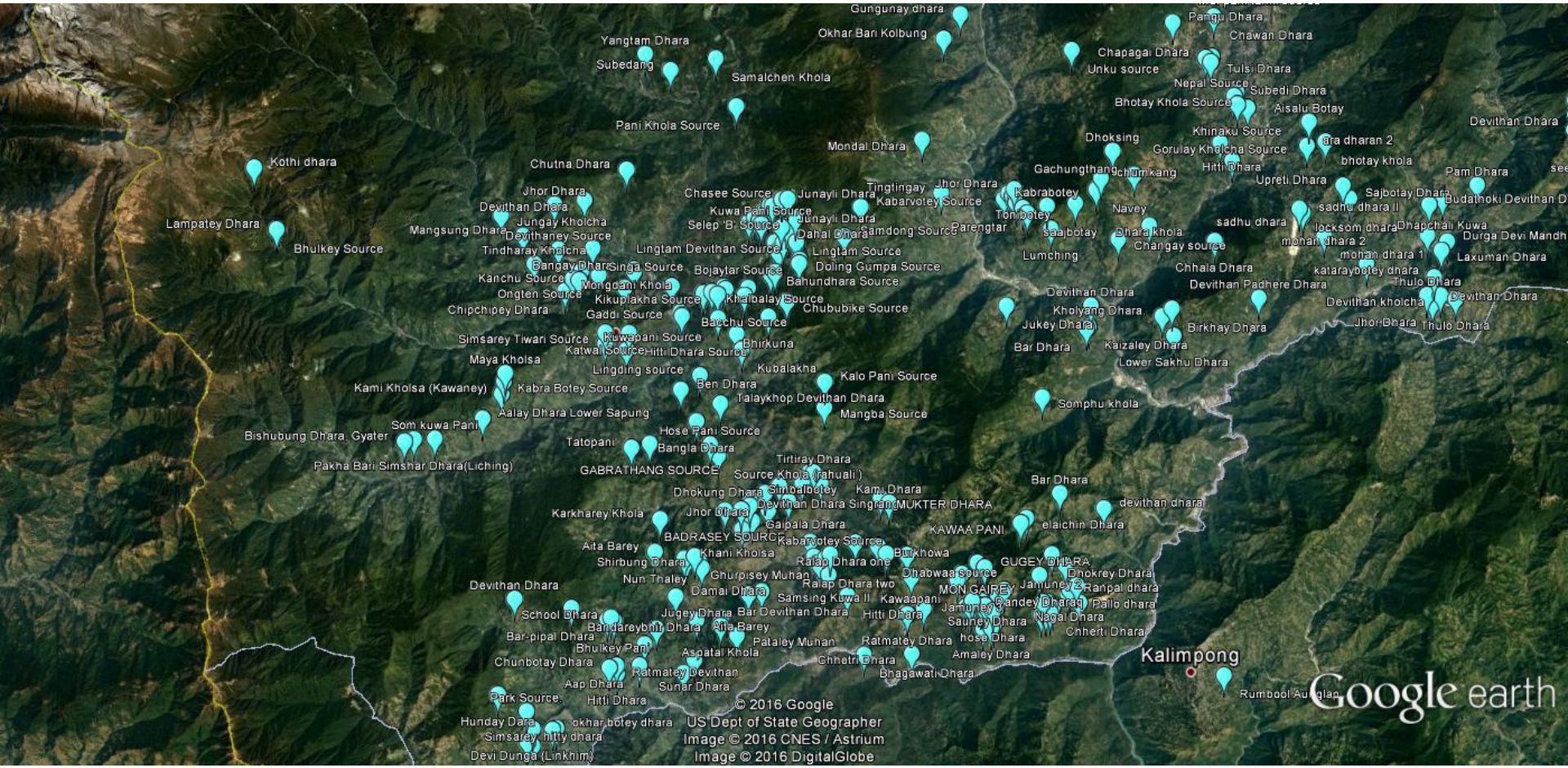
Natural isotopes study (BARC)
Findings

- It establishes the rainfall-spring interdependence thus making it clear that the source of recharge of the springs is rainwater.
- The electrical conductivity measurements further indicate that the recharge points of the springs are locally situated. The fluctuations shown by electrical conductivity values over the period suggests that the flushing process is dominant in most of the springs.
- Aquifers of the springs are a group of small interlinked aquifers. During monsoons, when the recharge is high, these individual aquifers get interlinked which increases the discharge of the spring. Post monsoon the interconnectivity of these aquifers is broken and thereby decreasing the spring discharge. This ultimately results in minimum discharge during lean period.

Mapping of springs



Additional 1000 springs are being map under UNDP support

National Adaptation Fund for Climate Change

Village Water Security Planning




Village water plans for 60 additional GPs are being made in 12 drought prone blocks

Introduction: Village Water Security Plan

- A comprehensive prior-need assessment report for ensuring rural drinking water security

through

- training and PRA consultation at GP level
- water-resource and vulnerability mapping
- water source/resource survey
- household survey on Drinking Water
- field visit in vulnerable hamlets/villages/habitations

towards

- improving the access to clean drinking water in the rural areas
- efficient implementation of RWSS, NRDWP and other rural water security programs in the GPUs
- Future-need based solutions highlighted by the water users

Research questions

Adaptive experiments in Sikkim

Methodology adopted in the field

Some success stories

Challenges faced

On going projects

Learning from mistakes

Learning from mistakes

- Digging trenches on terraced fields
- Location of the trenches and ponds
- Lack of baseline information
- Independent monitoring is essential
- Concretizing of hill-top lakes to store water
- Pine plantations in upper catchments of drought prone areas
- Focusing on individual springs and their recharge areas

Concretizing a hill top lake

Tamle pokhri in South Sikkim

Old pine plantations in upper catchments

Future Plans

- set-up critical zone observatory for the springs by instrumenting critical springs by automatic gauges with the support from UNDP – Proposal accepted.

- Development of Decision support system for spring-shed development using hydro-geological modelling with CDAC - Ongoing.

- Taking-up intensive research on hydrogeology of springs and aquifer characteristics in collaboration with CDAC Pune and Dept. Of Geology University of Pune - Started.

- Android based springs database management system -Ongoing

Knowledge Sharing

Nagpur, 17 Feb 2018, Bhu Jal Manthan, Mrs. Sarika Pradhan, Adl. Secy, RM&DD
Delhi, 6th Feb 2018, Minister- Water Resources, Mrs. Sarika Pradhan, Adl. Secy, RM&DD
Thimpu, 26th Dec 2017, Workshop, Mrs. Sarika Pradhan Adl. Secy & Dr. S. Dhakal OSD
Guwahati, 15th Sept 2017, Nabard Workshop for NE States, Dr. S. Dhakal OSD RM&DD
New Delhi, **8th August 2017**, Niti Aayog, Dr. S. Tambe, IIFM & Dr. S. Dhakal OSD RM&DD
Jorethang, **7th June 2017**, Forest Officials Himachal Pradesh, OSD RM&DD
New Delhi, **2nd February 2017-** NRM Workshop, Mrs. Sarika Pradhan, Adl. Secretary RMDD
New Delhi, **31st January 2017** – NWHRS, Dr. Subash Dhakal, OSD RMDD
Guwahati, 13th January 2017, NABARD workshop, Dr. Subash Dhakal OSD RM&DD
Shillong, **19-20th December 2016**, SDG-Niti Aayog, Binod Adhikari, DE Project RMDD
Dehradun, **21-22 June 2016** – Dr. Subash Dhakal, OSD RMDD
New Delhi, **24 Feb 2016** – Int. CCA, Mrs. Sarika Pradhan, JS- RMDD
Gangtok, **26 NOV 2015** – HI Aware, Mrs. Sarika Pradhan, JS- RMDD
Gangtok, **24 Nov 2015** Springs initiative meet, Dr. S. Dhakal, RMDD
Nagaland, **30 Oct 2015**, by Mr. Pem Norbu Sherpa, DVC, RMDD
Itanagar, **8th Oct 2015**, SMDS, by Dr. S.Dhakal, OSD, RMDD
Kathmandu, **Aug 2015**, by Dr. S. Dhakal, OSD RMDD
Uttarkhand, **May 2015**, by Dr. S. Dhakal,OSD RMDD
Orrisa, **April 2015**, by Mr. Pem Norbu Sherpa,DVC, RMDD
Kathmandu, **Feb 2015** by Mr. Pem Norbu, RMDD
Jammu, **21st Aug 2014** by Mr. Sandeep Tambe, Special Secretary, RMDD
Nagaland, 7th May 2014 by Mr. Tashi Chophel, ADC, RMDD
Mizoram, **19th March 2014** by Mr. Manoj Pradhan, ADPC, RMDD
Uttarakhand, 5th March 2014 by Mrs. Sarika Pradhan, JS-RMDD
Meghalaya, on **3rd March 2014** by Mr. Pem Norbu Sherpa, DVC RMDD
Assam, **20th Jan 2014** by Mr. Sandeep Tambe, Special Secretary
Manipur, **16th Jan 2014** by Mr. Sandeep Tambe, Special Secretary

Knowledge Sharing

Visit by Officers from MoRD

Study team Royal Govt. of Bhutan,2014

Study team Meghalaya and Nagaland 2015

Study team ICIMOD 2017

Partners who made it possible

Mt. Khangchendzonga (8,598 m)
The Guardian Deity of Sikkim
3rd Highest Peak in the World

Guru Padmasambhava
Patron Saint of Sikkim

Thank You