CASE STUDIES

CLIMATE ADAPTIVE PRACTICES GRASSROOTS INITIATIVES

Development Alternatives

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Population	As per 2011 census, Sikkim has a population of 610,577, and Ranks 29th in India in terms of population.[1]
Climate	The state has five seasons: winter, summer, spring, autumn, and a monsoon season between June and September. Sikkim's climate ranges from sub-tropical in the south to tundra in the north.season (June to September) and north east monsoon season (October-December).
Climate Vulnerabilities	Changing weather patterns and rising temperatures, water scarcity, spatial variation in rain fall, increase intensity of extreme rain fall.
Average Annual Rainfall	2756.3 millimetre[2]
Economy	Sikkim's economy is largely agrarian, based on the terraced farming of rice and the cultivation of crops such as maize, millet, wheat, barley, oranges, tea andcardamom.[3,4]

[1] *2011 Census of India.*

[2] *District-wise monthly rainfall data from 2004-2010 for the whole of India by Indian Meteorological department from www.indiaportal.org*

[3] *Dutt, Ashok K.; Baleshwar Thakur (2007). City, Society and Planning: Society. Concept Publishing. p. 501. ISBN 81-8069-460-7.*

[4] *Bareh 2001, pp. 20–21.*

Sikkim is a northeastern state of India landlocked in the Himalayan range. It is home to one of the world's highest peaks, Kanchenjunga. Like most of the Himalayan region, Sikkim is rich in beautiful springs, lakes, mountains, deep valleys and biodiversity; making it a sought after tourist destination. Water is one of the most important sectors on which climate change (increase in temperatures, evapo-transpiration, spatial variation in rain fall, increase intensity of extreme rain fall and drought events) can have a profound impact, which in turn can have cascading impacts on other sectors. The agricultural sector is highly dependent on the climate, and given the low productivity increase of the last few years compared to population growth, climate change is likely to have serious consequences for Sikkim's agriculture[1].

[1] *http://www.moef.nic.in/sites/default/files/sapcc/Sikkim.pdf*

Spring Revival

Key Messages

- Springshed development under MGNREGA revived the drying spring facilitated co-benefit for communities dependent on springs and streams for domestic and cultivation purposes.
- An innovative mechanisms of using scientific methodology (geohydrology) with decentralised decision making facilitated in success and sustainability of the initiative.

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1. Context

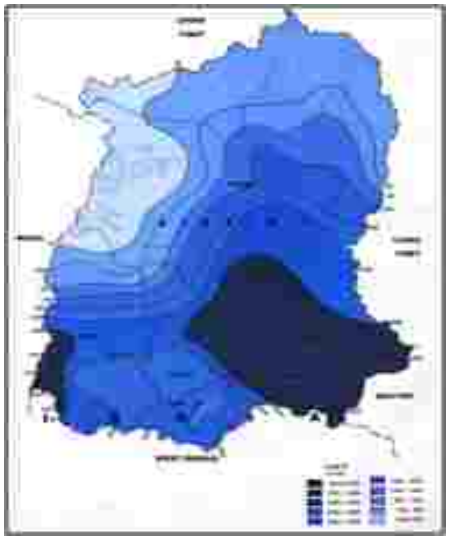
1.1. Need:

Long-term reliable data from Gangtok indicates that the temperature in Gangtok has been rising at the rate of 0.2^0 Celsius every year, with the annual rainfall increasing at the rate of nearly 50mm per decade. Due to climate change, the monsoon rains are erratic coming in at shorter bursts and the winters are becoming longer, warmer and drier. Over the decade, increasing instances of springs drying up or becoming seasonal, with reduction in lean periods have been reported.

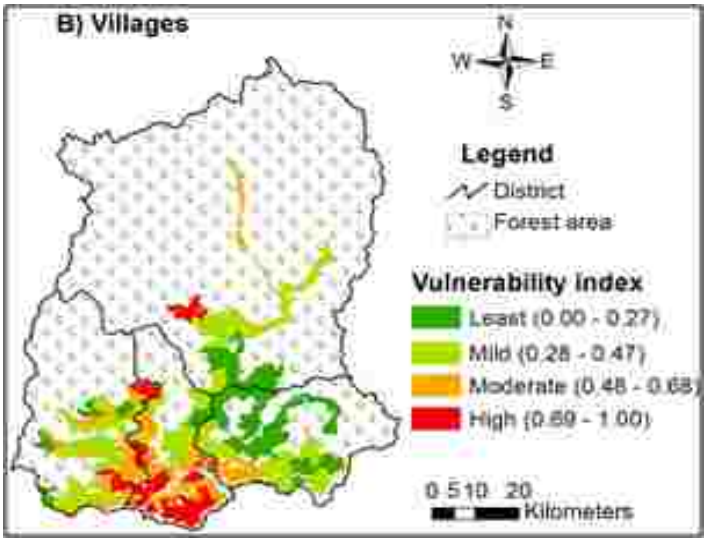
With the growing population and increasing temperatures; issues of top soil erosion, sporadic rainfall patterns, deforestation, development activities, etc. springsheds which used to comprise of well-forested catchments are being reduced to few trees or bamboo clumps. Even though the rainfall during monsoons is essentially adequate, the high surface run-off causes hindrance in the natural ground water recharging. Less than 15% of the rainwater percolates down to recharge the springs, while the remaining just flows down as run-offs. Further, in South Sikkim most of the villages are situated in the upper catchments, while the reserve forests are situated in the valley along the riverbank; thereby, reducing their rainwater harvesting potential. Access to rivers, Teesta and Rangeet is difficult due to steepness of the slopes. Thus, the rural people are almost entirely dependent on springs for their livelihood.

With winters being drier than usual, little or no rainfall occurs during the lean period of

[1] *http://sikkimforest.gov.in/climate-change-in-sikkim/1-chapter-Climate%20Change%20Synthetic%20Scenario%20over%20Gangtok.pdf*



Rainfall Variation



Vulnerability Index

November to April causing severe water shortage. The springs are drying up as their aquifers are not getting adequately recharged and consistent winter droughts are further affecting the soil moisture retention. Being located in the rain-shadow of the Darjeeling Himalayas, it receives only 150cm of annual rainfall, which is much less than the 250cm or more received in east and North Sikkim. Increasing studies have indicated that spring discharge shows strong response to rainfall patterns, while a healthy catchment is vital for a good discharge of the springs. South Sikkim suffers from various vulnerabilities, which adversely impact the groundwater recharge of the region.

Considering that agricultural and horticultural activities is the main source of livelihood for the rural population of Sikkim and the quality of the spring water is at acceptable standards for drinking water; there is a desperate need to revive the perishing springs of South Sikkim.

1.2. Response:

To address the scarcity and vulnerability of the people of Sadam block, South Sikkim, Rural Management and Development Department (RMDD) with funding support from MGNREGA initiated the Dhara Vikas Programme (Spring-shed Development). It is modelled with idea of reviving and protecting the spring's catchment area and essentially recharging its aquifer.

2. Objectives

- Recharge the ground water to increase the discharge of springs in Sadam block.
- Tackle the problems of water scarcity faced in the region.
- Empower and protect the livelihood of the beneficiaries.

3. Approach

The initiative started with collecting data regarding the number of springs that had dried up or were drying up. Analysing the gravity of the issue, the new scientifically proven artificial method of ground water

recharging was coined and implemented in a decentralised manner through the Gram Panchayat Units. The project was conceptualised in 2008, when the drastic effects of climate change were in the forefront. 2009 was dedicated to capacity building and 2010, the first project was implemented and monitored.

"Springshed development under MGNREGA to revive the drying spring facilitated co-benefit for communities dependent on springs and streams for domestic and cultivation purposes"

4. Key Stakeholders

Government:

- Rural Management and Development Department: Facilitated and guided the initiative.
- MGNREGA: Provided support for funding and labourer to work on the initiative.
- Department of Forest, Environment, and Wildlife Management: Granted permission to carry out the task of digging trenches/ponds in the hilltop forests.
- Department of Science and Technology, and Climate Change: Studied the climate change in the state.
- ISRO, Department of Space: Installed Automatic Weather Stations (AWS) to record the weather parameters, like temperature, rainfall, etc.

NGOs/Institutions:

- ACWADAM, Pune: Supported in knowledge sharing, technical guidance, and research
- Arghyam, Bangalore: Supported in knowledge sharing, technical guidance, and research
- WWF India: Provided capacity building opportunities

Communities:

- Locals: The beneficiaries of the initiative, who got access to water through gravity pipelines.

5. Key Components

The technology behind the Dhara Vikas Programme is to slow down the movement of water down the slope adequately, in order to ensure water percolation into the soil, as well as recharge of spring aquifers. The construction of the artificial recharge structures is essentially easy. The technical challenge lies in the accurate identification of the spring recharge area, while taking into account the type, structure, and orientation of the rocks. For this entire process the geohydrology technique is adopted, that takes into account the type and structure of the rocks along with the nature and geometry of the underlying aquifers. This method provides high levels of accuracy, as it deals with the distribution and movement of groundwater in the soils and rocks mainly in the aquifers. Artificial recharge methods were taken up on the sloping lands, comprising mostly of rows of staggered contour trenches and ponds.

The installation of trenches and ponds in

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Water harvesting structures

barren lands of the forest hilltops, gives rainwater a place to stagnate and percolate down into the ground. The trenches were dug 6 feet by 3 feet, with a depth of 2.5 feet along the contour lines. The trenches are staggered between contours to ensure maximum collection of runoff water. Similarly, ponds are dug 10 feet by 10 feet, with a depth of 2.5 feet. The vertical gap between trenches and ponds were kept according to the degree of the slope. Furthermore, a critical criterion is that if the slope was greater than 50 degrees, no trenches or ponds are dug. On the other hand, plants were planted in hedgerows to slow down the flow of water. Mechanical and vegetative measures were taken along with social measures such as bans on grazing, firewood cutting, and fencing of the recharge area.

6. Outcomes and Impacts

Impacts in South Sikkim – Sikkim's Dhara Vikas programme has:

- Covered 7 hill top forests in South Sikkim (namely: Simkharka, Sadam, Tendong, Maenam, Gerethang, Chakung, and Sudunglakaha.
- Revived 55 springs in Kaluk, Rhenock, Ravangla, Sumbuk, Jorethang, and Namthang areas.
- Recharged 1,035 million litres of ground water annually in the last 4 years.
- A total investment of Rs.250 lakhs was made in the last 4 years.

Impacts in Sadam Block – The Dhara Vikas programme in Sadam block of Sikkim has:

- Recharged 150 million litres of ground water.
- A total of 10,000 trenches and 2500 ponds dug in the 100-hectare hilltop forest land of Sadam Block.
- A total investment of Rs.20.88 lakh were made in the last 4 years.

Name of spring	Spring discharge, May 2011 (LPM)	Spring discharge, May 2013 (LPM)	Increase in discharge (LPM)	Number of dependent households
Nagal Dhara	8	13	5	98
Aiman Dhara	3	5.9	2.9	17
Dewarey Dhara	13	23.1	10.1	199
Lungaley Dhara	7	7.9	0.9	30

Table shows the impact of springshed development

- Benefitted nearly 500 households in the three GPUs in Sadam.
- Revived a total of 21 springs.
- The water from the springs is now directly connected households through gravity based piped systems.

7. Lessons Learnt

- Buoyed with the success of this new water conservation programme, this initiative has been initiated in other regions of South Sikkim, as well as West and East Sikkim.
- This initiative showcases how local communities can be empowered to take decisions locally and subsequently; enable decentralised way of execution, best suited for sustaining rural livelihoods.
- Based on the success of the pilots, spring shed development was added to the list permissible works of MGNREGA, the national flagship programme in 2012.
- Sikkim's Dhara Vikas programme has not only been successful in reviving the rain-fed springs and streams, but has also set an example for teams from WWF Nepal, Bhutan Government, Arunachal Pradesh Government are looking at this approach for revival of springs.

Sources:

http://www.sikenvis.nic.in/writereaddata/web-Sikkim%20Census%202011%20Data.pdf

http://www.sikkimsprings.org/dv/Educational%20research/South_sikkim.pdf