

# “Eco-Village Development Plan”

Baghali Village, District Shimla, Himachal Pradesh



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**The Study Team**

**CTRAN Consulting**

# Eco-Village Development Plan

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## BACKGROUND

Himachal Pradesh is a mountainous state in Himalayan region. Around 90% of the population resides in rural areas and are dependent on natural resources for agricultural purposes. Global environmental changes are threatening the natural resources, thus pose a great threat to the livelihood of rural population. The Eco Village Concept under the scheme by Department of Environment, Science and Technology, Govt. of Himachal Pradesh aims to develop an environmentally sustainable model village. The programme endeavors to sustain prosperity in villages that is built around sustainable use of the key natural resources of a village, through the adoption of low-impact practices that result in water security, food security and livelihood security for the village communities. These eco-friendly villages will be developed with support of villagers and shall aim to reduce the ecological footprint by as much as 50% of the base assessment from launch of the scheme. It aims to create new means to build climate resilient village communities. It will focus on development of environmentally responsible practices in areas of sustainable agriculture, water management, waste management, energy conservation, management of natural resources, climate change action and livelihoods.

## OBJECTIVE

The main objective of this engagement is to assist the local authorities in the identified villages in the following aspects:

- (a) Designing the Eco-village Development Plan with concrete activities (as per the notified guidelines) in a participative manner
- (b) Support the implementation of the scheme providing guidance on change in vulnerability and other agreed indicators every quarter during the life cycle of the project and document best practices, barriers, lesson learning and policy briefs based on scientifically obtained micro-level data.

## PROJECT LOCATION

TABLE 1 PROJECT LOCATION

State	Himachal Pradesh
District	Shimla
Block	Mashobra
Panchayat	Dhamun Panchayat
Village	Baghali

## **How to reach Baghali**

The revenue village of Baghali is located on the Shimla – Nalagarh – Ghanoli Road from Shimla to Shimla Airport. Therefore, well established connectivity is available to and from the revenue village.

- Reaching by Bus
  - Regular buses from Shimla, Jutogh and Totu ply at routine intervals on the road/s adjacent to the village
- Driving from major nearest cities
  - Shimla – 14 km
  - Kalka - 73 km
  - Chandigarh – 98 km
  - Delhi – 328 km
- Reaching by Train
  - The closest Small Railway Station is Shimla from which it takes 7 hrs by train to reach Kalka, which is the nearest railhead, connect Delhi and Chandigarh.
- Reaching by Air
  - Shimla airport is located at a distance of 14 kms from the revenue village.

## **Demography**

Baghali is a revenue village in Dhamun Gram Panchayat. As per the Panchayat records, the revenue village Baghali, inclusive of its 5 hamlets, namely: Koti, Shakoli Masera, Mander and Baghali, displays a slightly male favoring sex ration of its total resident population of 610 individuals. The individuals reside in a total of 144 households distributed across Ward 1 and Ward 2. Female population constitutes 47.8% (292 Nos) of the total population while Males constitute 52.2% (318 Nos) of the total population.

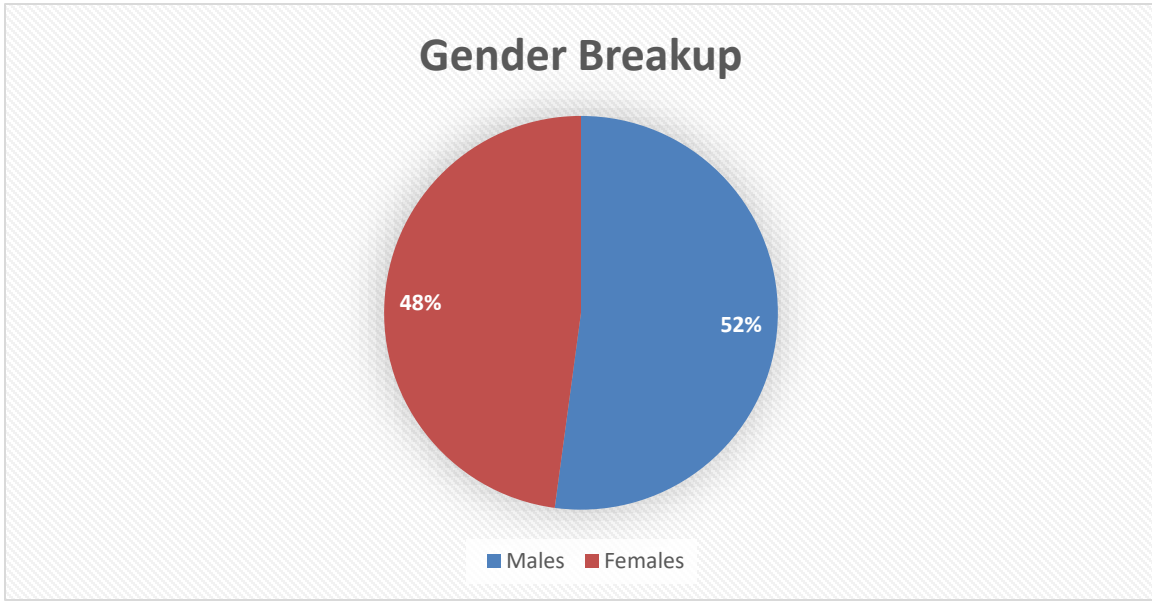
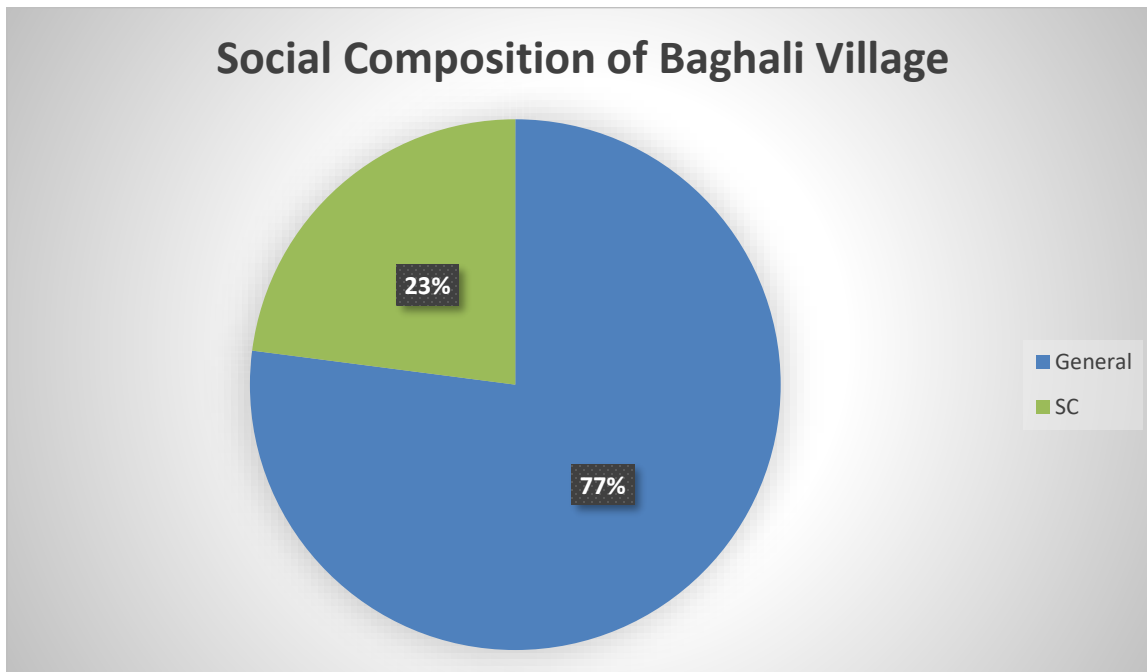


FIGURE 1 GENDER BREAKUP

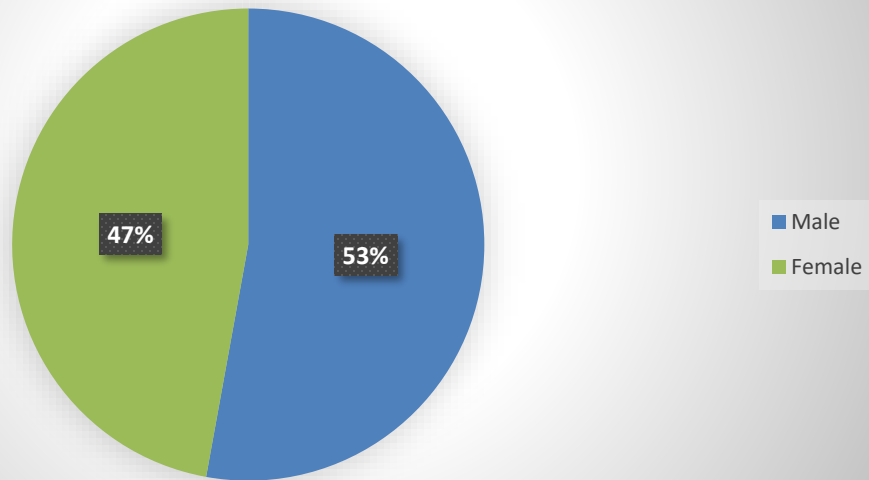
### Social Composition

As per the panchayat records, the total number of schedule caste individuals are 140 in the village out of the total population of 610 individuals. This displays a 22.95% and 77.05% breakup of the population as Schedule caste and general. Out of the 140 SC individuals, 74 are male and 66 are female.

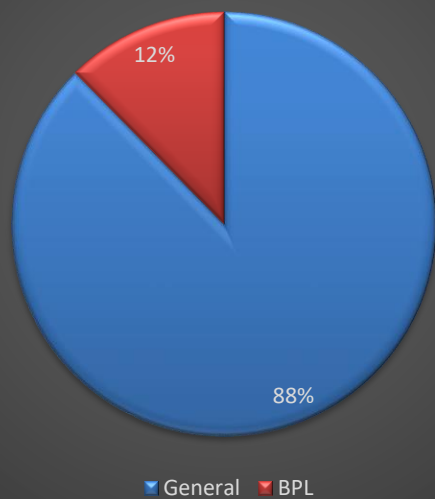
There are 18 households or 12.5% of the total 144 households belonging to families living under the poverty line (BPL).



### Social Composition of Schedule Caste in Baghali



### Social Composition of BPL households in Baghali Village



## Approach for the given Tasks

### Task I

- Develop Eco-village Development Plan for one identified village—Village *Baghali* in Shimla district

The Eco-Village Development Plan aims to regenerate the natural environments, preserve cultural heritage, increase social resilience and improve livelihoods. An eco-village development plan is a function of the ambition of the stakeholders and accordingly rigor, resources and regulation (voluntary and mandatory) are determined.

Formation of an Eco village development plan initiated with a baseline study in the selected village for identification of existing legal and regulatory frameworks, outlining initiatives government could take for an enabling environment. Community interaction initiated the participation of community and other stakeholders.

Bio-physical parameters estimated (precipitation and temperature) from the state stations at the block scale or estimated from the IMD GRID for 63 years (up to 2013).

- Future climate projections (modelled output) upto mid-century under relevant scenario
- Risk and return periods (based on the risk/multi-hazard maps) if not available recall method
- Forest cover from relevant Grids (current and future)
- Biodiversity register from the village if available
- Baseline emission from the village

*Tools used: Multivariate analysis and Participatory Vulnerability analysis at the village scale, PRA tools, FGD.*

- *Community level resource mapping and vulnerability assessment using participatory tools like PRA, FGD etc. to understand the baseline climatic trends and its impact on the life and livelihood of communities and natural resources in the two villages*

Development of Plan is facilitated by allowing local stakeholders to identify assets, needs and leverage points for the community.

- Key informant interview on past experience and impact (past, near term, future) using picto-gram, story board techniques
- Using the modeled output (block scale) for village level interpolation.
- Socio-economic impact (future projection for a longer term may not be feasible at the village scale)
- A future vision of the community for their eco-village (movement from current to a desirable future)

Tools: Modelled output, force field analysis technique, future search visioning technique with community

- *Identification of the current and potential impacts of climate change and resource depletion on the ongoing activities and the life and livelihood of the communities in the selected village through corroboration of scientific and community level findings*

Along with the secondary level data findings and stakeholder consultation at district, block and village level helped in understanding current impacts on the natural resources and livelihoods of the communities in selected villages.

- Transect walk through the village for identification of existing natural resources and their depletion.
- FGD with old villagers for understanding the impact
- Stakeholder Consultation
- *Developing a list of strategies to addresses environmental, climate change and resource depletion related challenges in line with the guidelines for Eco-village Scheme notified by the State Government available Review of the current government development programmes/ schemes that are ongoing in the identified district with focus on addressing identified challenges related to climate change, resources depletion and other environmental issues.*

The guidelines highlight environmental issues in rural areas of Himachal Pradesh. Sector wise tools and strategies proposed are:

Climate stressor on sectors	Tools used to Observed/Modelled impact outputs	Strategy/Activity	Available resources
Water	From baseline survey	Spring-shed rejuvenation	Financial resources (current and projected)  Skills/capacity
Climate change	From V&A study, SAPCC	Adaptation Plan Contingency Plan	Analysis of status of funding, linkages under missions
Forest and Biodiversity	From state of forest inventory, biodiversity register	Participatory forest management	Linkages with flagship schemes, national missions, external aided projects
Agriculture	Agri-vulnerability, trend analysis, market analysis, livelihood analysis, cropping system	Diversification of crops or varieties based on the stressed, cropping system change  Farmer Field Schools	Linkages with schemes Own budget
Waste Management	Waste and emission analysis  Livestock profile	ODF village Source segregation plans	Swachh Bharat  Budgets from state and flagship schemes

	PRA to pinpoint	Vermiculture Voluntary compliance to regulation on polythene	
Energy	Energy profile analysis Ex-ante baseline and ex-post analysis for emission reduction	Integration of solar energy in streetlight, water heating, crop preservation, water purification	Convergence fund (HIMURJA)

- Stakeholder consultation and prioritization of programmes/ schemes and strategies implemented based on identified criteria vis-à-vis climate change, resources depletion and other environmental issues.
- Coordination with DEST on leveraging funds available for Eco-Village Scheme as well as coordination and liaisoning with state line departments and local government institutions to identify entry points for convergence with various other projects/ schemes
- Mapping and selection of the potential actors who involved at the district, block and panchayat level

Presence of social networks like water user groups, SHG groups, JFM groups, Farmer Interests Groups, ANM/ASHA, Para teachers, etc. have been analysed. Assessment of their efficiency and effectiveness is key to sustainability of the eco-village.

PRA techniques like spider diagram, influence chart, etc

Tools: PRA/FGD/Stakeholder Consultation

*Preparing a detailed plan of action in the form of Eco-village Development Plan (one for each village) including convergence with other schemes/ programmes with clear indicators on the future environmental/ adaptation benefit to implement the prioritized strategies including M&E plan, implementation mechanism, steering structure and budget for the proposed Plan.*

List of prioritized actions were proposed under Eco village development plan with list of schemes for convergence. It is based on gap assessment and analysis taking in accounts the baseline status of all components.

Plan of action for Baghali village is based on:

- Identifying climate vulnerability of the identified village
- Participatory vulnerability assessment to recalibrate local indicators
- Community response on vulnerability
- Identification of modern and indigenous sustainable options in the identified sectors
- Budgeting of climate change adaptation investment for different activities
- Convergence of identified activities in existing schemes

## Resource mapping

The resource mapping exercise was conducted between 11<sup>th</sup> April, 2019 and 14<sup>th</sup> April, 2019. This was carried out post the briefing about the required legend for the resource map of the village of each individual sub-village. The villagers present, comprising mainly of Land-owning individuals from the village, were informed about the required indicators to be displayed on the map. This was followed by a community exercise to inter-discuss, interact and to devise a map of the resources of the village which was accurate to the perception of the villages and accepted by all present.

**Transect Walks** were carried out regularly during the entire duration of the on-site planning. This allowed for successful confidence building amongst villages and hence allowed for continual assessment of village conditions and situation. It also allowed for the successful mapping of resources such as unidentified springs through local knowledge along with site specific issues..

**Focus Group discussion** were conducted at various levels. This includes meeting with individuals from the entire revenue village (inclusive of 5 hamlets) as well as individual hamlet as well as social group specific meetings.



FIGURE 2 COMMUNITY GENERATED RESOURCE MAP OF BAGHALI VILLAGE



FIGURE 3 COMMUNITY GENERATED RESOURCE MAP OF MANDERA AND MASERI VILLAGE

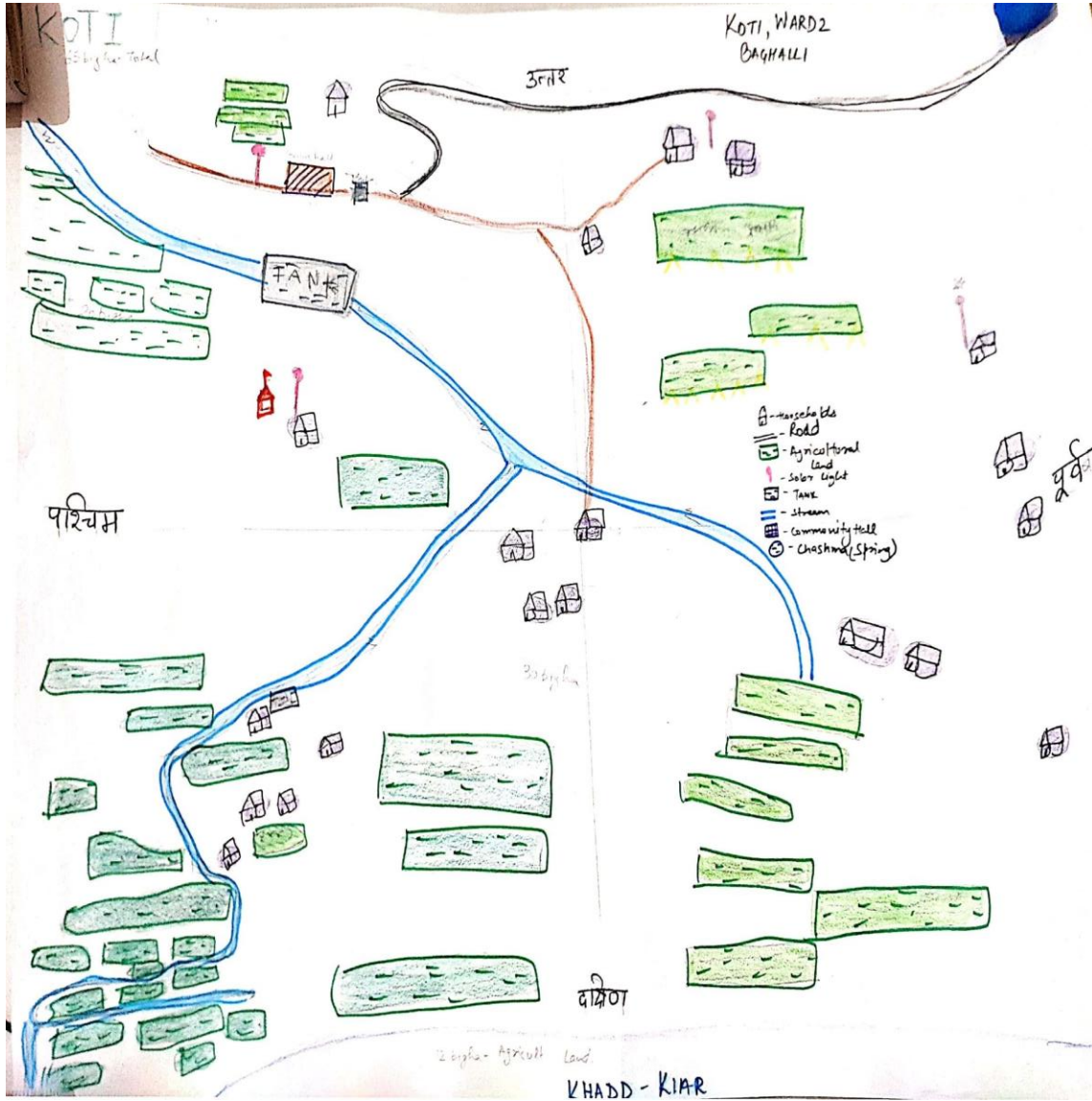


FIGURE 4 COMMUNITY GENERATED RESOURCE MAP OF KOTI VILLAGE

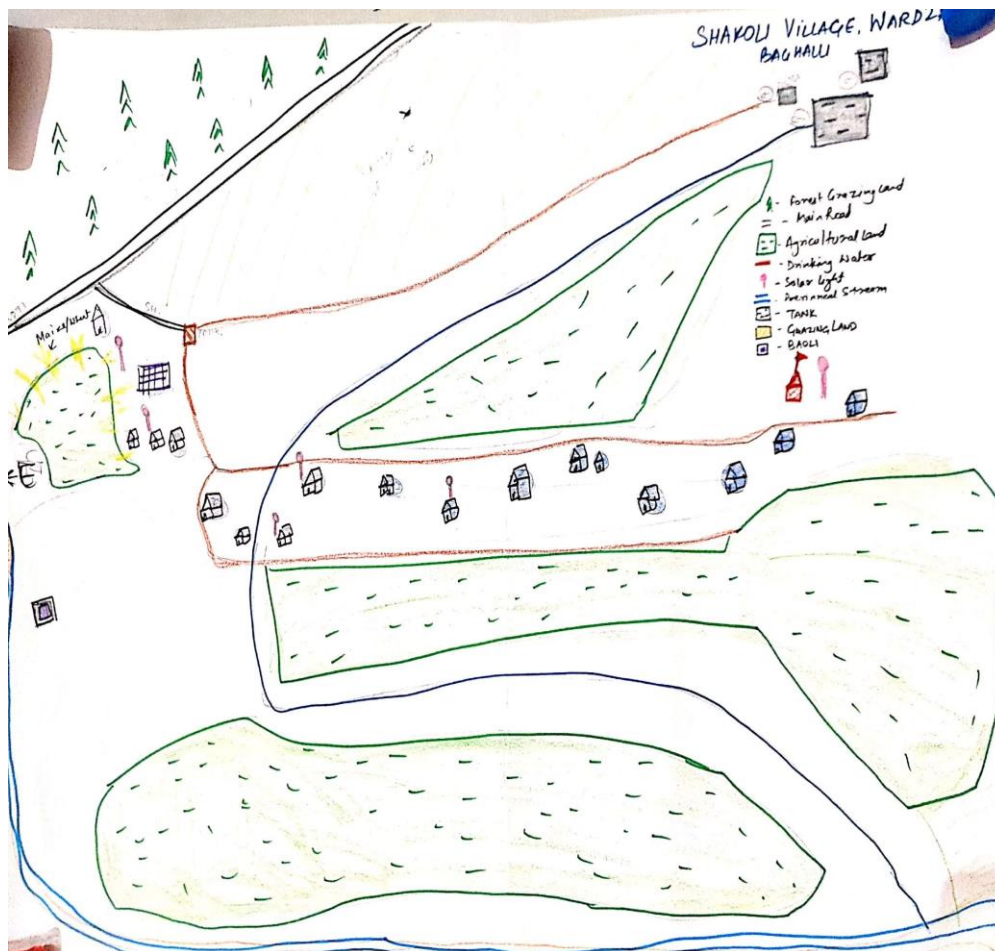


FIGURE 5 COMMUNITY GENERATED RESOURCE MAP OF SHAKOLI VILLAGE

## Land Use

TABLE 2 LAND USE IN BAGHALI REVENUE VILLAGE

<b>173.2 Hectares under Revenue Village</b>	
Agricultural land	22.1 hectares
Non-Agricultural Land	151.1 hectares
Forest Land	0.01 hectares
Grasslands	75.96 hectares
Grazing Land	43.04 hectares
Barren Land	11.31 hectares

SOURCE 1 PATWARI, BAGHALI PANCHAYAT. REVENUE DATE

Total land under the revenue village Baghali is 173.2 hectares. While 22.1 hectares or 12.75% of the total land is agricultural, majority or 87.25% of the land is non-agricultural in use. It can also be observed

that very little or 0.01 hectares of forest land resides within the revenue village boundary whereas majority of the non-agricultural land remains open as grassland (43.85%) and as grazing land (24.84%).

## **CLIMATE CHANGE IMPACT**

Himalayan ecosystems are highly vulnerable due to the stress caused by forest land conversion, forest degradation, habitat fragmentation, overgrazing, fuel wood collection, forest fires, infrastructure development, mining, and other related challenges. The effect of these current stressors will be most likely exacerbated due present and future climatic changes.

The environment has a limited carrying capacity so there is a need to make our villages sustainable, ecologically sound & environment friendly so it becomes imperative that we address the environmental issues. These considerations are of prime importance as nature can sustain a negative impact up to a level & sensitive systems are not so resilient to cope up with changes in physical and natural environment therefore reviewing relevant impacts of eco village development proposals prior to major decisions taken and commitments being made, to account environmental values in their decisions as there may be impact on people and other social components. Similarly, there can be direct or indirect impact on flora, fauna, water resources, land use etc. Therefore, a sustainable and climate adapted village will have more resilience to overcome the future challenges associated with climate change.

## **Climate Change Trends in District Shimla**

### **Climate**

Shimla features a subtropical highland climate (Cwb) under the Köppen climate classification. The climate in Shimla is predominantly cool during winters and moderately warm during summer.[27] Temperatures typically range from  $-4^{\circ}\text{C}$  ( $25^{\circ}\text{F}$ ) to  $31^{\circ}\text{C}$  ( $88^{\circ}\text{F}$ ) over the course of a year.[28]

The average temperature during summer is between  $19$  and  $28^{\circ}\text{C}$  ( $66$  and  $82^{\circ}\text{F}$ ), and between  $-1$  and  $10^{\circ}\text{C}$  ( $30$  and  $50^{\circ}\text{F}$ ) in winter. Monthly precipitation varies between  $15$  millimetres ( $0.59$  in) in November and  $434$  millimetres ( $17.1$  in) in August. It is typically around  $45$  millimetres ( $1.8$  in) per month during winter and spring, and around  $175$  millimetres ( $6.9$  in) in June as the monsoon approaches.

The average total annual precipitation is  $1,575$  millimetres ( $62$  in), which is much less than most other hill stations but still much heavier than on the plains. Snowfall in the region, which historically has taken place in the month of December, has lately (over the last fifteen years) been happening in January or early February every yea

### **Climate Change Vulnerability of Project Area**

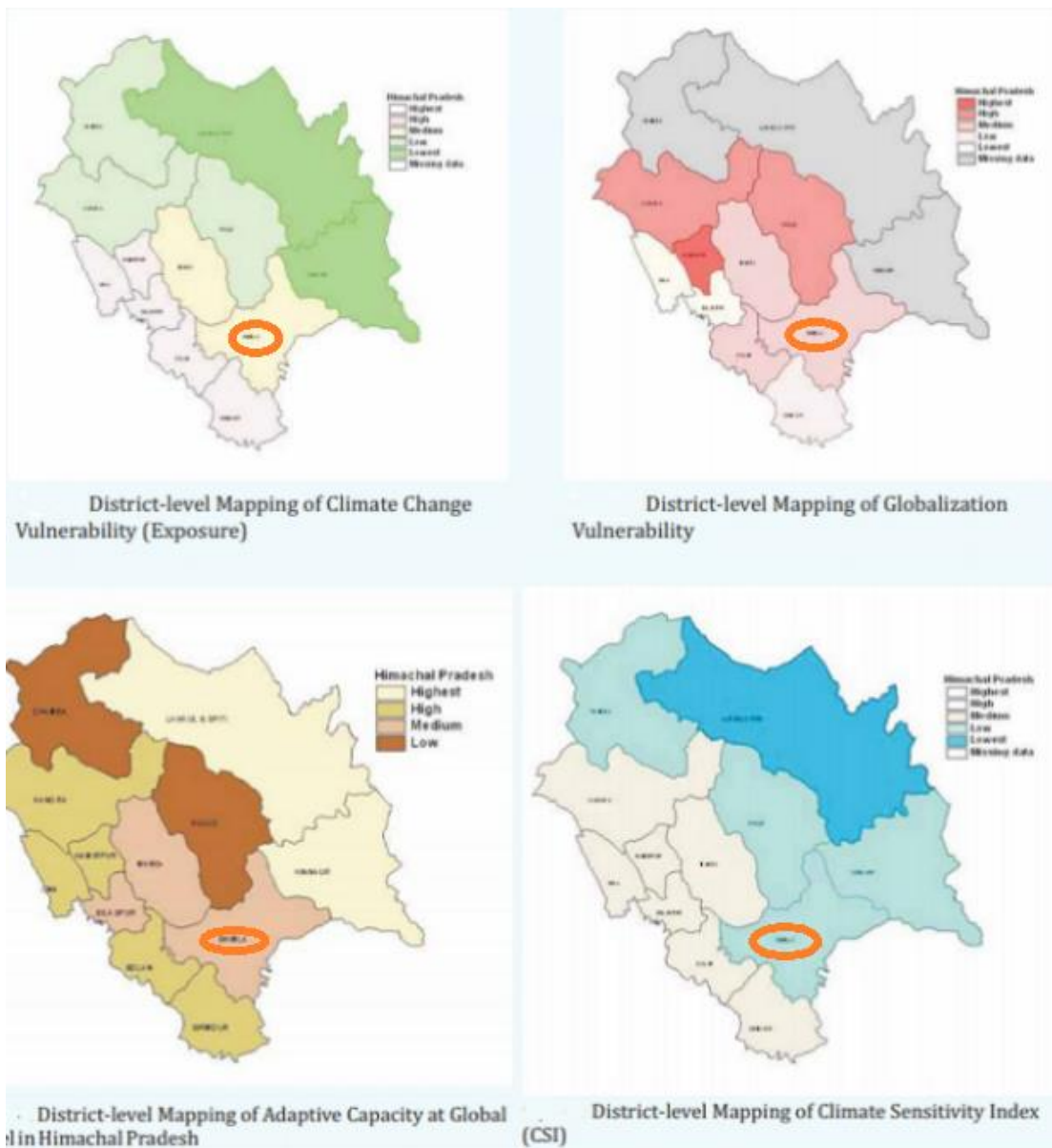
According to Himachal Pradesh climate change state action plan various factors show that Himachal Pradesh possesses a high degree of vulnerability to climatic variations, which will affect millions of poor rural people. Some of the identified key aspects of Himachal Pradesh have been elaborated using parameters such as adaptive capacity, exposure and sensitivity that contribute to its net vulnerability to climate change in the State.

From global level assessments of vulnerability on the basis of database for the period 1960-1990 carried out by K. O'Brien et al. / *Global Environmental Change* 14 (2004) 303–313 following spatial representations of adaptive capacity, sensitivity and exposure have been observed.

District-level mapping of adaptive capacity of Himachal Pradesh at global level measured as a composite of biophysical, social, and technological indicators (1960-1990) shows lowest adaptive capacity for Chamba and Kullu whereas higher adaptive capacity of Kangra, Hamirpur, Una, Solan and Sirmour districts

District-level mapping of Climate Sensitivity Index (CSI) for India based on observed climate data (1961–1990) and based on results from the HadRM2 model is shown in the and as per estimate, sensitivity is lowest for Lahaul & Spiti and low in Chamba, Shimla, Kullu and Kinnaur regions.

Districts in the country that rank highest under climate change vulnerability and globalization vulnerability are considered to be double exposed.



### CLIMATE CHANGE PROJECTIONS

The HPSSAPCC 2012 contains extensive sections about past, current and projected climate change trends Upgupta et al (2015) carried out climate change projections for Himachal Pradesh under Representative Concentration Pathways RCP4.5 and RCP8.5 scenarios for the period 2021–2050 (2030s) and 2071–2100 (2080s) which are briefly presented below.

In the midterm (2030s), most districts in Himachal Pradesh are projected to experience a warming of 2–3 °C. However, in the long term (2080s), the mean warming under RCP4.5 is in the range of 3 to 4 °C, and under RCP8.5, the warming increases to 4–5 °C

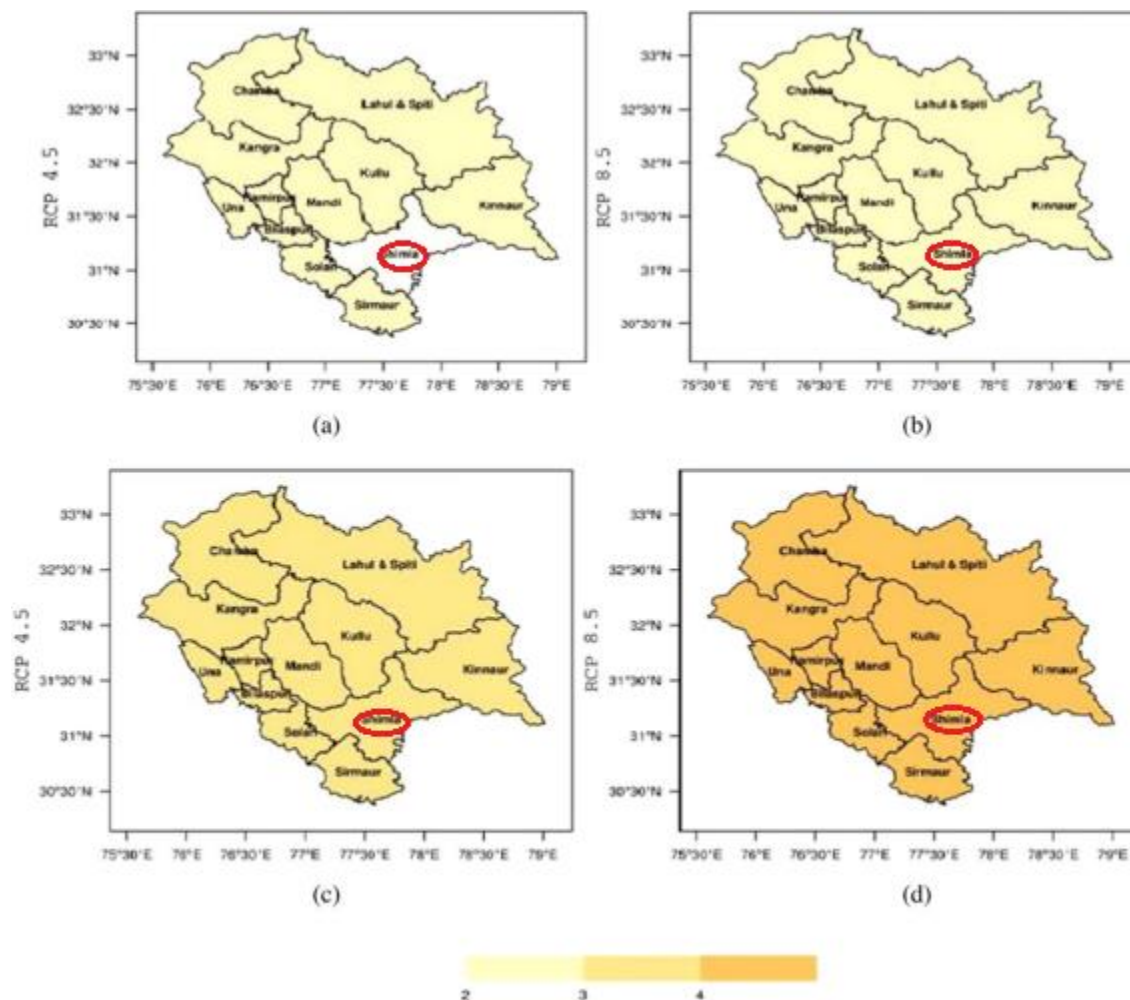


FIGURE 6 District-wise projected warming of temperature: (a) for 2030s under RCP4.5, (b) for 2030s under RCP8.5, (c) for 2080s under RCP4.5, (d) for 2080s under RCP8.5.

Precipitation is projected to increase by 4–8% under RCP8.5 for most districts in the midterm. The percentage increase in precipitation could be over 16% for all districts, except, Shimla, Mandi, Solan and Una districts by 2080s.

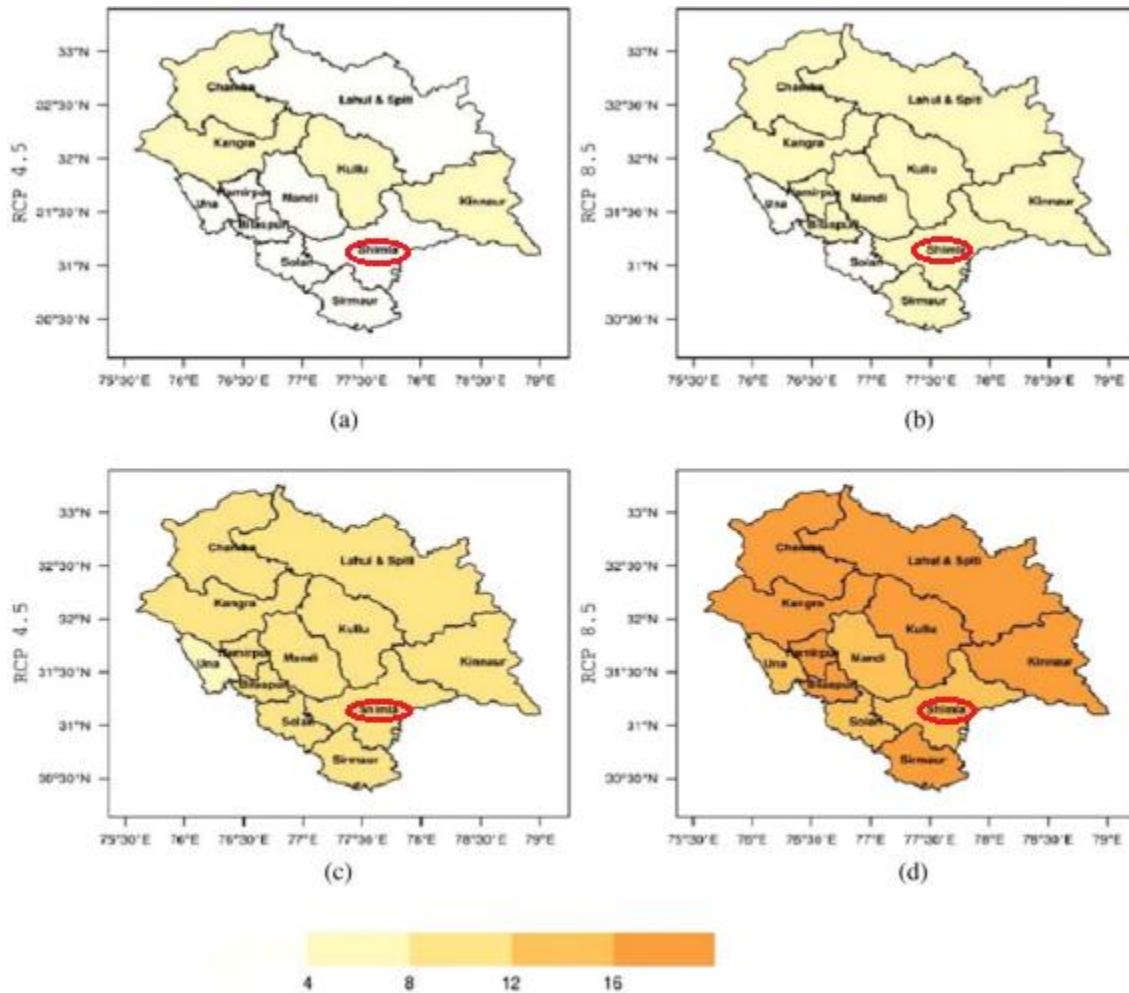


FIGURE 7 District-wise projected changes in precipitation: (a) for 2030s under RCP4.5, (b) for 2030s under RCP8.5, (c) for 2080s under RCP4.5, (d) for 2080s under RCP8.5.

The Energy and Resources Institute (TERI) in collaboration with the Global Green Growth Institute (GGGI) used a high-resolution dynamical model to simulate a baseline run from 1970–2000 and for near future (2030s: 2020–50) to arrive at future climate variability over the study domain area (CRGGS 2015). Main conclusions are:

- The spatial distribution of precipitation in the near future will change relative to the baseline period.
- The precipitation change for monsoon months will be in the range of –8 and 12 per cent. This change for winter months of December to February shows a much larger variation from less than –10 per cent to over 30 per cent in some areas.

- The whole State shows a positive change for summer rainfall in the range of 5 per cent and 30 per cent. Post-monsoon season also shows a variation in the changes of precipitation percentage in the range of less than –15 per cent in some areas to more than 30 per cent in others.
- There will not be much changes in the occurrences of extreme rain events during the summer monsoon season in the near future from the baseline period. Extreme rain events are expected to increase for the State in the long run.
- The temporal distribution of rainfall will be different.
- Annual mean temperature is projected to increase by 1.3–1.9°C for 2021–50 relative to 1971–2000.
- Mean Annual Maximum temperature (Tmax) over the State is projected to increase by 1.1–1.9°C. The Mean Annual Minimum Temperature (Tmin) also is projected to increase over the study domain area in the range 1.5–1.9°C.

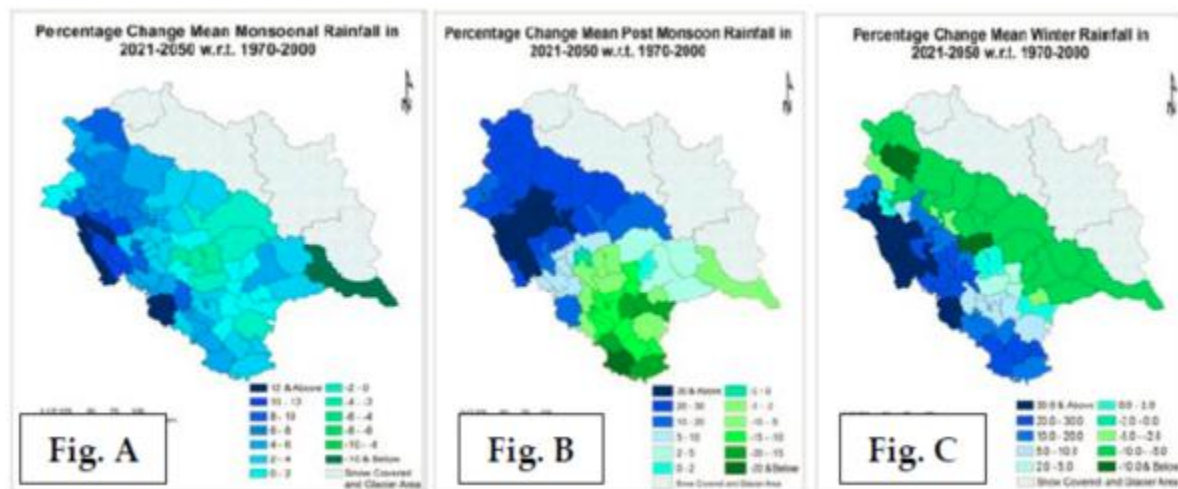


FIGURE 8 Precipitation projections for near future (2021-50) for different seasons

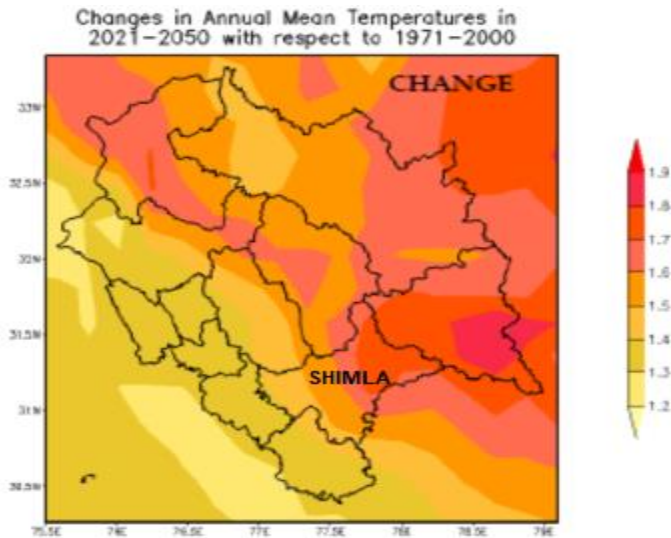


FIGURE 9 Forecast increases in annual mean temperature in the short-term (2021-50) for Himachal Pradesh

AS per Himachal Pradesh Climate change Action plan (HPCCAP) the overall climate change variations are set to arrive in following manner:

#### Temperature

- The annual temperatures are set to rise.
- The rise in temperature with respect to 1970s shows a range between 1.5 C to 2.8 C.
- Temperatures are also showing a rising trend in all seasons.

#### Precipitation

- The mean annual rainfall likely to vary between  $1250 \pm 225.2$  and  $1550 \pm 175.2$  mm in Himachal Pradesh.
- The rate of increase is more in North-western parts of the State i.e. areas of district Kangra, Chamba, Kullu, Una are likely to receive rainfall with increased intensity.
- The High Hill areas like Kinnaur, Lahul & Spiti and some parts of Chamba and Kullu districts may also experience rainfall in place of snowfall with increased temperature.
- There may be staggering decrease in snowfall patterns in mid-hills temperate wet agro climatic zone.
- An increase in rainfall in the pre-monsoon and post-monsoon months with increasing incidence of storms in Himachal Pradesh.

#### Extreme Events

- Change in rainfall patterns with increased variability in future some regions (Southeastern parts) may be experiencing less rainfall Drought like conditions may prevail in given projections.
- Projected increase in temperature, rainfall, rainfall variations and intensities in the State may lead to accelerated summer flows leading to situations like floods/flash floods in North-western parts of the State.
- Health risks are also associated indirectly with extreme events in sub montane, low hills, and sub humid agro climatic zones of the State.

## CLIMATE CHANGES OBSERVED IN SHIMLA

According to Himachal Pradesh state action plan, the State climate variables are showing changes in trends:

- Change in trend of rainfall.
- Change in trend of snowfall.
- Change (shift) in cropping pattern and vegetation species.
- Change (shift) in apple contour.

The above trends which have been established on scientific data base are also supported by concerns raised by the community in Baghali eco-village. Below is the detailed perception of villagers with regard to climate change impacts.

<b>Climate changes observed</b>	<ul style="list-style-type: none"> <li>• Increase in temperatures</li> <li>• Rainfall is now more intense and erratic, previously rains were less intensive, but it rained longer, i.e. for a number of consecutive days (i.e. rains were easier to predict)</li> <li>• Winters are drier as compared to the past</li> <li>• Reduced snowfall</li> </ul>
<b>Impact on soil and water</b>	<ul style="list-style-type: none"> <li>• Water scarcity due to drying of streams and springs</li> <li>• Heavy downpours do not allow percolation of water into the ground leading to water scarcity</li> <li>• Severe runoff of rainwater across the slopes</li> <li>• Soil erosion, loss of topsoil and exposure of rocks due to intense rain</li> <li>• Increased number and severity of landslides</li> </ul>
<b>Impact on agricultural crops</b>	<ul style="list-style-type: none"> <li>• Decrease in agricultural production as no timely rains and scarcity of water in summers</li> <li>• Change in cropping patterns due to change in rainfall patterns</li> <li>• Change in rain pattern is impacting them badly, high rains at the time of sowing or immediately after sowing leads to washing away of seeds and damage to the fields; also rains at the time of harvest destroy their</li> </ul>

	<ul style="list-style-type: none"> <li>crops.</li> <li>Increased infestation by weeds</li> <li>Abandonment of agricultural fields since cultivation of crops (e.g. paddy rice, brown rice) is not economically anymore due to drought / erratic rainfall</li> </ul>
<b>Impact on forests</b>	<ul style="list-style-type: none"> <li>With climate heating up and prolonged dry spells between the rains, not much moisture available for new saplings to survive during summer months</li> </ul>
<b>Impact on health</b>	<ul style="list-style-type: none"> <li>Increase in diseases as previously there were less mosquitoes and flies</li> </ul>
<b>Pests</b>	<ul style="list-style-type: none"> <li>The pest infestation and agricultural related diseases are on rise</li> </ul>
<b>Direct impacts on livelihoods (apart from agriculture)</b>	<ul style="list-style-type: none"> <li>Landslides damaging houses, roads and property, also leading to degraded land patches and lesser grass for fodder.</li> </ul>

TABLE 3 Perception of villagers with regard to climate change impacts.

## BASELINE ASSESSMENT

### WATER RESOURCES

Due to climate change the rains have become erratic, the intensity of rains has increased leading to low percolation of water which can have a severe impact on water security, availability & increase in occurrence of extreme events like flash floods.

With climate change leading to rising temperatures, rise in rainfall intensity and a marked decline in winter rain/ Snow, the problem of drying springs is being increasingly felt across the Indian Himalayan Region, NITI Aayog constituted group of experts have submitted report titled 'Inventory and Revival of Springs in the Himalayas for Water Security' it has mentioned that nearly 30% of springs crucial to water security of people are drying and 50% have reported reduced discharge in Himalayan region.



FIGURE 10 WATER RESOURCES OF BHAGHALI REVENUE VILLAGE

In Baghali eco village many streams crisscross the Baghali and other sub villages; some of the streams are perennial and others seasonal.

TABLE 4 BASELINE INDICATORS OF SPRING SHED DEVELOPMENT

<b>Strategy</b>	<b>Protect, celebrate, and appropriately utilize water</b>
<b>Indicators</b>	Many streams have reduced flow or dried down and now have become seasonal

TABLE 5 VULNERABILITY IMPACT MATRIX OF WATER SECTOR

Climate change hazard	Climate change impact	Determinants of vulnerability	Possible Adaptation options
-----------------------	-----------------------	-------------------------------	-----------------------------

Increased aridity from temperature increase	<ul style="list-style-type: none"> <li>•Drying up of water sources</li> <li>•Decrease in water levels in ground water</li> <li>•Lowered ground water levels lead to reduction in vegetation cover</li> <li>•Impacts on agriculture</li> </ul>	<ul style="list-style-type: none"> <li>•Impact on agriculturally based livelihood source</li> <li>•Loss of biodiversity</li> <li>•Impact on forest cover and biodiversity</li> <li>•Competition for surface water for agriculture</li> <li>•Loss of livelihood</li> </ul>	<ul style="list-style-type: none"> <li>•Shifting to low water-based agriculture</li> <li>•Change in crop diversity</li> <li>•Shifting to modern agricultural practices like drip irrigation.</li> </ul>
Increased rain intensity	<ul style="list-style-type: none"> <li>•Low water percolation</li> <li>•High runoff</li> <li>•Soil erosion</li> <li>•Increased flash floods</li> </ul>	<ul style="list-style-type: none"> <li>•Drying of Springs leading to water scarcity</li> <li>•Drying of streams leading to low water availability for agriculture</li> <li>•Loss of fertile top soil</li> <li>•Low income</li> </ul>	<ul style="list-style-type: none"> <li>Soil &amp; water conservation</li> <li>Water harvesting</li> <li>Ground water recharge</li> </ul>
Decreased winter rains & snow	<ul style="list-style-type: none"> <li>•Low water availability in summers</li> </ul>	<ul style="list-style-type: none"> <li>•Impact on agriculture summers</li> </ul>	<ul style="list-style-type: none"> <li>Rain water harvesting</li> </ul>
Increased frequency of flash floods	<ul style="list-style-type: none"> <li>•Loss of assets &amp; life</li> </ul>	<ul style="list-style-type: none"> <li>•Loss of agricultural land</li> <li>•Erosion</li> <li>•Damage to property</li> </ul>	<ul style="list-style-type: none"> <li>Basic engineering measures and structures combined</li> <li>Flood resistant crops during monsoon season</li> </ul>
Decreased water availability in Springs	<ul style="list-style-type: none"> <li>Loss of perennial sources of water</li> <li>Loss of potable water</li> </ul>	<ul style="list-style-type: none"> <li>•Competition for surface water for domestic consumption</li> </ul>	<ul style="list-style-type: none"> <li>•Spring restoration</li> <li>•Springshed management</li> <li>•Stream Preservation &amp; restoration</li> </ul>
Decreased water flow in river	<ul style="list-style-type: none"> <li>Low water availability for irrigation and other human use</li> </ul>	<ul style="list-style-type: none"> <li>•Competition for surface water for agriculture consumption</li> </ul>	<ul style="list-style-type: none"> <li>Watershed management</li> <li>Rain water harvesting,</li> </ul>
Water based conflicts	<ul style="list-style-type: none"> <li>Low availability of water resources</li> </ul>	<ul style="list-style-type: none"> <li>• Competition for water and inter and intra village conflicts</li> </ul>	<ul style="list-style-type: none"> <li>•Spring restoration</li> <li>•Springshed management</li> <li>Stream Preservation &amp; restoration</li> </ul>
Water thefts	<ul style="list-style-type: none"> <li>Very Low availability of water resources during</li> </ul>	<ul style="list-style-type: none"> <li>• Village based as well as commercial based</li> </ul>	<ul style="list-style-type: none"> <li>•Planned development</li> </ul>

	summer	thefts of water from sources	<ul style="list-style-type: none"> <li>•Spring restoration</li> <li>•Springshed management</li> <li>Stream Preservation &amp; restoration</li> </ul>
<b>Water Impact on tourism</b>	Decrease in availability of potable water	<ul style="list-style-type: none"> <li>• Negative impact on tourism</li> <li>•Decrease in tourism-based revenue</li> <li>•Loss of Livelihood</li> </ul>	<ul style="list-style-type: none"> <li>•Planned development</li> <li>•Spring restoration</li> <li>•Springshed management</li> <li>Stream Preservation &amp; restoration</li> </ul>

### IMPACT ON WATER SOURCES

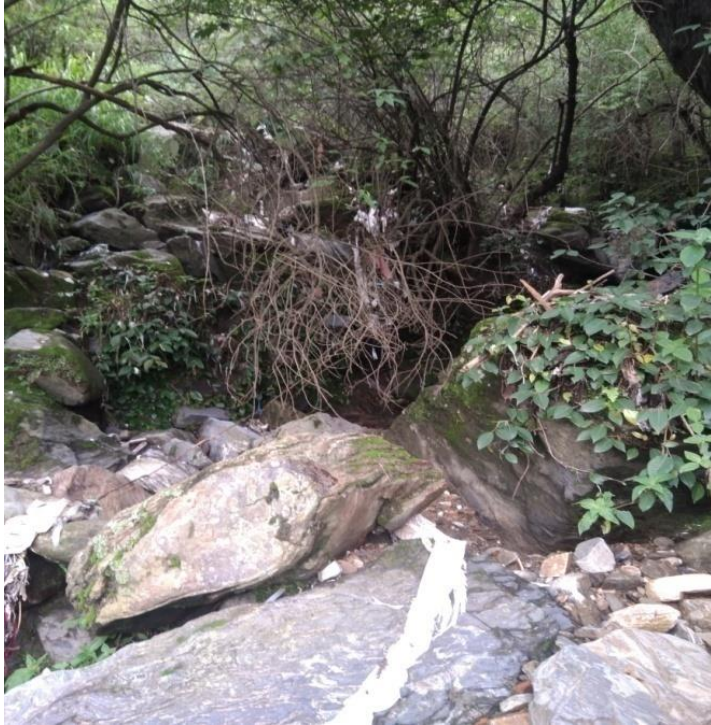
Across Baghali revenue village a number of Nallas, perennial streams zigzag its sub villages while moving downwards, some streams which were perennial in past have reduced flow or have dried down and now have become seasonal.

As Heavy intense downpours do not allow percolation of water into the ground leading to low recharge which in turn leads to drying down of natural sources leading to water scarcity. Except for year 2019, the snowfall has been showing a decreasing trend for last many years which can also have a direct bearing on the summer water output.

Number of springs are dotted across Baghali revenue village. The spring discharge is reported to be declining as per community and in summers some of the resources dry up while most of them have a lower discharge; it is on the expected lines as across Himachal overall discharge from springs is on decline.

Few springs dry up completely in summer while others have reduced output in comparison to past. The springs need to be monitored and regular flow needs to be measured and data collected, so that comprehensive spring restoration plan is made.

**Koti sub village:** Three perineal streams pass through it.



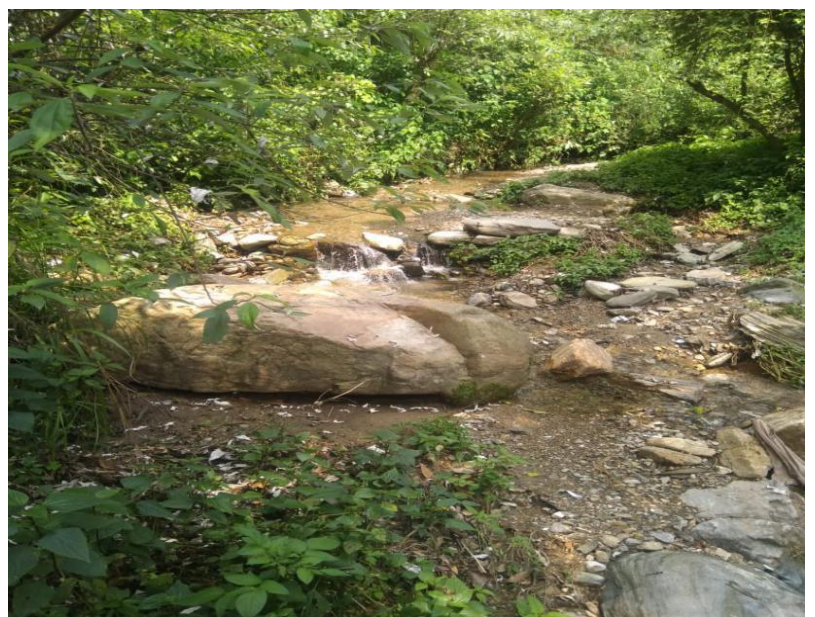
**koti manoon stream :** It is at an elevation which is just right to be used for irrigation by gravitational flow, in the village tanks have been built to store water from this stream as during summer the usage and supply is based on the mutually agreed date and time on rotational bases between inter & intra village community.

**Proposed work:** it is proposed that check dams should be built so that the flow of water can be gradual as it was observed that the flow water cuts through soil on both sides leading to erosion so better land water conservation measures should be

undertaken. Based on the assessment and need storage tanks can be made to secure present & future water needs.

**Koti Maseri:** Stream: Another stream comes from Maseri, it could be seen that lots garbage and waste coming through this stream which is being dumped by villages at higher levels. The flow during our visit was not so much and it seemed to be basically a seasonal Nalla/ Stream.

**Proposed work:** check dams along with soil conservation activities for better water



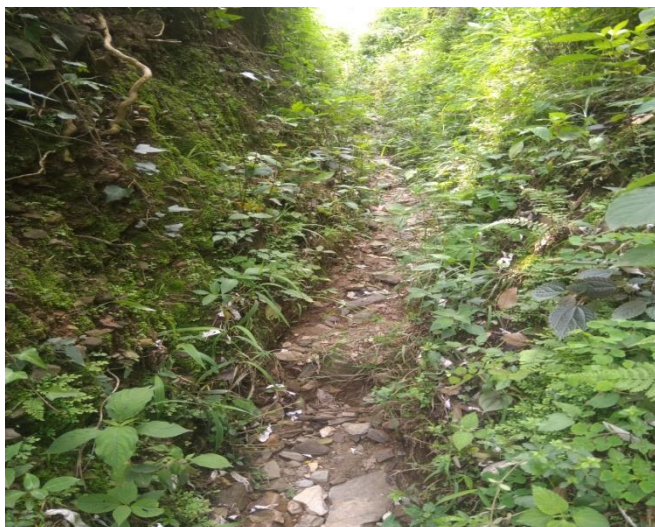
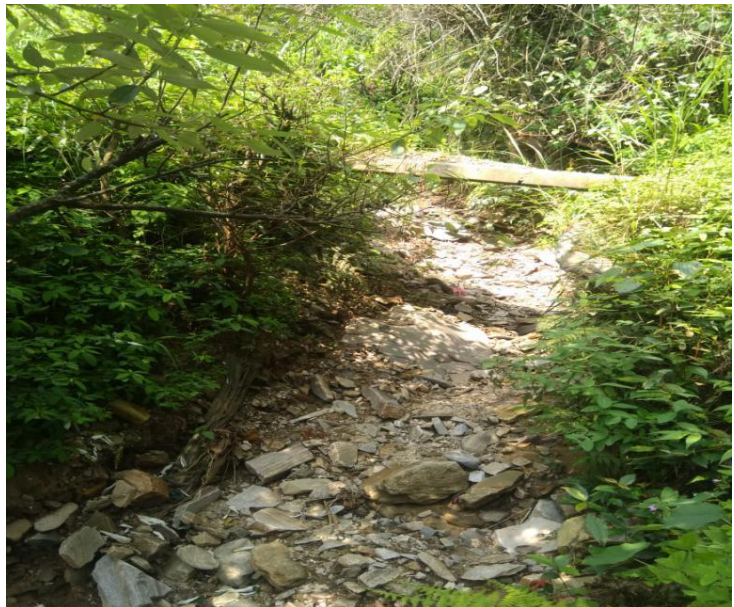
management and conservation of soil on the bunds.

**Koti Baghali stream:** This stream enters Baghali Shiv Mandir area and passes through Koti sub village, mostly the flow is quite high during monsoon season and at some places it passes through a steep slide leading to erosion, the stream while passing through Koti is at lower elevation than agricultural fields

**Proposed work:** check dams along with soil conservation activities for better water management and conservation of soil on the bunds.

**Nariyawali drain:** The drain is dry and only active during monsoon; it has got a deep depth which suggests the amount of water it carries with it after rains or during monsoon season.

**Proposed Work:** Soil and water conservation activities along with check dams to harness water and better percolation of water in the soil.



**channel formation/ Nala formation due to lack of drainage at village:** Due to lack of drainage system the water coming from the village during rains follows a certain path gradually it has eroded the soil on both sides in that particular area leading to deep, steep gully formation.

**Proposed work:** It is recommended that soil conservation activities are planned for

this and suitable work is undertaken to channelize drainage water.

**Koti Spring-** Just near the Koti Maseri Stream is a spring the water of which is already being harnessed through tanks and supplied to the village.

**Proposed work:** The watershed area of that spring needs to be strengthening so that in future it becomes sustainable and like many springs in Himalayan ranges it doesn't dry out and become a part of history.

### **Shakoli Sub Village:**



**Kayari Stream:** one perennial stream kayari stream passes through Shakoli it comes from baderi, this stream is a source of irrigation for villagers. During Monsoon the stream is flooded with water and gushes downwards leading to soil cutting on the banks.

**Proposed work:** check dams would not only stop water from gushing down but it will also help in ground water percolation.

**Spring:** *Dade ke Bawdi* is located near the bunds of Kayeari Stream, although village gets water from PHE department but still people prefer the spring water for drinking purpose.

**Proposed work:** strengthening and rejuvenation of spring watershed through plantations and other watershed activities.



**Bagheli Sub Village:**



A big perennial stream or Nalla enters Bhaghali from Manon, various water conservation construction activities like water tanks, have been built on this stream. The water enters steeply from the top and gushes down, in monsoon the flow of water very high. As per villagers the check dams built in the past were not built taking into consideration the flow and steepness, due to high flow of water and steep slope they got destroyed. The stream has a very high potential of being a source which can easily fulfil the water demands of the villagers sustainably.

**Proposed work:** A comprehensive plan needs to worked out involving

departments from watershed, PHE, soil and water conservation and forest department to plan a road map for sustainable development of this stream.

***Natural Stream (Dhobay ka khalta):*** A natural stream enters the Baghali village from road side its known as Dhobay ka khalta .

**Proposed work:** strengthening and rejuvenation of spring watershed through plantations.



Plantations on the sides of stream so as stop to protect and preserve the stream for future generations.



**Drain Pipe:** A drain pipe from the road side flushes the monsoon and rain water directly into Baghali village area a closer look at it shows how it is leading to sliding and erosion in that area, so some soil conservation activities need to be undertaken so that least damage happens and rather than damaging the environment the water flowing down the drain helps in sustaining and improving the environment.

**Shiv Mandir Spring:** The Spring is located inside the premises of shiv mandir, it is at very little distance from the manon –bagheli nalla.

**Proposed work:** strengthening and rejuvenation of spring watershed through plantations.





**Lower Tal:** The Spring is just below the Bagheli road, the water is diverted into tank which is used by villagers for drinking.

**Proposed work:** strengthening and rejuvenation of spring watershed through plantations and other watershed techniques.

Upper Tal: The Spring upper tal is on the road side and it is also the source of drinking water for Bagheli village.

**Nala ka Prihar:** The spring water is used for irrigation and drinking purpose. As seen in the picture various households have connected pipeline for drinking.

**Proposed work:** strengthening and rejuvenation of spring watershed through plantations and other watershed techniques





**Spring Just below the road side:**

Just below the road side near the drain pipes another spring which also supplies water to one household.

**Proposed Work:** strengthening of watershed and rejuvenation of spring watershed through plantations. Watershed activities like trenching needs to be undertaken

**Shared Spring between Badheri and Bagheli:**

The spring water collects in a tank and through tank, the water is channelised through tank to both the villages. Proposed work: strengthening and rejuvenation of spring watershed through plantations and other watershed techniques



**Maseri Sub Village:**



Maseri jadhni nala passes through the village; villagers dump the waste in the Nala which is polluting the stream.

**Proposed work:** check dams along with soil conservation activities for better water management

and conservation of soil on the bunds.



**Spring (Biju devta spring):** only one spring is located at Maseri village and the area is considered sacred and the spring is named after the deity of that village, Biju devta .

**Proposed Work:** strengthening of watershed and rejuvenation of spring watershed through plantations. Watershed activities like trenching needs to be undertaken.

**Mandera Sub Village:** The Mandera sub village is located at a higher elevation than other subvillages, there is no natural source of water located in the village, and the only source is located above it and comes directly under army cantonment area.

**Water Theft-** The water theft is very common across the area, the tankers directly extract water from the streams, during our visit we could witness water tanker extracting water from jhadhani Nala, this nala enters the koti village and the villagers are dependent on this stream for irrigation of agricultural fields. The tankers supply water to hotels and also fulfil the demand of water at construction sites. The theft needs to be plugged as in future its severity may increase impacting the village water security and may also lead to major water disputes and fights.



TABLE 6 WATER THEFT IN JAHDANI NALLA

## AGRICULTURE

Himachal Pradesh is highly vulnerable to climate change. Climate change also poses additional challenges as higher temperatures increase the need for water, irrigation and the risk of heat stress on crops. Changing weather patterns and rising temperatures will leave the farmers of the State vulnerable to crop losses on one hand and excessive precipitation also destroy the crops on other hand. Climate change will also negatively affect the water resources with increased water scarcity in hill stations. The increase in water demands will increase the vulnerability in the State.

The sub villages like Shakoli and Koti have reliable water source for irrigation even in summer months but villages like Masri & Mandera have very limited available water sources and they are mostly dependent on PHE water for irrigation.

The animal raids (monkeys, wild bore's etc.) also destroy the agricultural crops and the impact is very predominant across bagheli revenue village but it has severely impacted agricultural activities in Masri & Mandhera village and because of that the villagers in these villages do cash crop agriculture on those land areas only were they can continuously monitor the area 24 X 7 and other areas were no monitoring can be done are left open.

Indicators	<ul style="list-style-type: none"> <li>• <b>Current cropping system (to be available with VLW)</b> Off Season climate favoring vegetables like Cauliflower, Cucumber, Peas, Spinach, raddish, shalgam, Potato, Ginger, karela, Colacasia, haldi,</li> <li>• <b>Chemical fertilizer and pesticide use (crop wise recommended and current use) per ha basis for each crop</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Crop</th> <th style="width: 50%;">Chemical/Pesticide applied in each season</th> </tr> </thead> <tbody> <tr> <td>Ginger/Adrak</td> <td>1.5 litre/ bigha</td> </tr> <tr> <td>Peas</td> <td>2.5 litre/bigha</td> </tr> <tr> <td>Potato</td> <td>0.5 litre/ bigha</td> </tr> <tr> <td>Cauliflower/Cabbage/Broccoli</td> <td>2.5 litre/bigha</td> </tr> </tbody> </table> </li> <li>• <b>Use of vermi-compost (no of pits or no of HH using now)</b> 12 Households have vermin compost in village, only 2 Households are using it.</li> <li>• <b>Organic crop production in ha (crop wise)</b> 15 bigha organic crop production is currently practiced by farmers.</li> <li>• <b>Productivity (kg/ha) crop wise</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Crop</th> <th style="width: 50%;">Productivity</th> </tr> </thead> <tbody> <tr> <td>Peas</td> <td>3 quintal/bigha</td> </tr> <tr> <td>Potato</td> <td>5 quintal/bigha</td> </tr> <tr> <td>Cauliflower</td> <td>7 quintal/bigha</td> </tr> <tr> <td>Wheat</td> <td>1 to 2 quintal/ bigha</td> </tr> </tbody> </table> </li> <li>• <b>No of irrigation required/crop</b> Channels or Nalas have been constructed to divert and distribute water to the fields.</li> <li>• <b>Processing and value addition (current practice)</b> Harvesting is done manually. No mushroom cultivation, apiculture is practiced. Floriculture can be promoted.</li> <li>• <b>Farm waste handling</b> Not practiced</li> </ul>	Crop	Chemical/Pesticide applied in each season	Ginger/Adrak	1.5 litre/ bigha	Peas	2.5 litre/bigha	Potato	0.5 litre/ bigha	Cauliflower/Cabbage/Broccoli	2.5 litre/bigha	Crop	Productivity	Peas	3 quintal/bigha	Potato	5 quintal/bigha	Cauliflower	7 quintal/bigha	Wheat	1 to 2 quintal/ bigha
Crop	Chemical/Pesticide applied in each season																				
Ginger/Adrak	1.5 litre/ bigha																				
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## **Horticulture**

As per Himachal Pradesh state action plan for climate change, with increasing temperatures, it is anticipated that there may be an all-round decrease in horticultural- agricultural production in the region in long-term, and the line of production may shift to higher altitudes.

District Shimla is the main apple producing district but the eco-village area is mostly suitable for apricots, peach, etc. Climate change is not a good indication for such fruit production. Since last few years snowfall is not occurring in time and at times there is no snowfall. Earlier the months of December and January used to receive enormous snowfall but over the years a significant decrease in the actual amount along with the extended period of snowfall through the months of February-March has been noticed. Weather conditions, like, uninterrupted rainfall, low and inconsistent temperature and incidence of frost during flowering, affects pollination and fruit-quality negatively and also reduce the yield.



FIGURE 11 BAGHALI AGRICULTURAL AREA DEPICTED IN LIGHT GREEN COLOR

TABLE 7 CLIMATE CHANGE IMPACT MATRIX- AGRICULTURE

Climate change hazard	Climate change impact	Determinants of vulnerability	Possible Adaptation options
Increased aridity from temperature increase	Scorching /wilting of crops	<ul style="list-style-type: none"> <li>• Low crop yield</li> <li>• Crop failure</li> <li>• Impact on agricultural based livelihood source</li> </ul>	Shifting to modern agricultural practices like drip irrigation. • Shifting to low water based agriculture Change in crop diversity
Increased rain intensity	Flash floods	Loss of fertile top soil Resulting in crop loss/ damage/	Soil & water conservation Water harvesting

		low crop yield •Loss of agricultural land	Ground water recharge
<b>Decreased winter rains &amp; snow</b>	Water scarcity / droughts	Decrease in Apple production Low availability of water in summers Decrease in farm produce	Rainwater harvesting Watershed management
<b>Changing rainfall pattern &amp; distribution</b>	Unseasonal rains and dry seasons in between the seasons. Late onset and early cessation of rainfall	Effects cropping calendar Lowers crop yield Late harvesting/ Droughts	Change in crop diversity Change in cropping calendar
<b>Increased frequency of flash floods</b>	Large scale destruction	Loss of crop Loss of farm assets Damage to property erosion	Basic engineering measures and structures combined Flood resistant crops during monsoon season

TABLE 8 EXISTING STRUCTURES AT VILLAGE LEVEL

S.No	Existing Structures	Numbers
1	Roof top rainwater harvesting structures	4
2	Vermi-compost pits	0
3	Community Irrigation Tanks	3

## SOIL EROSION (Agricultural land) & LANDSLIDES –

### Landslides

Intense rain the phenomenon associated with climate change has increased the risk in terms of number and severity of landslides.

Also, construction of roads in this area has led to landslides and erosion, at few places the road construction has made the agricultural fields and orchids vulnerable and it can have a catastrophic impact on them and may jeopardize the livelihood of some community members.

The topography of the Eco village is such that road a leading to these villages it will be prone to landslides at various locations; the landslides are caused by the poorly consolidated rock formation, the slope angles and the erosive forces of the surface run-off during the monsoon

period or rainy period. In addition, the disturbance of slopes by roads and buildings, undercutting the loose materials, is the main cause of the phenomenon.

The hilly area on the road side lacks healthy vegetation and mostly land area is highly degraded due to constant sliding and erosion. It was observed that various points on the roadside land sliding was happening.

The upper sub villages particularly Madehra sub-village is facing sliding of agricultural fields impacting the livelihood and food security.

### **Soil Erosion**

Bagheli has uneven terrain therefore risk of erosion is very high Runoff produces a highly variable discharge in terms of volume and quality and also degrades the land area.

Severe runoff of rainwater across the slopes due to intense rains, construction of new roads on mountainous slopes has made it vulnerable to Soil erosion, loss of top soil and exposure of rocks.

## IDENTIFIED SOIL EROSION SITES / SLIDING AREAS

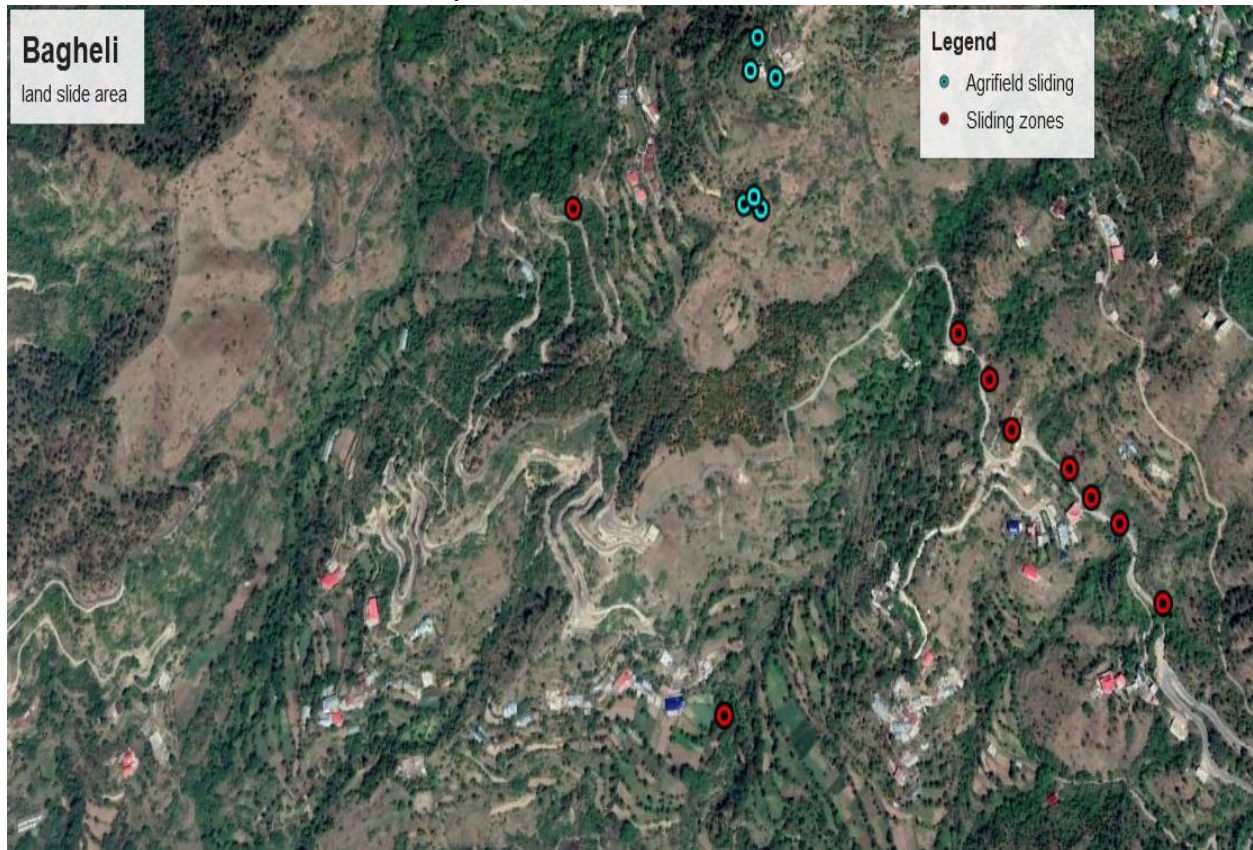
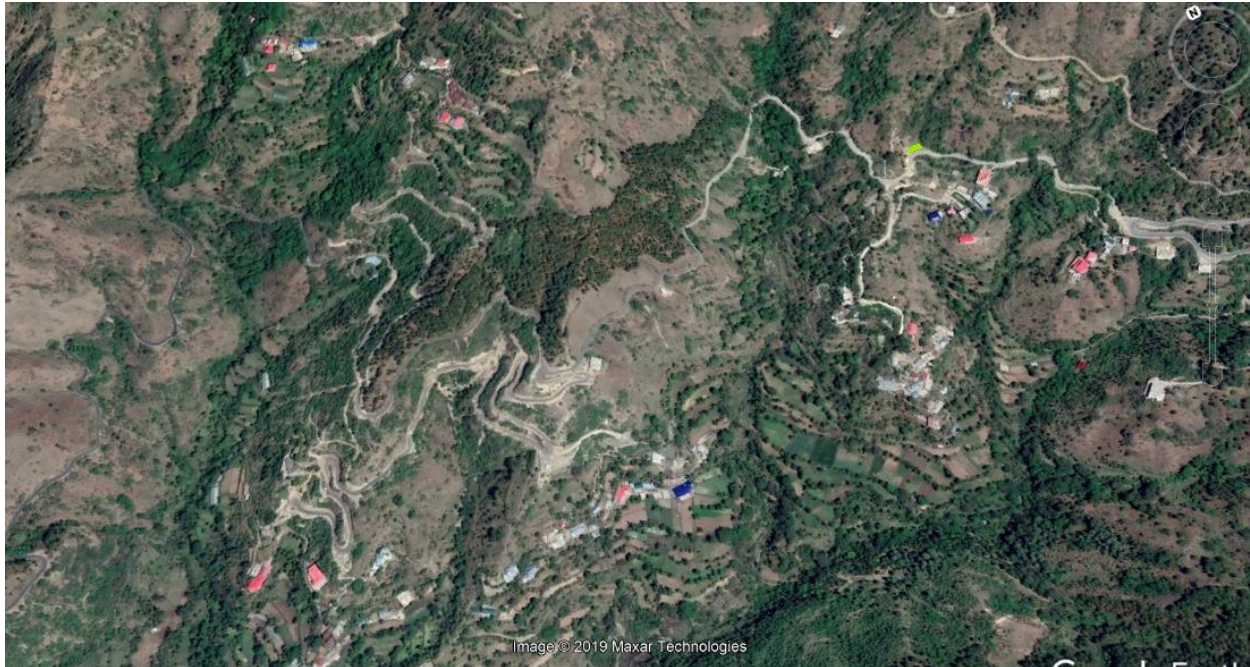


FIGURE 12 SLIDING AREAS IN BAGHALI ECO VILLAGE WHICH WERE VISIBLE AT THE TIME OF MAPPING

The area on the road sides is vulnerable to sliding and erosion due to steep road cutting done by the agencies and also due to degraded vegetation on the slopes. The Mandhera sub village problem doubles because the agricultural land areas are sliding due to steep slopes as well as poor retention support. These areas have been marked wherever possible soil erosion in the form of land sliding is occurring or is prone to due to precipitation & other natural causes. This holds relevance as any erosion of land around these locations either means a decrease in agricultural productivity or the damage of an existing habitat.

### **Problem of Degradation:**

In Bagheli eco village the soil all around the slopes is degraded, the vegetation is scarce due to poor upkeep and overgrazing. The topsoil runoff is very high which has left many places barren and others highly degraded.



**FIGURE 13** SATELLITE VIEW SHOWING THE HIGHLY DEGRADED AREA AROUND BAGHELI ECO VILLAGE

A comprehensive restoration strategy needs to be evolved it may include:

1-Contour barriers: live barrier to intercept down slope flowing water and soil particles. These barriers will slow down the water movement and reduce its erosive force. It will filter out and trap many of the suspended soil particles, keeping them from being washed out of the field. A long-term advantage of barriers is that soil tends to build up behind them, creating a terrace

2-Retaining walls on road side: Using Terraces or Retaining Walls to Control Erosion on the road side area. The most effective actions to mitigate the problem of an eroding slope on road side is to break up the rate of water descent by constructing terraces or retaining walls.

3- Enrichment Plantation: To restore the ecosystem, this can be achieved by planting in canopy gaps where there is insufficient tree cover and/or natural regeneration. Enrichment planting should be strictly limited to canopy gaps without sufficient natural regeneration.

4 – Plantations on barren land areas: The whole Bagheli revenue village is highly grazed area. The planting fodder trees in and around the village and after suitable treatment of barren lands is to make sufficient quantity available of feedstock for animals at village level and also reduce the grazing pressure on forest, thereby contributing to natural forest rehabilitation and carbon enhancement.

## FOREST

The immediate repercussions of climate change on the forests is in the form of shifting of tree line to higher altitudes and movement of pine species to higher altitudes. But in Bahghali revenue village most of the area is already degraded and problem is compounded due to overgrazing. Most of the people in Baghalei revenue village are dependent directly or indirectly on forests for fodder, timber etc.

TABLE 9 BASELINE INDICATORS OF FOREST PRODUCE MANAGEMENT

<b>Strategy</b>	<b>Maximize biodiversity to support the ecosystem</b>
<i>Indicators</i>	<ul style="list-style-type: none"> <li>Bio-diversity register to get (green: abundant, blue: declining, red: extinct species) Biodiversity register is maintained in Panchayat. Requires Updating</li> <li>Plantation in ha No recent plantation in peripheral forest land in Baghali.</li> </ul>

### Expected impact of climate change on forests in Western Himalaya

According to the HPSSAPCC, the following impacts of Climate Change on forests can be expected:

- Change in distribution of floral species & forest areas
- Change in forest productivity
- Shift in tree line
- Threatened species will be highly exposed
- Forest productivity may increase initially by higher atmospheric CO2 levels but with adverse impacts in the long term
- Decrease in snowfall may result in greater mortality of species
- Occurrence of forest fire may increase
- Change in climate conditions in subtropical regions will favour expansion of certain species upwards
- Spread of diseases
- Reduced water yields of forests
- Reduced biodiversity and ecotourism values

The climate change driven vulnerability of forests depends on the extent and rate with which the climate change occurs, the implication of non-climatic stressors, and the adaptation responses through forest management.

Ugupta et al. (2015) assessed forest ecosystem vulnerability to climate change across Himachal Pradesh and identified the priority districts for vulnerability reduction under 'current climate' and 'future climate' scenarios. Vulnerability of forests under 'current climate' scenario

was assessed by adopting indicator-based approach, while the vulnerability under ‘future climate’ scenario was assessed using climate and vegetation impact models.

As can be seen below the district Mandi falls under very high current vulnerability class.

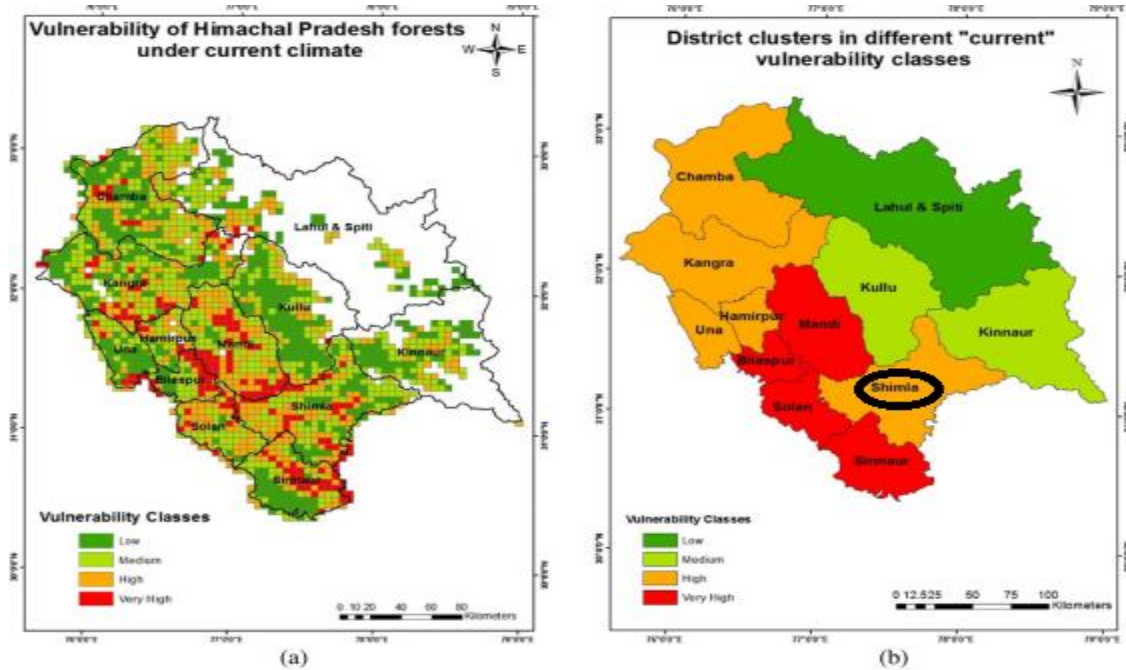


FIGURE 14 VULNERABILITY OF FORESTS IN HIMACHAL PRADESH SOURCE: UPGUPTA (2015)

The Baghali village is surrounded by degraded forest area, The stress on forest was quit visible and as seen in pictures below, the over grazing impact can be seen across the area. The forests are the frontline resource to counter climate change and if the forests get altered it impacts the whole ecosystem and will also impact the adaptive capacity of community negatively.



FIGURE 15 DEGRADED LAND AND FOREST AREA AROUND BAGHELI REVENUE VILLAGE( VILL. HOUSES MASKED IN LIGHT MUSTARD COLOUR)

### Fire Hazard

Research shows that changes in climate, particularly early snowmelt due to warming in the spring and summer, have led to hot and dry conditions leading to longer wildfire season which in turn increases the chances of fire incidences. Also, forest fire contributes to global warming in two ways firstly forest fires add to release of carbon in atmosphere, secondly impacting sequestration of carbon as damaged forest would otherwise had removed CO<sub>2</sub> from the air.



FIGURE 16 THE AREA SUSCEPTIBLE TO FIRE IN AND AROUND BAGHELI REVENUE VILLAGE MASKED IN RED

## ECO TOURISM

The unique location advantage of Baghali can be easily realized given its location on the main connecting road from Shimla to the Shimla Airport. The area offers a serene and peaceful option of stay for travellers traveling to Shimla, Tutu among other towns present around 10 kilometres from Baghali.

The derived benefits of setting up Baghali as a tourism centre are the following: -

- Alternate livelihood
- Better management of resources
- Better infrastructure
- Better market opportunities
- Recognition
- Discovery and protection of potential tourist sites
- Higher income

Given the overall advantage of Tourism interventions and set up within the village through direct as well as indirect effects of the inflow of visitors in the village, Tourism seems like a viable option for the village as well as the villagers. The village stands to face less and less deteriorating effects of development in the form of deviation from the original or the current state of being into a state that is unnatural or artificial in terms of replication of urban centres.

The authenticity of the place can be retained through eco-centric tourism initiatives that focus on maintaining the natural structure of the area as well as contain and restrain the mild or severe

deviations that might happen to the nature. Such form of tourism is called Eco-Tourism and is characterised by its inclination towards environment centric development of tourist sites and tourism attraction. The overall benefits for a new site to invest into eco-tourism rather than opting for commercial tourism are huge and not only is the benefit to environment and maintenance of the surrounding a derivative, but also, a higher price can be commanded as well as access to a new and fast growing eco-tourist market be generated for the area which would help retain the core competencies of the area. For example, in the case of Baghali which may develop lodging establishments as well as services for the numerous treks, both short and long, that originate from and around the site to nearby locations. The Benefits of eco-tourism as compared to conventional tourism are: -

- Retention of the Natural advantage of the location in terms of avoidance of degradation.
- Preservation of the nearby and linked natural ecosystems
- Access to unique eco-tourism market
- Less or no deviation of the normal way of life of local residents
- Lesser alteration of existing surroundings.

The identified locations for Eco Park or Eco Tourism sites are: -

**Shiv Mandir:** - There is potential of tapping an available water stream to create a water attraction such as a water fall, along with the proposed large pond. This will create a site unique to the location and the surroundings.



**Eco Park Site:** - The above location can be converted into a suitable eco park with village knowledge and information available to visitors.

**Sacred Spring-** The Sacred Spring is situated at the village Maseri, the spring is dedicated to Biju Devta a village deity , the area around the spring is lush green , the water is crystal clear and the water falls into a bowl like pond, the space around the pond is quite big and it can be easily turned into an eco-tourist site after developing it.



## RENEWABLE SOURCES OF ENERGY

TABLE 10 BASELINE INDICATOR OF RENEWABLE ENERGY STATUS IN BAGHALI REVENUE VILLAGE

<b>Strategy</b>	<b>Develop non-fossil energy alternative</b>
<i>Indicators</i>	<ul style="list-style-type: none"> <li>• Presence/absence of solar street lights: 20 Solar Street Lights at present</li> <li>• Households using LED bulbs (share of conventional/LED) Privately owned LEDs</li> <li>• Use of Solar Water heaters (0) 6 solar water heaters installed across all sub villages</li> <li>• Use of solar lights (in community halls/schools/public buildings) No</li> <li>• Use of solar lights private buildings (HH) 6 (private)</li> <li>• Use of bio-gas (HH) Not used</li> <li>• Solar fencing Not used</li> </ul>

One way is to reduce carbon footprints is by use solar energy, by this way we mitigate fossil fuel electricity production and replace it with clean, environment friendly renewable energy. Bayla Village will use solar street lights to lighten up the village road and also one government building will be used set up solar electricity unit. This initiative will not only lead us to cleaner energy source though small but significant intervention to help overcome climate change in future.

## **WASTE MANAGEMENT**

The major source of waste water includes the grey water from kitchens, bathrooms & water from toilets To maintain the surrounding environment & to reduce the demand of potable water by providing secondary and tertiary treated water, it is important to ensure treatment of the wastewater generated from the village and nearby areas,

There is no provision for channelization of wastewater generated in the village except from the toilet waste for which government has already taken initiative.

There are certain areas where dumping of waste was seen near the stream or Nalla. Due to climate change water scarcity will be an issue so it becomes imperative upon us that we keep our resources clean and sustainable.



**FIGURE 17 SEWAGE DIRECTLY DRAINS INTO STREAMS**

As it can be seen above, due to lack of any dustbins mostly Nallas are being used as dumping channels by the villagers, they empty waste directly into streams and as result these site act as a point for waste disposal and entire stream environment is polluted by either residential, organic or plastic waste.

**Municipal Solid Waste-**

Municipal solid waste management is essential for sustainable Eco-village development. Its components are segregation, storage, collection, relocation, and finally disposal of solid waste so as to minimize adverse impact on environment. Presently there are no arrangements for waste collection, disposal or management.

**Organic waste management**

**Vermi compost pits-** In Bagheli Revenue village no household is having any vermin-compost pit, the villagers are willing to have a compost pit in their backyard.

The easiest way to tackle organic household and agricultural waste (cow dung, kitchen waste, forest biomass, farm residues) by recycling it to produce high quality compost through vermin- composting.

Compost pit of any convenient dimension can be constructed in the backyard or garden or in a field. It may be single pit, two pits or tank of any sizes with brick and mortar with proper water outlets.

**Waste water Management**

**Soakage Pits -** In Bagheli Revenue village no household is having any soak pit . The soak pits can offer a cost-efficient way of treating waste water soakage pits in all households will take care of the kitchen and bathroom waste, waste water can be directed underground a relatively safe way of discharging it to the environment and therewith recharging groundwater bodies.

**TABLE 11** BASELINE INDICATORS OF WASTE MANAGEMENT IN BAGHALI VILLAGE

<b>Strategy</b>	<b>Sustainable waste management, cleanliness and reduction in plastic waste</b>
<i>Indicators</i>	<ul style="list-style-type: none"> <li>• Composition of domestic household waste: (i) Plastic waste (including single use plastics and hard plastic) which are openly disposed (ii) Kitchen and Agricultural waste are openly composted directly in fields.</li> <li>• Current level of segregation (at house-level) of solid and liquid waste, degradable and non-degradable waste: Segregation absent</li> <li>• Vermi-compost use (no of HH) No Vermi compost pit present. Households also lack training to composting</li> <li>• Disposal of waste Domestic waste dumped along with dung. Collection and migration of waste required</li> <li>• Open defecation (extent) IHL are constructed in all households</li> <li>• Percentage use of sanitary napkins: 80%</li> </ul>

- Use of sanitary napkins (its disposal) : Disposed in landfills

## **WATER MANAGEMENT AND IRRIGATION**

Water Management is one of the important components of climate change adaptation strategy. The main challenge of water management in agriculture is to improve water use efficiency and its sustainability.

Efficient irrigation systems and water management practices can help in overcoming the impacts in a scenario of limited water availability due to climate change. To achieve the goal of water security, water-use efficiency may not be the only tool required to achieve water security, other adjustments & improvements in watershed are needed to so a comprehensive long-term plan and execution is required.

In shakoli & Koti sub villages following water sources are presently used for irrigation-

Surface water- water mostly from streams is uplifted directly by nearby fields downstream for irrigation. Another source Matla stream is used by fields on uplands for irrigation.

Artificial water tanks - some artificial water tanks have been built to channelize the stream water to fields.

In Masri and Mandera- villagers mostly store drinking water supplied by PHE department for irrigation.

TABLE 12 BASELINE INDICATOR OF WATER MANAGEMENT AND IRRIGATION

<b>Strategy</b>	<b>Ensure water security and water use efficiency</b>
<i>Indicators</i>	<ul style="list-style-type: none"> <li>• No of roof top rainwater harvesting structures 4 Households</li>   <li>• Other water resources (for irrigation and drinking water) Drinking Water Sources: Springs – 5:Baghalli, 3:Shakoli. 4:Koti, 1:Masri</li>   <li>Household Water Sources: IPH water tap available in almost all households. Streams with irrigation channels constructed for irrigation.</li>   <li>• Water availability per capita (for drinking, for livestock, for irrigation, for enterprise): Varies across sub - villages</li>   <li>• Identify low water requiring crops/varieties (grown in ha, not grown): No such crops are grown</li>   <li>• Small ruminant and poultry (reared and nos, not reared): Reared in small numbers, not used for commercial selling of meat.</li> </ul>

## COMMUNITY INSTITUTIONS AND CAPACITY

Community level participation and active involvement is necessary for both the successful establishment as well as the maintenance of the numerous eco-village specific activities and interventions. This is necessary as the uptake of activities and in order for them to yield a productive advantage, a behavioral change might be required. This form of change can only be enabled after the complete or proper sharing of knowledge. Therefore, through building of capacities of various village institutions such as committees, it becomes possible for village locals to demand and receive better benefits and profits.

<b>Strategy</b>	<b>Develop capacity of community institutions to sustain the eco-village</b>								
<i>Indicators</i>	<ul style="list-style-type: none"> <li>• SHG (nos and their self-rating or based on observation rate them as green: account up to date, interest earned, at least 3 years, regular meeting registered blue: infrequent meeting, some on lending, not up to date accounts red: for name sake exist)</li> </ul> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>SHG</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Saraswati</td> <td>Blue</td> </tr> <tr> <td>Jwala</td> <td>Green (max. activities undertaken)</td> </tr> <tr> <td>Asha</td> <td>Blue</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>Names of 6 new SHG's is not registered</li> <li>• JFM groups (no and status): No</li> <li>• FIGs (no and status): No</li> <li>• Mahila Mandal: 1 – Laxmi Mahila Mandal</li> </ul>	SHG	Rating	Saraswati	Blue	Jwala	Green (max. activities undertaken)	Asha	Blue
SHG	Rating								
Saraswati	Blue								
Jwala	Green (max. activities undertaken)								
Asha	Blue								

## PROBLEM/ BARRIER ANALYSIS

Component	Problems	Possible causes			
		Low participation	Low awareness	No technology	No Finances
<b>Spring shed Management</b>	Lack of protection intervention Landslides and Soil erosion in spring periphery	✓	✓	✗	✗
<b>Sustainable Agriculture</b>	Lack of knowledge of benefits and training of Organic/Natural/Zero-budgeting. Lack Composting infrastructure	✓	✓	✓	✗
<b>Water Management and Irrigation</b>	Lack of Irrigation infrastructure Water storage structures, Water lift	✓	✓	✓	✓
<b>Renewable Energy</b>	Lack of knowledge of benefits and scope	✓	✓	✓	✓
<b>Solid Waste Management / Cleanliness</b>	Lack of concern (collection) and end term measure (final disposal)	✓	✓	✓	✓
<b>Forest Produce Management and Eco Services</b>	Lack of knowledge of Threats (due to overconsumption – Fuel wood, Forest fires), No Eco-tourism sites	✓	✓	✗	✗
<b>Capacity Building</b>	Lack of In-situ trainings	✓	✓	✗	✗

## GOALS

S.No	Activity	Indicator	Baseline	Target
1	Trenching	Reduced soil erosion through constructed trenches	Absent	Rejuvenation of Existing Springs
2	Plantations (Ground Utility)	Increased Green cover within village	In Village absent	In Village Plantations to assist soil and water conservation
3	Check Dam and loose boulder implementation	Collection and retention of stream water	Absent	Soil Retention, Improved in-ground water percolation
4	Loose Boulder and Crate Wall	Top soil retention	Absent	Water conservation and availability for irrigation
5.1	Organic farming training	Improved productivity through organic farming	In-Village training camp absent	Motivation of farmers for take-up and eventual 100% organic farming in village
5.2	Individual testing of Organic Farming	Increased adoption of organic farming	Absent	Motivation of farmers for take-up and eventual 100% organic farming in village
6	Solar Fencing	Agreement and adoption for all cluster farm lands	Absent	Retained agricultural productivity
7	Rooftop Rain Water Harvesting	Storage of rain water	Absent	Water Conservation
8	Irrigation Tank	Construction of multiple farm feed tank	Damaged / dysfunctional current infra	Decreased dependence on rain-fed irrigation
9	Solar Pump	Reduced dependence on scheduled Nala irrigation	Absent	Recharge and utilization of irrigation tanks through solar energy

<b>10</b>	Solar Plant for Computer/Security room	Village security measures generated	Absent	Security and Village Infra
<b>11</b>	Solar CCTV camera and equipment	Village security measures generated	Absent	Water theft and soil dumping security
<b>12</b>	Solar Street Light	Illumination of night streets using renewable energy	Limited. 20 present	Lighting of unlit pathway
<b>13</b>	Solar water heater	Mass adoption	Community resource for demonstration absent	Shift from traditional fuel wood dependence for heating purpose
<b>14</b>	Plantations (Beautification)	Increased green cover	In-village absent	Plantation of Fruiting and flowering tree species
<b>15</b>	Fireline Management	Reduced asset loss due to forest fires	Existing sites mapped and maintained by forest department	Protection of village from accidental and mismanaged fires
<b>16</b>	Existing Village Site Development (Sitting area, fountains)	Increased visitor footfall within village	Absent	Increased Tourism potential of existing sites
<b>17</b>	New Camping Site Development	New visitor and tourist engagement	Absent	Creation of new recreation tourist sites
<b>18</b>	Awareness activities	Placement of sign boards and information signs	Absent	Generated environmental awareness and village information displayed through sign boards and displays

<b>19</b>	Entry gate	Demarcation of village entry point	Absent	Distinction and labeling of eco-village site and significance
<b>20</b>	Landslide prevention	Creation of landslide prevention structures	Absent	Retention of top soil and prevention of loss of property
<b>21</b>	Wire Mesh dump/pickup bins	Reduced open waste	Absent	Waste collection and promotion
<b>22</b>	Demonstration of Vermi Compost and poly house (Two Phases)	Increased adoption by villagers	Infrastructure and training absent	Creation and Utilization of Vermi Compost pits for conversion of residential organic waste
<b>23</b>	Training on Micro irrigation	Increased adoption by villagers	Mostly absent	Water conservation and increased crop productivity through advanced irrigation techniques
<b>24</b>	SHG/Mahila Mandal Training (In Village and Exposure Visit)	Improved productivity through responsibility knowledge and delegation	3 Registered and 6 Unregistered groups present	Training of local SHG groups for organic farming among other value addition activities
<b>25</b>	Exposure visit (Phase I)	Improved Recognition of benefits as well as training	Ongoing on limited scale and reach	Training for organic farming
<b>26</b>	Farm Pond	Retained Rain water	Absent	Conservation of water and retention of top soil

## PLAN OF ACTIVITIES

### SPRING RESTORATION

As per Niti Aayog report, any programme attempting to develop this natural resource must broadly involve the following sets of activities:

- Assessment of the hydrogeological controls on the springs (at micro level).
- Recharge potential of the spring through spring shed development measures (at micro level).
- Embedding the micro-level perspective in the macro-picture of the water resources in a region.
- Maintenance and protection of springs.
- Effective monitoring of the spring discharge and water quality during planning, implementation and impact assessment stages.
- Active participation of the community at all stages including during the stage of knowledge generation.

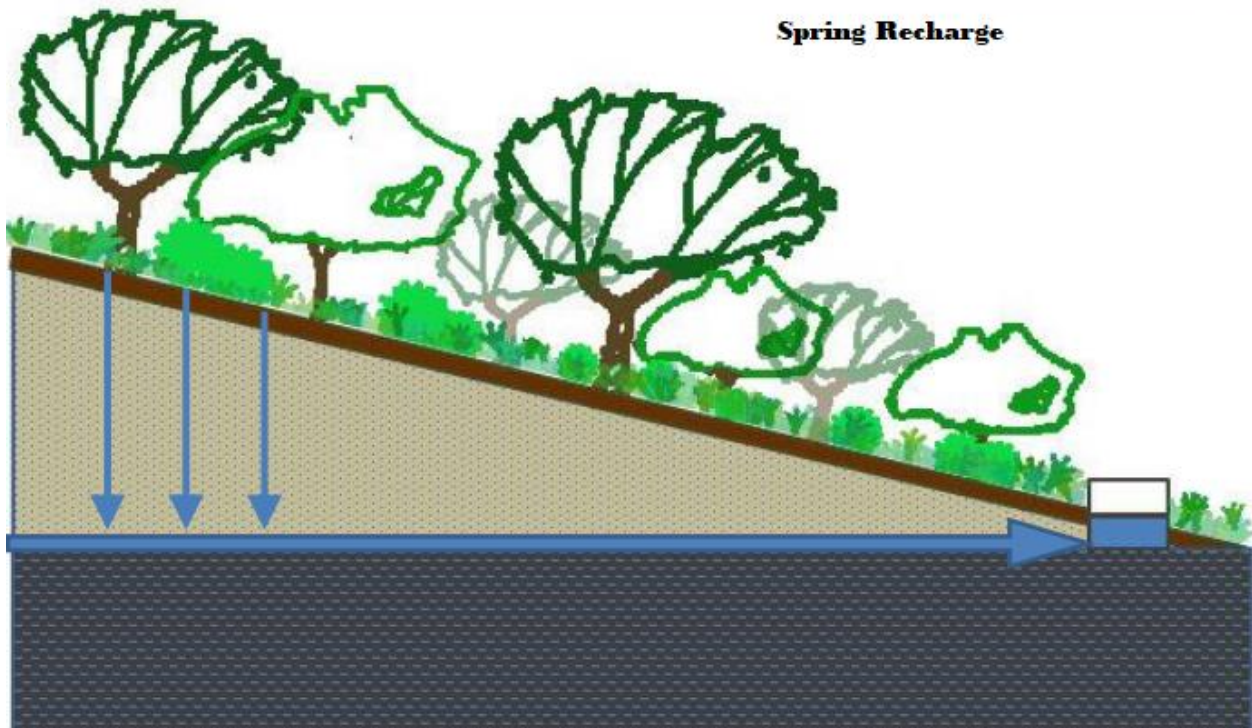


FIGURE 18 SPRING RECHARGE

The NITI Aayog Report of Working Group on Revival of Springs in the Himalayas for Water Security recommendations include mapping of springs, implementing revival of springs & capacity building.

### Mapping Springs

- Mapping to include detailed hydrological, geo-tectonic, morphological, meteorological, land use and demographic details.
- Follow a selective methodology – based on current approaches including the 8-step methodology and more recent protocol of approaches. Application of isotopes to identify origin/source of springs can be an important tool. Hot-spot analysis to identify vulnerable springs must also be included.

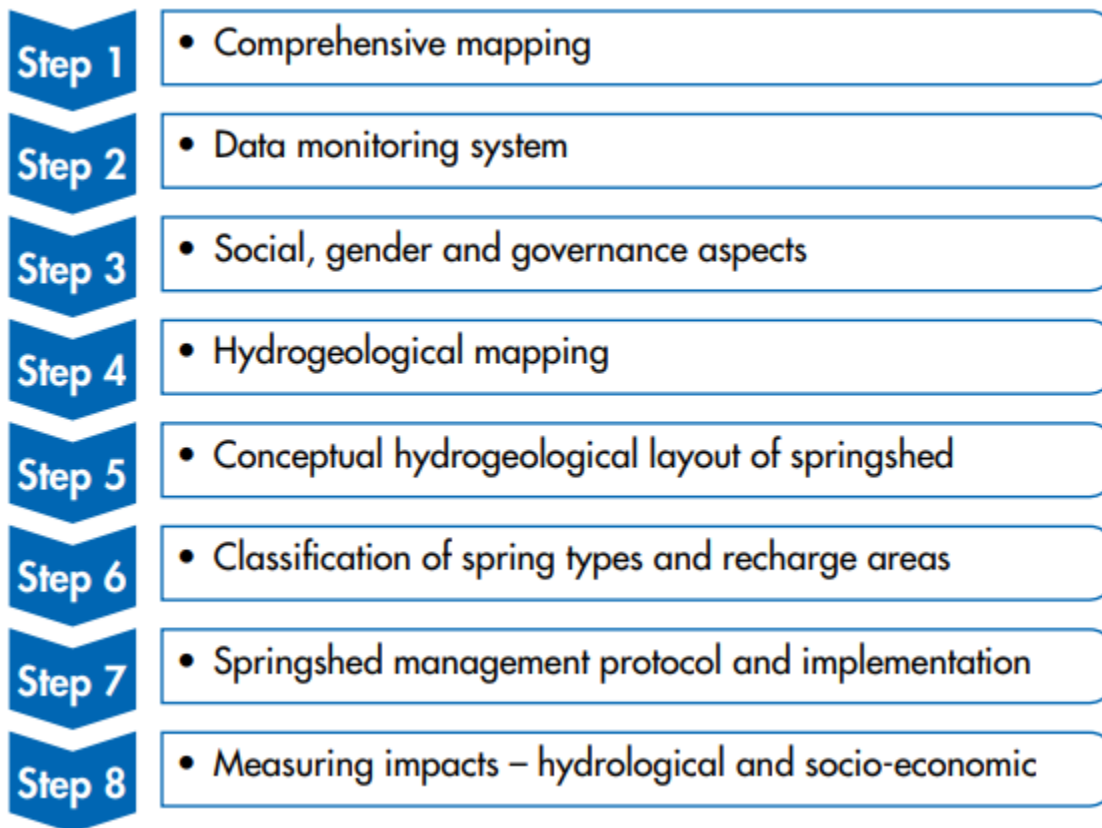


FIGURE 19 -EIGHT STEP METHODOLOGY FOR SPRING SHED MANAGEMENT - SOURCE: (NITI AAYOG)

### Implementing Revival of Springs

Reviving springs and sustaining them requires a combination of scientific knowledge (hydrogeology) and community ownership of the resource

Basic engineering measures and structures combined with vegetative measures and management are need for revival. Identification of local level management practices/traditional

knowledge (and practices) for springs is needed to strengthen the plans for spring shed management.

Dhara Vikas a government programme has created a significant impact by recharging lakes and successfully reviving springs in north east and achievements have been recognized by Niti Aayog and many independent experts.

Trenches for groundwater recharge will be needed to be dug scientifically in adherence to geo-hydrological requirements which will be best judged by the hydrologist.

Before starting any work, a training handbook on Dhara Vikas training manual should be consulted for groundwater recharge.

**ACTIVITY PLANFOR SPRING REJUVENATION And STREAM / NALLA Management-**

Spring rejuvenation				
Sl.No.	Activity	Location	Beneficiaries	Outcomes
1	Trenching	Springs:- Masri - 1, Baghali - 6, Shakoli - 1 Koti -1	Whole Ward	Rejuvenation of existing springs
2	Plantations	Across Village	Whole Ward	In village plantations to assist soil and water conservation
3	Check Dam and loose boulder implementation on streams or Nalla	<b>Koti sub village:</b> Koti Manoon Stream Koti Maseri Stream Koti Bagheli Stream Nariyawali Drain <b>Shakoli sub village:</b> Kayari Stream <b>Bagheli sub village</b> Manon Bagheli nala Dhobay ka khalta <b>Masri Sub village</b> Maseri jadheni Nala	Whole Ward	Soil Retention, percolation, flash flood prevention.

## **SOIL EROSION AND LANDSLIDES FLOODS & FLASH FLOODS**

The sub villages houses in Masri and Mandra are located at a elevations that are above or far off from the Streams and Nallahs, therefore there is a very little danger of them being impacted by flash floods but some agricultural fields in koti , shakoli and bagheli villages are bordering the streams which makes few patches of Agricultural land vulnerable to flash floods. Some of the agricultural fields near which streams pass are depicted in red.



**FIGURE 20 THE AREA AGRICULTURAL FIELDS AT LOWER ELEVATION SUSCEPTIBLE TO FLOODS**

As lower elevated area of the village mostly fields near the streams become highly dangerous during monsoon season, the area maybe susceptible to flash floods and floods which can lead to considerable damage to land and property.

## **LAND SLIDES AND SOIL EROSION**

Whole area of Baghali revenue village is vulnerable to landslides and erosion but Mandehra village is particularly susceptible to agricultural land sliding, it was seen at number of places the agricultural land sliding down, impacting the livelihood and also endangering the lives of the people.



**FIGURE 21 AGRICULTURAL LAND SLIDING PROBLEM IN MANDEHRA VILLAGE**

All across the road side it was seen that number of land sliding points are their and due to less green cover, the problem will aggravate in future.

### **No-construction zone near the seasonal river bed**

No building construction should be allowed near the seasonal riverbed area as it will lead to serious environmental consequences.

Precautions and suitable engineering measures should be taken to prevent flooding of the area due to stream passing close to fields

### **Mitigation Measures Flooding, soil erosion & landslides-**

#### **(A) Flooding**

Strengthening of embankment / bunds near the river streams through loose boulders and vegetation.

**(B) Soil erosion & Landslides-**

Structural measures need to be taken to strengthen the land slide prone areas to avoid landslide hazard and possible impacts of hazard

The structural measures include, but are not limited to drainage, erosion protection, channeling, vegetation, anchoring systems and retaining structures and slope stabilization techniques. The best suited possible method needs to be applied based on the site specific needs so that it can withstand the impacts and forces of landslides.

**ACTIVITY PLAN FOR LANDSLIDE MANAGEMENT**

**TABLE 13** LANDSLIDE MANAGEMENT AND PREVENTION

Landslide management and prevention				
Sl.No.	Activity	Location	Beneficiaries	Outcomes
	<b>Retention walls</b>	<b>sliding areas</b>	<b>Whole Ward</b>	<b>Prevention of soil runoff/erosion</b>
<b>1</b>	Landslide prevention/ soil stabilization	1. near steep slopes on road side  2. Along agricultural land and pathways 3. Near steep Nalla / Streams	Whole Baghali eco village area	Prevention of soil runoff/erosion and protection of village pathways through crate walls and wire mesh interventions.

**SUSTAINABLE AGRICULTURE**

**Adaptation measures –**

**The aim should be to go for low input cost organic farming**

- Promoting the diversification of crops based on the ability, adaptability to changing climate patterns.
- Vermi- composting
- promoting soil management practices that contribute to productivity
- Improving water efficiency through better management practices like drip irrigation to reduce vulnerability to variable conditions and water scarcity.
- Using drought-resistant and flood resistant varieties based on the season pattern

- Modifying crop rotations to include cover crops that help build resilience to climate change and climate variability
- Promoting the use of weather monitoring systems and trends analysis to reduce the risks associated to climate variability.

Activities completed- already Construction of vermin composting pits has been done

### Adaptation/ mitigation Measures for water management and irrigation-

As climate change leads to erratic rainfall and change in rainfall pattern therefore based on the area the type of crop & the suitable water conserving methods of irrigation should be promoted-

Sprinkler irrigation- is a method of irrigation in which water sprinkled through the air in rain like drops.

Drip irrigation system- A micro-irrigation method, the discharge rate of the emitters is low so this irrigation method can be used on all soil types.

Construction of water Tanks for storage and distribution - water tanks at technically identified appropriate place and elevation needs to be built so that water from those tanks water can be used for irrigation and micro-irrigation.

**Activities to be undertaken** –There will be lot of uncertainties due to climate change with regard to agriculture so overall adaptation / mitigation plan is to decrease the input cost. Below is the activity plan for the activities which incur cost that will be undertaken during the project life span

### ACTIVITY PLAN OF SUSTAINABLE AGRICULTURE AND WATER MANAGEMENT

TABLE 14 SUSTAINABLE AGRICULTURE AND HORTICULTURE

Sustainable Agriculture and Horticulture				
Sl.No.	Activity	Location	Beneficiaries	Outcomes
	Construction of vermin-compost pits	Across Village and sub villages	Whole Baghali eco village	Organic waste utilization, good quality manure
1	Organic farming training	Across Village	Whole Ward	Motivation of farmers for take-up and eventual 100%

2	Individual testing of Organic Farming	Across Village	140	organic farming in village
3	Solar Fencing	Across Village	Whole Ward	Retained agriculture productivity
4	Rooftop Rain Water Harvesting	Across Village	Potential Households	Water Conservation

**FOREST MANAGEMENT AND ECO SERVICES**

**Mitigation measures**

**1. Planting of climate change-adapted, multipurpose species on open forest land**

The purpose of planting of climate change-adapted, multipurpose species on open forest land is to restore the ecosystem functions of the forest, increase the climate resilience and sequester carbon.

A mix of climate change-adapted and multipurpose species as prescribed in the Forest Management Plan will be planted, with the aim to re-establish a mixed natural forest. During tree selection, locally-adapted indigenous and deciduous trees will be preferred as they can better cope with increased temperatures and extended dry spells.

As an initial climate change safeguard, it is suggested to plant tree species up to 200 m above their present distribution (elevation line). The planting of conifers shall be limited to higher elevations which are too cool and wet for broadleaved species.

**2. Enrichment planting**

The purpose of enrichment planting of climate change-adapted, multipurpose species is to restore the ecosystem functions of the forests and increase the climate resilience. This will be achieved by planting in canopy gaps where there is insufficient tree cover and/or natural regeneration. Enrichment planting should be strictly limited to canopy gaps without sufficient natural regeneration.

**3. Planting of vegetation alongside ravines (Nallah)**

On both sides of a ravine (dry creek), plants like local bamboo varieties etc. should be planted along each side of the ravine. Existing vegetation should not be cleared as the roots of the vegetation helps to retain the soil.

The purpose of planting vegetation along ravines is to prevent soil erosion and gully development, which causes the loss of top soil and uprooting of trees. To be effective, it may have to be combined with physical soil and watershed measures.

Planting of vegetation along ravines will help to cope with anticipated climate change impacts, especially heavier, erratic rainfalls and flash floods which may even cause human casualties and destroy infrastructure such as houses and roads.

This measure has multiple environmental benefits, such as soil and water conservation, water retention, and biodiversity conservation,

#### 4. Planting of fodder & fruit trees

The whole Bagheli revenue village is highly grazed area. The main purpose of planting fodder trees in and around the village is to make sufficient quantity available of feedstock for animals at village level and also reduce the grazing pressure on forest, thereby contributing to natural forest rehabilitation and carbon enhancement. Plantation of 20% Fruit trees as per norms will help wild animals to get food and to check human animal conflict; this will increase the climate resilience of the forest as well. The area is suitable for plantation of fruit varieties like peache different barriers species, apricot etc.

The environmental benefits mainly consist of reducing the grazing pressure on neighboring natural forests. If native trees (such as oaks, wild olive) and grasses are planted, the biodiversity will also increase.

#### ACTIVITY PLAN FOR FOREST MANAGEMENT

TABLE 15 FOREST MANAGEMENT ACTIVATES

Forest management				
Sl.No.	Activity	Location	Beneficiaries	Outcomes
1	Plantations	Across Village	Whole eco village	In village plantations to assist soil and water conservation
2	Enrichment plantations	Across degraded land patches, road sides	Whole eco village	
3	Fireline Management	Village perimeter	Whole eco village	Protection of village property from

				accidental and mismanaged fires.
4	Awareness activities	Across Village	Whole eco village	Generated environmental awareness and Village information display through sign boards and displays

### 5. Demand-side Measures to reduce pressure on Forests

Devices that help reduce the dependence of communities on forests for fuelwood.

- Promotion of fuel-efficient stoves
- Promotion of alternative renewable energies (solar heaters and solar geysers)

#### Mitigation measures (Fire Hazards)

- Prevention of human-caused fires through community education and environmental awareness
- Fire-line Construction: A fire-line cuts off the supply of fuels, the objective of fire wall is to remove or reduce the flammable materials available on ground that allow the fire to build up in intensity or continue to spread.
- Setting up of fire management committee for early warning and mitigation

## PLAN OF ACTION ON ECO-TOURISM

TABLE 16 ECO TOURISM SERVICES

Eco Tourism Services				
S.No	Activity	Location	Beneficiaries	Outcomes
1	Existing Village Site Development (Sitting area, fountains)	Increased visitor footfall within village	Absent	Increased Tourism potential of existing sites
2	New Camping Site Development	New visitor and tourist engagement	Absent	Creation of new recreation tourist sites
3	Awareness activities	Placement of sign boards and information signs	Absent	Generated environmental awareness and village information displayed through sign boards and displays
4	Entry gate	Demarcation of village entry point	Absent	Distinction and labeling of eco-village site and significance

## ADOPTION OF RENEWABLE ENERGY

### ACTIVITY PLAN ON RENEWABLE ENERGY:

TABLE 17 RENEWABLE ENERGY ACTIVITIES

Renewable Energy				
Sl.No.	Activity	Location	Beneficiaries	Outcomes
1	Solar Pump	Reduced dependence on scheduled Nala irrigation	Absent	Recharge and utilization of irrigation tanks through solar energy
2	Solar Plant for Computer/Security room	Village security measures generated	Absent	Security and Village Infra
3	Solar CCTV camera and equipment	Village security measures generated	Absent	Water theft and soil dumping security
4	Solar Street Light	Illumination of night streets using renewable energy	Limited. 20 presents	Lighting of unlit pathway
5	Solar water heater	Mass adoption	Community resource for demonstration absent	Shift from traditional fuel wood dependence for heating purpose

## WASTE MANGEMENT

### Waste water Mitigation Measures to be Undertaken

A major focus of the strategy in Bagheli eco-village is to create a circular process which involves re-use, rather than disposal. This process has four key stages from source to eventual return to the environment:

- managing wastewater at source (including water conservation and recycling)
- collection and treatment
- re-use of treated wastewater and sludge
- Re-entry of treated waste into an ecosystem.

Waste water treatment plant will be setup to treat waste water generated from the eco village.

### PLAN OF ACTIVITIES ON SEWAGE WASTE MANAGEMENT AND CLEANLINESS

TABLE 18 SEWAGE WASTE MANAGEMENT AND CLEANLINESS

Sewage Waste Management and Cleanliness				
Sl.No.	Activity	Location	Beneficiaries	Outcomes
1	Soakage pits	At every household	Whole Ward	cost-efficient way of treating waste water and increasing ground water recharge

### PLAN OF ACTIVITIES ON SOLID WASTE MANAGEMENT AND CLEANLINESS

This type of waste is generated from houses, shops etc. It is mostly non-hazardous solid waste that requires collection and processing or disposal it consists of decomposable food waste, dry material such as glass, paper, cloth, or wood etc.

Following major categories of waste will be generally generated in Eco village-

- **Biodegradable Waste:** Food and kitchen waste, green waste (vegetables, flowers, leaves, fruits) and paper.
- **Recyclable Material:** Paper, glass, bottles, cans, metals, certain plastics, etc.

- **Biomedical waste:** This includes used menstrual clothes, sanitary napkins, disposable diapers, bandages and any material that is contaminated with blood or other body fluids

TABLE 19 MUNICIPAL SOLID WASTE MANAGEMENT THROUGH

Municipal Solid Waste Management				
Sl. No.	Activity	Location	Beneficiaries	Outcomes
1	Wire Mesh dump/pickup bins	Reduced open waste	Absent	Waste collection and promotion

### Municipal solid waste management - Plan

A key issue to consider when planning primary and secondary collections in the village is the question of final disposal. While all measures will be undertaken to recycle or compost recoverable materials, there will be residual wastes for which there are no markets. The question is where this residual waste should be directed. It is vital that waste collection programs do not simply shift the residual waste problem from one location to the next.

- Bio-degradable waste can be managed in the eco village itself through Bio-Composting or vermin- composting pits the structures of which have been already made .
- Recyclable waste after segregation should be sent for recycling
- Biomedical waste needs to be taken out and treated in an appropriate way as per rules of waste treatment

## CAPACITY BUILDING INTERVENTIONS

The following capacity building interventions have been proposed for the Baghali revenue village: -

Capacity Building Interventions				
S.No	Activity	Location	Present Status	Outcomes
1	Demonstration of Vermi Compost and poly house (Two Phases)	Increased adoption by villagers	Infrastructure and training absent	Creation and Utilization of Vermi Compost pits for conversion of residential organic waste
2	Training on Micro irrigation	Increased adoption by villagers	Mostly absent	Water conservation and increased crop productivity through advanced irrigation techniques
3	SHG/Mahila Mandal Training (In Village and Exposure Visit)	Improved productivity through responsibility knowledge and delegation	3 Registered and 6 Unregistered groups present	Training of local SHG groups for organic farming among other value addition activities
4	Exposure visit (Two Phases)	Improved Recognition of benefits as well as training	Ongoing on limited scale and reach	Training for organic farming
5	Maintenance and overview of Village Security	Security Infrastructure including computer room and cameras	Absent	Upkeep and derivation of benefits from security measures.

As it can be noted from the above table, the activities to enable and introduce organic farming and new and improved skill for agriculture need to be introduced and taken up at an individual level. Therefore, for it to be successfully introduced, which would imply a maximum uptake,

generation of people's interest through demonstration of practice and identification of benefits is required. This can be achieved through Phase wise implementation of various demonstration exercises within the village, training camps and initiative for the select group as well as through exposure visit to visualize already successful interventions and hence motivate and guide villagers for implementation. The exposure visit is to be carried out in two phases to ensure prompt and complete realization of benefits and uptake of organic farming by all villagers, similar to other demonstration and training exercises.

## Funding of Proposed Activities

S. No.	Activity	Cost (INR)	Scheme/ Associated Department	Cost (reference) (in INR)
1	Trenching	180,000	MGNREGA	20,000 -1 site
2	Plantations (Ground Utility)	80,000	Forest Department	50 x 1000 (per hectare) Maintainance 1st - 30%, 2nd - 20%, 3rd - 10%)
3	Check Dam and loose boulder implementation	375000	MGNREGA	Small - 15,000 (x15) Large loose Boulder - 30,000 (x5)   2500/m
4	Loose Boulder and Crate Wall	400000	MGNREGA	20 loose boulders for 20,000/each
5	Organic Farming			Zero Budget Farming Training
5.1	Organic farming training		Department of Agriculture	Zero Budget Farming Training
5.2	Individual testing of Organic Farming		Department of Agriculture	Zero Budget Farming Training
6	Solar Fencing	10000000	Department of Agriculture	1 panel - 1500m   3 panel for Baghali, 3 panel for Koti/Shakoli, 1 panel for Masri (80% subsidy for cluster fencing)
7	Rooftop Rain Water Harvesting	200000	MGNREGA	1 Lac per house
8	Irrigation Tank	1500000	Soil Water Conservation Department	5,00,000 per Tank
9	Solar Pump	3000000	IPH / Dept. of Agriculture/ Dept. of Horticulture	10,00,000/ pump
10	Solar Plant for Computer/Security room	500000	DEST Fund / HIMURGA	Cost of construction of room - 3 lac, PC + Networking + Solar Panel + Battery + UPS, CCU - 2 lac

11	Solar CCTV camera and equipment	30,000	DEST Fund / HIMURGA	10,000/ unit. 5 units + cable and set up cost
12	Solar Street Light	600000	HIMURJA / DEST Subsidy	40 units (upto 90% subsidy through HIMURJA)
13	Solar water heater	60,000	HIMURJA / DEST Subsidy	3 Units for demonstration at village commons   20,000/unit
14	Plantations (Beautification)	50000	Eco-village Scheme, DEST	30 x 1000 (per hectare) Maintenance 1st - 30%, 2nd - 20%, 3rd - 10%)   11 hectare barren land + road side fallow land
15	Fireline Management		Department of Forest	
16	Existing Village Site Development (Sitting area, fountains)	200,000	Department of Forest/ Eco tourism	6 benches: 5000 each (bamboo), 5 stools: 3000 each, Site Preparation
17	New Camping Site Development		Eco-village Scheme, DEST / Dept. of Eco-Tourism (Forest Dept.)	
18	Awareness activities	100,000	Panchayat	Sign boards, direction markers, demarkation of pathways
19	Entry gate	350000	Panchayat	2.5 lac - main gate(x1). 50,000 - small gate (x2)
20	Landslide prevention	400000		
21	Wire Mesh dump/pickup bins	40,000	Eco-Village Scheme, DEST	10,000 - Large 8ft.x5ft.x5ft (x1), 6 - Small 4ft.x4ft.x4ft (x5)
22	Demonstration of Vermi Compost and poly house (Phase I)	150,000	Department of Agriculture	250 - perday cost per farmer, 2 -days of training required, 144 - number of farming households
23	Demonstration of Vermi Compost and poly house (Phase II)	150,000	Department of Agriculture	250 - perday cost per farmer, 2 -days of training required, 144 - number of farming households

24	Training on Micro irrigation	72,000	Department of Horticulture	
25	SHG/Mahila Mandal Training (In Village)	50,000	Panchayat	
26	SHG/Mahila Mandal Training (Exposure Visit)	100,000	Panchayat	
27	Exposure visit (Phase I)	200000	Dept. of Agriculture	1200 for interstate, 700 within-state
28	Exposure visit (Phase II)	200000	Dept. of Agriculture	1200 for interstate, 700 within-state
29	Farm Pond	3400000 without subsidy, 2320000 with subsidy	DEST Fund and Soil and Water Conservation department – under National Food Security Mission	80,000 – 50 m <sup>3</sup> (22000 subsidy) with poly and brick lining x 40; 1,00,000 - 150 m <sup>3</sup> (27000 subsidy) without poly and brick lining x 2   3200000 (880000), 200000 (54000),
30	Maintenance and overview of Village Security	1,00,000	DEST Fund / Panchayat	Maintenance and upkeep of security measures by panchayat
	Total	<b>2,24,37,000</b>		

**Note**

1. Solar Fencing – The cost of Solar Fencing of **1,00,00,000** is to be borne by farmers after a 85% subsidy on cluster solar farming under the Mukhyamantri Khet Sanrakshan Yojana. Therefore, the amount to be borne by farmers is **15,00,000**. This can be further divided on the basis of 140 identified households with lands for cluster farming therefore totaling the amount to be borne by each farmer to **10,714** rupees.
2. Subsidy of 9,34,000 may be subtracted from the cost of farm ponds as per subsidy from Soil and Water Conservation Department.

## Implementation Schedule

		Year of Implementation				
S. No.	Activity	Y1	Y2	Y3	Y4	Y5
<b>Spring Rejuvenation</b>						
1	Trenching					
2	Plantations (Ground Utility)					
3	Check Dam and loose boulder implementation					
4	Loose Boulder and Crate Wall					
<b>Sustainable Agriculture and Horticulture</b>						
5	Organic Farming					
5.1	Organic farming training					
5.2	Individual testing of Organic Farming					
6	Solar Fencing					
<b>Water Management and Irrigation</b>						
7	Rooftop Rain Water Harvesting					

8	Irrigation Tank					
9	Farm Pond					
<b>Renewable Energy</b>						
10	Solar Pump					
11	Solar Plant for Computer/Security room					
12	Solar CCTV camera and equipment					
13	Solar Street Light					
14	Solar water heater					
<b>Forest Management and Eco Services</b>						
15	Plantations (Beautification)					
16	Fireline Management					
17	Existing Village Site Development (Sitting area, fountains)					
18	New Camping Site Development					
19	Awareness activities					
20	Entry gate					

21	Landslide prevention					
<b>Solid Waste Management and Cleanliness</b>						
22	Wire Mesh dump/pickup bins					
<b>Capacity Building Interventions</b>						
23	Demonstration of Vermi Compost and poly house (Phase I)					
24	Demonstration of Vermi Compost and poly house (Phase II)					
25	Training on Micro irrigation					
26	SHG/Mahila Mandal Training (In Village)					
27	SHG/Mahila Mandal Training (Exposure Visit)					
28	Exposure visit (Phase I)					
29	Exposure visit (Phase II)					

## ANNEXURE

### Baseline Questionnaire

#### Baseline survey Questionnaire

General							
1	Village:				2	Ward No./Locality:	
3	Respondent's Name:				4	Father/ Husband's / Wife's Name:	
5	Gender:	1. Male			2. Female		
6	Social Category:	1. SC	2. ST	3. OBC	4. Muslim	4. General	5. Other (specify)
7	Education:	1. Illiterate	2. Primary /UP	3. High School/ Inter		4. Graduate & above	5. Technical/T rade
Natural Water Source Availability and Management							
1.	Main Source of Drinking Water in Household?						
2.	Do you have access to water from natural resource/spring?	1. Yes			2. No		
3.	Is there any depletion in the natural water resource in last five years?						
4.	If yes, in which season do you face depletion?						
5.	How do you use water from natural resource/spring?						
6.	Do you practice rainwater harvesting?	Yes			No		
7.	Do you treat waste water?	Yes			No		
8.	If yes, what do you practice for waste water management?						
9.	Do you practice water conservation in your household?						
10.	Do you wish to secure water for use in your household?						
Agriculture							
1.	Type of Cropping System	1. Sole	2. Inter	3. Mixed		4. Periphery plantation	5. Others
2.	Are you growing Short	1. Yes		2. No	If yes what crops do you grow?		

Duration Crops									
3. Crop Production									
S. No.	Type of Crop	Area (bigha)	Productivity from dry farming (Q./bigha)			Productivity from irrigated farming (Q./bigha)			
4. Do you irrigate your crops?			Yes	No					
5. If yes what is the source of irrigation?									
6. Crop economics (in Rs. per bigha):									
Crop	Land Preparation	Seeds	Fertilizers/ Nutrient	Plant Protection	Irrigation	Intercultural Operations	Harvesting & Packaging	Labor	Tractor or Rent
7. Income									
Type of Crop	Net Income	Total Market Price			Gross Income				
8. Do you practice organic farming?		Yes	No						
9. If no, would you like to shift to organic farming?		Yes	No						
Energy Consumption									
1. Which fuel is used for cooking in the household?									
2. Electricity Bill/ month (in Rs)									
3. LPG/ month (in kg)					Charcoal/ month (in kg)				
Firewood Consumption (kg/ month)					Diesel/ Month (in lt.)				
Is Biogas used in the household?									
4. Do you have Solar fencing in your farm?									
5. Do you use solar heaters/ cookers?									
Waste Management									
1. Do you have a vemi compost in your household?					Yes		No		
2. Do you segregate biodegradable and non biodegradable waste?									
3. Do you reuse unwanted material in your household?					Yes		No		
4. Do you use treated waste water for farming purposes?					Yes		No		
Irrigation									
1. Type of irrigation used:	1. Surface irrigation	2. Drip irrigation	3. Sprinkler irrigation	4. Community Lift irrigation	5. Rainfed	6. Others, Specify			
2. Do you use Irrigation channels?	1. Yes			2. No					
3. If Yes, Name the Channel Source:				4. What is the length of channel?					
5. Do you need water for irrigation?	1. Yes			2. No					

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6. Which source would you prefer for irrigation?	1. Borewell	2. Canal	3. Others, Specify
<b>Climate Change Adaptation</b>			
1. Have you heard about climate change?			
		Yes	No
2. Is there any climate change impact observed in last ten years?			
		Yes	No
If yes, What Climate Change Impact you have observed? <i>(Multiple response possible)</i>			
1. Less rain in monsoon	Yes	No	7. Extinction of species
			Yes
			No
2. Sporadic / uneven monsoon rain	Yes	No	8. Less surface & ground water
			Yes
			No
3. Less rainy days	Yes	No	9. Less agricultural production
			Yes
			No
4. High rainfall in less rainy days	Yes	No	10. High agriculture production (mention crop)
			Yes
			No
5. Increasing temperature in summer	Yes	No	11. More insect & pest attack to agriculture
			Yes
			No
6. Increased temperature in winter	Yes	No	
3. Climate resilient practices adopted:			
(i) Use of tolerant/resistant variety	Yes	No	(ii) In-situ incorporation of crop residue
			Yes
			No
(iii) Change/adjustment of sowing/planting time	Yes	No	(iv) Water harvesting (Farm Pond, in-situ water conservation practices)
			Yes
			No
(v) Mulching	Yes	No	(vi) Water conservation
			Yes
			No
(vii) Sowing of crops which requires less water	Yes	No	(viii) Change of sowing period
			Yes
			No
(ix) Participatory resource management and conservation planning	Yes	No	(x) Alternative livelihood
			Yes
			No
(xi) Store crop harvest	Yes	No	(xi) Crop Intensification
			Yes
			No
4. Shift in Employment due to risk / hazard	1. Yes	2. No	5. If yes Specify the Sector
6. Is there any migration situation due to droughts	1. Yes	2. No	
7. What are the other adaptive measures taken by you			
8. Integrated Nutrient Management:	A. Organic:	1. Farm Yard Manure	2. Vermi compost
	B. Inorganic:	1.	2. Super
		3. Potash	4. Others(specify)
			3. Green Manure
			4. Other(specify)

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		Urea				
	C. Micronutrient:		D. Bio fertilizer:			
	E. Application method:	1. Broadcasting	2. Behind plough	3. At root zone	4. Fertigation	5. Other(specify)
9. Integrated Pest management:	1. Chemical pesticide	2. Organic pesticide	3. Beneficial organism	4. Mechanical control	5. Cultural practice	
<b>Capacity Building</b>						
1. Do you receive any training from schemes like MIHD (Horticulture), ATMA, PMKSY, NAM (Agriculture), IPH?						
Yes			Yes			
If yes, what are the subjects of training you receive?						
2. Do you have MGNREGA job card?		1. Yes			2. No	
3. Days of employment you receive under scheme?			4. Amount you receive per day?			
5. Is there formation of any Water Committee under govt. schemes?		1. Yes			2. No	
6. Do you know about Farmer's Committee under NABARD scheme?		1. Yes			2. No	
7. Is anyone member of Farmer Club by NABARD?		1. Yes			2. No	
8. If yes, How do you get benefitted?						
9. Do you wish to be part of Farmer's Committee		1. Yes			2. No	
10. Is there any functional watershed committee in village?						
If yes, how many						
11. How many women members part of this committee?						
12. Do you know about Indira Awas Yojna (IAY)?		1. Yes			2. No	
13. Have you received any benefit from housing schemes like Indira Awas Yojna? If Yes Specify		1. Yes			2. No	
14. Do you know about Mukhyamantri Adarsh Gram Yojna? (MAGY)		1. Yes			2. No	
15. Have you received any benefit from housing schemes like Mukhyamantri Adarsh Gram Yojna? If Yes Specify		1. Yes			2. No	
16. Do you know about Mukhyamantri Khet Sanrakshan Yojna? (MKSY)		1. Yes			2. No	
17. Have you received any benefit from housing schemes like Mukhyamantri Khet Sanrakshan Yojna? If Yes Specify		1. Yes			2. No	
18. Have you received any demonstration on new crops other from govt.		1. Yes			2. No	
19. Have you observed any works under SBM in your locality?		1. Yes			2. No	
20. Is there any existing village water & sanitation committee?		1. Yes			2. No	

21. Is anyone member of water & sanitation committee in your house? If yes, describe	1. Yes	2. No
<b>Training Need Assessment</b>		
If yes, please specify and no. of family members attended		
1. Do you get training on drought management due to climate change	1. Yes	2. No
2. Do you ever get any training to adopt climate smart agriculture practices	1. Yes	2. No
3. Receive Benefits from Agro Advisory	1. Yes	2. No
4. Receive training on farm Level efficient irrigation technologies	1. Yes	2. No
5. Participation in awareness building on water management	1. Yes	2. No
6. Training on Sensitization programme on climate change	1. Yes	2. No
7. Do you face any problem in animal husbandry during water stress Situation.	1. Yes	2. No
8. Adaptive capacity building Training programmes Attended		