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How Can Himalayan Communities Anticipate Risks and Adapt to a Changing Climate?

Evidence from 12 Gram Panchayats in Himachal Pradesh

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Cover images: CEEW/Unnayan Productions. A local boy from Himachal Pradesh writes a letter to the mountains, asking why it is changing. Gram Panchayat Sharchi, Kullu, Himachal Pradesh, February 2026.

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How Can Himalayan Communities Anticipate Risks and Adapt to a Changing Climate?

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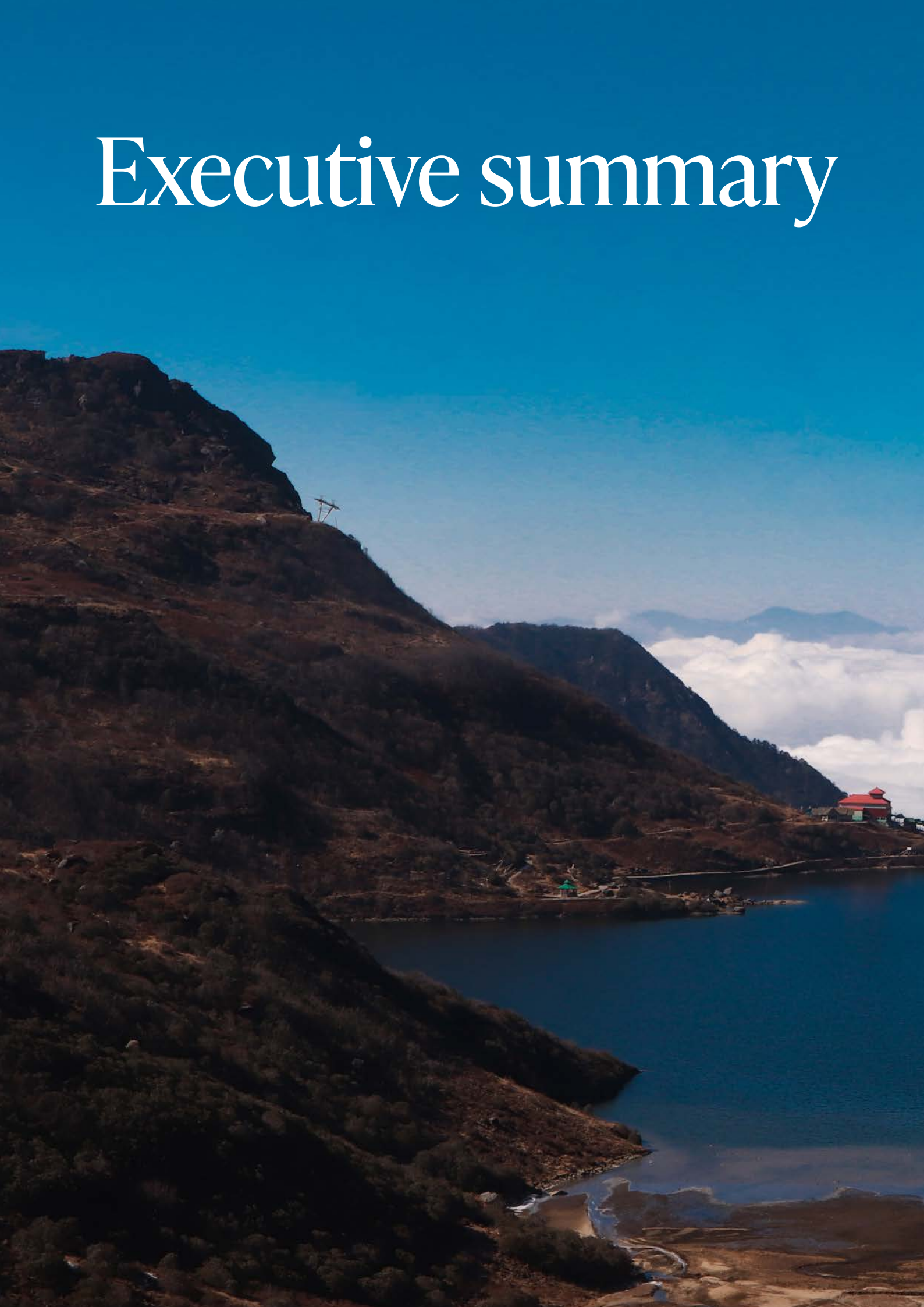
CEEW researchers conducting a 'STEEPLE' exercise with vulnerable communties.

Image: Aparna Chatterjee/CEEW

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Executive summary



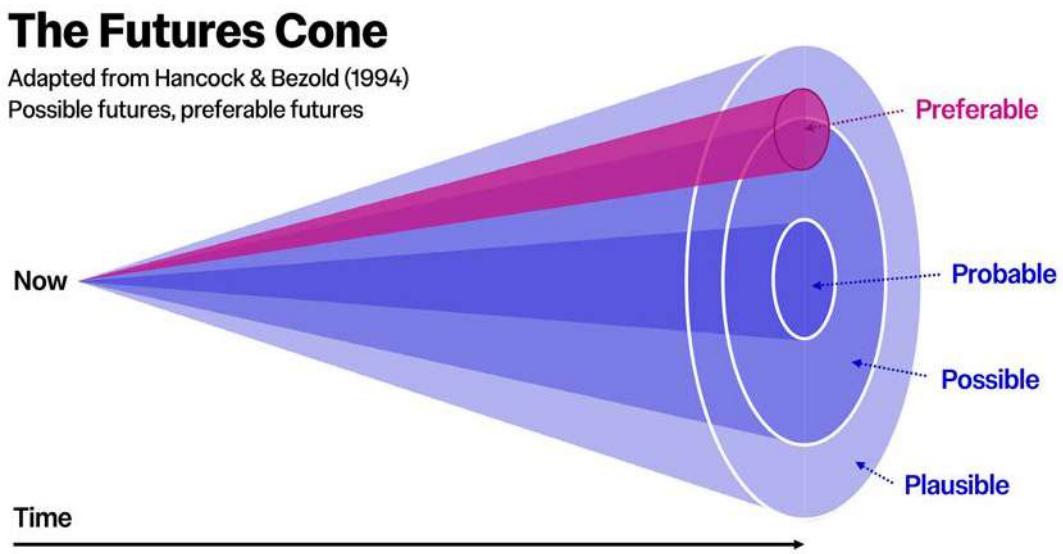


Background: The Himalayas are increasingly vulnerable to a changing climate

In August 2026, an ice-rock avalanche in Nepal's Rasuwa district triggered a catastrophic flash flood along the Bhote Koshi and Trishuli river systems (ICIMOD 2026a; USGS 2026), sweeping away homes, destroying villages, bridges and hydropower infrastructure across nearly 100 km downstream, and causing widespread loss of life (ICIMOD 2026b). Such an event is not an isolated anomaly. Across the Hindu Kush Himalayan Region, including the Indian Himalayan Region, a rapidly changing climate has led to a marked increase in the frequency and intensity of extreme climate events (ICIMOD 2019; Wester et al. 2023). As climate change increasingly interacts with urbanisation, environmental degradation and associated socio-economic shifts, climate risks will become increasingly complex and interconnected (Adler et al. 2022), threatening the quality of life of Himalayan communities, and also those of 1.9 billion people downstream (ICIMOD 2019). Adapting to these changes, reducing future loss and damage, and building resilience to future climate-induced impacts therefore requires not only understanding risks that mountain communities experience at present, but also anticipating how these risks may evolve, identifying potential impacts, and enabling adaptation before the risks materialise.

Strategic foresight can help bridge this gap by bringing together scientific evidence, local knowledge and multiple stakeholder perspectives to explore plausible futures and identify actions that can be taken today for a climate-resilient future (Copenhagen Institute for Future Studies 2024; United Nations Department of Economic and Social Affairs 2026).

Figure ES1. Foresight is the disciplined analysis of alternative futures.



Source: Adapted from Strategic Futures Design Lab (n.d.).

This is the premise that this study builds on. It asks: ***How can Himalayan communities utilise strategic foresight to be able to anticipate and adapt to climate risks that may emerge in the future? And, how can they reduce disaster risk through collaboration between communities, government institutions, research organisations, and civil society, enabling effective, collective response?***

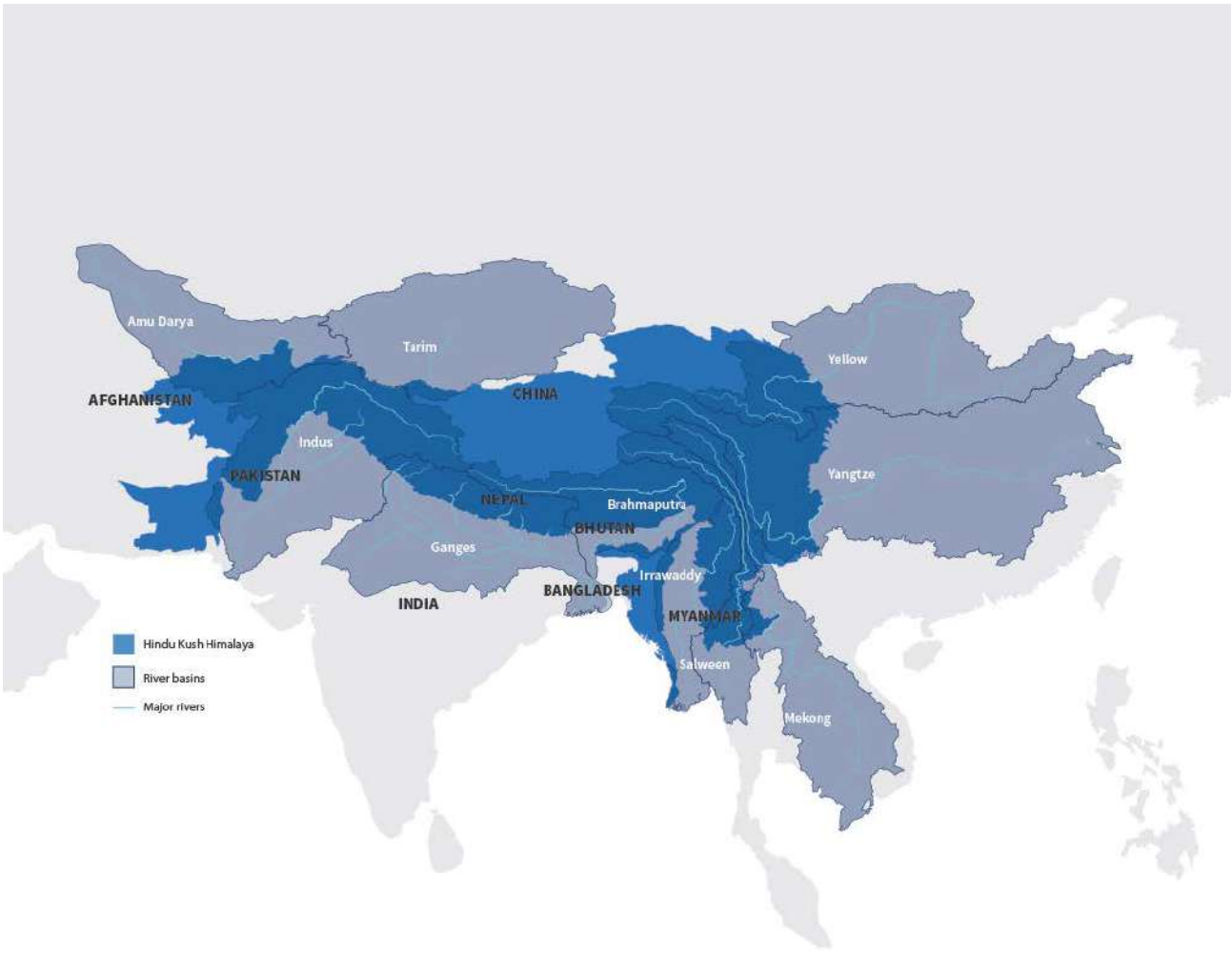
The study thus illustrates how strategic foresight could be used to inform disaster risk reduction and climate adaptation. It deploys the strategic foresight approach in Himachal Pradesh, a climate-vulnerable state within the Indian Himalayan Region which showcases strong community knowledge and adaptive practices, and growing state-level emphasis on decentralised disaster

risk management. It brings together perspectives from various actors using *foresight tools*. It thus explores future scenarios under conditions of uncertainty and complexity posed by the changing climate.

Background: The Himalayas are increasingly vulnerable to a changing climate

The Hindu Kush Himalayan (HKH) region, the world's Third Pole, is warming twice as fast as the global average (ICIMOD 2019 and Sabin et al. 2020). Glaciers are disappearing 65 per cent faster than in the previous decade (Shrestha et al. 2015; ICIMOD 2023b; Wester et al. 2023), while 10 of its 12 major river basins have recorded significantly below-normal snow persistence for four consecutive years (Muhammad 2025). This has sharply increased the frequency and intensity of extreme climate events, including heatwaves, extreme precipitation, flash floods, cloudbursts, glacial lake outburst floods (GLOFs), landslides, or a compound event that arises from the combination or interaction of these hazards (Lohan et al. 2025). The Intergovernmental Panel on Climate Change (IPCC) now identifies the HKH as the world's most vulnerable mountain system (IPCC 2022).

Figure ES2. The Indian Himalayan Region makes up 15% of the Hindu Kush Himalayan Region by area



Source: Authors' analysis.

The Indian Himalayan Region (IHR) makes up 15 per cent of the HKH and faces these rising climatic and developmental risks. The IHR is undergoing rapid, largely unplanned and unregulated urbanisation (Walker 2011), marked by extensive land-use change (Sharma et al. 2022), encroachment into fragile ecological zones (Kumar et al. 2021), obstruction of natural water bodies, and slope cutting for road construction (Dennehy 2017). These rapid changes are straining critical ecological and infrastructural systems in the IHR, which contains some of the youngest and most geomorphologically sensitive folds of the Himalayas (Banerjee 2026). As a result, the region faces cascading physical and socio-economic risks from rising climate extremes. For instance, more than 14,390 landslides were recorded across the IHR between 2020 and 2024, disrupting road access, cutting off communities from critical services, and compounding existing infrastructural and livelihood vulnerabilities (CEEW 2025).

Within the IHR, Himachal Pradesh, in the western Himalayas, faces particularly high risk due to the combined impacts of rapid urbanisation, environmental degradation, and changing weather patterns (Tolani et al. 2024). Between 2020 and 2025, the state recorded cumulative damage of INR 21,097 crore (USD 2.19 billion) and the loss of more than 2,000 lives (HPSDMA 2025). Infrastructure, including road networks and education and healthcare facilities, was most affected, followed by key livelihood sectors. Satellite assessments also reveal a 10 per cent reduction in seasonal snow cover (IMD 2024), which has adversely impacted mountain agriculture and horticulture in a state where more than 60 per cent of the population depends on these sectors for household income (Wing et al. 2021). In response to these impacts, however, communities and institutions across Himachal Pradesh are taking active steps towards disaster risk reduction (DRR) and climate adaptation.

The policy window: Himachal Pradesh is taking active steps for disaster risk reduction

Local communities are best placed to lead both climate adaptation and disaster risk reduction (Soanes et al. 2021; Gupta et al. 2026) as they face long-term cascading socio-economic impacts of climate risks and are often the first responders during and immediately after extreme events, especially in remote mountain contexts. Having historically been exposed to such events, local communities in Himachal Pradesh demonstrate a high capacity for both climate adaptation in the long term and disaster risk reduction in the short term, with many adaptive practices culturally embedded and locally sustained for decades.

Box ES1. The difference between climate change adaptation and disaster risk reduction

Climate change adaptation (left) is the process of adjusting to actual or expected climate and its effects to reduce harm or take advantage of beneficial opportunities (IPCC 2022). Disaster risk reduction (DRR) (right) is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development (UNDRR 2017).



Image: Google Gemini

1. Integrated farming systems
2. Natural farming techniques
3. Indigenous seeds custodian
4. Renewable energy and power backups
5. Crop diversification

1. Early-warning systems
2. Slope stabilisation to reduce landslide risk
3. Check dams and flood-control measures
4. Community risk mapping and emergency planning
5. Trained community volunteers and response teams

Source: Authors' illustration.

Recognising this opportunity, the Himachal Pradesh State Disaster Management Authority (HPSDMA) is taking active steps to strengthen disaster preparedness at the panchayat level and decentralise disaster response. Through the state's *Panchayat Emergency Response Centre Scheme*, launched in 2025, it plans to institutionalise community-based disaster risk management (CBDRM) by establishing an organised, community-based framework for disaster preparedness, response, and recovery at the grassroots level, particularly during the critical hours immediately following a disaster, when external assistance may be delayed due to Himachal Pradesh's challenging terrain.



Image: Himachal Pradesh Institute of Technical Administration

A state-level workshop was conducted by the Himachal Pradesh State Disaster Management Authority in March 2026 to prepare the Monsoon Preparedness Plan

At the same time, communities across Himachal Pradesh are anticipating risks and taking action towards climate adaptation in the long-term (see fig ES3). Himachal Pradesh therefore presents a rare opportunity to demonstrate how **anticipatory adaptation**[1] pathways can be co-developed by aligning strong community capacities with pioneering state-led institutions.

Methodological overview: The strategic foresight framework

The study built an evidence base through a literature review and stakeholder consultations, then documented climate risks and existing adaptation solutions with communities across 12 gram panchayats in four districts. We then convened stakeholders in Shimla to collectively vision a climate-resilient future for each sector and used foresight tools to map the actions, actors and mechanisms needed to reach it (see Chapter 2).

1 Anticipatory adaptation refers to the "adaptation that takes place before impacts of climate change are observed. Also referred to as proactive adaptation" (IPCC 2001).

Key findings

All 12 gram panchayats surveyed are experiencing socio-economic impacts from a changing climate, as climate hazards combine with local development choices to amplify risk factors. However, all 12 Panchayats also demonstrate strong initiatives taken to reduce disaster risks and adapt in the long-term.

a. Socio-economic risks of a changing climate across 12 gram panchayats in Himachal Pradesh



Gram Panchayat Kothi Gaihri, District Mandi

is frequently affected by extreme precipitation and landslides. The region's steep and unstable slopes are becoming increasingly unsuitable for agriculture. Community members report that prolonged use of chemical fertilisers has degraded soil structure, reduced water infiltration capacity, and increased surface runoff, leading to declining agricultural productivity and higher risks of landslides and land subsidence.



Gram Panchayat Sunah Lamba Thach, District Mandi

is frequently affected by flash floods, forest fires, and cloudbursts. Communities have observed a marked reduction in snowfall, which prevents aquifer recharge and restricts apple cultivation. Additionally, a cloudburst in 2025 severely damaged the local primary school, disrupting students' education for months.



Gram Panchayat Pandoh, District Mandi

is frequently affected by floods, often linked to water release from the Pandoh Dam and rising water levels in the Beas River and Jayuli channel. The proximity of residential areas and market infrastructure to the river increases exposure, while illegal debris dumping and a lack of flood-protection measures further intensify flood risk. Although sirens are used for early warning, communities report that warnings do not clearly explain the timing or volume of water releases, limiting preparedness and effective early action.



Gram Panchayat Sharchi, District Kullu

is frequently affected by cloudbursts and landslides. Communities report that encroached and silted watershed channels have weakened natural drainage, increasing the risks of flash floods and landslides during extreme rainfall. Rapid, unregulated tourism growth, especially by non-local establishments, has also placed pressure on local water sources, roads, forests, and natural resources.



Gram Panchayat Banogi, District Kullu

is frequently affected by floods caused by heavy rainfall and dam-related water discharges. Communities report major losses to homes, shops, market infrastructure, and livelihoods during recent flood events. A lack of clear dam safety protocols, weak early-warning communication, and dumping of construction waste into the river continue to increase flood exposure and mistrust among residents.



Gram Panchayat Bajaura, District Kullu

is frequently affected by extreme heat, forest fires, and flash floods. Rising temperatures, declining snowfall, and erratic rainfall have affected traditional apple cultivation, pushing farmers to shift towards pomegranate, persimmon, and other climate-resilient crops. However, declining water availability for irrigation and domestic use, a lack of water-lifting infrastructure, and road damage during disasters continue to affect crop productivity and market access.



Gram Panchayat Chalal, District Kullu

is frequently affected by cloudbursts and riverine floods. Rapid tourism-driven development near rivers and streams has increased the exposure of homestays, cafes, camps, and local infrastructure to flood damage. Cloudbursts in 2022 and 2023 caused severe loss and damage, including damage to the Chojh bridge and disruption to schooling, while the absence of a functional early-warning system continues to limit preparedness.



Gram Panchayat Parara, District Sirmaur

is frequently affected by heat, forest fires, erratic rainfall, and hailstorms. Communities report that changing rainfall patterns and rising temperatures have shifted crop calendars and increased the incidence of crop diseases, particularly affecting tomatoes and garlic. Farmers have responded by adopting natural farming, rainwater harvesting, and crop diversification, but poor transport, limited cold storage, and weak market access continue to restrict income stability.



Gram Panchayat Thana Kashoga, District Sirmaur

is frequently affected by droughts, water scarcity, landslides, and forest fires. Communities report declining rainfall and rising temperatures over the last few years, reducing water availability and increasing summer stress on springs and baoris. Pastoralism has also declined due to fodder scarcity and forest fires, while landslides have damaged homes, fields, and electricity infrastructure.



Gram Panchayat Dhamun, District Shimla

is frequently affected by heat, erratic rainfall, and forest fires and is witnessing a shifting snow line. Increased deforestation and construction on slopes have contributed to soil erosion, landslide risk, and disruptions to road access. Agriculture remains important, but declining productivity, weak market linkages, the lack of cold storage, and declining youth interest in farming are affecting livelihood security.



Gram Panchayat Sandhu, District Shimla

is frequently affected by heat, forest fires, hailstorms, and erratic snowfall and rainfall patterns. Communities report that declining snowfall and reduced water flow in traditional water-harvesting structures (*baoris*) are affecting water availability, while landslides disrupt agriculture, roads, and access to services. Extensive use of chemical fertiliser has also affected soil quality, fertility, and stability, prompting local women to adopt natural farming methods.

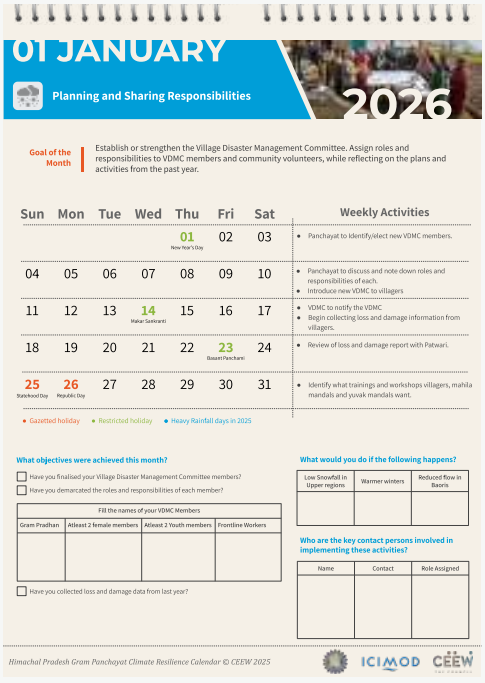


Images: CEEW

Gram Panchayat Shoghi, District Shimla

is frequently affected by heat and landslides, compounded by the impacts of rapid urbanisation. The expansion of highways and tourism infrastructure has led to deforestation, slope instability, and increased landslide risk, especially after extreme rainfall events. Reduced rainfall and the drying of traditional water sources have worsened water scarcity, while unregulated tourism growth has placed additional pressure on sewage and waste systems and local utilitarian infrastructure.

Box ES2. Planning for Climate Resilience Through the Seasons



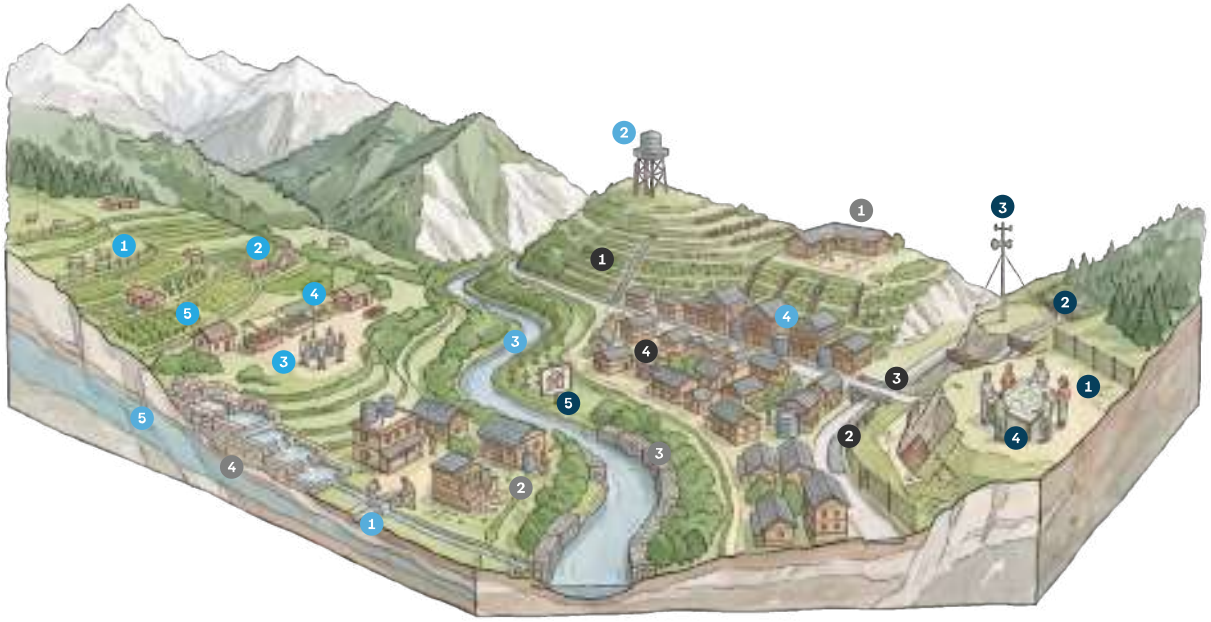
Lives of Himalayan communities are closely shaped by seasonal rhythms, influencing water availability, livelihoods, mobility and local practices. Adaptation and disaster preparedness must therefore align with these cycles. CEEW's Gram Panchayat Climate Resilience Calendar offers a community-friendly microplanning tool that brings together seasonal climate risks, agricultural and cultural cycles, monthly preparedness goals and locally relevant anticipatory actions for Panchayats to plan throughout the year.

Source: Authors' illustration.

b. Adaptation solutions for building climate resilience of Himalayan communities

25 anticipatory adaptation solutions were co-identified across five critical sectors: mountain agriculture, water management (including domestic and agricultural), community-based disaster risk reduction (CBDRR), critical infrastructure, and development planning (see Figure ES3). These range from natural farming and a shift to climate-resilient crops in mountain agriculture, to rainwater harvesting and the rejuvenation of baoris and springs in water management, to the development of village-level disaster management committees, and relocating critical infrastructure to safe zones.

Figure ES3. What a climate-resilient Himalayan village looks like: visualisation of adaptation solutions



Images: Google Gemini

Mountain agriculture

1. Crop protection systems
2. Traditional farming practices
3. Knowledge exchange systems
4. Farmer markets
5. Integrated farmings models and natural farming

Water management

1. Cleaning watersheds
2. Water lifting and storage infrastructure
3. Replantation of indigenous species
4. Rain-water harvesting
5. Recharging traditional water sources

Community-led disaster risk reduction

1. Establishing local committees
2. Check dams and trenches
3. Graded early warning systems
4. Participatory risk mapping and contingency plans
5. Community-led enforcement of No development zones

Infrastructure development

1. Bio-engineering for soil stabilisation
2. U-ducts and Underground utility lines
3. All weather roads
4. Disaster-resilient construction

Development planning

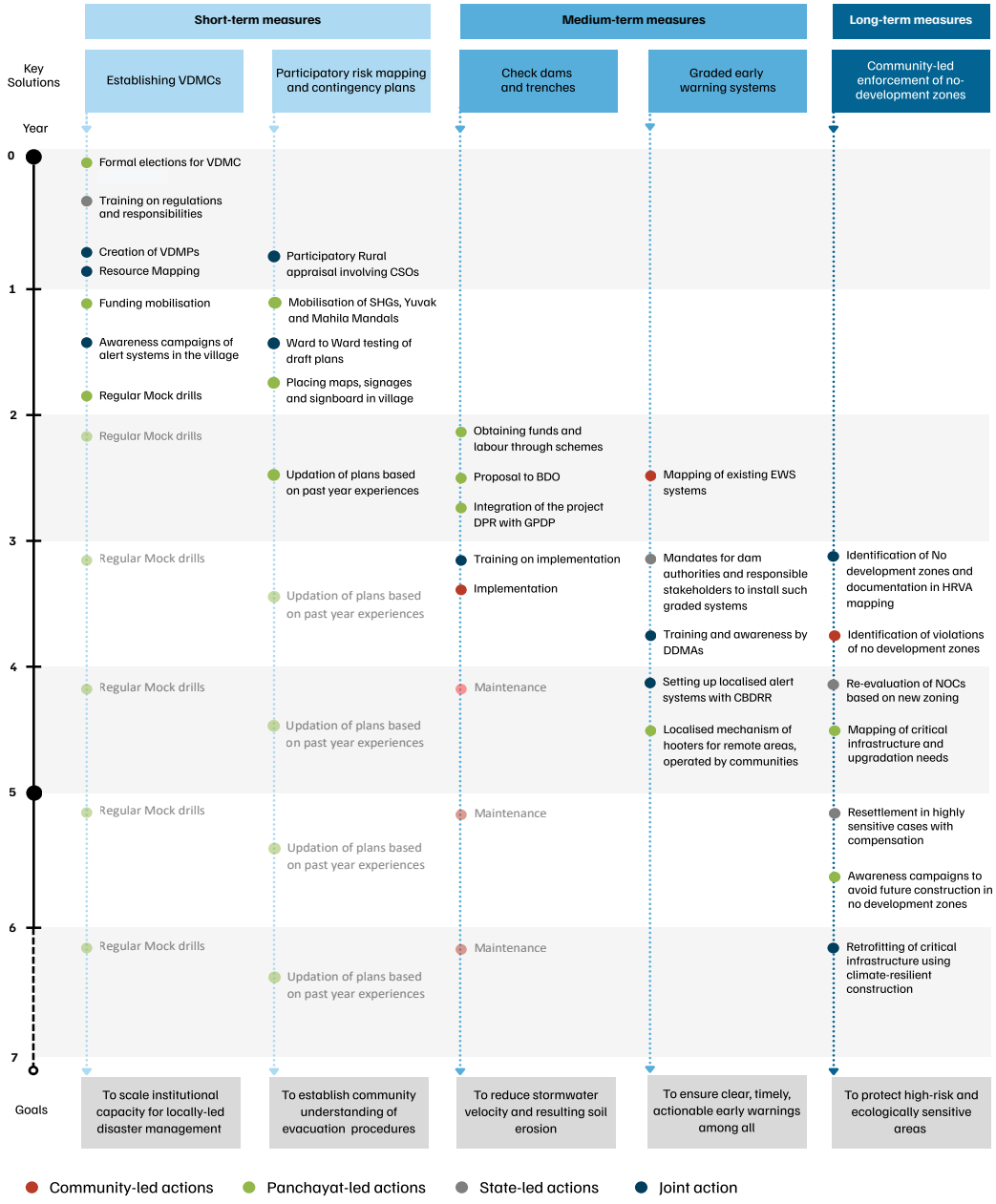
1. Relocation of critical infrastructure
2. Planned relocation and secured livelihoods
3. Flood protection systems
4. Retrofitting infrastructure for disaster safety

Source: Authors' compilation based on community consultations in 12 gram panchayats and the multi-stakeholder consultation in Shimla (2025).

c. Anticipatory adaptation pathways for disaster risk reduction in Himachal Pradesh

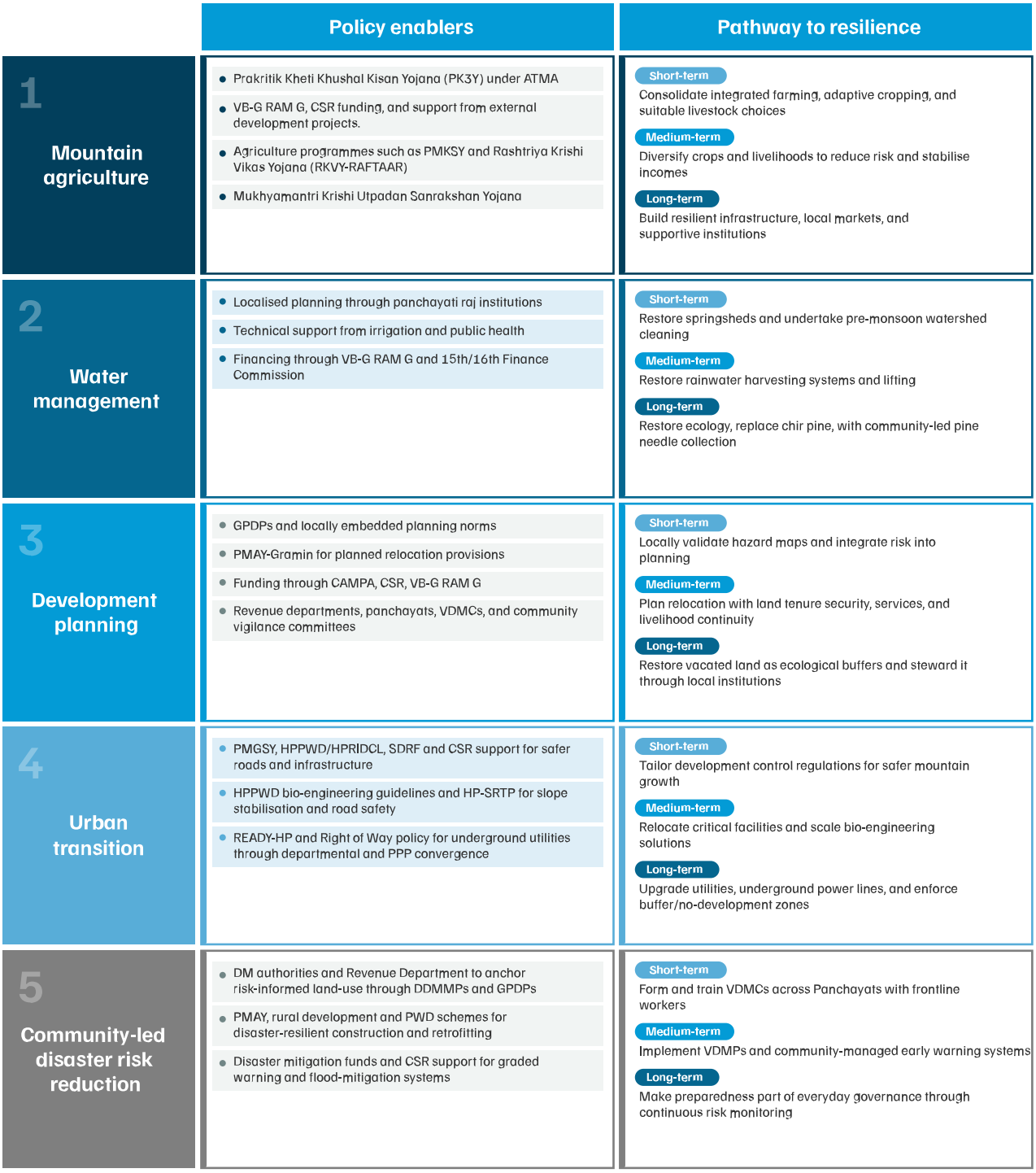
A two-day multi-stakeholder consultation in Shimla brought together representatives from 12 gram panchayats, NGOs, CSOs, and district disaster management and rural development officials to assess the feasibility and scalability of identified adaptation solutions. More than 60 participants discussed resource and time constraints, stakeholder roles and responsibilities, and relevant government schemes to scale community-level solutions into anticipatory adaptation pathways (see Chapter 4).

Figure ES4. Anticipatory adaptation pathway for community-led disaster risk reduction



Source: Authors' compilation based on hands-on activity conducted jointly with disaster management and rural development officials, NGOs, and community members in Himachal Pradesh in July 2025.

Figure ES5. Existing schemes and funds can finance anticipatory adaptation across five sectors



Source: Authors' analysis.

Note: ATMA: Agricultural Technology Management Agency; CAMPA: Compensatory Afforestation Fund Management and Planning Authority; CSR: corporate social responsibility; DDMP: District disaster management plan; DM: disaster management; GPDP: gram panchayat development plan; HPPWD: Himachal Pradesh Public Works Department; HPRIDCL: Himachal Pradesh Road and Other Infrastructure Development Corporation Limited; HP-SRTP: State Roads Transformation Program; PK3Y: Prakritik Kheti Khushhal Kisan Yojana; PMAY: Pradhan Mantri Awas Yojana; PMGSY: Pradhan Mantri Gram Sadak Yojana; PMKSY: Pradhan Mantri Krishi Sinchayee Yojana; PPP: public–private partnership; PWD:Public Works Department; RAFTAAR: Remunerative Approaches for Agriculture and Allied Sector Rejuvenation; READY-HP: Resilient Action for Development and Disaster Recovery Project in Himachal Pradesh; RKVY: Rashtriya Krishi Vikas Yojana; SDRF: State Disaster Response Fund; VB-G RAM G: Viksit Bharat – Guarantee for Rozgar and Ajeevika Mission; VDMC: village disaster management committee, and VDMP: village disaster management plan.

Policy recommendations

- ## Village Disaster Management Committees (VDMCs) must be strengthened as frontline institutions for disaster risk management

Positioned closest to communities, VDMCs can translate early warnings into anticipatory action by coordinating preparedness, last-mile response, and community mobilisation. Regular training, clear standard operating procedures (SOPs), and micro-planning tools such as the Gram Panchayat Climate Resilience Calendar, developed by CEEW, can help VDMCs anticipate risks and strengthen disaster preparedness as part of everyday local governance.

- ## Gram panchayat development plans (GPDPs) must be positioned as institutional anchors of climate-resilient rural development

As the primary statutory instruments for village-level planning and budgeting, GPDPs provide a strong platform for mainstreaming climate adaptation into rural development. They can enable effective adaptation through cross-sectoral planning and coordination and by aligning local priorities with state and national missions and schemes.

- ## The National Disaster Management Authority (NDMA) should institutionalise strategic foresight for disaster risk reduction by establishing a dedicated foresight cell

A dedicated foresight cell could enable a systematic shift from reactive response to a more proactive approach by embedding anticipatory action and scenario-based planning into disaster preparedness and decision-making. Evidence from Nepal, Bangladesh, and Bhutan demonstrates that such institutional arrangements are both practical and effective (ICIMOD 2026).

- ## Research and science institutions must leverage the latest technologies to upgrade climate risk assessments and disaster forecasts

Artificial intelligence (AI), machine learning, high-resolution geospatial analytics, and remote sensing could be leveraged to improve forecast precision and lead times and translate meteorological warnings into impact-based localised forecasts (IbFs). Such forecasts can enable VDMCs to pre-define anticipatory actions against set thresholds, helping to prevent damage and loss when disasters strike (IWMI 2025).

- ## Disaster management authorities must adopt forecast-based financing models to fund anticipatory adaptation

Disaster management authorities should adopt forecast-based financing models that release funds when pre-defined risk thresholds are reached. Forecast-based financing (FbF) can be integrated into state, district, and gram panchayat disaster management plans by defining triggers and action protocols and establishing decentralised contingency financing. This can support early actions such as pre-emptive evacuation, route clearance, and preparedness measures, potentially reducing losses (IFRC 2017).

1. Introduction

Himalayan communities must anticipate climate risks to build resilience





Image: Ahana Chatterjee/CEEW

Extreme weather events in Himachal Pradesh have increased eightfold over the past five decades (Tolani et al. 2024). This chapter explains why waiting for disasters to strike is no longer viable, and why resilience must be built from within communities and their local institutions.

1.1 Indian Himalayan communities face increasingly complex climate risks

Climate change is increasing the frequency and intensity of climate-related extremes worldwide, and mountain regions are among the most exposed and vulnerable (IPCC 2021, 2022). In the Indian Himalayan Region (IHR), where communities depend directly on fragile ecosystems for agriculture, forestry, and water, this climatic stress compounds existing socio-economic vulnerabilities (Department of Science and Technology [DST] 2018; IPCC 2022). Climate-induced risks in mountains are also frequently cascading: compound and cascading impacts affect people, ecosystems, and infrastructure, and generate spill-overs across multiple, interconnected natural and human systems (IPCC 2022). A landslide, for instance, can obstruct river channels, alter river courses, breach to trigger downstream flooding, and inundate or sever transport corridors, generating inter-systemic risks across sectors such as water, infrastructure, ecosystems, and livelihoods (Dutta et al. 2026; IPCC 2022). As a result, a changing climate not only causes physical damage and disruption but also harms the quality of life and socio-economic development of IHR communities (DST 2018; IPCC 2022).

The remoteness and geographical marginality of human settlements in the IHR also make response, relief, and recovery efforts extremely difficult for external support agencies at the state or district level. Communities in the IHR must therefore anticipate and adapt to climate risks before their impacts fully unfold.

1.2 Himachal Pradesh: a case in point

Over the past five decades, the frequency of extreme climate events in Himachal Pradesh, located in the Western part of the Indian Himalayan Region, has increased eightfold, including heatwaves, extreme precipitation, floods, cloudbursts, and thunderstorms (Tolani et al. 2024). Between 2020 and 2025, the state recorded more than 600 landslides, 112 cloudbursts, and 287 flash flood events, with around 300 of these events occurring in 2025 alone (Post Disaster Needs Assessment 2025). Forest fire incidents have also increased sharply. Satellite assessments reveal a 10 per cent reduction in seasonal snow cover, threatening downstream water security and orchard productivity (IMD 2024). These events have led to cumulative damage of INR 21,097 crore, primarily affecting infrastructure such as road networks and education and healthcare facilities, followed by key livelihood sectors (PDNA 2025).

1.3 Communities in Himachal Pradesh are well-placed to build climate resilience

Historically, local communities in Himachal Pradesh have demonstrated a strong capacity for environmental adaptation through culturally embedded, locally sustained practices (Negi et al. 2025). However, the growing scale and intensity of recent risks have outpaced these traditional mechanisms (ICIMOD 2019). Mountain communities are indispensable agents in building climate resilience for several reasons:

- **First responders and knowledge holders:** Local communities observe early signs of ecological stress, such as erratic snowfall or drying springs, complementing scientific monitoring (ICIMOD 2023).
- **Direct livelihood dependence:** Agriculture, horticulture, and pastoralism in the hills are closely linked to microclimates. Resilience therefore begins at the household and community levels (CEEW 2023).
- **Social capital and networks:** Panchayats, cooperatives, and self-help groups often act as informal safety nets, facilitating collective responses (IIED 2022).
- **Ownership and sustainability:** When communities co-design adaptation interventions, uptake and maintenance improve, reducing dependence on external support (WRI 2021).

1.4 What is anticipatory adaptation and why it matters for community resilience

Adaptation practice has progressed from reactive coping after disasters to anticipatory (or proactive) adaptation, which occurs before projected impacts and includes adaptation solutions, such as alternative livelihoods, risk-informed land use and infrastructure development, and resource mobilisation that reduce communities' sensitivity.

Table 1. Anticipatory adaptation acts before climate impacts are observed; reactive adaptation acts after

Term	Definition
Anticipatory adaptation	"Adaptation that takes place before impacts of climate change are observed. Also referred to as proactive adaptation" (IPCC 2001, 982).
Reactive adaptation	"Adaptation that takes place after impacts of climate change have been observed" (IPCC 2001, 982).
Anticipatory action	"Acting ahead of a predicted hazardous event to prevent or reduce the impacts on lives, livelihoods and humanitarian needs before they fully unfold." This works best when activities, as well as trigger thresholds or decision-making rules, are pre-agreed, and decisions are made to guarantee the fast release of pre-arranged funding (IASC 2024).
Adaptive capacity	"The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities or to respond to consequences" (IPCC 2022, 121).
Vulnerability	"The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt" (IPCC 2022, 121).
Climate risk	"The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems." Risks arise both from the impacts of climate change, through interactions between hazards, exposure and vulnerability, and from responses to it that fail to meet their objectives or carry trade-offs (IPCC 2022, 121).
Resilience	"The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management" (UNDRR 2017).

Source: Authors' compilation from IPCC (2001, 2022), IASC (2024), and UNDRR (2017).

Why anticipatory measures are crucial for Himalayan communities

- **Reduces loss and damage by shifting** from crisis response to risk reduction
- **Proves to be cost-effective in the long run;** FAO's assessment of ten anticipatory action interventions found benefit-cost ratios of over 7:1 in the strongest cases, though returns were considerably lower for rapid-onset hazards, where impacts are harder to prevent (FAO 2023).
- **Enhances adaptive capacity and risk awareness** by enabling communities to adjust land use, cropping patterns, and water management to reduce climate risks.
- **Ensures inclusion** by embedding equity and prioritising women, children, older persons, persons with disabilities, displaced populations, and other marginalised groups who are disproportionately affected by climate hazards (Anticipation Hub 2024).

1.5 Strategic foresight can help Himalayan communities anticipate risks

Uncertain forecasts, limited finance, and weak institutional coordination often impede anticipatory measures at the local level (UNDRR 2023). Integrating scientific forecasts with traditional knowledge and ensuring equitable participation also remain key challenges in mountain regions. Additionally, climate risks emerge from **complex, interlinked systems** influenced by multiple environmental, socio-economic, and anthropogenic drivers. To effectively address these complexities, a foresight-led approach rooted in **systems thinking** offers valuable tools and perspectives.

Strategic foresight is the "structured and explicit exploration of multiple futures in order to inform decision-making" (OECD 2019, 3). It enables governments and institutions to anticipate, prepare for, and shape long-term futures by systematically exploring emerging trends, uncertainties, and potential disruptions. Systems thinking is a crucial component of foresight, as it identifies interlinkages among drivers of change and reveals hidden dynamics inside complex contexts. It is an exercise in analysing complex systems, understanding how different system variables interact, and identifying leverage points for successful actions.

Unlike conventional adaptation planning, which often assumes a linear and predictable future, foresight recognises that the future is uncertain and non-linear. This can enhance anticipatory governance and support more adaptive, inclusive, and resilient policy design (UNDP 2018).

While foresight is often used at policy or institutional levels, it can also strengthen community-based climate resilience through bottom-up processes. Integrating strategic foresight into community-based adaptation (CBA)[2] can enable communities to explore future risks, co-develop scenarios, and plan locally relevant adaptation strategies.

2 Community-based adaptation (CBA) is an approach that aims to empower communities to prepare for and respond to climatic stress by facilitating adaptation that is inclusive, community-driven, and sustainable. In theory, this is achieved by enabling local communities to plan for the impacts of climate change and determine the methods and goals of adaptation (Kirkby et al. 2015)

This participatory approach places local voices and concerns at the centre and values indigenous knowledge alongside scientific data. Communities in Himachal Pradesh, for example, hold deep traditional knowledge of weather patterns, ecological changes, and coping practices. Foresight exercises provide a structured way to integrate this local knowledge with technical and scientific inputs (Sustainability Directory 2025). They can also help uncover innovative solutions and traditional practices that could be reintroduced and scaled as contemporary adaptation measures.



Image: CEEW

CEEW members with Anganwadi workers in Dhamun, Shimla, piloting a foresight tool.

Foresight-led anticipatory adaptation can thus align local priorities with broader institutional objectives. It reframes communities not as passive recipients of support but as active enablers of resilience, using their lived experience and collective intelligence to guide adaptation efforts. By prioritising collective intelligence and building a shared vision for adaptation, foresight can help unify fragmented adaptation efforts and strengthen institutional support towards the common goal of building climate resilience. A foresight-led approach for anticipatory adaptation can thus address the urgent need for robust, well-resourced, and transformative adaptation at systemic scales in the IHR and beyond.

2. Methodology

How we used strategic foresight to develop anticipatory adaptation pathways

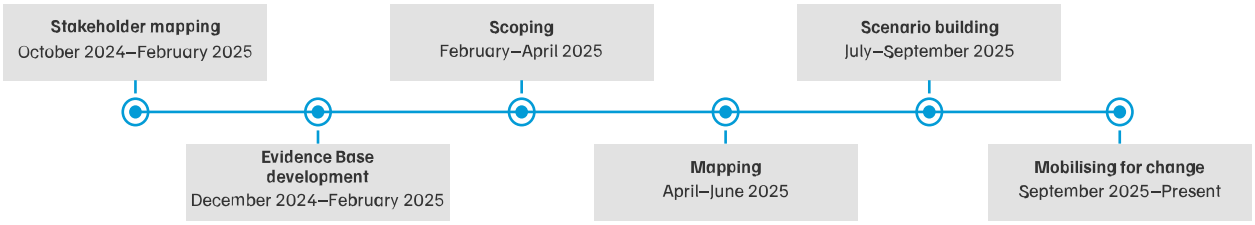




Image: Ahana Chatterjee/CEEW

Scaling community-led adaptation requires both communities and governments to anticipate future risks and uncertainties (Shammin et al. 2021). This chapter describes the methodological approach used to apply strategic foresight to identify, understand, and deliberate on the potential of community-led adaptation solutions in Himachal Pradesh.

Figure 1. The foresight process ran in six overlapping stages from October 2024



Source: Authors' illustration.

The following sections describe the three core phases – scoping, mapping, and scenario building.

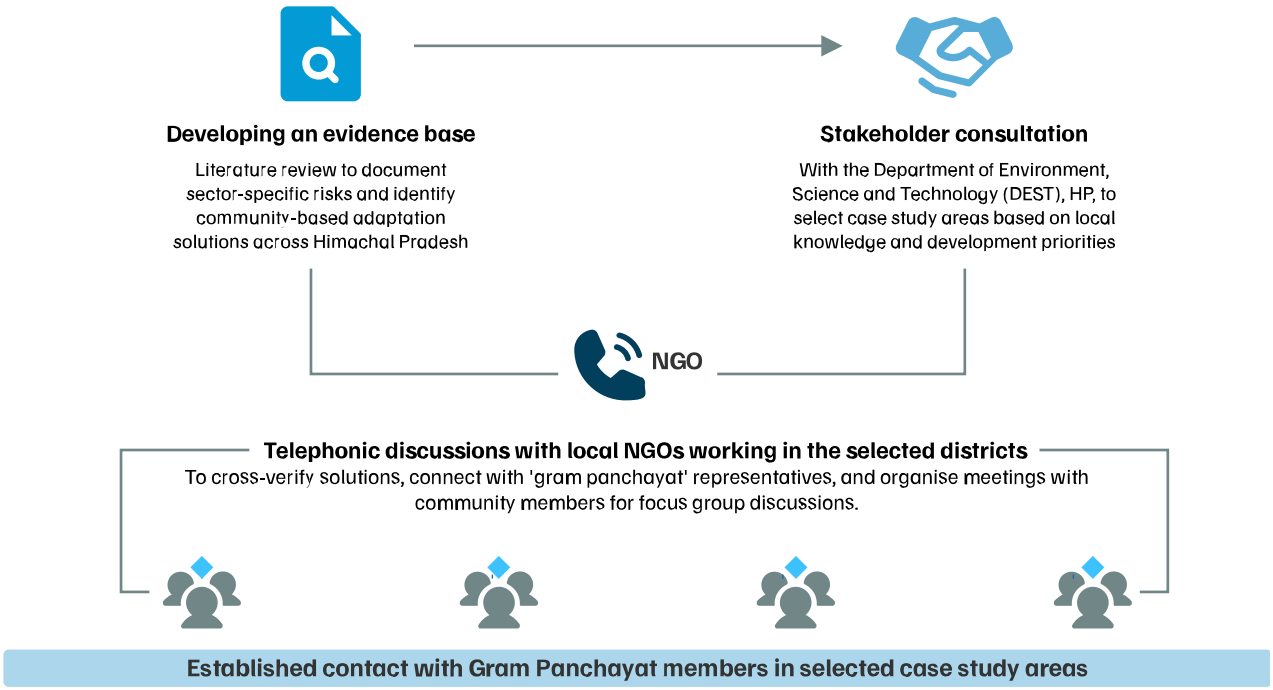
2.1 Scoping: selection of case study areas and themes

During the first phase of the foresight process, known as the 'pre-intelligence' phase (Saritas 2013), a multi-step purposive sampling process[3] was used to identify case study locations (gram panchayats) within Himachal Pradesh, accounting for a range of climate risk drivers, vulnerability profiles, and adaptation actions (see Figures 2 and 3). This enabled the.... (continue) of geographically and socio-economically diverse case study areas across heterogeneous contexts.

In the first step, we developed a scientific evidence base through a narrative literature review to identify drivers of climate risks across thematic areas and document community-based and government-led adaptation responses across Himachal Pradesh. These findings were complemented by consultations with the state government. Based on this evidence, four districts, **Mandi, Kullu, Shimla, and Sirmaur**, were shortlisted for the field study. Each was selected based on its exposure to specific climatic risks and identified adaptation responses, with landslides, cloudbursts, extreme heat, and drought emerging as core themes. In the second step, village-level climate vulnerability assessments conducted by the Department of Environment, Science Technology and Climate Change, Himachal Pradesh (DEST 2020), informed the selection of gram panchayats across these districts.

3 Purposive sampling, also termed purposeful or judgmental sampling, refers to the "deliberate selection of individuals or groups based on predefined characteristics, experiences, or knowledge that are directly relevant to the research purpose" (Zrineh 2026, 1).

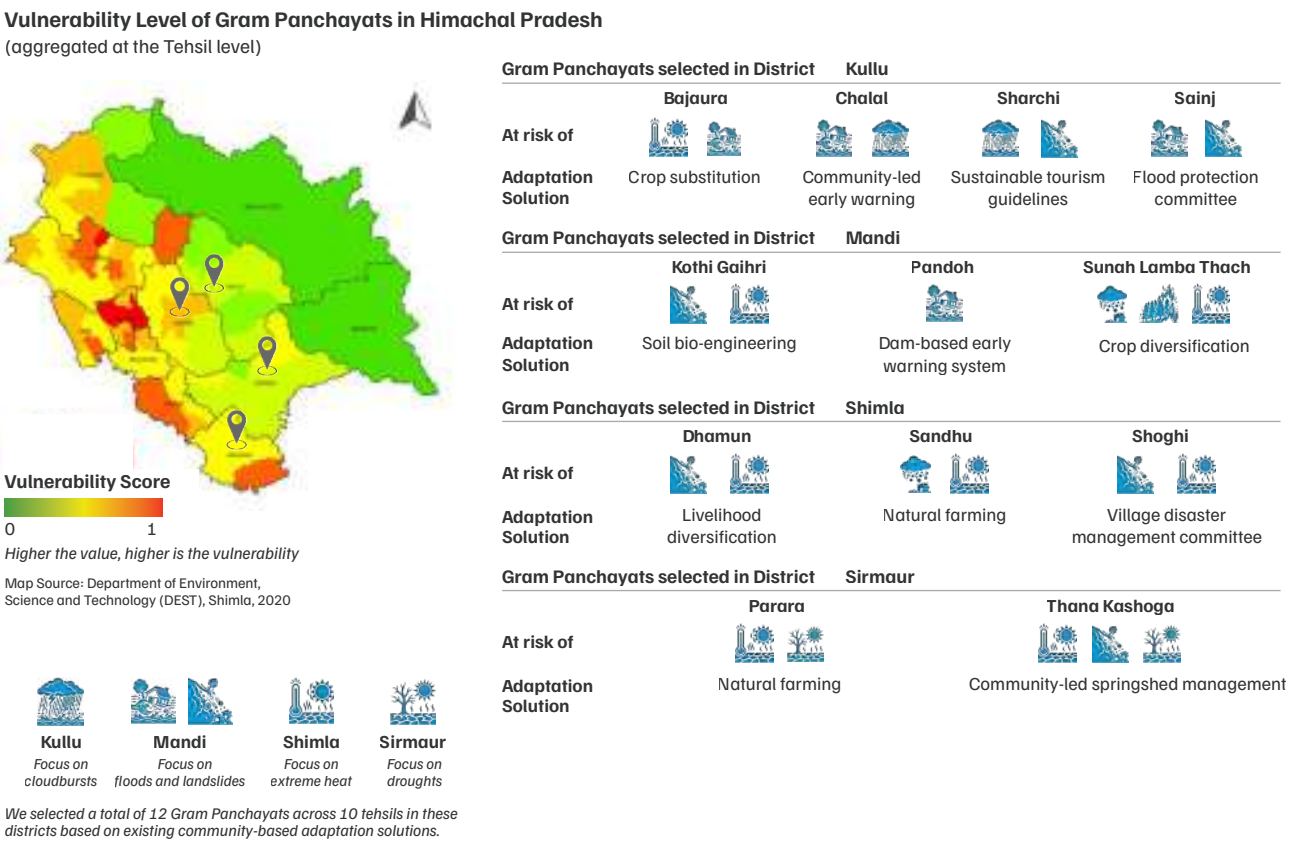
Figure 2. Local NGOs played an integral role in establishing contact with gram panchayats during the scoping phase



Source: Authors' illustration.

In the final step, the shortlisted gram panchayats were finalised in consultation with the Department of Environment, Science Technology and Climate Change, Shimla, and the Himachal Pradesh State Disaster Management Authority (HPSDMA), incorporating their institutional knowledge and aligning the selection with developmental priorities. Local NGOs working in the selected districts were subsequently consulted through telephonic interviews to cross-verify the ground-level adaptation solutions already identified and to establish contact with gram panchayat leaders and community members. This three-step process resulted in the final selection of 12 gram panchayats for deeper field engagement and analysis.

Figure 3. We selected 12 gram panchayats in four districts with distinct climate risks and existing community-based adaptation



Source: Authors' analysis.

The Department of Environment, Science and Technology conducted a A Village Level Climate Change Vulnerability Analysis across river basins in the State in 2020. The vulnerability assessment is aligned with the IPCC AR4 Framework and assesses the exposure, sensitivity and adaptive capacity of villages in the State. Based on this assessment, 4 districts were identified for detailed study:

2.2 Mapping: primary data collection and analysis using strategic foresight

The second phase of the foresight process involved generating grounded evidence and mapping system dynamics through primary data collection. Field visits were conducted in the 12 selected gram panchayats to understand how communities perceived climate risks, how these risks influenced or were influenced by socio-economic conditions, which adaptation solutions were already being implemented, and what enabled them.

A five-member multidisciplinary research team, with expertise spanning climate risks and adaptation, environmental management, social sciences, urban and regional planning, disaster management, and community consultations, conducted the primary data collection. Fieldwork was undertaken over two months across all 12 gram panchayats in the four selected districts, spanning three agro-climatic zones: low hills, mid hills and high hills, and three river basins: the Beas, the Satluj and the Yamuna. Strategic foresight tools were central to the field engagement and were used for communication and documentation within focus group discussions.

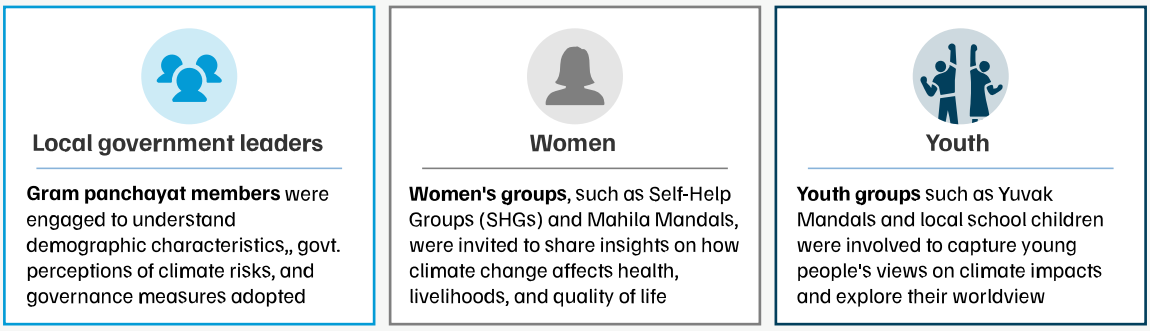
Ethical considerations were incorporated throughout the field engagement process. Participants were informed about the purpose of the study, how their inputs would be used, and the voluntary nature of their participation. Verbal informed consent was obtained for participation and for photographs and other identifiable visual material used for research and dissemination.

Box 1. Integrating gender equality and social inclusion (GESI) in the foresight process

The GESI approach is a framework used in projects and policies to address power imbalances and inequalities based on social identities such as gender, age, disability, and ethnicity (Gomes et al. 2024).

Following a GESI approach in the foresight process is important, as climate risks and adaptation needs are not experienced equally; ignoring gender and social inclusion can reinforce inequalities, exclude vulnerable groups from decision-making, and therefore undermine the effectiveness, fairness, and sustainability of adaptation strategies (Caswell and Jang 2024).

To incorporate GESI in this study, **focus group discussions** were conducted with three social groups:



The field design included at least 8–10 women and 6–8 youth in each gram panchayat, alongside local government representatives. Discussions also explored factors such as age, livelihood, and access to services and information. Across the 12 case areas, this approach helped ensure that the experiences and priorities of different social groups were incorporated. The diversity of responses gathered from each focus group shaped collective insights on gender dynamics, social inclusion or exclusion, and persisting inequalities in relation to climate risk.

a. Interaction with communities using foresight tools

To minimise facilitator-induced bias, the research team adopted a facilitative rather than advisory role during field interactions. Open-ended questions and participant-led exercises enabled communities to respond based on their own experiences. Communities were encouraged and supported to develop **'rich pictures'**[4] to illustrate how a changing climate has impacted their daily lives. Through hands-on interaction and collective brainstorming, this activity fostered a systemic understanding of risks specific to the local context, mapped critical uncertainties in terms of socio-economic and climatic trends, and identified feasible adaptation pathways based on existing institutional capacities and resources within each gram panchayat.



Community members were prompted to draw two scenarios based on the questions asked: a picture of their village impacted by climate change and a picture of their village a few years later, when it is climate resilient (safe from any impact of climate change with a prospering economy)

4 Rich pictures are graphical representations that serve as a means of understanding, communicating, and exploring the intricacies of a particular situation or problem. Often cartoon-like representations, they identify all potential stakeholders, their concerns, and some of the structures underlying the work context. By creating a rich picture, individuals or teams can gain a shared understanding of the problem's complexity, helping uncover hidden assumptions, challenges, and conflicts (Cristancho and Helmich 2019).

Moderators from the CEEW team also supported communities in articulating their responses and probed deeper using the **STEEPLE framework.**[5] By asking targeted questions across **social, technological, economic, environmental, political, legal, and ethical** dimensions, we explored drivers of vulnerability and resilience. Discussions covered access to education, age profiles, social exclusion, use of local technologies, leadership roles, and awareness of government schemes. These prompts helped identify risk drivers and assess community readiness to scale anticipatory adaptation.

Box 2. Identification of physical risk factors using area appreciation techniques

- **Participatory resource mapping and hazard mapping** were conducted by presenting communities with maps of their gram panchayats and local landmarks to identify areas most vulnerable or affected the most by past disasters. This also included activity mapping to identify local livelihoods, centres of social importance (such as temples), and community gathering spaces, as a baseline assessment to guide the development of gram panchayat–level disaster management plans and emergency response plans.

- **Transect walks** were conducted to observe and gather information on different areas and their land use characteristics. Additional site visits were conducted in areas severely affected by recent climatic disasters or those showcasing adaptation solutions. These included visual and spatial assessments to document observable climate risk drivers, such as topography, housing typology, road conditions and access, and visible infrastructure damage, as well as mapping key assets or activities relevant to climate-related activities or hazards.





Image: CEEW

Source: Authors' analysis.

5 A STEEPLE analysis at the community level examines the macro-environmental factors (social, technological, economic, environmental, political, legal, and ethical) that can impact a community's well-being and development. It helps identify opportunities and challenges, enabling informed decision-making and strategic planning for community development initiatives.

b. Systems mapping: data analysis using strategic foresight tools

Primary data collected from the field examined not only the hazards communities faced but also how critical systems, such as mountain agriculture, water management (including domestic and agricultural), critical infrastructure, and development planning, responded to them. This enabled an assessment of what made certain solutions possible and what may have constrained their uptake. To analyse such systemic interdependencies, the foresight tool 'causal loop diagram'[6] was used to conduct a systems mapping[7] exercise.

The analysis provided insights into enabling factors, such as social capital, institutional support, and access to finance, alongside barriers, including fragmented governance, resource gaps, and limited technical capacity. Together, this phase helped build a systems-based understanding of adaptation pathways and revealed where foresight-driven anticipatory action could be strengthened. This paved the way for the next phase of scenario development, which considered these factors during visioning.



Image: CEEW

CEEW researchers synthesise field data into a causal loop diagram.

6 Causal loop diagrams (CLDs) are qualitative systems-thinking tools that represent the feedback structure of complex systems by linking variables through causal relationships. Each link is denoted as positive (same-directional change) or negative (opposite-directional change), with delays explicitly marked when present. They enable researchers to map interactions, identify potential leverage points, and explore system dynamics (Meadows 2008).

7 Systems mapping is a foresight tool that helps understand and visualise the complex interrelationships within a system, revealing connections, feedback loops, and emerging trends. By providing a holistic understanding of a system's structure and dynamics, it identifies potential leverage points and can help simulate consequences of climate adaptation actions (Heneghan et al. 2024).

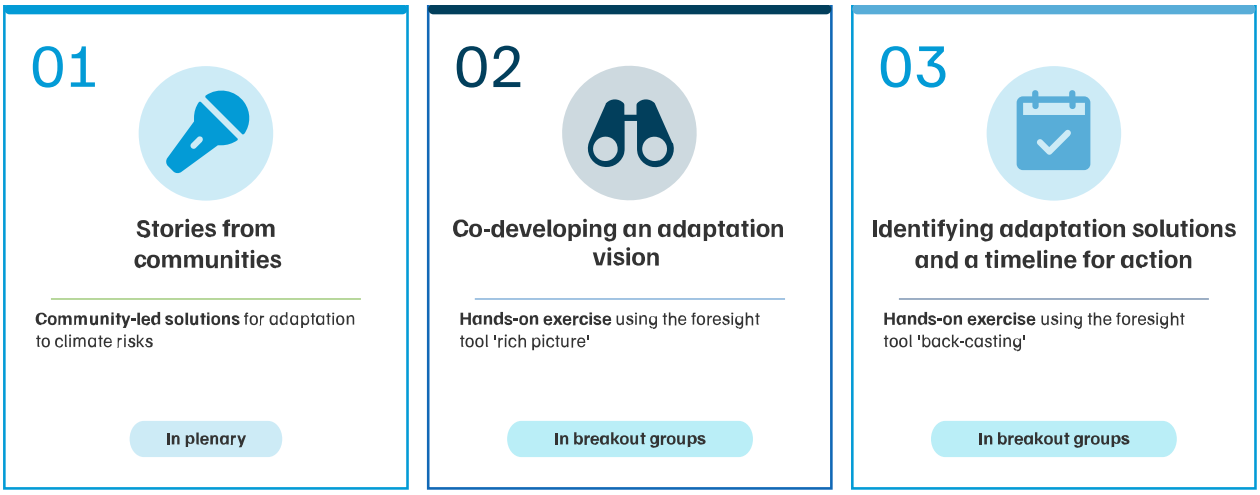
2.3 Exploring future scenarios: multi-stakeholder consultation in Shimla, Himachal Pradesh

As the third phase of the foresight process, a two-day multi-stakeholder consultation in Shimla brought together community representatives from 12 gram panchayats, NGOs, and district disaster management officials to jointly reflect on field findings and identify scalable anticipatory adaptation options for Himachal Pradesh.

Workshop design: The workshop was conducted over two consecutive days. On day 1, participants from different geographical regions and areas of expertise were organised into thematic working groups based on the climate challenges they faced and their awareness of existing adaptation practices. Each group deliberated on a problem statement and proposed scalable adaptation solutions based on their knowledge of best practices (see Figure 4).

Foresight tools: Data walks, rich pictures, visioning, back-casting, and stakeholder mapping were used to help participants surface priorities, imagine climate-resilient futures, and translate local experience into pathways for action. Structured discussions enabled communities and government officials to align perspectives while accounting for causal relationships between risks, drivers, and responses.

Figure 4. The consultation moved from community stories to a shared vision and a timeline for action



Source: Authors' compilation based on the multi-stakeholder consultation in Shimla (July 2025).

Using a systems-thinking lens, the consultation thus facilitated the co-development of **25 anticipatory adaptation solutions** across five thematic sectors: agriculture, water, critical infrastructure, disaster management, and development planning (see Table 2). The consultation also helped clarify the institutional, financial, and technological conditions needed to enable these solutions, drawing on rigorous stakeholder input.

Table 2. Anticipatory adaptation solutions co-identified by community leaders, district disaster management and rural development officials, NGOs, and researchers by adopting the foresight approach.

Key sectors	Co-identified solutions	
Climate-resilient agriculture	1	Integrated farming model: multi-cropping, crop rotation, mixed/intercropping, mulching, indigenous crops, and natural farming
	2	Development of farmer markets to boost the profitability of natural farming produce
	3	System of knowledge exchange to boost productivity and scale best-suited practices
	4	Protection of crops from stray animals
	5	Development of a modern farming system reintroducing traditional methods
Reducing water stress	6	Installation of pumps in the low-lying areas of the valley to store water in overhead tanks at naturally elevated areas
	7	Pre-monsoon cleaning of water streams and *nullahs*; proper disposal of waste to ensure no clogging of drains
	8	Recharging traditional water sources: trenches, channels, and reservoirs such as *baoris*, lakes, and ponds
	9	Phased replacement of invasive pine species with indigenous tree species
	10	Mainstreaming rainwater harvesting at the individual and community level
Developing climate-resilient critical infrastructure	11	Relocation of critical infrastructure to hazard-safe areas to ensure connectivity and access
	12	Mandatory bio-engineering solutions for landslide protection
	13	Construction of U-ducts along roads for utility pipelines
	14	Installation of underground electricity lines to reduce damage and disruption
	15	Upgrading local access roads to all-weather roads
Community-led disaster management	16	Development of village disaster management committees
	17	Development of evacuation plans through participatory mapping exercises
	18	Community-led construction of check dams and trenches to reduce stormwater velocity
	19	Graded early warning systems to enhance risk perception and prompt disaster preparedness
	20	Community-led enforcement and vigilance in no-development zones
Climate risk-informed development planning	21	Preventive buffer zoning along the rivers and *nullahs* to protect the outflow of water
	22	Development control regulations (DCR) for mountain settlements
	23	Participatory resource mapping across communities and institutions
	24	Digitalisation and mapping of resources and hazard-prone areas using geographic information system (GIS) and artificial intelligence (AI)
	25	Mandate for afforestation and building-level ground coverage norms

Source: Authors' compilation from inputs received and agreed upon in July 2025.

Finally, a **'back-casting'**[8] exercise traced the steps required to move closer to the envisioned future through present-day actions. This process identified enabling departments, policies, schemes, and possible funding channels to support implementation.



Image: CEEW

Participants at the Shimla consultation use back-casting to set a timeline for adaptation actions.

In doing so, the consultation demonstrated how foresight methods can help communities and institutions jointly anticipate risks, prioritise actions, and build shared ownership of climate-resilience planning and adaptation pathways. Combining scientific evidence, participatory planning, and strategic foresight, an anticipatory adaptation plan of action for each critical system was co-designed (see Chapter 4). The plans identify points of integration with existing policies, develop an implementation timeline, and demarcate stakeholder roles.

8 One of the key methodologies used in this strategic foresight is 'back-casting', a planning method that starts with defining a desirable future and then works backwards to identify policies and operational strategies that connect that specified future to the present. The fundamental question of back-casting asks: 'If we want to attain a certain goal, what actions must be taken to get there?'



3. How mountain communities are adapting to climate risks

Voices from the ground



Image: CEEW/Unnayan Productions



In Parara, farmers maintain wooden, mud, and wall-mounted beehives in their cowsheds, primarily to support cross-pollination in crops. Although honey collection was discontinued three years ago, apiculture remains a vital practice that supports natural farming.

Image: Aharna Chatterjee/CEEW

3.1 How communities are adapting mountain agriculture for a changing climate

Farming is the backbone of rural Himachal Pradesh, supporting nearly 60 per cent of the workforce (Department of Economics and Statistics 2024–25). However, unpredictable seasons, rising temperatures, and extreme events such as floods and hailstorms are cutting harvests and incomes. On steep slopes, where modern farming methods are hard to access or use, farmers have few options to adapt.

a. How a changing climate threatens agriculture in Himachal Pradesh

- **In Gram Panchayat Bajaura, District Kullu**, rising winter temperatures and a shifting snow line are reducing snow accumulation and altering snowmelt, which affects soil moisture and water availability during critical crop-growth periods and disrupts traditional cropping cycles. Farmers report that erratic rainfall threatens dry-season water availability as aquifers deplete, while frequent monsoon flash floods disrupt supply chains. These shifts have made apple cultivation—the community's traditional livelihood—unviable over the past decade.

- **In Gram Panchayat Sunah Lamba Thach, District Mandi**, communities reported a marked reduction in snowfall and more frequent, intense windstorms and hailstorms. Reduced snowmelt now prevents local aquifers from replenishing, while sudden hailstorms damage crops. Residents also linked rising forest fires to reduced forest cover, combined with human-induced accidental fires, or deliberately created grazing fields. Flood-induced landslides have also washed away land parcels, shrinking average landholdings.

- **In Gram Panchayat Parara, District Sirmaur**, traditionally drought-prone, heavier early-spring rain and hailstorms now waterlog fields, increasing crop infestation. Residents believe infestation is also driven by hybrid seed varieties, adopted for higher yields but more disease-prone under unpredictable seasons. Many have switched to cash crops such as garlic, which residents note resists pests better, to maximise profits.

b. Socio-economic impacts of agricultural loss in the mountains



When landslides wash away farmland, boundaries disappear, and disputes over land rights often follow, as farmers struggle to identify what remains theirs.



Farmers now consider small-scale agriculture unviable, switching from subsistence farming to chemical-based cash cropping.



As subsistence farming declines, food supply chains grow longer and become more vulnerable to climate-induced disruptions putting food security at risk.



As agriculture becomes less profitable, the youth is increasingly migrating to nearby urban centres in search of education, employment, and a better quality of life.



"For me, deciding to switch to natural farming has turned out to be a lifesaver, besides being a profitable option", said Satya Devi, an apple cultivator from Sandhu Panchayat in Shimla district (IANS 2022).

Image: Ahana Chatterjee/CEEW

c. Adaptation solutions to climate-proof mountain agriculture

Facing growing climate risks, farming communities in Himachal Pradesh are adopting new and innovative ways to adapt. From adopting natural farming methods to experimenting with new varieties of traditional crops, farmers are rethinking how to make their fields more resilient to a changing climate. In many villages, local knowledge is being combined with modern practices, demonstrating how adaptation can take root from the ground up.

How farmers from Parara and Sandhu are switching to natural farming methods

In Gram Panchayat Parara, the shift began about seven to eight years ago, when 15–20 households, most of them with adult children who have received higher education, decided to experiment with natural farming. They were driven by rising input costs. As they began to see profits and health benefits, they shared their experiences with neighbours, and gradually, more households followed their lead. "That's how the practice spread", recalls Mr Arjun Attri, a progressive farmer from Parara:

"One family, motivated by the health benefits of naturally farmed produce, initially started the practice. Once it was profitable, more than 20 families took an interest and replicated the practice, finding that it is also better suited to the changing climate."

The community then collectively invested in water storage tanks and rainwater harvesting systems to transition entirely from chemical to natural farming. A few families also signed memorandums of understanding (MoUs) with agricultural universities and built ties with krishi vigyan kendras (KVKs), gaining both technical assistance and market access. Through government schemes such as *Rashtriya Krishi Vikas Yojana-Remunerative Approaches for Agriculture and Allied Sector Rejuvenation* (RKVY-RAFTAAR), the community has also set up greenhouses to grow horticultural crops such as kiwi, plum, and walnut. Although Parara lies in a warmer belt of Sirmaur and is traditionally unsuitable for apples, farmers have invested in new irrigation techniques and unique apple varieties to grow them commercially. Community members further reported that these developments have improved household incomes and have also begun reversing youth out-migration trends.

Similarly, in Laphughati, a village in Sandhu Panchayat, mahila mandals have been cultivating apples, peas, cabbage, and capsicum using natural methods since 2018. They are also experimenting with natural insecticides made from locally available medicinal plants and cow waste, which protect crops from infestation without harsh chemicals. Motivated by her own health concerns, Ms Satya Devi from Laphughati village spearheaded the natural farming movement. After attending a workshop by the Agriculture Department, she adopted *Subhash Palekar Natural Farming (SPNF)*, earlier called *Zero Budget Natural Farming*, cutting her input costs by over 90 per cent while increasing yields, as natural crop varieties were more resilient to hailstorms and crop infestation as shared during her interview with the CEEW team.

"The natural farming technique has increased my income by 15 to 20 thousand rupees monthly"

- Satya Devi, highlighting her satisfaction with providing chemical-free, healthy fruit to her customers. Seeing her success, other women in the village have begun following in her footsteps.



Himachal Pradesh farmers are adopting ‘low-chill’ and haybrid apple varieties better suited to warming conditions, expanding apple cultivation into lower altitudes alongside traditional high-altitude belts (World Bank 2024).

Image: Anand Chakraborty/CEEW

How farmers from Bajaura and Sunah Lamba Thach are substituting and diversifying their crops

Fifteen years ago, farmers in Gram Panchayat Bajaura observed that rising winter temperatures and declining snowfall harmed soil fertility and disrupted cropping cycles. Erratic rainfall led to droughts and flash floods, while frequent damage to roads and bridges made market access difficult and led to post-harvest losses. Farmers in Bajaura, therefore, realised that their traditional apple crop was no longer profitable. Guided by indigenous knowledge and supported by the KVK, they gradually replaced apple orchards with pomegranate trees, a crop better suited to warmer, drier conditions.

> "In Bajaura, people share their knowledge and experiences with each other as a part of daily life. As a result, what started with a few orchards soon spread to the entire Panchayat"
>
> - *Mahesh Sharma, Up-Gram Pradhan of Bajaura.*

Intra-community knowledge exchange therefore brought about a major horticultural shift in the region. However, over the past decade, a changing climate has brought novel plant viruses (Jones and Naidu 2019), which have increasingly infected pomegranates in the region. Farmers in Bajaura have also recognised this challenge, prompting farmers to switch again to persimmons, a non-native fruit introduced by KVKs. Farmers in Bajaura have thus adopted crop substitution as a standard practice to adapt to climate change.

Meanwhile, in Sunah Lamba Thach, farmers have diversified their crops to reverse declining agricultural profitability. Over the last decade, they have begun growing a wider range of subsistence and cash crops within each landholding. This has reduced the risk of total crop failure during extreme events and improved income stability. The Department of Environment, Science and Technology, Himachal Pradesh, and GIZ supported the shift through training programmes for women on climate-resilient agriculture under the *Climate Adaptation and Finance in Rural India* (CAFRI) project.

To support this diversification, the community also invested in the construction of shared water storage and rainwater-harvesting infrastructure, ensuring irrigation during dry months. These shared water tanks are collectively owned and maintained, with community members responsible for opening and closing valves, regular cleaning, and maintenance.

> "Construction of water storage tanks not only supports the farmers but also generates employment opportunities through MGNREGA, most of which go to women"
>
> - *Santosh Kumar, Gram Pradhan of Sunah Lamba Thach, highlighting the multifaceted benefits of such infrastructure.*

New crops have also enabled women's self-help groups (SHGs) to manufacture and market products, such as jams, pickles, and chutneys, boosting their incomes and financial independence.



Under the Prakritik Kheti Khushhal Kisan Yojana (PK3Y), 3.06 lakh farmers in Himachal Pradesh have been trained in natural farming, with 2.22 lakh currently practising it on 38,437 hectares, and Pangi Valley in Chamba set to become the state's first natural farming subdivision (GoHP 2025).

d. Identifying levers of change: what enables adaptation of mountain agriculture?

For mountain agriculture to adapt to a changing climate, it needs both external support and conducive local conditions. Across the presented examples of local adaptation, certain internal and external levers, whether institutional, environmental, financial, or social, emerged as key enablers of change (see Table 3).

Table 3. Institutional and community-level variables that support adaptation of mountain agriculture

Adaptation solution	**Supporting institutional mechanisms:** policies, schemes, programmes, etc.	**Role of supporting actors:** NGOs, governments, universities, and research organisations	**Community-level factors of influence**
Natural farming	***Prakritik Kheti Khushhal Kisan Yojana (PK3Y)*** Launched in 2018, the state-level scheme promotes sustainable agriculture through non-chemical, low-cost, climate-resilient, and environment-friendly natural farming. To date, around 2.22 lakh farmers in Himachal Pradesh have adopted the scheme (GoHP 2025), including farmers in GPs Sandhu and Parara. ***Rashtriya Krishi Vikas Yojana-Remunerative Approaches for Agriculture and Allied Sector Rejuvenation*** **(RKVY-RAFTAAR)**	**Krishi Vigyan kendras (KVKs) by the Indian Council of Agricultural Research (ICAR):** KVKs act as agricultural extension centres that transfer new agricultural technologies to farmers through training, on-farm testing, and demonstrations. In GP Bajaura, KVKs enabled farmers to substitute apples for pomegranates. In GP Parara, they introduced new varieties and methods to enable natural apple farming. In GP Sandhu, they trained farmers to develop natural insecticides.	**Literacy and education:** In GP Parara, literacy levels are high, and a large percentage of youth are pursuing higher education. This enabled easy adoption of new methods and practices. **Awareness of health impacts:** Communities across the four GPs show high awareness of the negative health impacts (both human and soil health) caused by pesticide and fertiliser use. This nudged them to shift to natural methods.
Crop diversification	A flagship programme by the Ministry of Agriculture and Farmers' Welfare, with objectives to make farming a more profitable economic activity by strengthening farmer efforts, mitigating risk, and promoting agribusiness entrepreneurship. The scheme enabled farmers in GP Parara, district Sirmaur, to experiment with new apple varieties for natural farming and build greenhouses to grow non-traditional cash crops.	**GIZ and the Department of Environment, Science and Technology, Shimla:** Under the CAFRI project, training programmes on climate-resilient agriculture were conducted for women to enable crop diversification, along with training to start micro-businesses for food processing using new crops.	**System of Knowledge Exchange:** Communities across the four GPs mention having a formal or informal system of knowledge exchange, which enabled the community at large to adopt best practices.

Source: Authors' analysis.



Himachal Pradesh has approximately 10,512 traditional water sources, including *baoris* used for domestic water supply, yet only about 30 per cent are reported to be in good working condition (Bhardwaj n.d., AVPN 2023).

Image: iStock

3.2 How communities are reducing water stress through conservation and rejuvenation

Water shapes mountain lives, livelihoods, and ecosystems. In Himachal Pradesh, communities often depend on local springs and streams because piped systems fail to reach remote settlements, especially during extreme events. A changing climate is now causing these traditional sources to disappear.

a. How a changing climate is impacting water resources

- **Gram Panchayat Thana Kashoga, District Sirmaur,** in Himachal's drought-prone region, once had 35 perennial baoris meeting daily water needs; only 10 remain. Locals link this decline to longer dry spells, erratic rainfall, and landslides that damaged water channels. Many believe chemical farming has reduced soil fertility, raising irrigation demand and water stress, and that development in spring catchments has reduced recharge.

- **In Gram Panchayat Bajaura, District Kullu,** rising temperatures and erratic rainfall threaten traditional water sources. With no remaining aquifers and a falling groundwater table, community leaders report frequent, severe shortages in summer and winter, making apple farming, Bajaura's traditional occupation, unviable. Despite multiple proposals under the Jal Jeevan Mission and Uthao Peyjal Yojana, water-lifting infrastructure is still unavailable, and the community sees a strong need for water-lift irrigation.

- **In Gram Panchayat Kothi Gaihri, District Mandi,** most households have had tap connections for 8–10 years through the Jal Jeevan Mission, but supply is uneven: water usually runs for about four hours a day, falling to under an hour in dry summer months. After the 2023 landslide, the village went without water for about three weeks. This adds to everyday stress, especially for women, who mainly fetch water.

b. How shrinking water resources reshape mountain life beyond availability



Disappearing traditional water sources add to the gendered burden of a changing climate, as women now walk longer distances to fetch water.



In some villages, piped water supply lasts less than an hour during summer and can remain cut off for weeks after disasters, impacting quality of life.



Communities often lay makeshift pipelines, tapping directly into nearby streams to secure their water supply. These pipelines also break down during disasters, adding to the economic burden.



Inequitable water supply infrastructure can deepen socio-economic disparities between upstream and downstream communities.



Baoris are spring-fed stepwells found in the outer Himalayan region that provide a vital domestic water supply in rural areas. Beyond their practical utility, they hold significant cultural and social value for villagers, serving as important social gathering spaces and having strong religious associations (Neeraj D 2026).

Image: Ahana Chatterjee/CEE

c. Adaptation solutions for water management

As water stress increases, communities across different regions have had to rethink how they manage water. Facing recurring water stress from disappearing springs and erratic rainfall, community members in Gram Panchayats Thana Kashoga, Bajaura, and Sunah Lamba Thach have adopted innovative solutions to anticipate and prepare for future shortages.

How the people of Thana Kashoga championed springshed management

The People's Science Institute (PSI), a Dehradun-based research organisation, observed that baoris (spring-fed step-wells), chashmas (natural springs), and kuhls (gravity-flow irrigation channels) were disappearing across the Himalayan states. In Thana Kashoga, it saw potential for participatory groundwater management (PGWM).[9]

"Initiated with the technical and financial assistance from PSI, Advanced Center for Water Resources Development and Management (ACWADAM), and Arghyam in 2011, the whole project is now completely managed by the local community"

- *shared Debashish Sen, Director of PSI, in an interview with NewsClick (Sharma 2022) .*

What began as watershed management grew into spring rejuvenation and springshed management, combining local hydrogeological studies and groundwater quality monitoring with active community participation. Trenches, check dams, drains, and afforestation restored catchment areas, rejuvenating five springs, with five or six more underway.

"Caring for the baoris has been a part of our daily lives for ages, which was discontinued in the last few generations"

- *a local woman from Thana Kashoga.*

Women play a crucial role in this initiative. Mahila mandals maintain the baoris through monthly cleaning, treated like a ritual. The baoris are also sacred spaces where women gather, connect, and collect water.

"Just before the monsoon, villagers start cleaning the weeds and grass from the trenches in the catchment area of the springs, to allow rainwater to percolate into the ground"

- *Santosh Kumar, the local coordinator for PSI for springshed work in Thana Kashoga, as well as a resident of the village.*

As baori discharge increased, farmers resumed cultivation and tried more diverse and cash crops, such as garlic and tomatoes. But higher demand also led many to use chemical fertilisers, gradually affecting soil quality.

9 PGWM is an aquifer-based, community-centric approach that has emerged as an alternative for managing groundwater as a common-pool resource. The approach enables local communities to take informed decisions about water use, cropping patterns, and crop water management through water budgeting (Arghyam 2015).



In District Mandi, officials sanctioned 3,571 rainwater harvesting tanks in 2015 under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) (The Tribune 2015).

Image: Meet Kumar/CEEW

How Gram Panchayats Bajaura and Sunah Lamba Thach mainstreamed rainwater harvesting

Faced with growing uncertainty, Gram Panchayats Bajaura in Kullu and Sunah Lamba Thach in Mandi turned to rainwater harvesting, a solution that appealed at both the household and community levels.

In Sunah Lamba Thach, realising that decreasing snowfall and erratic rainfall had begun reducing groundwater availability, the community actively sought government support. Following the government promotion of rainwater harvesting under the *12th Five-Year Plan (2012-2017)*, interest among villagers increased. The panchayat used MGNREGA funds to build community-level rainwater harvesting tanks, costing around INR 3–5 lakh each. These tanks not only store water but also generate short-term employment for local people, most of which is offered to women at a daily wage of INR 300.

"These bigger tanks help us irrigate our fields during dry spells"

- *Santosh Kumar, Gram Pradhan of Sunah Lamba Thach, District Mandi*

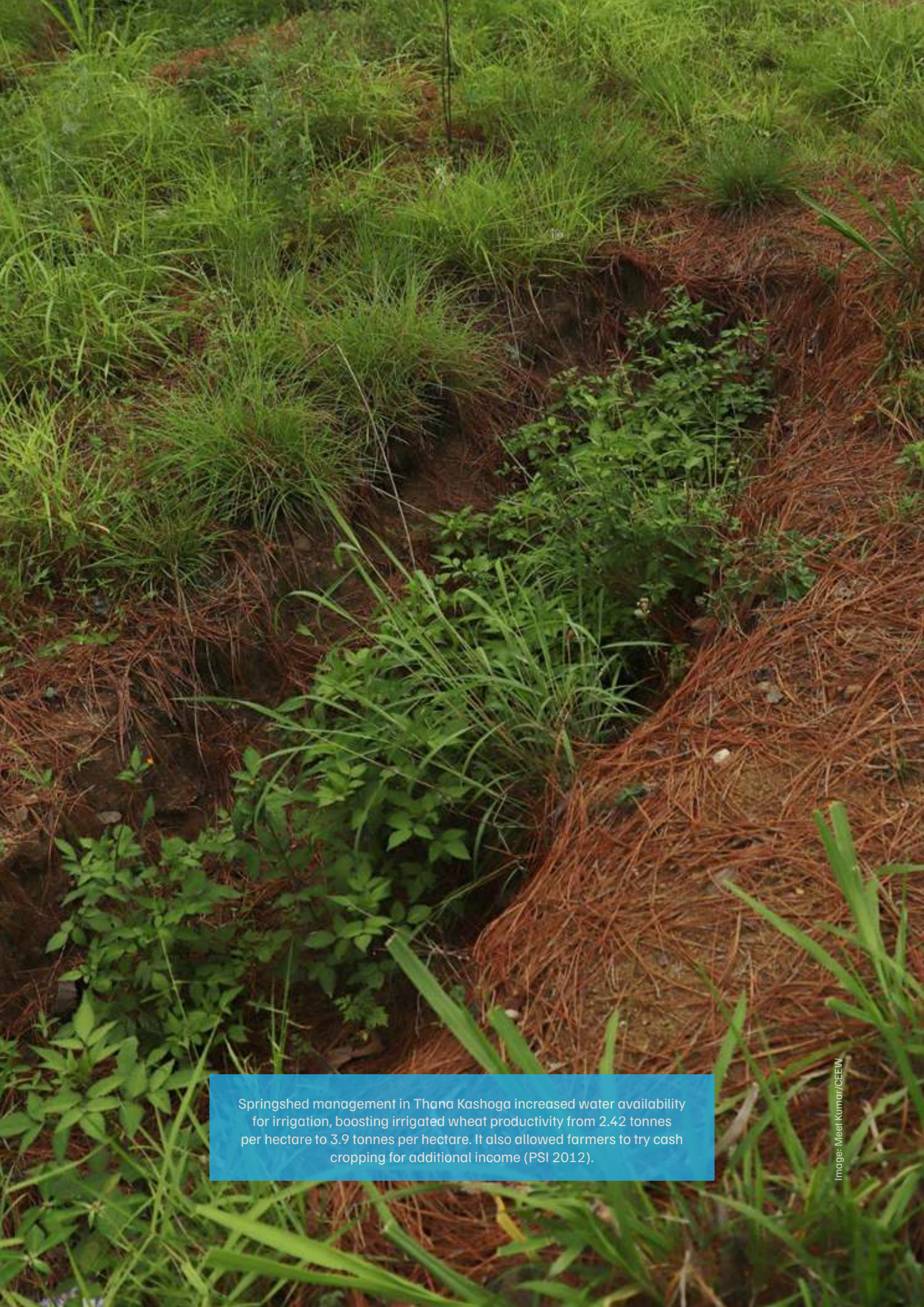
The tanks have helped families sustain cultivation during dry months, reducing agricultural losses and building resilience. Several households have also constructed personal tanks costing around INR 1 lakh. For instance, Satya Devi from Gram Panchayat Sandhu constructed a similar personal rainwater storage tank with a capacity of 10,000 litres. These household tanks are primarily used for domestic needs such as laundry and dishwashing.

In Bajaura, the push came directly from the community. Following discussions in the gram sabha, community members collectively agreed that rainwater harvesting was their best option against seasonal droughts. The situation was especially critical in higher-elevation areas, where groundwater was limited, and infrastructure to lift water from the Beas River was unavailable. With support from the *Integrated Project for Source Sustainability and Climate Resilient Rain-fed Agriculture in Himachal Pradesh (HPIDP), the panchayat* constructed large storage tanks with capacities of up to 20,000–30,000 litres.

"These tanks have been especially useful for us during the dry months"

- *highlights Baneeta Bhandari, Secretary of Bajaura, District Kullu*

The community's rainwater harvesting strategy also supported its transition from apple to pomegranate cultivation, as the latter requires less water and can be irrigated using piped water from stored sources. Borewell tanks of 10,000 litres each have also been constructed to store drinking water. While the tanks meet key water requirements, the community noted that their functioning depends on regular maintenance and, most importantly, sufficient rainfall to keep them full. Therefore, they continue to demand water-lifting infrastructure to meet their water needs.



Springshed management in Thana Kashoga increased water availability for irrigation, boosting irrigated wheat productivity from 2.42 tonnes per hectare to 3.9 tonnes per hectare. It also allowed farmers to try cash cropping for additional income (PSI 2012).

Image: Meet Kumar/CEEW

d. Identifying levers of change: what enables water management in the mountains?

Achieving climate-resilient water management requires a combination of supportive external interventions and enabling local conditions. A range of external actors enabled improved water management in the studied gram panchayats (see Table 4).

Table 4. Institutional and community-level variables that support adaptation of the water sector

Adaptation solution	**Supporting institutional mechanisms:** *policies, schemes, programmes, etc.*	**Role of supporting actors:** *NGOs, governments, universities, research organisations*	**Community-level factors of influence**
Rainwater harvesting	***Mahatma Gandhi National Rural Employment Guarantee Act* (MGNREGA):** The scheme guarantees at least 100 days of wage employment in a financial year to every rural household whose adult members volunteer for unskilled manual labour, enhancing livelihood security and creating durable rural infrastructure assets. GPs Bajaura, Sunah Lamba Thach, and Sandhu leveraged the scheme to build community-owned rainwater harvesting tanks.	**People's Science Institute (PSI):** A research organisation based in Dehradun, PSI first identified rising water stress in Thana Kashoga and initiated community-led springshed management there. **Arghyam:** A public charitable foundation based in Bengaluru, Karnataka, that supports sustainable water and sanitation solutions and funded PSI's project. **Centre for Ecology, Development and Research (CEDAR Himalaya):** Continuing the research project as the "bridge between research and practice, to facilitate socially just and equitable natural resource management in the Himalaya".	**Community culture:** In GP Thana Kashoga, community-level management of water resources was rooted in the community's culture. Thus, spring rejuvenation and maintenance became a community ritual that sustained the practice.
Springshed management	***Jal Shakti Abhiyan*:** A campaign to promote water conservation, the scheme supports pre-monsoon cleaning of water bodies, restoration of traditional water storage systems such as *baoris*, and development of water-lifting infrastructure.		
Increasing household water supply	***Jal Jeevan Mission* (JJM):** The programme seeks to provide safe and adequate drinking water to every rural household through individual household tap connections. It fosters community participation through '*jan aandolans*' by involving local communities through a community-based approach. Bajaura has requested a water lift scheme through this.	**Advanced Center for Water Resources Development and Management (ACWADAM):** Provided technical assistance to PSI. **Block Development Office, Nahan:** Partnering with the research organisation. **World Bank:** Developed community-level rainwater harvesting tanks in Sharchi.	**Community Awareness:** Communities in Bajaura were aware of the ward-level disparities in water access, and of the success of water-lifting infrastructure in other GPs.
Increasing water supply for irrigation	***Irrigation and Public Health–Integrated Development Project* (IPH-IDP Scheme):** The scheme aims to improve water availability, particularly for agriculture, in rain-fed areas of Himachal Pradesh. Through the scheme, water tanks have been constructed on uphill slopes in Bajaura, Thana Kashoga, Sandhu, and Shoghi.		

Source: Authors' analysis.



The IHR has experienced an average decadal urban growth rate of 49 per cent, compared to India's national average of 30 per cent (Sharma et al. 2022).

Image: Ahana Chatterjee/CEEW

3.3 How mountain communities are diversifying livelihoods in the face of urban transition

Between 2001 and 2011, Himachal Pradesh's urban population [Source is Census 2011] grew by almost 16 per cent (Office of the Registrar General and Census Commissioner 2011). Peri-urban settlements around centres such as Shimla and Mandi are increasingly shaped by this growth.

a. How urbanisation and climate change together reshape peri-urban mountain settlements

- The socio-economic landscape of **Gram Panchayat Pandoh, District Mandi**, has been shaped by the Pandoh Dam. Operational since 1977, the dam shifted livelihoods from agriculture to a market economy, with shops, manufacturing units, and mixed residential units along the new National Highway 3, parallel to the Beas River. Settlements that encroached on the riverbank to be near the market and dam were among the worst hit in the 2023 floods.

- **In Gram Panchayat Shoghi, District Shimla,** a four-lane highway has caused large-scale deforestation, hill cutting, and pollution, triggering localised warming, water contamination, and higher landslide risk. Better connectivity to Shimla has also raised tourism, diverting existing water pipelines to new hotels, whose untreated wastewater often flows into khuds and nullahs.

- **In Gram Panchayat Dhamun, District Shimla,** urban influence and declining farm productivity have shifted livelihoods towards cash crops or non-farm work. Proximity to Shimla encourages seasonal and circular migration: many young men work as masons, carpenters, and drivers, and children commute to schools in Shimla. This is also driven by the lack of secondary education and healthcare within the gram panchayat.

b. What makes peri-urban mountain settlements disproportionately vulnerable to climate change?



Peri-urban settlements undergoing urban transition often face administrative ambiguity due to blurred administrative boundaries between expanding urban areas and Panchayat jurisdictions.



Urban spillover facilities, such as landfills or waste-to-energy plants, are often located on the outskirts, creating health and environmental burdens for peri-urban residents.



Disruptions to livelihoods and services during extreme climate events interrupt schooling and restrict access to healthcare, heightening anxiety among residents.



The agriculture sector's contribution to Himachal Pradesh's gross domestic product (GDP) has declined from 35% in FY 1990–91 to 14% in FY 2023–24 (GoHP 2025), highlighting a shift in livelihoods towards the secondary and tertiary sectors.

Image: Ahana Chatterjee/CEEW

c. Adaptation solutions for a climate-resilient urban transition

As rapid urban growth reshapes many hill cities, communities increasingly face pressure to adapt not only to new developments but also to changing livelihoods, risks, and social dynamics. In this context, the Gram Panchayats Pandoh, Dhamun, Shoghi, and Chalal are carving out distinct pathways to build their socio-economic resilience.

How Pandoh's mahila mandals are building micro-businesses through government programmes

Pandoh has experienced adverse effects on agriculture and pastoralism due to increasingly erratic rainfall patterns and rising temperatures. As agricultural productivity declines, women's collectives in Pandoh have emerged as a crucial adaptive force, providing households with financial, social, and moral support as they diversify their livelihoods. These collectives conduct and attend regular training sessions in the panchayat and in nearby cities such as Mandi, Dharamshala, and Kangra.

Under the *National Rural Livelihoods Mission* (NRLM), women have also received training as financial literacy community resource persons (FLCRPs). These sessions have helped mahila mandals manage their own funds, whether pooled or received through the block development office, and use them to build new skills and ventures. Additionally, NRLM provides technical assistance to help them establish small businesses.

"Pandoh's mahila mandals are strong and independent, creating not only incomes but a name for themselves by starting small businesses of their own"

- *Neeraj Gupta, Secretary of Gram Panchayat Pandoh, District Mandi*

As a result, the mahila mandals of Pandoh have successfully established a range of micro-enterprises, including jam and pickle making, tailoring, beauty parlours, soap-making from tulsi seeds, broom-making, and *baddi* making (sun-dried spiced lentil dumplings) .

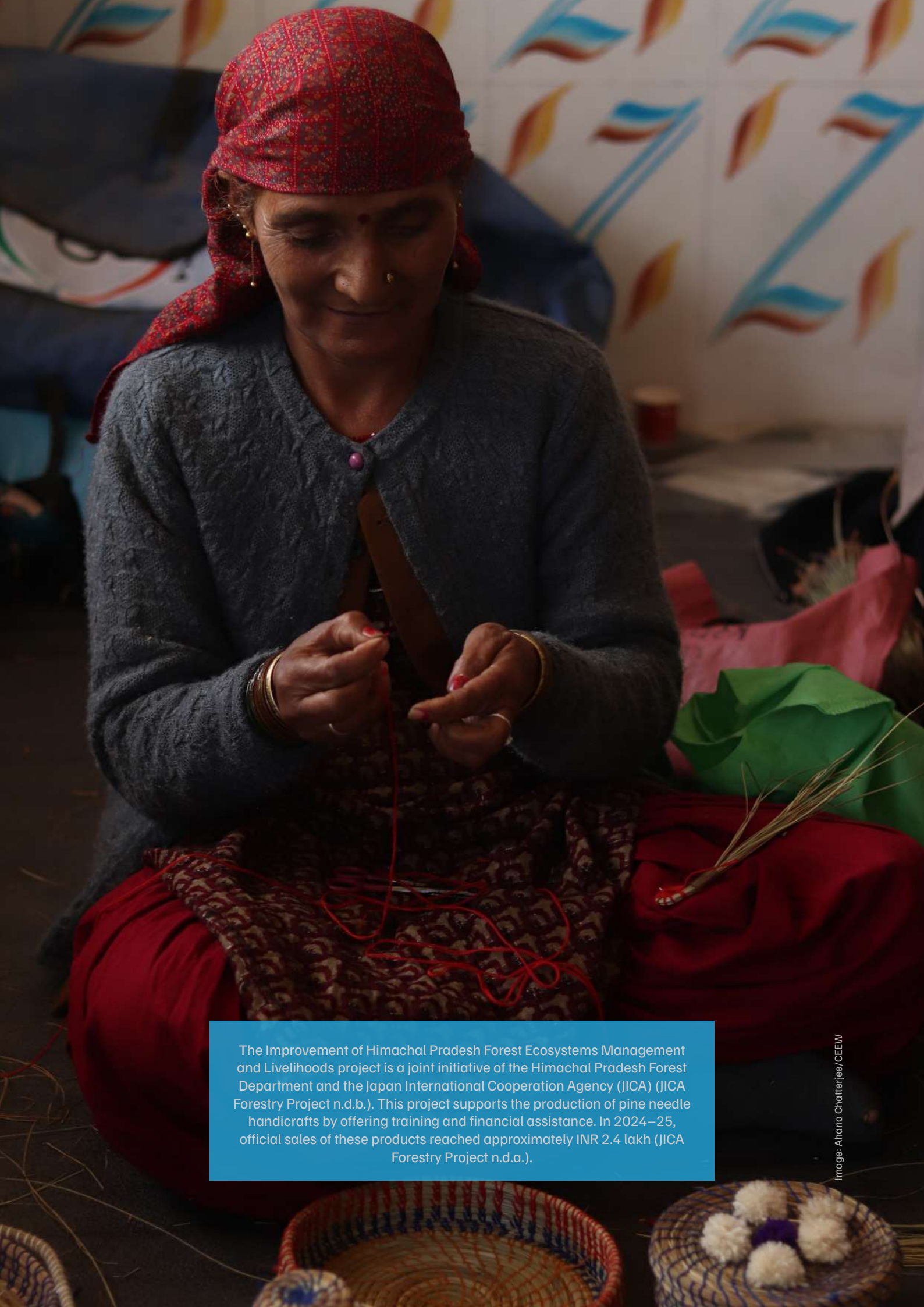
"The panchayat rents stalls and shops in the markets of Mandi and festival fairs for mahila mandals to sell their products"

- *Geeta Devi, Gram Pradhan of Pandoh, District Mandi*

This has helped women become more financially independent by increasing their incomes and giving them a greater say in household decisions, while providing a steady income families can rely on if crops fail.

The village officer for women's SHGs in Pandoh, Ms Poonam, also highlighted a remaining need:

"We need more contextual training that fits our different education levels, as some of us are educated and some are not."



The Improvement of Himachal Pradesh Forest Ecosystems Management and Livelihoods project is a joint initiative of the Himachal Pradesh Forest Department and the Japan International Cooperation Agency (JICA) (JICA Forestry Project n.d.b.). This project supports the production of pine needle handicrafts by offering training and financial assistance. In 2024–25, official sales of these products reached approximately INR 2.4 lakh (JICA Forestry Project n.d.a.).

Image: Ahana Chatterjee/CEEW

How Gram Panchayats Dhamun, Shoghi, and Chalal are reinventing their identity

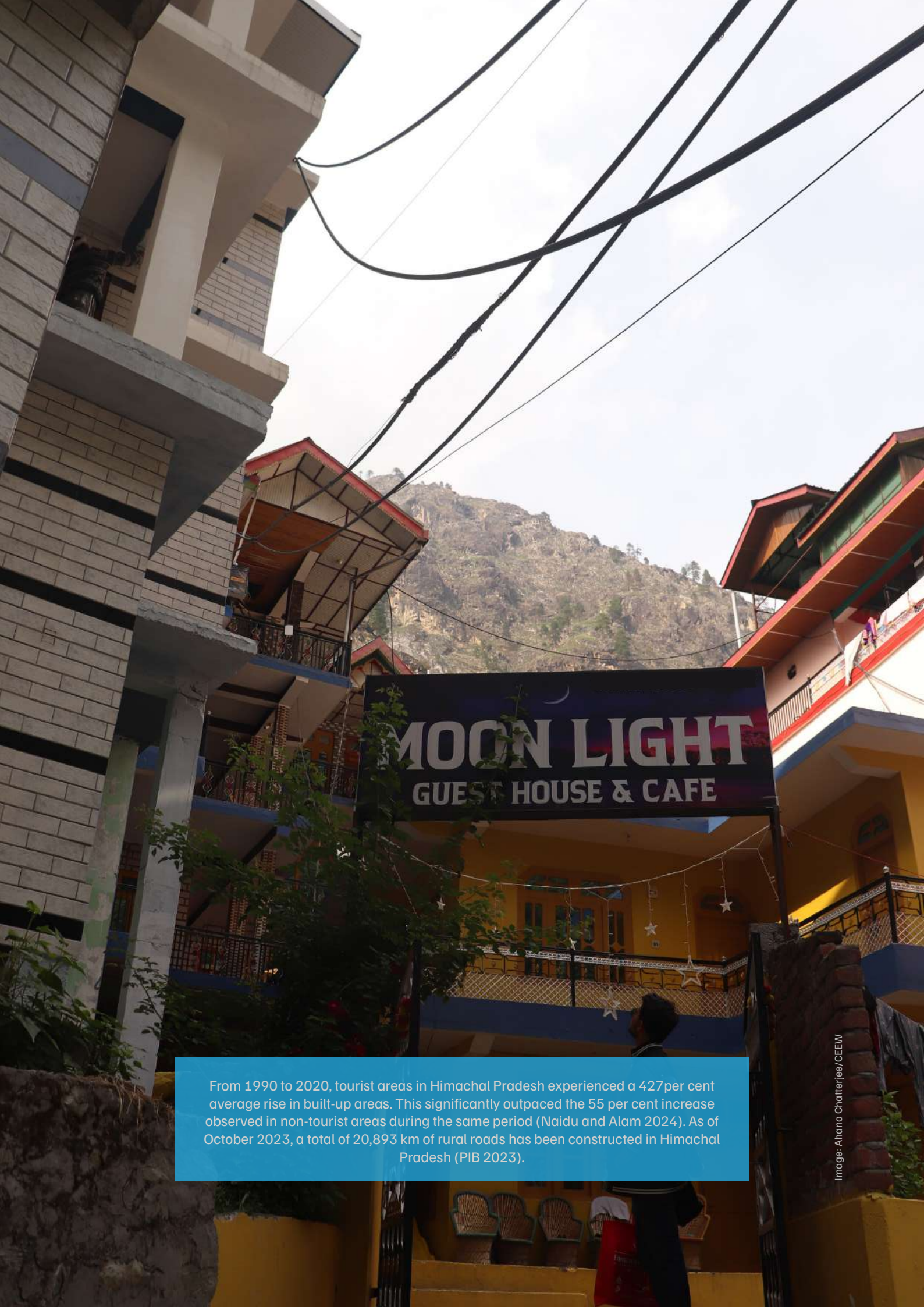
Dhamun and Shoghi, located near Shimla, and Chalal, located near Kasol and Manikaran, are gram panchayats where residents are leveraging their proximity to nearby cities to improve their quality of life. With better access to markets, tourist destinations, raw materials, and knowledge, these panchayats are finding new ways to diversify[10] their livelihoods and increase their incomes.

In Dhamun, women's groups are moving beyond farming and taking up other income-generating activities. They are using their traditional skills to produce handicrafts from pine needles, as well as shawls, Himachali topis, bags, and crocheted accessories. Ms Guldavri, head of the mahila mandal in Dhamun, shared how these activities began: *"As chir-pine needles fallen from the pine trees are very flammable, we collect them from the forests. As a pastime activity, we boiled the needles and started making handicrafts by weaving them, which we realised could be marketed."* Meanwhile, households still engaged in pastoralism have started dairy farming for brands such as Amul and are setting up small-scale food-processing units for pickles and juices within the village. Some women have also embraced social media platforms such as Facebook and YouTube to showcase their day-to-day lives as an additional income stream. *"We live-stream our mahila mandal's activities like crochet, milk production, farming, etc., on Facebook. Most of our viewers are from outside the village",* said a local woman from Dhamun.

In Shoghi, located near a developing highway, communities are tapping into tourism-based opportunities by opening homestays, cafes, and transport services as alternatives to agriculture amid climate risks. While people express concerns about cultural erosion and waste mismanagement, there is cautious optimism about this shift towards tourism. Better connectivity and higher education levels in these peri-urban panchayats have played an important role in enabling this livelihood change.

A similar transition can be seen in Chalal Panchayat, located in the Bhuntar tehsil of Kullu, between the popular tourist destinations of Kasol and Manikaran along the Parvati River. As tourism in the region grew, Chalal residents began to leverage their strategic location by setting up homestays, hotels, and cafes. This transition also came in response to changing climatic patterns that reduced the productivity of their agricultural and horticultural crops. Over time, Chalal transformed from an agrarian village into a tourism hub, even attracting in-migrants who helped the community by sharing their knowledge and skills. This shift has not only strengthened the panchayat's economy but also introduced a mix of cultures that attracts tourists. *"Locals and in-migrants live together cohesively",* highlights Mr Manu, a ward member in the Chalal Panchayat.

10 Livelihood diversification is defined as the process by which rural families construct a diverse portfolio of activities and social support capabilities to survive and improve their standards of living (Ellis 1998).



From 1990 to 2020, tourist areas in Himachal Pradesh experienced a 427per cent average rise in built-up areas. This significantly outpaced the 55 per cent increase observed in non-tourist areas during the same period (Naidu and Alam 2024). As of October 2023, a total of 20,893 km of rural roads has been constructed in Himachal Pradesh (PIB 2023).

Image: Ahana Chatterjee/CEEW

d. Deep-dive: identifying conditions that enabled urban-oriented livelihood shifts

While external institutional mechanisms are necessary for livelihood shifts, community-level conditions play a major role (see Table 5).

Table 5. Institutional and community-level variables that support adaptation of mountain livelihoods

Adaptation solution	Supporting institutional mechanisms[11]: *policies, schemes, programmes, etc.*	Role of supporting actors: *NGOs, governments, universities, and research organisations*	Community-level factors of influence
Agri-allied micro-businesses	**The *National Rural Livelihoods Mission* (NRLM):** NRLM government programme aims to reduce rural poverty by supporting self-employment. It achieves this by mobilising poor households, particularly women, into self-help groups (SHGs) to provide access to financial services and skills training, aiming for sustainable livelihoods and income growth. In GPs Pandoh, Bajaura, and Sunah Lamba Thach, NRLM officials trained women in jam-making, pickle-making, etc.	**Village organisation (VO) under NRLM:** As a federation of SHGs at the village or panchayat level, the VO is the primary institutional body for improving rural livelihoods. VOs promote the solidarity and socio-economic development of their member SHGs by providing financial services, managing funds, taking up social issues, and facilitating knowledge transfer, acting as the main point of integration for the NRLM's livelihood interventions at the village level. In Pandoh, the VO consists of 20–25 mahila mandals with 6–7 women representatives from each member Panchayat.	**Market economy:** In contrast to other studied panchayats, Pandoh reports low youth aspiration to migrate to other urban centres. With enough jobs available locally, youth and women are shifting to business and retail. **Access to social media:** SHGs in Dhamun have explored social media as a passive income stream and a catalyst for micro-businesses through content creation surrounding village life and the SHGs' activities. **Vehicle ownership:** 90% of households in Dhamun own a four-wheeler or a two-wheeler, providing them easy access to markets in Shimla.
Non-agricultural micro-businesses	***Himachal Pradesh Forest Ecosystems Management and Livelihoods Improvement Project*** The project aims to manage and enhance forest ecosystems through sustainable ecosystem management, biodiversity conservation, and livelihood improvement support. In GP Dhamun, Shimla, with this project's support, SHGs are being trained in pine needle collection and handicraft production, as well as replanting chir pine trees on forest-fire-prone slopes.	**Japan International Cooperation Agency (JICA):** JICA provides official development assistance (ODA) to support India's economic and social development through concessional loans, technical cooperation, and grant aid. It focuses on ecosystem management in Himachal Pradesh as a key sector. **Himachal Pradesh Forest Department (HPFD)** has partnered with JICA on the project, aiming to improve forest ecosystems and support livelihoods through sustainable management, biodiversity conservation, and institutional strengthening. The partnership includes activities such as community participation, capacity building, and non-timber forest produce (NTFP) management.	

Source: Authors' analysis.

11 *The Government of Himachal Pradesh has also recently approved the* ***Chief Minister Tourism Startup Scheme*** **in October 2025:** A state-level scheme to boost the tourism industry by promoting and supporting new tourism-related businesses such as homestays.



In the 2025 monsoon alone, Himachal Pradesh reported nearly 450 fatalities across the state and losses exceeding INR 4,800 crore (Mullick 2025b).

Photo: CEEW

3.4 How mountain communities are leading disaster preparedness and recovery

Climate-induced disasters often cut off remote rural settlements, delaying institutional response and preventing external agencies from reaching communities in time for anticipatory action. Communities in Himachal Pradesh have responded with locally led efforts.

a. How extreme events cause damage to infrastructure, lives, and livelihoods in the mountains

- **Gram Panchayat Sharchi, District Kullu,** is a high-altitude settlement in the growing tourist hotspot of Tirthan Valley. Cloudbursts and intense rainfall, especially in the last three to four years, have triggered flash floods and landslides; in 2023 and 2025 the panchayat suffered severe losses to homes, roads, farms, and tourist infrastructure, disrupting incomes and in some cases displacing residents.

- **Gram Panchayat Chalal, District Kullu,** is a tourism-dependent settlement near Kasol and Manikaran on the Parvati River. Cloudbursts in 2022 and 2023 diverted the river into the village, washing away homestays, cafes, tourist camps, and the Chojh bridge, the only motorable link to nearby settlements. Four residents went missing, children lost almost 15 days of school, and many families lost property and livelihoods.

- In **Gram Panchayat Banogi, Tehsil Sainj, District Kullu**, two hydropower projects within 5 km have worsened floods through dam-controlled releases into the Parvati River. The 2023 and 2024 floods were traced to simultaneous releases from both dams, destroying markets, homes, bus depots, and roads, and claiming lives (SANDRP 2023; Tribune 2024). Construction and demolition waste dumped from road projects has also raised river levels, and residents fear that recurring disasters may force migration as a last resort.

b. Why communities must take charge during a climate-induced disaster



Road blockages during floods or landslides often prevent disaster management officials from reaching affected communities in time.



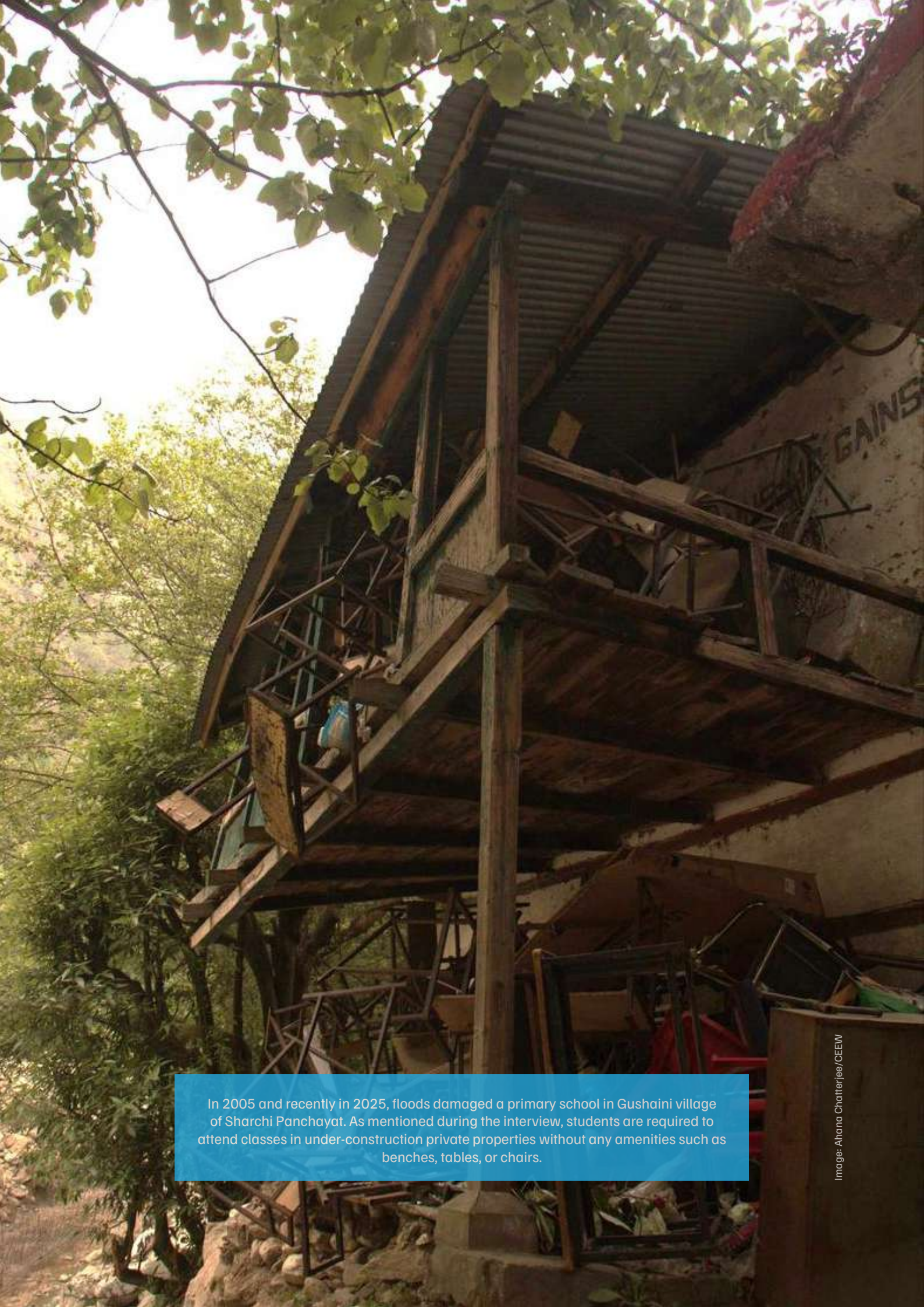
Early warnings rarely reach most residents directly. Information is often limited to WhatsApp alerts sent to gram panchayat officials, who must then pass them on.



In the absence of graded early warning systems, communities, especially those living near dams, must interpret warnings themselves.



Local knowledge of evacuation routes, safe shelters, and higher ground is critical for effective disaster response.



In 2005 and recently in 2025, floods damaged a primary school in Gushaini village of Sharchi Panchayat. As mentioned during the interview, students are required to attend classes in under-construction private properties without any amenities such as benches, tables, or chairs.

Image: Ahana Chatterjee/CEEW

c. Leading at the frontlines: solutions for community-led disaster management

With climate-induced disasters becoming more frequent and severe in Himachal Pradesh, local communities need to lead disaster preparedness and response, drawing on their indigenous knowledge, close social networks, and awareness of context-specific risks.

How Gram Panchayat Sharchi pioneered locally led disaster recovery and restoration

With frequent landslides and floods damaging homes, roads, and businesses, Gram Panchayat Sharchi needed a quick and effective way to support recovery. Leveraging the strong social cohesion and disaster awareness of Sharchi's residents, the Society for Scientific Advancement of Hilly and Rural Areas (SAHARA), a local NGO, in collaboration with Tata Trusts and People's Science Institute (PSI), Dehradun, pioneered an archetype for rehabilitated housing structures. These structures can be constructed for displaced community members within three days using local materials, at the same location as the original housing unit. The model proved invaluable after the 2023 cloudbursts, when it was used to rehabilitate displaced households in Sharchi and other affected areas across Mandi and Kullu districts.

Additionally, to support recovery from damage and losses to agricultural fields caused by extreme climate events, Sharchi partnered with PSI for a five-year programme focused on climate-resilient agriculture, livelihoods, and disaster risk reduction, combining traditional knowledge with innovative adaptive practices. The institute is particularly supporting flood-affected and economically vulnerable farmers to retool their practices by introducing climate-resilient hybrid pea seeds and cash cropping of cabbage and helping establish 10 mini orchards of plum, apple, and persimmon. This has helped the affected population recover more quickly and effectively. These initiatives demonstrate the potential of local government bodies, when equipped with appropriate tools and knowledge, to create sustainable and practical governance models.

How Chalal's in-migrants became drivers of change

Chalal Panchayat demonstrates how in-migrants can play a constructive role in community adaptation. After the 2023 floods destroyed the Chojh Bridge, residents and non-locals pooled INR 3 lakh to rebuild it over the course of a year. The in-migrants, drawing on their experiences of living and working in cities such as Delhi-NCR, Chandigarh, and Bengaluru along with better education and awareness, recognised that a reliable early warning system alerting them to cloudbursts or the opening of upstream dam gates could have enabled them to take measures to protect their lives and belongings. This understanding, voiced strongly by youth groups, has led to growing demands for a dedicated early warning system for the village, as current sirens from hydropower authorities fail to reach downstream settlements during disasters. At the same time, the panchayat filed a legal petition against the felling of 300 trees for electricity tower installations. This reflects growing environmental awareness within the community. It also demonstrates how shared experiences among locals and non-locals are shaping a more environmentally conscious community that can learn from the past and prepare for the future.



Himachal Pradesh currently operates 22 automatic weather stations and is installing 48 more across the state under an INR 890 crore project to strengthen its early warning systems (Tribune News Service 2024).

Image: iStock

How Gram Panchayat Shoghi institutionalised disaster management at the village level

To enable community-based disaster risk reduction (CBDRR), the National Institute of Disaster Management recommends establishing village disaster management committees (VDMCs) and preparing local disaster management plans. Since communities are the first responders during disasters, they should be equipped to plan, act, and adapt in ways that suit their local context.

However, only a few villages in Himachal Pradesh have constituted VDMCs so far. Following the devastating landslides and floods in Himachal Pradesh in 2023 and recognising the urgency of CBDRR, Adventist Development and Relief Agency (ADRA) India, an NGO based in Shimla, stepped in. Shoghi Gram Panchayat partnered with ADRA India to establish one of Himachal Pradesh's first VDMCs. Recognising the need for collective action, Shoghi brought together men and women from diverse socio-economic backgrounds to establish the committee.

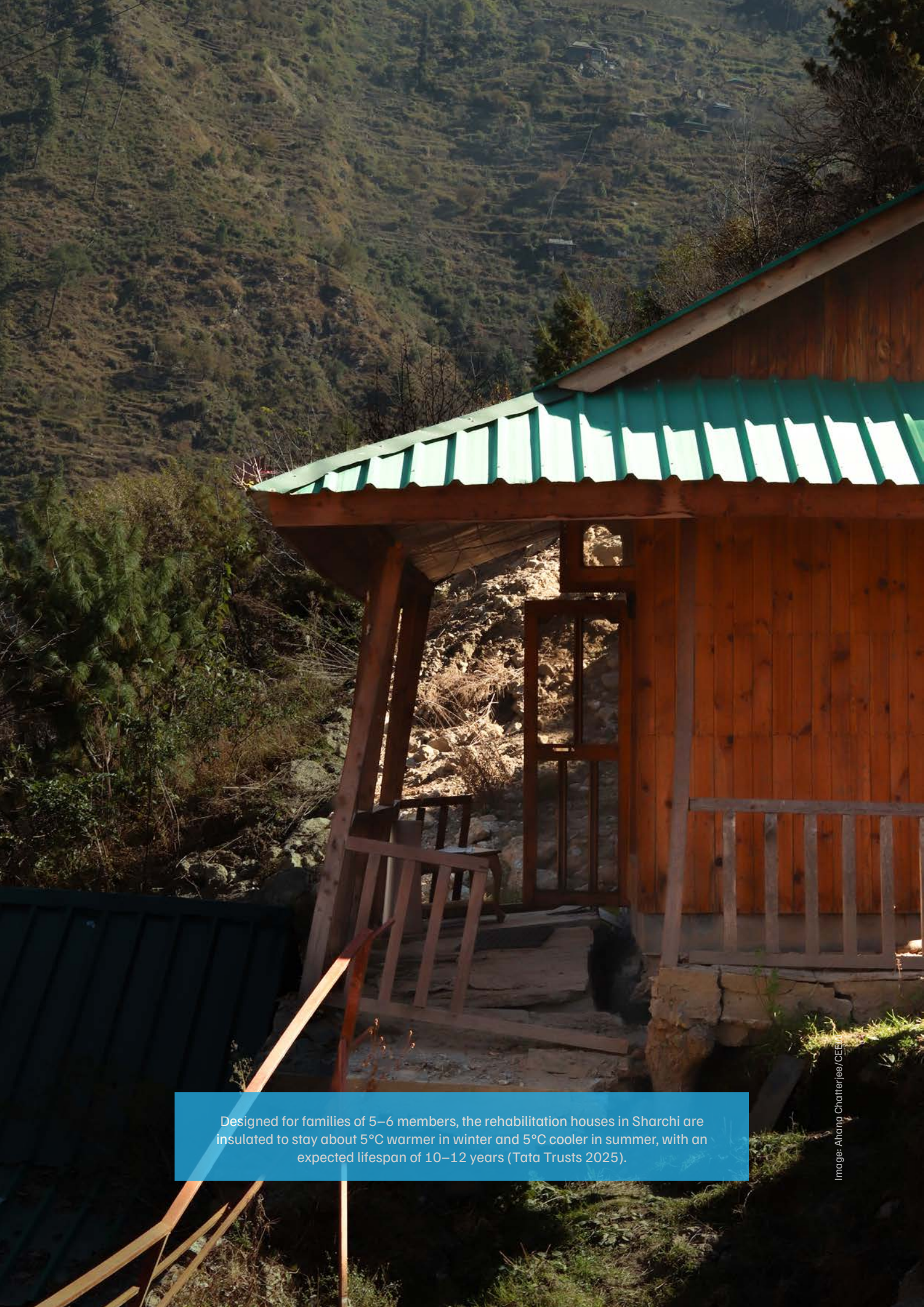


Shreya Wadhawan, CEEW and village disaster management committee members in Shoghi with a community-drawn 'rich picture' of climate-induced impacts in their gram panchayat

"We have trained the VDMC on their expected functions and carried out a participatory vulnerability and resource mapping exercise for Shoghi"

- *Mr Rakesh Yadav, Project Coordinator at ADRA India*

The VDMC also created simple hazard-specific 'dos and don'ts' which were circulated among villagers, and organised training sessions on first aid and evacuation. Though still new, this initiative has created a strong foundation for building the village's resilience to a changing climate.



Designed for families of 5–6 members, the rehabilitation houses in Sharchi are insulated to stay about 5°C warmer in winter and 5°C cooler in summer, with an expected lifespan of 10–12 years (Tata Trusts 2025).

Image: Ahana Chatterjee/CEE

d. Deep-dive: identifying conditions that enabled community-led disaster management

Table 6. Institutional and community-level variables that support community-based disaster risk management

Adaptation solution	**Supporting institutional mechanisms:** *policies, schemes, programmes, etc.*	**Role of supporting actors:** *NGOs, governments, universities, and research organisations*	**Community-level factors of influence**
Relief and rescue for disaster-affected households	**State Disaster Response Fund (SDRF):** Under the *Disaster Management Act, 2005,* the state government administers relief for households in Himachal Pradesh using funds from the State Disaster Response Fund (SDRF), as determined by the Himachal Pradesh Emergency Relief Manual (Government of Himachal Pradesh 2019). Following the cloudbursts in 2023, disaster-affected households who reported significant damage were compensated with INR 3.5 lakh, with an additional INR 3.5 lakh granted if the beneficiary showed proof of rebuilding activities using the compensation received, as stated by the beneficiaries. **National Disaster Response Force teams (NDRF):** Deployed in Pandoh for relief and rescue after the 2023 Beas floods.	**Bhakra Beas Management Board (BBMB):** As the dam authority, led local rescue in GP Pandoh with NDRF. **Religious institutions:** The local gurdwara in Pandoh provided food and shelter during the 2023 crisis.	NA
Community -led restoration	***Pradhan Mantri Awas Yojana* (PMAY):** PMAY emphasises environmentally sustainable, disaster-resilient construction practices, ensuring rural housing is affordable, durable, and safe. Under beneficiary-led construction, the scheme provides financial assistance to eligible families to build new houses on their own land or retrofit existing houses. ***Pradhan Mantri Gram Sadak Yojana* (PMGSY):** The scheme focuses on building and upgrading rural roads. While not a disaster recovery scheme, it can be used to upgrade rural roads for climate-resilient construction. Roads damaged in Pandoh after the 2023 floods were reconstructed by leveraging the PMGSY scheme.	**Society for Scientific Advancement of Hilly and Rural Areas (SAHARA):** An NGO based in Kullu, SAHARA leveraged local knowledge and resources to pioneer an archetype for safe shelters in Sharchi that can enable post-disaster rehabilitation. **Tata Trusts:** Supported SAHARA's initiatives through financial aid.	**Participation of women:** In Sharchi GP, self-help groups (SHGs) and mahila mandals represent a strong voice that collaborated with SAHARA to introduce disaster-resilient rehabilitated housing.
Establishment of village disaster management committees (VDMCs)	***Disaster Management Act*, 2005:** Under the *Disaster Management Act*, 2005, VDMCs are tasked with preparing village-level disaster management plans and leading preparedness and response (NDMA 2023).	**Adventist Development and Relief Agency (ADRA) India:** Members from ADRA engaged in a project to enable community-led disaster management identified Shoghi as a case study area to pilot VDMCs in Himachal Pradesh.	**Community willingness:** Residents of Shoghi were aware of rising climatic risks. As a result, they readily collaborated with ADRA India.

Source: Authors' analysis.



Himachal Pradesh recorded losses of USD 105 million (INR 6,013 crore) over the 2017–22 monsoon seasons, averaging INR 1,000 crore per year (GoHP 2023). In the past three years alone, average annual monsoon losses have escalated to over USD 625 million (INR 6,000 crore) (Down to Earth 2025; Mullick 2025b).

Image: Aharna Chatterjee/CEEW

3.5 How mountain communities are encouraging climate risk-informed development

a) How extreme climate events threaten rural development: insights from the field

- **Gram Panchayat Sharchi,** once a remote settlement in Tirthan Valley in Kullu District, has experienced firsthand the impacts of a surge in tourism since the Great Himalayan National Park was declared a UNESCO World Heritage Site in 2014. As tourist infrastructure such as resorts, homestays, and cafes rapidly expanded, mostly on the Tirthan River floodplain, locals observed tourist encroachment on aquifers, rivers, forest trails, and roads. Water availability became a major concern as supply lines were redirected to hotels, leaving local households with inadequate access. Much of this infrastructure has also been built on the Tirthan River floodplain, contrary to river-zoning guidelines prescribed by the National Green Tribunal. Residents have also expressed concern that the designation of Sharchi and other Tirthan Valley panchayats as planning areas under the Town and Country Planning (TCP) Act, following the March 2024 notification, could intensify haphazard development and further strain natural resources while diluting Panchayats' autonomy and decision-making authority in locally led planning (GoHP 2024).

- In **Gram Panchayat Kothi Gaihri,** in Balh block of District Mandi, annually recurring landslides, caused by excessive rainfall and weak geomorphic structures, have resulted in loss of life, damage to agriculture, and the destruction of critical infrastructure. Major instances occurred in 2012, 2022, and 2023. Repeated erosion and landslides have made it difficult for residents to demarcate their land and agricultural fields. Erratic rainfall further affects the area, causing surface runoff and damaging soil fertility, while long summer dry spells lead to droughts and further agricultural losses due to water scarcity. Community members report that excessive fertiliser use has hardened the soil, triggering flash flood–induced landslides. Additionally, winter rains, a recent phenomenon over the past few years, have damaged wheat crops, forcing the community to alter cropping calendars. The direct and indirect impacts of a changing climate have therefore pushed community members to consider relocation and rehabilitation as an adaptation strategy.

- In **Gram Panchayat Banogi,** in Sainj block, District Kullu, community members have faced repeated and intensifying flood events over the past two years, which they primarily link to dam-related water discharges from the two hydropower projects operating within a five-kilometre radius of the panchayat - the 520-MW NHPC Parbati Hydroelectric Project Stage III (Siund dam) and the 100-MW Sainj Hydro Power Project of the Himachal Pradesh Power Corporation Limited (Niharni dam). The 2023 flood was particularly devastating, washing away 35–40 homes and more than 50 shops in the market and severely affecting the local economy. These repeated shocks have significantly altered Sainj's socio-economic fabric. Business losses have curtailed employment opportunities, especially for youth, many of whom are now migrating, primarily to Chandigarh, in search of livelihoods. This outward migration is compounded by growing post-disaster health concerns. Villagers report rising incidences of hypertension, diabetes, respiratory diseases, fatigue, and joint pain, which they attribute to prolonged stress, poor housing conditions, and reduced healthcare access, despite being located close to the newly built national highway.

कार्यालय ग्राम पंचायत शरची

विकास खंड बंजार जिला कुल्लू (हि. प्र.)

॥ ग्रामीण विकास एवं पंचायती राज विभाग ॥

आज दिनाँक 02/10/2024 को प्रधान श्रीमती रामेश्वरी ठाकुर की अध्यक्षता में हुई साधारण बैठक/ ग्राम सभा की बैठक में उपस्थित 373 सदस्यों द्वारा पारित प्रस्ताव संख्या 18 की वास्तविक प्रतिलिपि।

विषय :- ग्राम पंचायत शरची में सतत व् दीर्घकालीन पर्यटन व्यवसाय तथा अन्य निर्माण कार्य विनियमन के लिए दृष्टि पत्र सह आदर्श योजना (vision document cum model plan) बारे

यह विज़न डॉक्यूमेंट सह मॉडल प्लान पूर्व में दिनाँक **09.12.2021** को पारित ग्राम सभा प्रस्ताव **(प्रस्ताव संख्या 05)** के अगले संस्करण के रूप में ग्राम सभा पास करती है।

भाग 1:- दृष्टिपत्र: हमारा पूरा सराज क्षेत्र पर्यटन की अपार सम्भावनाओं को समेटे हुए हैं। इस क्षेत्र में अलग अलग घाटी की अपनी पहचान भी बन चुकी है। इस समस्त क्षेत्र को जोडने वाली एक पवित्र तीर्थन नदी सभी को एकता के सूत्र में पिरोती है। क्योंकि एक दौर में इस क्षेत्र के सभी प्रबुद्ध लोगों ने इस क्षेत्र में तीर्थन नदी तथा इसकी सहायक छोटी छोटी नदियों में छोटे स्तर की जल विद्युत परियोजनाओं से मुक्त रखने के लिए अथक संघर्ष किया था। ताकि ये क्षेत्र पर्यटन के लिये ही जाना जाए। जिसका लाभ भी हमें मिल रहा है। इसलिए समस्त क्षेत्र को हम एकीकृत तीर्थन क्षेत्र की संज्ञा दे रहे हैं। पर्यटन की दृष्टि से वर्तमान में तीर्थन नाम अपने आप में एक ब्रैंड (brand) बन चुका है, और तीर्थन क्षेत्र छोटी छोटी सभी घाटियों जैसे जिभी घाटी, कोठी चेहनी व खावल घाटी इत्यादि का भी प्रतिनिधित्व करता है।

इस पूरे तीर्थन क्षेत्र की पारिस्थितिकी (Ecology) पूरी तरह से एक जैसी है। विशेषकर तीर्थन नदी पूरे क्षेत्र को एक सूत्र में बांधती है तीर्थन नदी का यहाँ की देव संस्कृति में बहुत ज्यादा धार्मिक व सांस्कृतिक महत्व है। इसलिये नदी के संरक्षण के लिये सम्पूर्ण क्षेत्रवासी दृढसंकल्प है। तीर्थन क्षेत्र की विशेषताओं और सम्भावनाओं को देखते हुए यहां की समृद्ध सांस्कृतिक मूल्यों, प्राकृतिक संसाधनों और भोगौलिक स्वरूप के अनुसार ही यहाँ पर पर्वत, पवित्र तीर्थन नदी, देव जंगल, देवताओं द्वारा संरक्षित झरने, देव समर्पित झीलें एवं कई धार्मिक स्थल जोकि प्रकृति के बरदान स्वरूप बहुत सारे ऐसे नजारे हैं, जो इस तीर्थन क्षेत्र को एक विशेष सामुदायिक पर्यटक स्थल अथवा इको टूरिज्म जगह के रूप में पहचान देते हैं। यहां की विशेषताओं के कारण ही हम सभी क्षेत्रवासी तीर्थन क्षेत्र के लिए एक सांस्कृतिक और प्राकृतिक पर्यटन क्षेत्र की संज्ञा देते हैं ताकि विश्व पटल पर सही मायने में इस क्षेत्र को cultural and eco-tourism destination के रूप में पहचान मिले जहां प्राकृतिक संसाधनों को कायम रखते हुए यहां के स्थानीय लोगों की पूर्ण भागीदारी हो और लोग अपने श्रेष्ठ जीवन मूल्यों

Agarwal and Mehra (2020) find that increasing tourism in the Tirthan Valley has enabled reverse migration, with youth who left for jobs returning and engaging in tourism-led enterprises. The image above shows a page from the Vision Document developed by Gram Panchayat Sharchi to guide sustainable tourism in the Panchayat.

Image: Gram Panchayat Sharchi, District Kullu

b) Leading at the frontlines: anticipatory adaptation actions for risk-informed development planning

Local insights, rooted in lived experience and awareness of compounding climate impacts, must anchor development planning to ensure that adaptation actions are anticipatory, context-specific, and transformative. Gram Panchayats Sharchi, Kothi Gaihri, and Banogi offer insights into how local communities can address one of society's most pressing challenges – pursuing development in the context of a changing climate.

How Gram Panchayat Sharchi is advocating for environmentally sustainable tourism

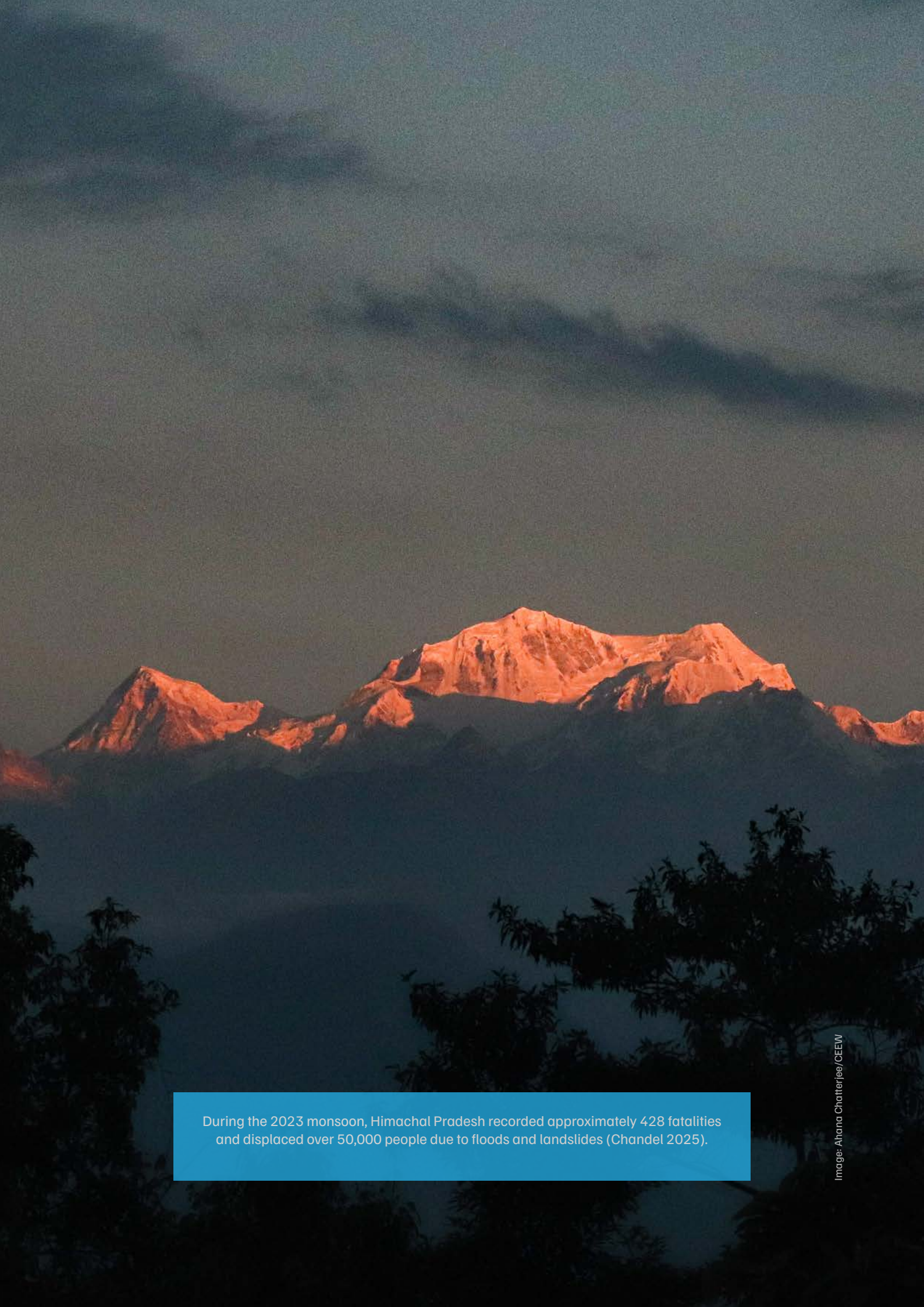
In response to the rapid growth of tourist infrastructure and associated disaster risk, Gram Panchayat Sharchi initiated the development of a model plan under the *Panchayati Raj Act* to regulate tourism activities across the Tirthan Valley. The plan, termed the ***Sustainable Tourism Guidelines***, mandates that any new tourism establishment obtain a no-objection certificate (NOC) from the panchayat. Key provisions include:

- An NOC fee of INR 1,000 for local applicants and INR 10,000 for outsiders.
- All establishments must be built at least 2 metres away from roads.
- Buildings taller than 3.5 floors or with more than 12 rooms are not permitted.
- Property tax has been amended: locals pay INR 50, while homestays and hotels pay INR 250 per room annually for up to four rooms and INR 500 per room for 5–15 rooms; campsites pay INR 100 per tent.
- Traditional trails and roads cannot be blocked or altered, protecting local pathways and heritage.
- No establishment can draw water directly from aquifers; only public water supply connections are allowed.
- Locals are guaranteed 90 per cent job reservation in any mass-tourism project introduced by the government.

These and other provisions aim to keep tourism sustainable and community-driven, ensuring that economic benefits reach local communities without harming the fragile ecosystem. The block development committee (BDC) approved this model plan, and it has been submitted to the chief secretary's office. So far, 12 panchayats in the Tirthan Valley have helped formulate the plan and intend to implement it. Once in place, it will empower panchayats and local communities to enforce context-specific guidelines, helping prevent resource exploitation and encroachment by private developers. At the same time, it will allow local communities to protect their cultural identity, which is increasingly at risk in popular tourist destinations.

Mr Hari Singh, Gram Pradhan of Sharchi, explained:

"The villagers gave up to 5 hectares of land for roads built under PMGSY (2008–14), willingly, and for free. Now, on one hand, tourist cars encroach upon our roads, while the presence of the road has also increased landslide risk in the villages."



During the 2023 monsoon, Himachal Pradesh recorded approximately 428 fatalities and displaced over 50,000 people due to floods and landslides (Chandel 2025).

Image: Ahana Chatterjee/CEEW

Why Kothi Gaihri and Banogi seek migration and resettlement as an adaptive measure

While bottom-up efforts are essential for adaptation, they are not always sufficient. This is evident in the experiences of communities in Gram Panchayat Kothi Gaihri, Balh Block, District Mandi, and Gram Panchayat Banogi, Tehsil Sainj, District Kullu.

In landslide-prone Kothi Gaihri, climate risks are closely interlinked with local socio-economic fragility. Subsistence agriculture and pastoralism are the primary livelihoods, but declining summer rainfall, damaging winter rains, and increased landslides have sharply reduced productivity. Farmers report being unable to rely on traditional cropping methods, while monsoon floods frequently wash away standing crops. Climate-induced unpredictability has led many to abandon farming altogether or turn to daily-wage work, masonry, or MGNREGA for survival. Youth out-migration is increasing, as many no longer see viable futures in agriculture. Despite compensation for damaged homes and agricultural produce, the absence of tailored support for lost farmland has further deepened discontent. Many residents now openly demand permanent relocation, believing that their original land parcels are no longer tenable.

> "With the increasing use of chemicals in our fields, the soil has become hard. When it rains, the water now runs off the hills instead of seeping into the ground, eroding the soil and causing flash floods"
>
> *- remarked Kishori Sharma, Gram Pradhan, Kothi Gaihri.*

Given the continued loss of productive assets, declining agricultural viability, and repeated exposure to landslide hazards, the community increasingly sees relocation as the only viable adaptation strategy. A local woman expressed her concerns, stating, *"Our land has become unproductive, and landslides are occurring more frequently. We hope the government can relocate us to a better place."*

In Gram Panchayat Banogi, post-disaster compensation mechanisms following the 2023 floods have provided limited and inequitable support. Community members report that while payments were uniform across affected households, they should have accounted for the extent of damage or permanent land loss. To demand fair compensation, 50 affected households organised themselves into a '*baadh prabhavit sangathan*' or '*flood protection committee*' and approached the High Court, resulting in an increase in compensation from INR 1 lakh to INR 3 lakh per person.

However, beyond temporary relief from NGOs, no long-term recovery or community-led adaptation initiatives have been implemented. The community has had no disaster-preparedness training programmes or bioengineering measures for slope stabilisation or improved early warning, leaving it exposed to recurring risks. Community members believe that institutional mechanisms such as the *Pradhan Mantri Awas Yojana* (PMAY) for resettlement and NDMA's *Guidelines for Safe Construction* could support necessary resettlement initiatives. However, effective implementation would require integrated planning among departments of rural development, disaster management, and agriculture to ensure that relocation is risk-informed, livelihood-secure, and socially equitable.



Climate-induced disasters in Himachal Pradesh lead to frequent school closures and damage, negatively impacting student attendance and academic performance (Kaushik 2025).

Image: Ahana Chatterjee/ CEEW

c. Deep-dive: identifying conditions that enabled community-led solutions for development planning

Table 7. Institutional and community-level variables that support risk-informed development planning

Adaptation solution	**Supporting institutional mechanisms:** *policies, schemes, programmes, etc.*	**Role of supporting actors:** *NGOs, governments, universities, and research organisations*	**Community-level factors of influence**
Sustainable Tourism Guidelines – model plan	***Panchayati Raj Act*:** The act provides GPs the legal authority to create and enforce local development plans, regulate land use, levy fees and taxes, and issue no-objection certificates (NOCs). In this case, it created the statutory framework that allowed Sharchi Panchayat to draft and notify the *Sustainable Tourism Guidelines* to regulate tourism activities, impose NOC fees, set property tax slabs, and protect local resources and pathways.	**SAHARA (NGO)** Providing inspiration from Uttarakhand's eco-tourism guidelines **Block development committee (BDC)** For approval and notification to other panchayats within the block facing similar challenges	**High social cohesion** enabled agreement on NOC rules **Local knowledge** identified the need for the guideline **Environmental stewardship** guided community-led resource management **Institutional collaboration** allowed enforcement
Flood protection committee	**Court petition:** In Banogi, Sainj, the court petition acted as a key pillar of support by giving the community a formal, rights-based channel to challenge unsafe construction and ecological harm. It compelled government departments to take action, ensured violations were officially recorded, and created administrative pressure for enforcement that local authorities had not provided. In doing so, the petition strengthened accountability, empowered residents to protect their safety and environment, and demanded rightful compensation.	**Directorate of Energy:** The directorate conducted official investigations to determine the causes of the 2023 flood.	**Education** **Knowledge of human rights** **Trust in the judicial system**

Source: Authors' analysis.

Words of wisdom | From the community to the policymaker



Mountain Agriculture

"When farmers shift from chemical to natural farming, yields drop for a short period of time. This makes a lot of farmers hesitate to make the switch. With the right support during this transition, such as regulated pricing for naturally farmed goods, many more farmers could benefit and stay committed to the change."

- *Woman farmer from Gram Panchayat Sandhu, District Shimla*



Mountain Agriculture

"Our small, fragmented fields and limited access to quality seeds and irrigation make it hard to diversify crops, especially for villages used to monocropping. With crop insurance and shared resources, more farmers could successfully try new crops."

- *Apple farmer from Gram Panchayat Sunah Lamba Thach, District Mandi*



Water

"While springshed management has improved water supply, increased availability has also fuelled demand. People now use more and tend to conserve less. Guidelines for sustainable use are needed to ensure everyone has enough water for themselves."

- *Sewanand, Gram Pradhan, Gram Panchayat Thana Kashoga, District Sirmaur*



Livelihoods

"While we are skilled in handicraft making and live streaming on Facebook, we do not know how to manage a website or ship orders. If training is provided to the youth on these digital and business skills, it will help us scale our businesses and reach markets in Shimla and beyond."

- *Mahila Mandal member, Gram Panchayat Dhamun, District Shimla*

Disaster Preparedness

"With the help of ADRA, we have conducted vulnerability mapping and resource mapping in Shoghi Panchayat. The VDMC has also prepared hazard-specific 'dos and don'ts' that have been shared with the Gram Pradhan and we have also received training on first aid and evacuation."

- *Devesh, Tourist Taxi Driver and VDMC Member, Gram Panchayat Shoghi, District Shimla*

Risk Informed Development

"Our old timber-stone homes (*Kath Kuni*) have always been safer and more resilient than modern pucca houses. But today they've become too costly because wood and stone aren't easily available, and contractors are losing traditional knowledge to build them. We need mountain-specific housing schemes that support and revive these traditional structures"

- *Hari Singh, Gram Pradhan, Gram Panchayat Sharchi, District Kullu*

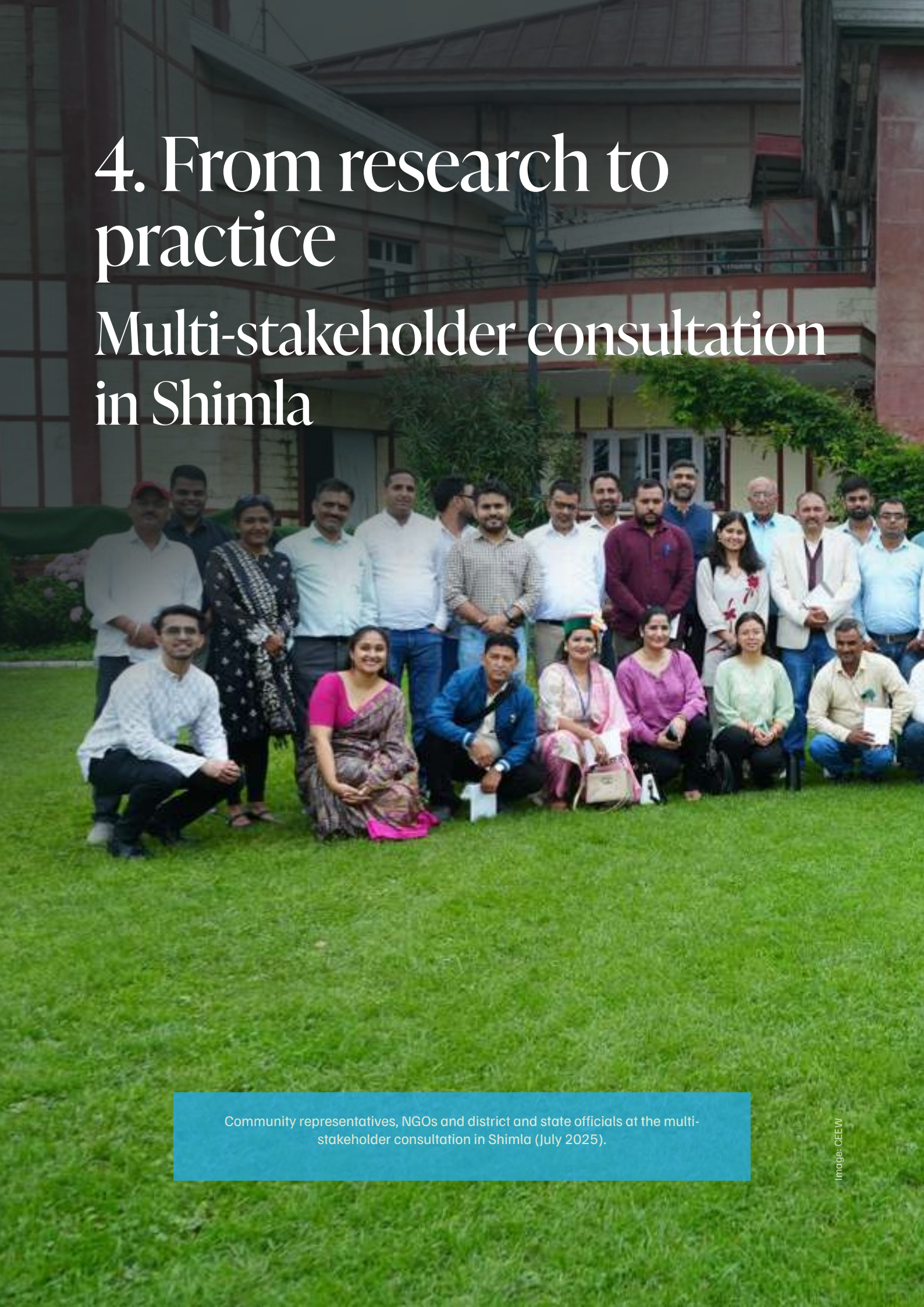
Risk Informed Development

"If the mountains are to stay safe, we urgently need river-zoning regulations designed for this terrain. Without clearly imposed restrictions, like keeping construction away from riverbanks and stopping muck dumping, unregulated development will only accelerate our risks."

- *Flood committee member, Gram Panchayat Banogi, District Kullu*

4. From research to practice

Multi-stakeholder consultation in Shimla



Community representatives, NGOs and district and state officials at the multi-stakeholder consultation in Shimla (July 2025).

Image: CEEW





Under the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), Himachal Pradesh subsidised up to 80 per cent of the cost of drip and sprinkler irrigation systems, covering over 12,000 hectares of farmland between 2015 and 2024 (MoAFW 2024).

Image: Ahana Chatterjee/CEEW

4.1 A route to resilience: towards climate-resilient mountain agriculture

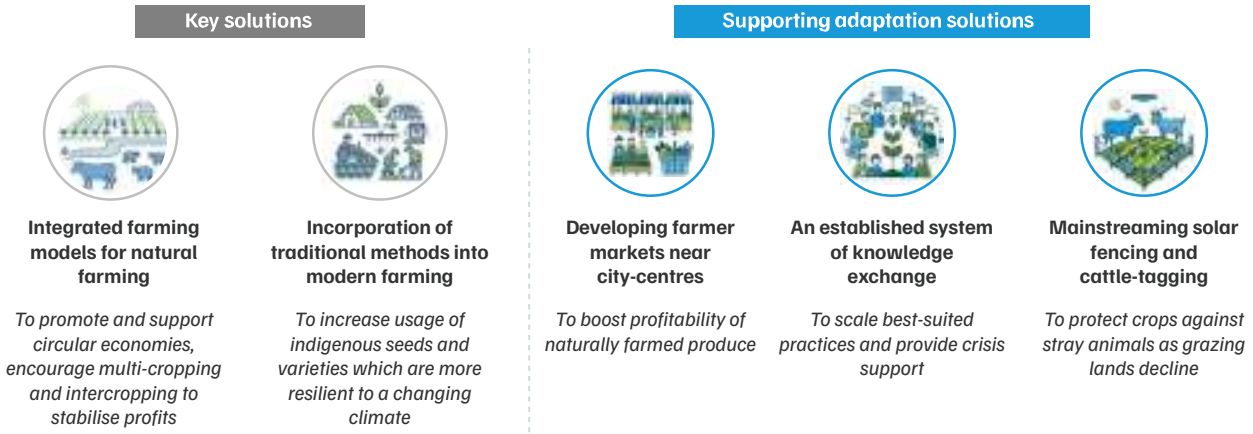
In Himachal Pradesh, agriculture sustains almost 60 per cent of the workforce (Department of Agriculture Himachal Pradesh, n.d.). Stakeholders agreed that climate-proofing the agriculture sector is a shared priority. However, adapting mountain agriculture to a changing climate must begin at the grassroots, reflecting local realities while remaining flexible enough to scale across regions.

a. Visioning: what does climate-resilient mountain agriculture look like?

Before identifying a route to resilience, it is important to envision a resilient future for mountain agriculture. Representatives from farming communities described climate-resilient agriculture as "*one that protects crops in a changing climate, supports recovery after losses, and maintains the soil's vitality for the next season*". This means creating a cropping system that allows experimentation and innovation while accommodating unpredictable weather patterns.

Farmers therefore identified **integrated and natural farming methods** as the most reliable pathway for sustaining agricultural livelihoods in the mountains. An **integrated farming system (IFS)** was co-identified as a practical pathway for strengthening natural farming practices across the state.

Figure 5. Farmer-led solutions and supporting adaptation measures for resilient mountain agriculture



Source: Authors' compilation based on the multi-stakeholder consultation in Shimla (July 2025).

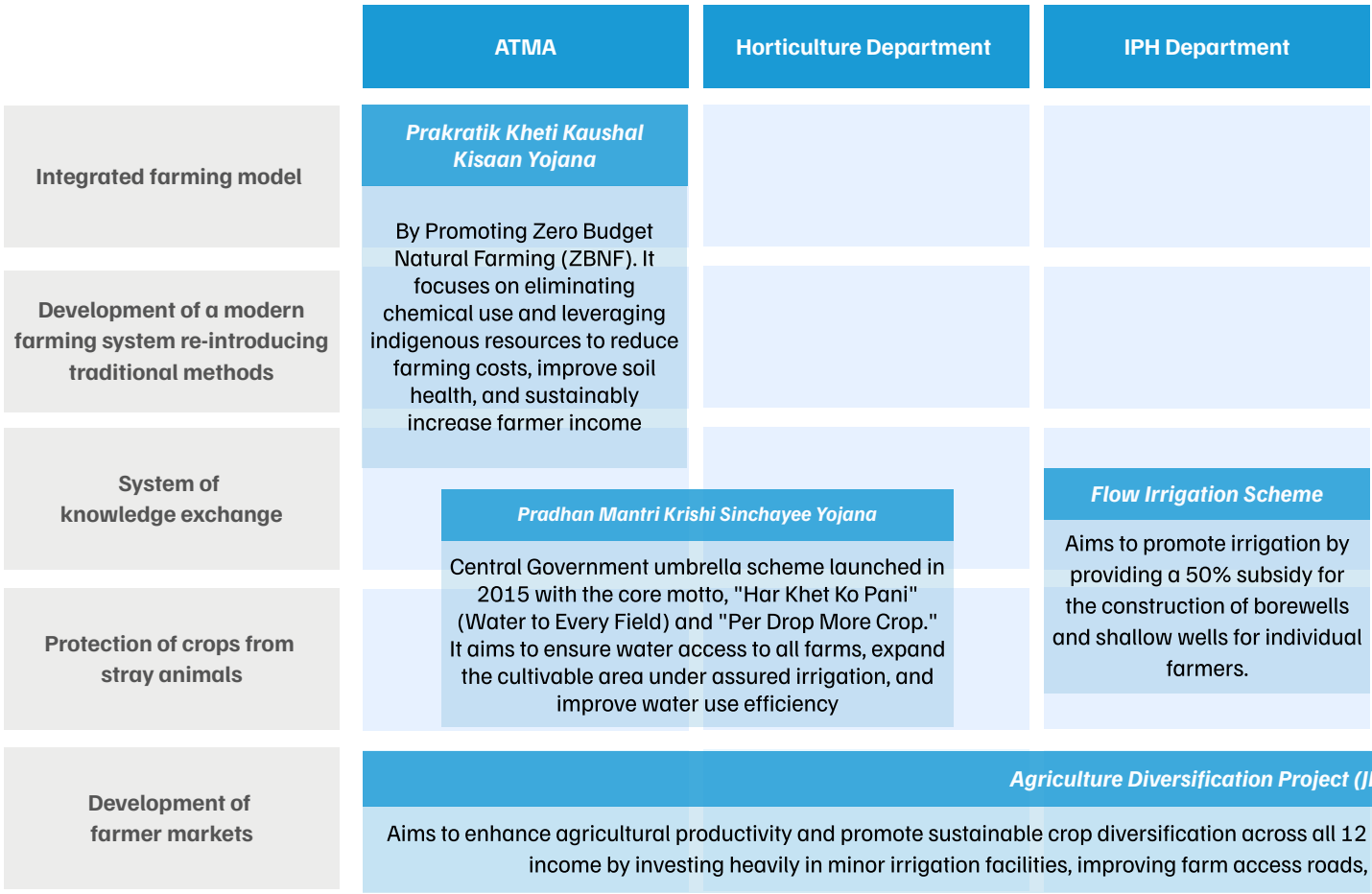
However, for these methods to be economically feasible, several supporting solutions are required. For instance, stakeholders stressed that reducing input costs alone may not be enough to make natural farming attractive to farmers. **Regulated pricing for naturally**

farmed produce and the introduction of **minimum support prices (MSPs)**[12] could be crucial for improving economic viability and market access. Stakeholders also emphasised the need for a strong community-led network for knowledge exchange. Such a network can prove invaluable for scaling innovative best practices and providing support during disasters.

b. Enabling action: identifying pillars of support for mountain agriculture

Institutional, financial, and administrative mechanisms are essential for embedding adaptation solutions into routine planning and implementation processes. Through a 'stakeholder mapping' exercise, participants deliberated on how existing plans, policies, and schemes could be used to leverage funding and technical support for each adaptation solution identified for the agricultural sector (Figure 7).

Figure 6. Seven schemes and six departments were identified as key stakeholders for enabling climate-resilient mountain agriculture



Source: Authors' compilation based on the multi-stakeholder consultation in Shimla (July 2025).

Abbreviations: ATMA: Agricultural Technology Management Agency; CSR: corporate social responsibility; MGNREGS: Mahatma Gandhi National Rural Employment Guarantee Scheme; RAFTAAR: Remunerative Approaches for Agriculture and Allied Sector Rejuvenation

12 MSP is a crucial mechanism through which the government supports farmers by purchasing their crops at a predetermined price (PIB 2025). In May 2025, Himachal Pradesh piloted MSPs for crops such as wheat and maize, benefitting farmers in Pangi Valley, now its first natural farming subdivision (GoHP 2025).

Agriculture Produce Market Committees (APMCs)	Forest Department	Gram Sabha	Funding mechanisms
RAFTAAR It aims to support agri-startups with financial and technical assistance. In Himachal Pradesh, this has included specific programs like the Him Utkarsh Programme, which offers grants and incubation support to local startups in areas like sustainable agriculture, food processing, and farm mechanisation.	***National Project on Soil Health and Fertility*** The essential goal is to ensure soil-test-based fertiliyer recommendations and promote a balanced approach to soil health and fertility management.	***Mukhya Mantri Krishi Utpadan Sanrakshan Yojana*** Includes the Badhbandi (Fencing) component to protect crops from wild animals like monkeys. This scheme provides a subsidy of up to 70% for installing solar fencing, barbed wire, or composite fences to prevent damage to crops. Another component, the Anti-Hail Net Structure, provides protection against damage from hailstorms	**Agricultural Department Schemes** **Research Project Funds from Central Govt. and Universities** **Community pooling + MGNREGS + 15TH FC** **CSR funding** **Externally aided multi and bilateral funded projects**
IKA) districts of Himachal Pradesh. The core strategy is to boost farmers' and strengthening market linkages and value chains.			

- To enable **integrated farming models**, the *Prakritik Kheti Khushhal Kisan Yojana* (PK3Y) under the Agricultural Technology Management Agency (ATMA) plays a central role, supported by the **Agriculture Department** and funded through departmental schemes, community pooling with VB-G RAM G (formerly MGNREGS), corporate social responsibility (CSR) resources, and external projects. To modernise farming systems and revive traditional methods, stakeholders agreed that PK3Y and relevant departments can lead these efforts, with additional support from research grants and CSR funding.

- **Knowledge-exchange systems** at the community level can be strengthened through the *Pradhan Mantri Krishi Sinchayee Yojana* (PMKSY), the *Flow Irrigation Scheme*, and the *Rashtriya Krishi Vikas Yojana* (RAFTAAR), spearheaded by the **Horticulture Department**, the **Irrigation and Public Health (IPH) Department,** and **Agricultural Produce Market Committees (APMCs)**, with financial backing from agricultural schemes, research funds, and externally aided programmes.

- **Protection of crops from stray and wild animals** can be enabled through the *Mukhya Mantri Khet Sanrakshan Yojana*, implemented mainly by gram sabhas in coordination with the Forest Department, with funding from VB-G RAM G (formerly MGNREGS) pooling, departmental schemes, and CSR.

- Finally, stakeholders discussed how **farmer market development and diversification** can be supported through RAFTAAR and the JICA-supported ***Himachal Pradesh Crop Diversification Promotion Project***, with support from APMCs, the Agriculture Department, and the Horticulture Department, and funding from departmental schemes, externally aided projects, and CSR.

Stakeholders believe these elements can converge to implement comprehensive, climate-resilient agricultural solutions across the state.

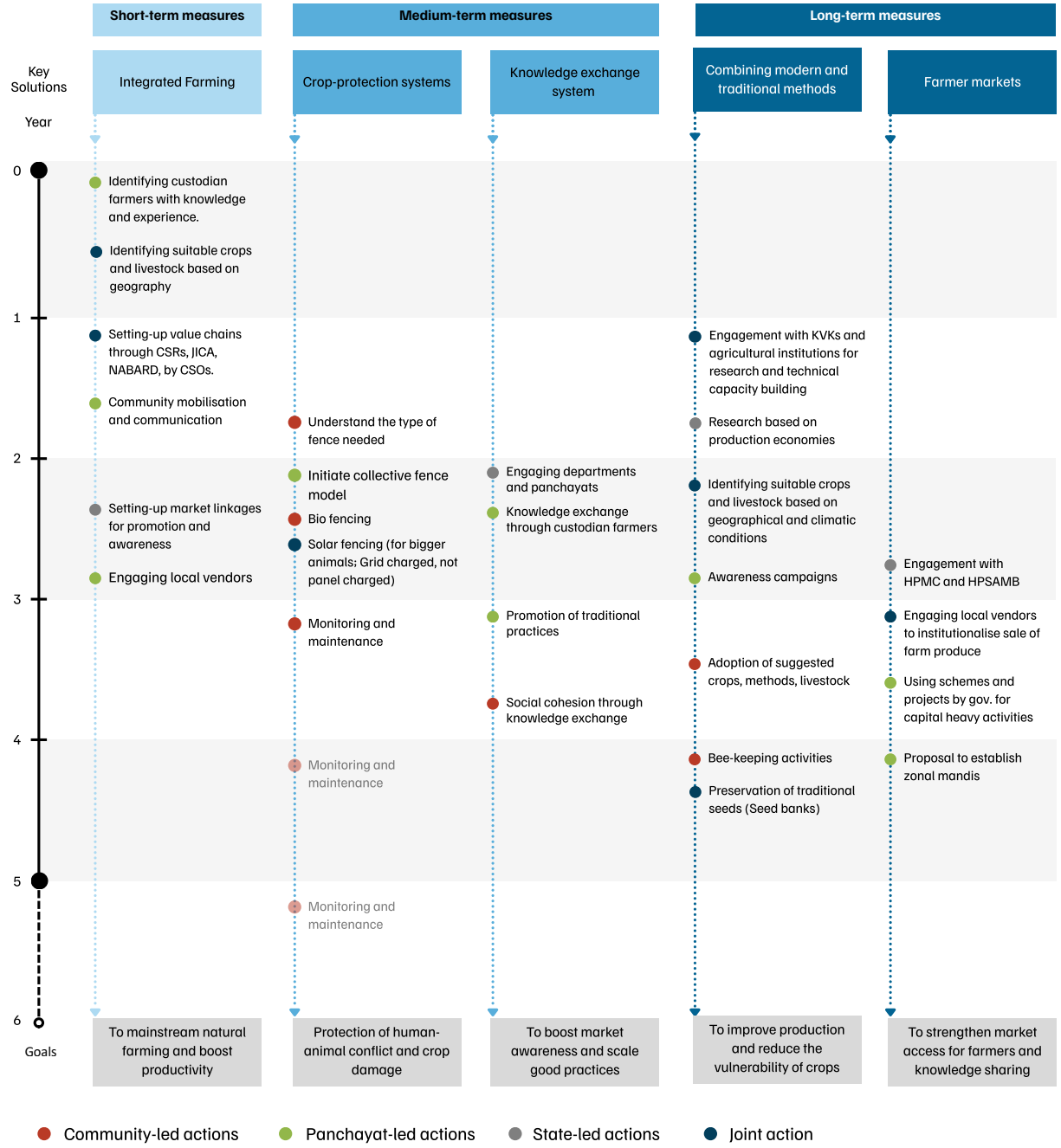
c. Co-developing a shared pathway towards climate-resilient mountain agriculture

Once key stakeholders and enabling mechanisms were identified, participants again deliberated in groups to co-develop a timeline for mainstreaming climate-resilient mountain agriculture. Using **'back-casting'** as the foresight tool, participants worked backwards from their shared vision to identify the **key actions** required to achieve the envisioned outcome.



CEEW researcher conducting a key informant interview with Mr Hari Singh, Gram Pradhan, Sharchi, Kullu.

Figure 7. Route to climate resilience of mountain agriculture in Himachal Pradesh: co-developed by communities, NGOs, and district disaster management officials



Source: Authors' analysis.

Note: CSO: civil society organisation; CSR: corporate social responsibility; HPMC: Himachal Pradesh Horticultural Produce Marketing and Processing Corporation; HPSAMB: Himachal Pradesh State Agricultural Marketing Board; JICA: Japan International Cooperation Agency; KVK: Krishi Vigyan Kendra; NABARD: National Bank for Agriculture and Rural Development.

The figure depicts the actions each stakeholder group needs to take to achieve the desired outcome for mountain agriculture. The following section elaborates on the actions required in the short, medium, and long term to enable climate-resilient mountain agriculture in Himachal Pradesh.

Short-term: laying the groundwork to protect against losses

In the immediate term, participants believed that strengthening the foundations of integrated farming is critical. At the community level, this involves identifying **custodian farmers** with knowledge of integrated practices and livestock management, supported by NGOs, SHGs, and agricultural institutes. At the same time, cropping patterns must be tested and updated in response to changing seasons, while suitable livestock options are selected based on geography. Research support services will be key, supported by local KVKs.

Key anticipatory adaptation solution: integrated farming model to support natural farming

Notes for the policymaker: Mobilising and engaging local vendors and agriculture departments and involving marketing boards (e.g. HPMC) can help farmers access markets and inputs for naturally farmed goods more effectively

Medium-term: diversifying practices and reducing risk

Scaling traditional practices alongside modern ones becomes vital over the medium term. Local knowledge systems should be strengthened and integrated with modern livestock rearing, fodder cultivation, and beekeeping. Communities believe that such activities can diversify farm incomes and reduce vulnerability. At the same time, collective solutions to reduce human–animal conflict, such as solar fencing, bio-fencing, or protected cultivation, must be encouraged, with significant support from agricultural schemes.

Key anticipatory adaptation solution: crop diversification using a knowledge exchange system

Notes for the policymaker: Success would depend on coordinated engagement with panchayats and line departments, ensuring that knowledge exchange continues to boost productivity

Long-term: transforming systems for resilient mountain agriculture

In the long term, communities believe that mountain agriculture would require systemic transformation backed by significant capital investment. This includes promoting zonal farmer markets (*mandis*) and scaling modern farming techniques alongside traditional methods. Government schemes and projects can support large-scale infrastructure development, such as irrigation, cold storage, and agricultural renewable energy. The goal is to enable mountain farmers to shift towards high-value, resilient agriculture supported by strong institutions, market access, and knowledge systems.

Key anticipatory adaptation solution: re-introduction of traditional farming methods

Notes for the policymaker: A multi-pronged financing strategy, supported by policies and schemes, can channel CSR, bilateral and multilateral funding, and government resources towards mainstreaming climate-resilient mountain agriculture through improved infrastructure, market access, and institutional support



Seasonal snow persistence across the Hindu Kush Himalaya (HKH) region dropped by 27.8% below normal in early 2026, affecting aquifer recharge.

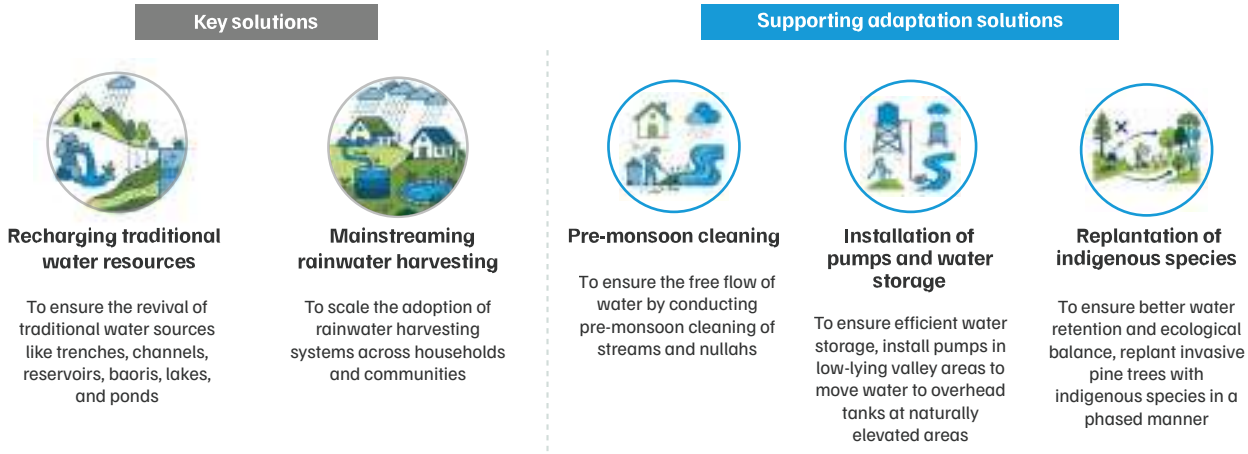
4.2 A route to resilience: towards water security in the mountains

Facing increasing water stress, communities across Himachal Pradesh have had to reconsider their approach to managing water. The stakeholder group emphasised that innovative local solutions can help anticipate and prepare for future water shortages.

a. Visioning: what does water security in Himachal Pradesh mean?

Stakeholders envisioned "*water security as a state where traditional water sources such as baoris and natural springs are rejuvenated; water supply, especially drinking water supply, is uninterrupted; water-conservation infrastructure, such as rainwater harvesting tanks, is adequate and accessible; and alternative water sources are available during crises, such as extreme climate events.*" To achieve this, stakeholders agreed that community-led action is necessary, coordinated with existing institutional levers.

Figure 8. Stakeholder-identified solutions for adaptive water management and reduced water stress



Source: Authors' compilation based on the multi-stakeholder consultation in Shimla (July 2025).

Integrated water resource management[14] emerged as the primary approach to reducing water stress. Drawing inspiration from Thana Kashoga's successful springshed management practice, participants emphasised that retrofitting traditional water sources is key. However, stakeholders also noted that simply reviving old structures would not be enough. They emphasised the need to simultaneously **mainstream rainwater harvesting** at both individual and community levels and support the **recharging of traditional water sources** such as *baoris*, lakes, and ponds through trenches, channels, and check dams.

13 Refer to Box 3, page 123.

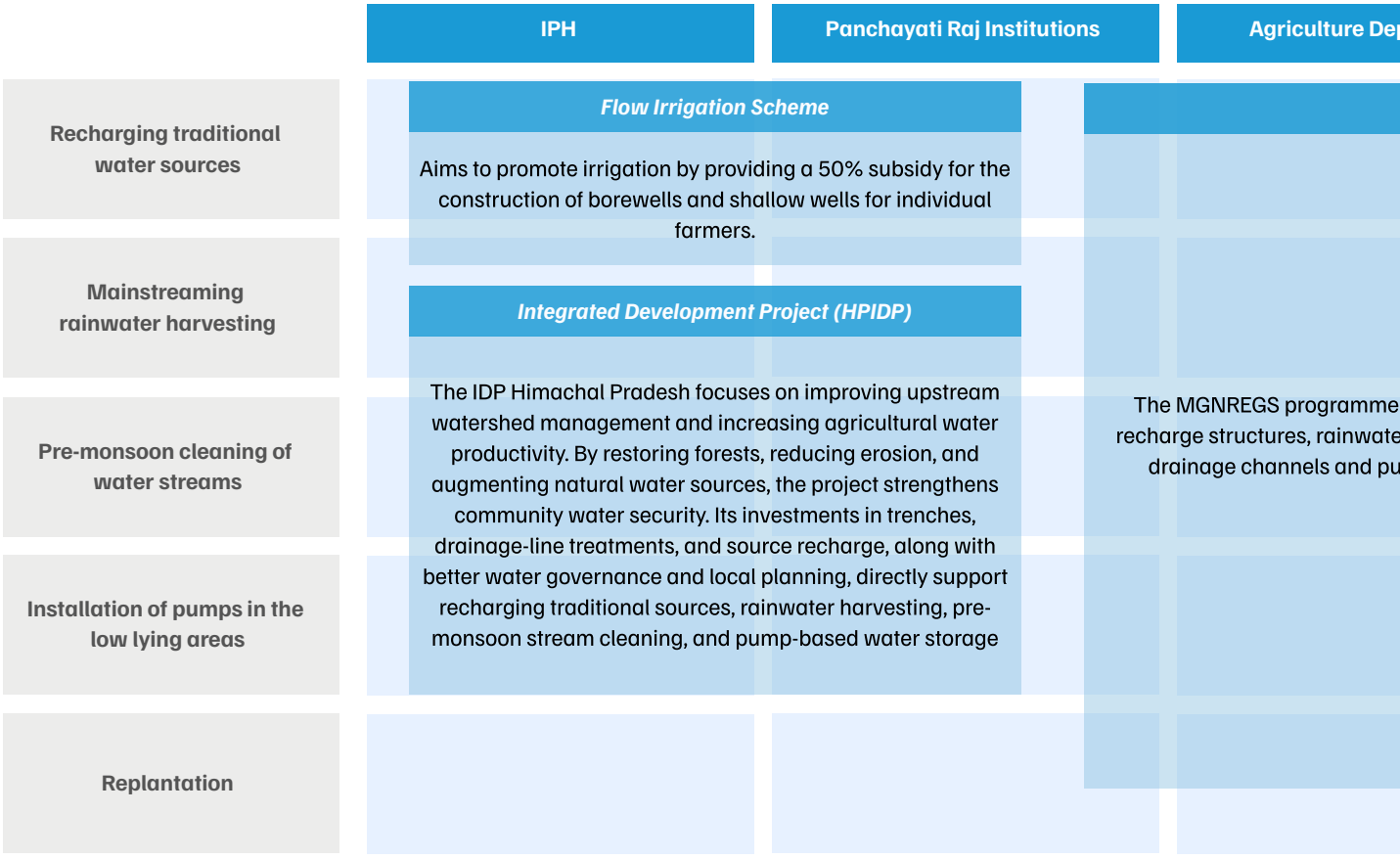
14 Integrated Water Resources Management (IWRM) is a process that promotes the coordinated development and management of water, land, and related resources to maximise the resultant economic [GWP IWRM definition wording; verify source] and social welfare equitably, without compromising the sustainability of vital ecosystems (Water Knowledge Hub n.d.).

Furthermore, stakeholders emphasised that these capital investments must be supported by community-led preventive and maintenance measures, such as pre-monsoon cleaning of water streams and *nullahs*, accompanied by proper waste disposal to ensure that drains remain unobstructed. Finally, this work must be supported by ecological and technical interventions, such as the **phased replacement of invasive pine trees with indigenous species** to improve natural water retention in catchments and the strategic **installation of pumps in low-lying valley areas** to store water in overhead tanks at naturally elevated locations.

b. Enabling action: identifying pillars of support

Institutional, financial, and administrative mechanisms are required to embed adaptation solutions into routine planning and implementation processes. Through a stakeholder mapping exercise, participants deliberated on how existing plans, policies, and schemes could be used to leverage funding and technical support for each adaptation solution identified for the water sector.

Figure 9. Three schemes and five governing institutions were identified as key stakeholders for ensuring water security amongst mountain communities[15]



Source: Authors' compilation based on the multi-stakeholder consultation in Shimla (July 2025).

Note: FC: Finance Commission; VB-G RAM G: Viksit Bharat – Guarantee for Rozgar and Ajeevika Mission; IDP: Integrated Development Project

15 The 16th Finance Commission's (FC) report was not public during this exercise (4 July 2025), so stakeholders did not identify it. However, the tied component of 16th FC basic grants to rural local bodies, earmarked for sanitation, solid waste management, and water management, is a potential funding mechanism.

partment	Horticulture Department	Forest Department	Funding mechanisms
MGNREGS			15^{TH} FC + MGNREGS
			15^{TH} FC + MGNREGS + IDP
strengthens rural water security by funding labour-intensive works like trenches, ponds, and r harvesting units, and pre-monsoon cleaning of streams and nullahs. It also supports creating mp-based water storage systems through community-led planning and guaranteed labour			Community pooling + MGNREGS + 15^{TH} FC
			MGNREGS
			MGNREGS

Note: From 1 July 2026, MGNREGS has been replaced by the Viksit Bharat-Guarantee for Rozgar and Ajeevika Mission (Gramin) (VB-G RAM G), under the VB-G RAM G Act, 2025.

- To strengthen the **recharging of traditional water sources**, the ***Flow Irrigation Scheme***, led by the IPH Department, can provide the core technical support needed. Panchayati raj institutions and the Agriculture Department can complement these efforts through local planning and coordination. These activities can be funded through the **15th Finance Commission (FC) and VB-G RAM G**.

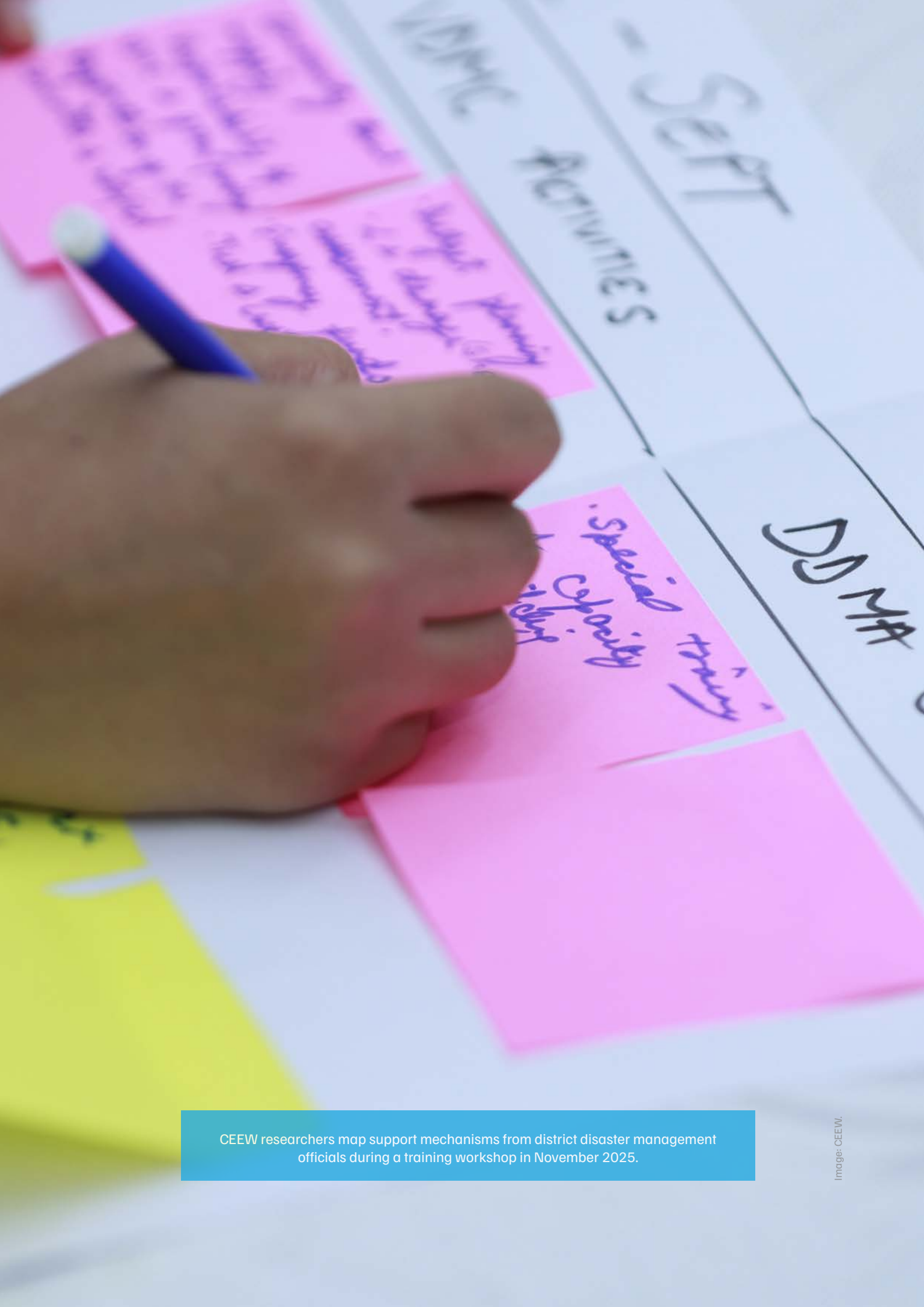
- To **mainstream rainwater harvesting**, the *Integrated Development Project (IDP)* can anchor watershed-level interventions across departments, with panchayati raj institutions facilitating community-level implementation. Stakeholders agreed that this work can be funded through a combination of the 15th FC, VB-G RAM G, and IDP resources.

- **Pre-monsoon cleaning of water streams** can be largely enabled through VB-G RAM G, supported by panchayati raj institutions and the Agriculture Department and financed through community pooling, VB-G RAM G, and the 15th FC. Stakeholders also highlighted that VB-G RAM G can primarily support pump installation in low-lying areas, with technical facilitation from panchayati raj institutions and the IPH Department. Moreover, **VB-G RAM G can also support replantation efforts critical for long-term water recharge**, with oversight from panchayati raj institutions and the Forest Department.

Existing mechanisms under the *Jal Jeevan Mission*, such as village water and sanitation committees or *pani samitis*, can also provide a platform for community mobilisation. These committees can support the implementation, monitoring, and maintenance of the identified adaptation measures, enabling local ownership and accountability.

c. Co-developing a shared pathway towards water security in Himachal Pradesh

To consolidate the discussion, participants convened in groups to co-create an action timeline. Using back-casting as the foresight tool, they traced backwards from the envisioned solutions to identify the key steps, responsible stakeholders, and financing mechanisms needed to realise these outcomes. This exercise provided a structured pathway for anticipatory adaptation aimed at reducing water stress.



CEEW researchers map support mechanisms from district disaster management officials during a training workshop in November 2025.

Image: CEEW.

Figure 10. Route to climate resilience to reduce water stress in Himachal Pradesh: co-developed by communities, NGOs, and district disaster management officials



Source: Authors' compilation based on the multi-stakeholder consultation in Shimla (July 2025).

Abbreviations: RWH: rainwater harvesting; SHG: self-help group; VDMC: village disaster management committee

Short-term: *foundation building and emergency preparedness*

Key anticipatory adaptation solution: springshed management with pre-monsoon cleaning of watershed channels

Participants believed that springshed management and pre-monsoon cleaning of watershed channels should be prioritised in the short term. Communities across panchayats agreed that these activities can be managed by village committees, such as SHGs, *yuva mandals*, and water committees, provided they receive training and basic tools from the Irrigation and Public Health Department and the Department of Environment, Science and Technology (DEST). Implementation can begin immediately once resources and community structures are in place, but sustained impact depends on regular maintenance and continued mobilisation. Institutionalising these activities through village panchayats, such as by including them under 'Water Conservation Week', can ensure consistent annual engagement.

Notes for the policymaker: Close cooperation between the Forest and Agriculture Departments is essential due to overlapping jurisdiction over watershed areas. Technical support, supervision, and monitoring by the **Irrigation and Public Health** and the **Environment, Science and Technology Departments** are critical to help community members scientifically identify aquifer locations, estimate the springshed catchment, and calculate water discharge.

Medium-term: *infrastructure development and system integration*

Key anticipatory adaptation solution: building critical water infrastructure facilities

Government subsidies become vital for infrastructure-intensive solutions such as water-lifting pumps and rainwater harvesting systems. While quick to deploy, these solutions need longer periods and sustained effort to scale across villages, making this a medium-term activity. Panchayats play a crucial role in identifying suitable locations for pumps and storage infrastructure, complemented by trench and tank construction to strengthen water-resource management. Participants proposed that the government could support initial setup costs, with communities managing ongoing maintenance through pooling mechanisms.

Notes for the policymaker: VB-G RAM G serves as a key financial and implementation mechanism alongside *Jal Shakti Abhiyan* and *Pradhan Mantri Krishi Sinchayee Yojana* (PMKSY), which could support irrigation-focused rainwater harvesting. For water-lifting and recharge measures, the *Jal Se Krishi Ko Bal Yojana* and *Uthao Peyjal Yojana* were suggested as the enabling schemes.

Long-term: *systemic transformation and sustainability*

Long-term resilience requires comprehensive infrastructure development for water resource management and ecological restoration. Priorities include systematically mapping available and accessible water sources, planning budgets, allocating dedicated funds, and adopting solar pumps. Phasing out chir pine also emerged as a long-term measure, given stakeholders' concerns about its excessive water use and depletion of groundwater and natural springs. Stakeholders recommended halting new plantations and replacing existing stands with alternatives such as amla. Community-driven chir pine needle collection can support ecosystem restoration, reduce wildfire risks, improve groundwater recharge, and create livelihoods through value-added products such as handicrafts and fuel briquettes.

Key anticipatory adaptation solution: chir pine replacement initiative (Economic Times 2016)

Notes for the policymaker: The 15th FC could fund comprehensive interventions. Multi-department coordination remains essential for ecosystem-based approaches.



Himachal Pradesh has secured sanction for the construction of 3,123 km of all-weather rural roads and 43 bridges with a total cost of INR 3,345.81 crore under Pradhan Mantri Gram Sadak Yojana-III (PMGSY-III), says PWD Minister Mr Vikramaditya Singh (The Economic Times 2025).

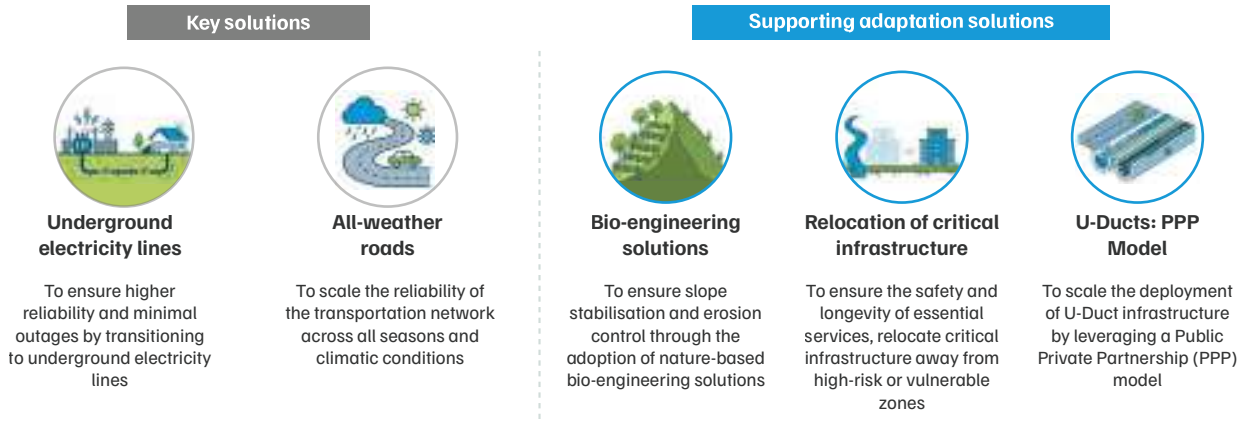
4.3 A route to resilience: towards a climate-resilient urban transition

Erratic rainfall, rising temperatures, infrastructure development, and growing urban influence are transforming the rural character of Himachal Pradesh. This transformation is most prominent in the state's peripheral urban (peri-urban) settlements, such as Gram Panchayats Pandoh, Shoghi, and Dhamun.

a. Visioning: what does climate-resilient infrastructure development in the mountains look like?

Stakeholders articulated that infrastructure development in the mountains must address both immediate threats from climate-induced extreme events and systemic vulnerabilities. This would involve improving disaster safety by ensuring uninterrupted access to essential services and promoting risk-informed infrastructure investments.

Figure 11. Infrastructure-focused pathways for a climate-resilient urban transition and supporting adaptation measures



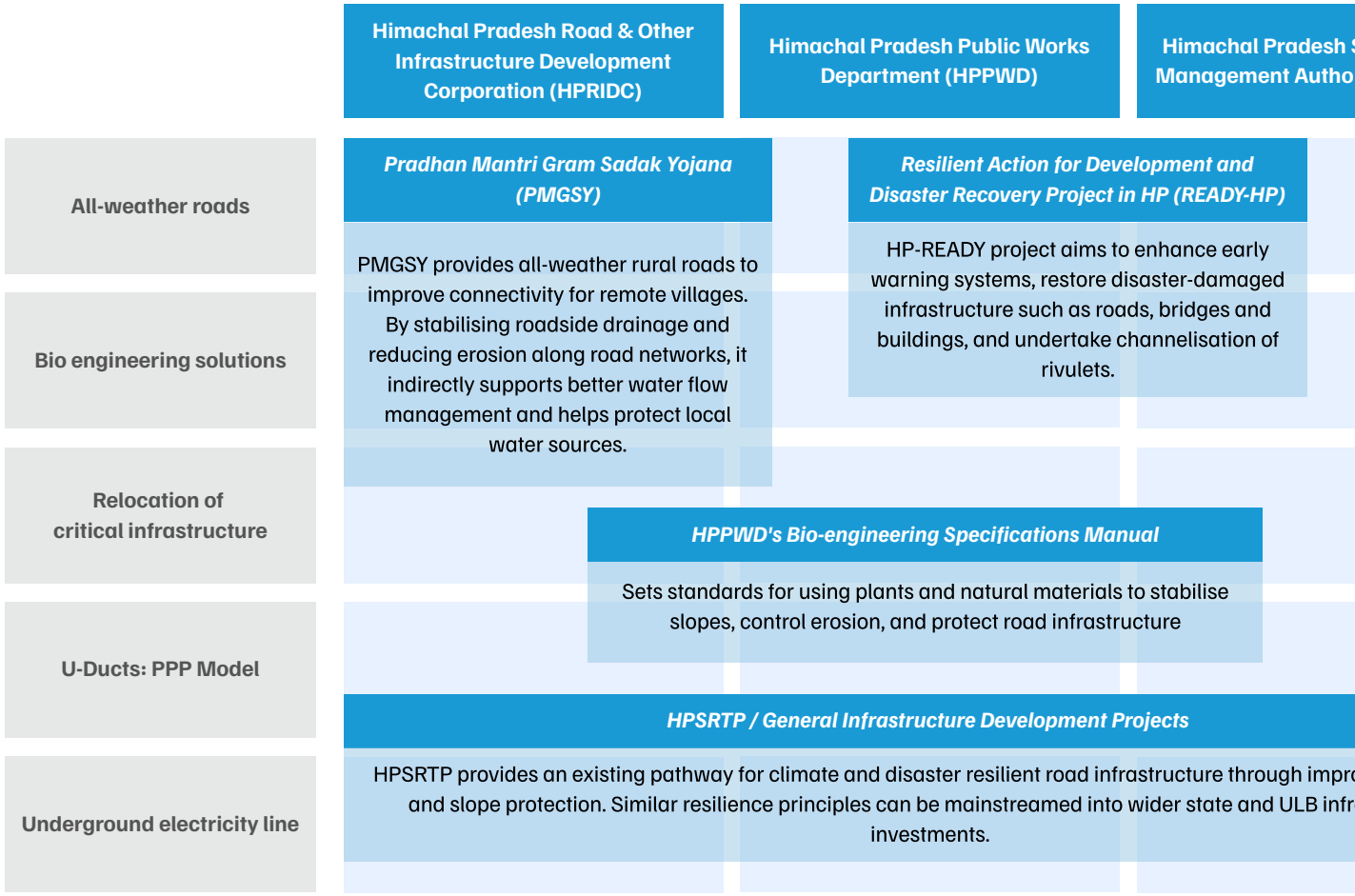
Source: Authors' compilation based on the multi-stakeholder consultation in Shimla (July 2025).

Stakeholders emphasised the need to **enforce regulated and ecologically guided development in sensitive areas**. They stressed that mandating the **integration of traditional and indigenous disaster-resistant construction techniques** through innovative public–private partnership (PPP) models would be key. Additionally, strategically relocating **critical infrastructure** away from hazard-prone locations, alongside slope stabilisation through **large-scale bio-engineering interventions,** would help minimise landslide risk. Further, rolling out **all-weather roads integrated with U-ducts** under PPP frameworks would be necessary to protect settlements and transport corridors from flash floods and debris flows. Lastly, systematically **converting overhead power lines to underground electricity networks** would be essential in the long term to prevent widespread outages during extreme rainfall, snowfall, and storms. By combining technical innovation with local knowledge, development in fragile mountain ecosystems can be safer and socio-economically sustainable in the long term.

b. Enabling action: identifying pillars of support

Institutional, financial, and administrative mechanisms are required to embed adaptation solutions into routine planning and implementation processes. Through a stakeholder mapping exercise, participants discussed how existing plans, policies, and schemes could leverage funding and technical support for each adaptation solution identified for the infrastructure sector (see Figure 12).

Figure 12. Six schemes and five departments were identified as key stakeholders for enabling climate-resilient urban development



Source: Authors' analysis.

Abbreviations: CSR: corporate social responsibility; PPP: public–private partnership

State Disaster rity (HPSDMA)	HP State Electricity Board (HPSEBL)	Urban Development Department	Funding mechanisms
	Himachal Pradesh State Roads Transformation Program (HPSRTP)		
	Provides standards and guidelines for using vegetation-based and low-cost natural techniques to stabilise slopes, prevent erosion, and protect road infrastructure. It supports climate-resilient construction by promoting environmentally sustainable methods suited to Himachal's fragile mountain terrain.		
	Himachal Pradesh Right of Way Policy, 2023 (HPROW-23)		• Global CSR Funds • Department-wise Scheme funds • Disaster Management/Mitigation Funds (State/National Disaster Response Funds)
	Focuses on regulating underground telecom infrastructure, which includes guidelines for laying fiber and other utilities, often done via ducts/trenches		
oved drainage astructure			

- Participants discussed how infrastructure solutions such as **all-weather roads** can be enabled through the *Pradhan Mantri Gram Sadak Yojana* (PMGSY), implemented by the **Himachal Pradesh Road and Other Infrastructure Development Corporation Limited (HPRIDCL)** and **Himachal Pradesh Public Works Department (HPPWD)** and supported by global CSR funding, departmental schemes, and the State Disaster Response Fund (SDRF).

- Stakeholders also agreed that **bioengineering solutions** can be guided by the ***HPPWD Bio-engineering Specifications Manual*** **and** ***Himachal Pradesh State Roads Transformation Program*** (HPSRTP), with **HPRIDCL** and the **HPSDMA** providing alignment with wider resilience priorities. The **HP-READY programme and departmental engineering guidelines** can support relocating critical infrastructure, with coordination among **HPPWD, HPSDMA, Himachal Pradesh State Electricity Board Ltd (HPSEBL),** and urban development authorities, drawing on disaster-mitigation and CSR funds.

- For establishing **U-ducts and PPP-based utility corridors**, HPSRTP and the *Himachal Pradesh Right of Way Policy* (HPROW-23) can be used to streamline the safe placement of underground utilities, jointly implemented by HPSEBL, HPPWD, and urban authorities.

- The shift to **underground electricity lines** can be facilitated by **HPSEBL** in partnership with **HPRIDCL and HPPWD**, using **CSR funds** to reduce vulnerability to landslides and extreme weather.

c. Co-developing a shared pathway towards climate-resilient infrastructure development in Himachal Pradesh

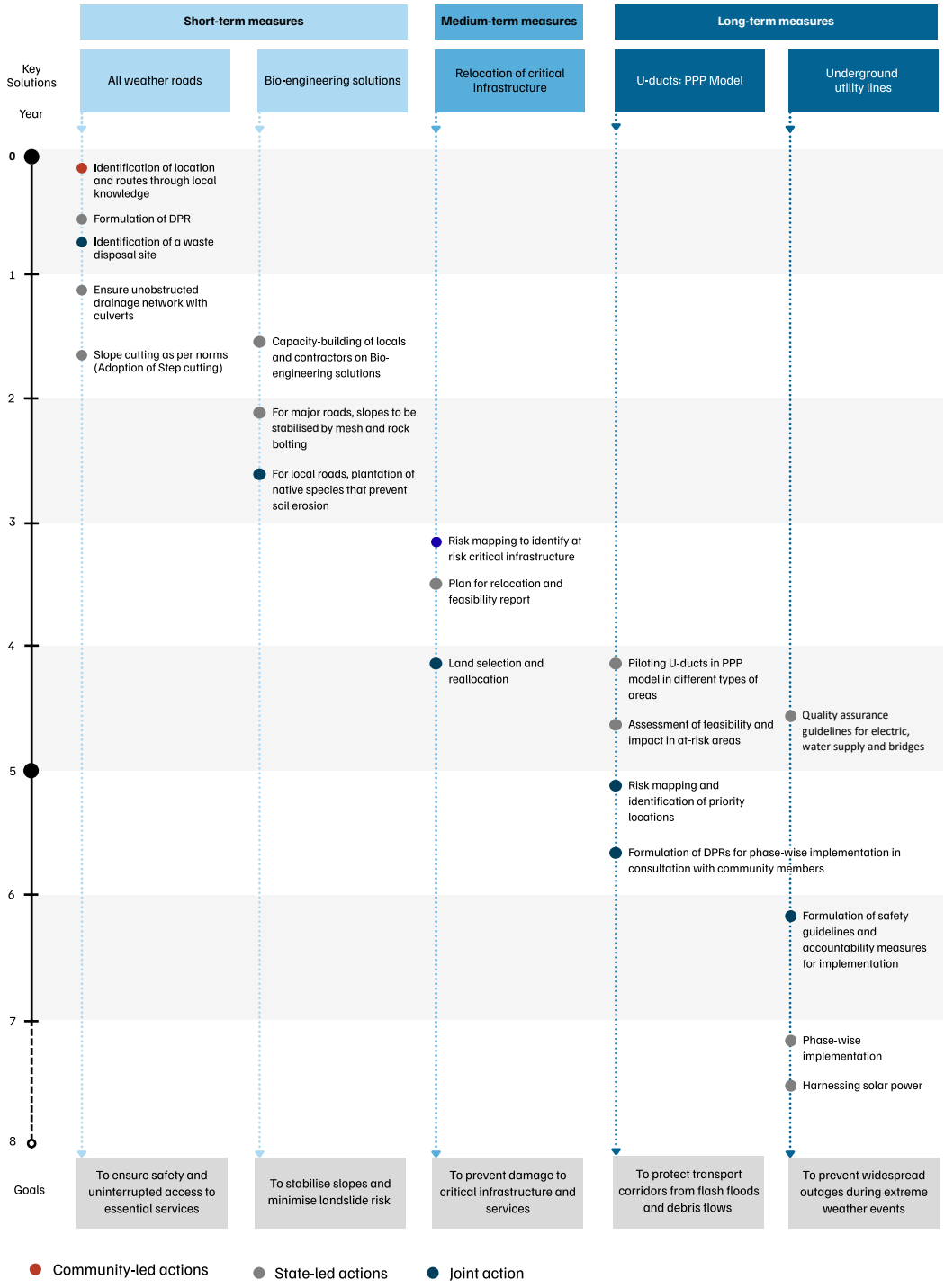
To consolidate the discussion, participants deliberated again in groups to co-create an action timeline. Using **back-casting** as the foresight tool, they worked backwards from the envisioned solutions to identify the key steps, stakeholders, and financing mechanisms required to make these outcomes achievable. This exercise enabled a structured pathway for anticipatory adaptation in planning.



CEEW researchers co-developing future scenarios under climate uncertainty with district disaster management officials in Himachal Pradesh, November 2025.

Image: CEEW.

Figure 13. Pathways to climate-resilient urban development in Himachal Pradesh: co-developed with communities, NGOs, and district disaster management officials



Source: Authors' analysis.

Abbreviations: DPR: detailed project report; PPP: public–private partnership..

Short-term: formulation of development controls

Key anticipatory adaptation solution: development control regulations (DCRs)

The stakeholders emphasised the need to create development control regulations (DCRs) sensitive to the unique topographical and ecological contexts of rapidly growing mountain settlements. This was seen as immediately important to ensure orderly, safe, and beneficial urban growth under increasing population pressure. Participants said these regulations must be rooted in scientific vulnerability mapping and district-level assessments by DDMAs, supported by NGOs, research organisations, and community insights gathered through VDMCs. At the same time, traditional housing practices require systemic integration into existing rural housing schemes like PMAY-Gramin and *Mukhyamantri Vidhwa Evam Ekal Naari Awas Yojana*, incorporating traditional construction practices as an eligibility criterion. This would help enhance earthquake resilience, reduce landslide vulnerability by following natural terrain, and provide natural insulation against extreme weather.

Notes for the policymaker: Himachal Pradesh Council for Science, Technology & Environment **(**HIMCOSTE), National Institute of Disaster Management (NIDM), and Himachal Pradesh State Disaster Management Authority (HPSDMA) can play a pivotal role in promoting the integration of traditional building practices through targeted training, capacity-building, and advocacy initiatives.

Medium-term: critical infrastructure relocation and bio-engineering

Schools, anganwadis and health centres must move from hazard-prone sites to safer ground. These facilities provide continuous care and safe shelter during disasters. The Revenue Department can help identify new sites. Reconstruction can be financed through the State Disaster Mitigation Fund (SDMF) and/or SDRF, CSR contributions, or 15th FC grants. All-weather roads to relocated facilities should be prioritised under *Pradhan Mantri Gram Sadak Yojana*, especially roads that serve as evacuation and response corridors. Bio-engineering was also seen as crucial to stabilise slopes against landslides caused by construction or rainfall.

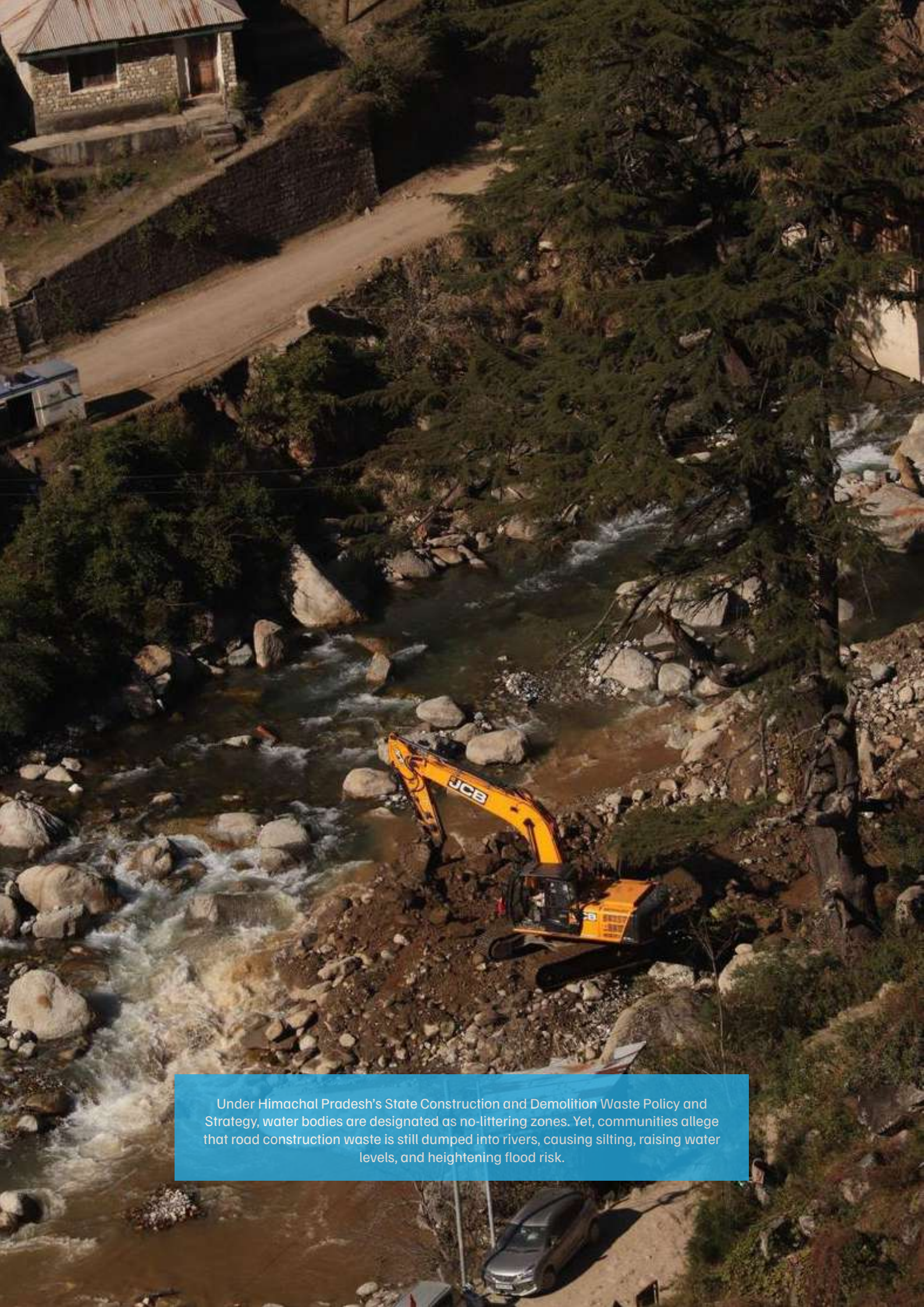
Key anticipatory adaptation solution: implementation of bioengineering solutions and relocation of critical infrastructure

Long-term: utility transformation and underground infrastructure

Long-term resilience needs a comprehensive upgrade of utility infrastructure. Electricity lines can move underground via U-ducts to protect them from extreme weather, improve reliability and reduce maintenance. This can be aligned with PMGSY, *Jal Jeevan Mission and Deendayal Upadhyay Gram Jyoti Yojana*. In parallel, DCRs can designate no-development and buffer zones along rivers, steep slopes and other high-risk areas. Ground coverage and floor area ratio (FAR) norms can curb unregulated construction in fragile areas, reducing flood and landslide risk. These rules can sit in development plans where a settlement lies within a planning area, or else in regional plans. GPDPs can address local, community-specific concerns.

Key anticipatory adaptation solution: comprehensive utility infrastructure transformation

Notes for the policymaker: Multi-scheme coordination enables comprehensive infrastructure transformation through sustained investment frameworks.



Under Himachal Pradesh's State Construction and Demolition Waste Policy and Strategy, water bodies are designated as no-littering zones. Yet, communities allege that road construction waste is still dumped into rivers, causing silting, raising water levels, and heightening flood risk.

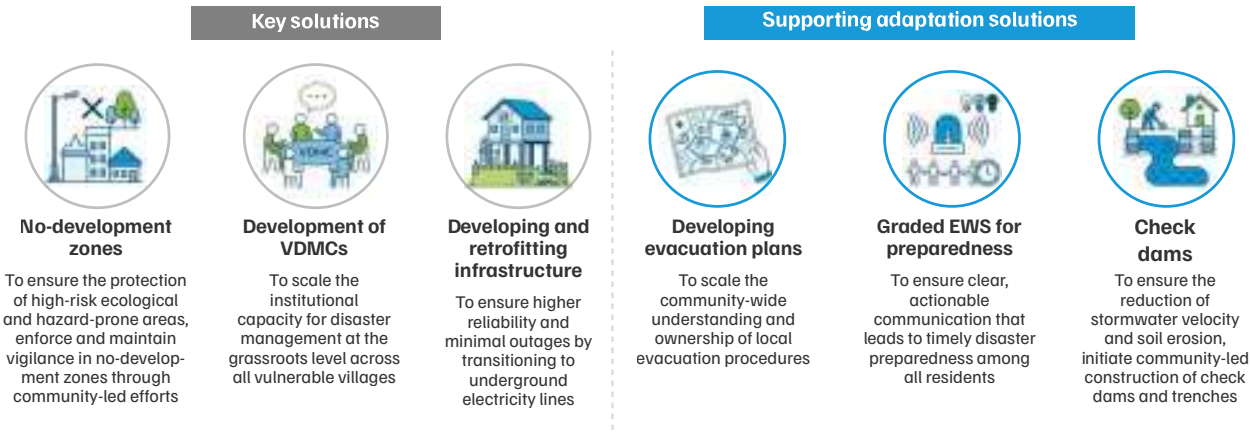
4.4 A route to resilience: towards community-led disaster preparedness

As disasters become more frequent and severe in Himachal Pradesh, local communities need to lead disaster preparedness and response, leveraging their local knowledge, social networks, and community strength.

a. Visioning: what does a community-led model for disaster preparedness look like?

Stakeholders envisioned community-led disaster preparedness as a model in which communities are equipped with decision-making power for disaster preparedness and response. Stakeholders drew inspiration from pioneering grassroots initiatives such as Shoghi's village disaster management committee (VDMC), established with the support of ADRA India to lead participatory hazard mapping, training, and community awareness. Stakeholders emphasised that VDMCs must act as nodal agencies, entrusted with identifying hyperlocal risk drivers and implementing local adaptation solutions.

Figure 14. Community-led disaster management pathways and supporting adaptation measures



Source: Authors' analysis.

Abbreviations: VDMC: village disaster management committee; EWS: Early Warning System

Participants emphasised that VDMCs must plan disaster management activities with defined community roles and context-specific targets to reduce risks. They highlighted the need to **enforce no-development zones in hazard-prone areas** and strengthen regulations to prevent resource overuse and environmental degradation, while also elaborating on the role communities can play in delineating such zones.

An innovative **graded early warning system** was proposed to replace existing siren and SMS alerts, incorporating distinct tones and loudspeaker announcements to communicate different danger levels and address power and network limitations. **Regular drills and awareness campaigns** were recommended to ensure that communities can effectively interpret and respond to warnings, demonstrating the potential of community-led systems supported by policy frameworks.

The consultation also focused on community-led construction and retrofitting of resilient infrastructure using local techniques and guided by participatory hazard mapping. Strengthening VDMCs and facilitating co-learning with technical agencies were prioritised to sustain adaptive planning. The system-wide upgrading process would include iterative risk monitoring and community feedback to adapt risk maps and preparedness measures over time, ensuring dynamic and inclusive disaster resilience.

b. Enabling action: identifying pillars of support

Institutional, financial, and administrative mechanisms are required to embed adaptation solutions into routine planning and implementation processes. Through a stakeholder mapping exercise, participants deliberated on how existing plans, policies, and schemes could be used to leverage funding and technical support for each adaptation solution identified for the disaster management sector Figure 15.

Figure 15. Three schemes and three departments were identified as key stakeholders for enabling community-led disaster management



Source: Authors' compilation based on the multi-stakeholder consultation in Shimla (July 2025).

pment SDM	Public Works Department	DAM Authority	Funding mechanisms
anchayat Development Plans chayat Development Plans (GPDP) are centralised, participatory local planning in g that infrastructure and service priorities ctual needs of the village community			• State Disaster Mitigation Fund • Other CSR Funds • DAM CSR Funds
n Mantri Awas Yojana (PMAY) rily involves direct financial assistance for t be integrated with local planning and risk reduction			
		Dam Safety Act Emergency Action Plans, downstream early warning and regular safety inspections for dams, coordinated with DDMAs.	
REGS s and other water rks through rural ments.			

- To guide the designation of **no-development zones**, stakeholders highlighted that the Revenue Department and Disaster Management (DM) authorities can anchor the process through the preparation, regular updating, and enforcement of **disaster management plans**, ensuring that land-use decisions reflect local risk conditions.

- For **developing evacuation plans**, **gram panchayat development plans (GPDPs)** led by rural development authorities can provide a participatory platform for identifying safe routes, shelters, and priority services, with DM Authorities providing technical guidance. Furthermore, to **develop and retrofit critical infrastructure**, schemes such as the ***Pradhan Mantri Awas Yojana*** **(PMAY)** can be linked with local risk assessments so that new construction and retrofitting efforts undertaken by the Rural Development and Public Works Departments align with disaster-resilient standards.

- The **development of VDMCs** can be facilitated jointly by DM authorities and panchayati raj institutions, ensuring community-led preparedness and planning. For **graded early warning systems**, coordination among DM authorities, the Public Works Department, and local authorities is essential to ensure that alerts are linked to infrastructure, communication channels, and village-level protocols.

- Finally, the construction of **check dams** can be supported by the **Revenue Department, Rural Development, and dam authorities**[16] to reduce flood risk and manage water flow in vulnerable areas. These activities can draw on the **State Disaster Mitigation Fund, sectoral CSR funds, and dedicated CSR allocations from dam authorities**, illustrating how interdepartmental coordination and blended financing can support comprehensive local disaster preparedness and resilience efforts.

c. Co-developing a shared pathway towards community-led disaster preparedness in Himachal Pradesh

Stakeholders developed a comprehensive anticipatory adaptation action plan to enhance community-based disaster risk reduction capacities. The multi-phase approach emphasises institutional convergence and empowers communities to lead disaster risk reduction (DRR) and climate adaptation efforts through structured participatory frameworks.

16 According to the *Dam Safety Act, 2021,* at the state level, the act provides for the constitution/establishment of the State Committee on Dam Safety and State Dam Safety Organisation by the state government for the purpose of maintaining standards of dam safety and prevention of dam failure related disasters for the dams located in the state (MoJS 2023); PIB 2023a;.



CEEW researchers conducting a training workshop on building strategic foresight within district disaster management authorities in Himachal Pradesh

Image credit: CEEW

Figure 16. Pathways to climate resilience through community-led disaster management in Himachal Pradesh: co-developed with communities, NGOs, and DDMA officials



Source: Authors' compilation based on the multi-stakeholder consultation in Shimla (July 2025).

Abbreviations: BDO: block development officer; CBDRR: community-based disaster risk reduction; CSO: civil society organisation; DDMA: District Disaster Management Authority; DPR: detailed project report; EWS: early warning system; GPDP: gram panchayat development plan; HRVA: hazard, risk, and vulnerability assessment; NOC: no-objection certificate; NGO: non-governmental organisation; PERC: panchayat emergency response centre; SHG: self-help group; VDMC: village disaster management committee; VDMP: village disaster management plan

Short-term: formulation of VDMCs with participatory risk assessment

Community members stated that establishing and strengthening VDMCs should be a foundational priority across panchayats. They enable timely responses during the crucial hours of a hazard and act as a bridge between the top-down disaster response system and community preparedness. They can be supported institutionally by Home Guards, SDMAs or DDMAs, while panchayat leaders provide accountability and decision-making authority.

Frontline workers and volunteers, including Accredited Social Health Activists (ASHAs) and Early Childhood Care and Education (ECCE) and National Service Scheme (NSS) volunteers, can help establish VDMCs across gram panchayats, with convergence at the block level. VDMCs can conduct vulnerability and risk mapping, prepare VDMPs, and develop standard operating procedures, including participatory evacuation plans. Gram panchayats can also use these assessments to identify no-development and hazard-prone zones and integrate them into GPDPs.

Key anticipatory adaptation solution: development of VDMCs

Notes for the policymaker: Rural development and state/district disaster management departments are major stakeholders for fund mobilisation and training on rules and regulations. Integration of DRR into GPDPs enables enforcement through local panchayats over the medium and long term.

Medium-term: community-led construction and early warning systems

Participants prioritised structural planning and building community capacity to implement VDMPs. They highlighted the need to engage self-help groups, youth groups, and village organisations through initiatives such as *Aapda Mitra*, *Van Mitra*, ASHA, and NCC, with support from NGOs, CSOs, and VDMCs, and to train pradhans in emergency preparedness.

They recommended community-led construction of resilient infrastructure using locally appropriate technologies, guided by participatory hazard mapping and implemented through VB-G RAM G and CAMPA, as these cost-effective solutions use local materials and villagers can maintain them.

Participants also proposed a graded early warning system, coordinated by DDMAs with NRSC, NGOs, panchayats, and VDMCs, linking water volumes and gate releases to sensor triggers, mobile alerts, and manual hooters, alongside localised CBDRR preparedness.

Key anticipatory adaptation solution: community-led construction of resilient infrastructure

Notes for the policymaker: Co-learning spaces involving DDMAs, PRIs, CSOs and technical institutions enable communities to interpret risk data and co-develop context-specific solutions. Gender-sensitive communication channels ensure accessibility for women.

Long-term: preparedness culture and adaptive risk monitoring

Participants noted that the implementation phase of the action plan turns early planning and capacity building into community-led action on rising climate risks, especially flooding, landslides, and infrastructure failures, embedding risk reduction in everyday governance, infrastructure development, and disaster preparedness.

Key anticipatory adaptation solution: institutionalised preparedness culture

Notes for the policymaker: Feedback-driven learning ensures system responsiveness to emerging threats such as new landslide zones or changing flood dynamics. Local functionaries require training in risk communication, social mobilisation, and technical oversight for sustained implementation.



"There is a need for strict construction guidelines tailored to slope type and geology of Himachal Pradesh", says former Additional Chief Secretary, Deepak Sanan (August 2025).

4.5 A route to resilience: enabling climate-risk-informed development through anticipatory adaptation

The consultation underscored that climate-risk-informed development is the need of the hour and requires planning systems to move beyond reactive action and embrace anticipatory adaptation. This approach depends on combining scientific assessments, community knowledge, and regulatory authority to shape development trajectories before crises unfold.

The first lever in this pathway is establishing a credible scientific basis for risk-informed decision-making. Hazard mapping for each sector, when combined with participatory validation by communities, can enable development authorities to identify zones unsuitable for habitation or infrastructure expansion. By supplementing spatial analysis with lived experience, development planners can pinpoint risk hotspots more accurately. Integrating field realities through VDMCs and other local forums would ensure that land-use maps reflect on-ground realities and account for future risks.

Where risks cannot be reduced in place, relocation emerges as a necessary medium-term strategy. Participants emphasised that this process must be developmental rather than extractive. Land identification by revenue authorities, supported by housing schemes such as PMAY-Gramin, provides a practical framework. However, relocation succeeds only when families are guaranteed tenure security, services, and livelihood continuity. Planned resettlement clusters, where housing, access roads, markets, and civic amenities are integrated from the outset, can reduce displacement trauma and economic loss. Lessons from past relocation efforts show that interdepartmental coordination and transparent land processes remain major hurdles, requiring political will and strong facilitation mechanisms.

Complementing relocation, regulatory integration is crucial. The discussions highlighted that generic building norms often fail in fragile mountain ecologies. Context-specific regulations, from ground-coverage limits and drainage requirements to materials suited to slope stability, must be embedded in GPDPs and other planning instruments. When such norms are codified locally, implementation shifts from periodic enforcement to everyday governance.

In the long term, anticipatory adaptation envisions not only safer settlements but also healthier landscapes. Land vacated through relocation can be repurposed as ecological buffers: zones that stabilise slopes, regulate runoff, restore biodiversity, and host livelihood activities such as nurseries or orchards. These buffers reduce disaster risk while enhancing ecosystem services. Sustainable financing models were seen as key: restoration funding can flow through CAMPA, CSR, VB-G RAM G, and convergence with forest or watershed missions. Equally important is institutional stewardship of these zones. Panchayats, VDMCs, and community vigilance committees can ensure compliance, prevent re-encroachment, and support long-term maintenance.

Taken together, these elements form a framework for anticipatory adaptation: science-driven risk mapping validated locally; planned relocation that secures livelihoods and tenure; regulatory frameworks embedded in decentralised planning; and ecological regeneration of vacated land. This pathway reflects a shift from incremental, sectoral responses to proactive territorial planning that protects lives, strengthens local economies, and reconfigures land use to build resilience. The consultation revealed that anticipatory adaptation is not a singular intervention but a governance transformation requiring coordination, trust, and sustained investment. If pursued with intent and inclusion, it offers a route towards safer, climate-resilient development in regions facing accelerating hazard pressures.

Words of wisdom | From the community to the policymaker



Mountain Agriculture

"Programmes like *Him Unnati Yojana* encourage integrated farming, where multi-cropping and crop rotation are performed using indigenous varieties, and even farm waste like crop-residue and animal by-products become resources through natural farming."

"Along with new farming methods, farmers should also receive training in marketing and value addition so we can earn better from our crops."

- *Mr Arjun Attri, Agricultural Entrepreneur, Gram Panchayat Parara, District Sirmaur*



Water

"Every year before the monsoon, a Water Conservation Week could be mandated across all gram panchayats, with institutional support, to carry out activities like watershed cleaning and constructing drains to reduce flood and landslide risks.

- *Mr Sewanand, Gram Pradhan, Thana Kashoga*



Water

"Our water supply gets contaminated every monsoon with soil and silt. Community members can help identify new springs that appear only during the monsoon and use their water for drinking after proper filtration. Support would be needed for its channelisation and filtration.

- *Mrs Geeta Devi, Gram Pradhan, Pandoh*



Livelihoods

"Since women here have different education levels, including some who are uneducated, we request targeted training and skill development programmes that match our varying literacy needs."

- *Mrs Poonam, Village Officer, Gram Panchayat Pandoh*

Livelihoods

"The government should first ask the community what kind of training we need, so the programmes are more contextually appropriate and relevant to us, and more people would be encouraged to attend."

- Mrs Meena Kumari, Mahila Mandal Leader, Gram Panchayat Sunah Lamba Thach

Disaster Preparedness

"Sharchi and other panchayats in the Tirthan Valley are hesitant about being included under the *Town and Country Planning* (TCP) Act. We fear that it would bring more unregulated development and put extra pressure on our natural resources. We already have strong sustainable tourism guidelines, and we worry that the TCP Act will dilute our local decision-making, which is important for locally led solutions."

- Mr Hari Singh, Gram Pradhan, Gram Panchayat Sharchi

Disaster Preparedness

"The government should allow some flexibility in forest rights so that forest land can be used, only during emergencies, for backup food storage, temporary shelters, and basic livelihood support."

- Mr Santosh Kumar, Gram Pradhan, Gram Panchayat Sunah Lamba Thach

5. Policy recommendations to mainstream anticipatory adaptation





Image: CEEW

5.1 Gram panchayats must be empowered as local leaders of climate adaptation and governance

As climate change increasingly manifests through localised impacts, governance systems must enable anticipatory adaptation at the community level. Gram panchayats, as the constitutionally mandated third tier of government under the *73rd Amendment*, are well placed to lead community-level climate adaptation implementation. Comprising community leaders, gram panchayat leaders possess detailed knowledge and first-hand understanding of local vulnerabilities, socio-ecological systems, and livelihood practices, making them well equipped to lead anticipatory and context-specific adaptation efforts (GIZ 2019; NIDM 2020).

Decentralised governance frameworks empower gram panchayats to make decisions on 29 subjects listed under the *Eleventh Schedule*, many of which are highly climate-sensitive, such as agriculture, water, health, sanitation, and rural housing (MoPR 2018). Moreover, the institutional reach of gram panchayats within communities, through mechanisms such as gram sabhas and village-level committees, enables participatory governance, inclusion, and transparency, which are central to the foresight approach (OECD 2023) and essential to the success of locally led adaptation (Wajih et al. n.d.).

However, strengthening these panchayati raj institutions through capacity-building ecosystems is crucial to institutionalise climate literacy and planning skills among elected representatives and frontline planners (NIDM 2023). Training models piloted by the Gujarat Institute of Disaster Management (GIDM), the State Institute for Rural Development and Panchayati Raj (SIRD and PR), Odisha, and Kerala Institute of Local Administration (KILA) have demonstrated how gram panchayats can be equipped to lead climate risk assessments and disaster preparedness planning and facilitate convergence with rural development schemes (GIDM 2023; KILA 2023; NIDM 2023).

The Himachal Pradesh State Disaster Management Authority (HPSDMA) has also taken concrete steps in this direction. In June 2025, the state cabinet approved the setting up of a **Panchayat Emergency Response Centre (PERC)** in each of the state's 3,645 panchayats (PTI 2025a). Through PERCs, the state aims to create an organised, community-based framework for disaster preparedness, response and recovery at the grassroots level. As gram sabhas bring together people from across the panchayat, they are natural spaces for jointly identifying local risks, weighing adaptation options and building consensus on what to do. In Bajaura, for instance, community members agreed through gram sabha discussions that rainwater harvesting was their best option against seasonal droughts (see Section 3.2). Linking PERCs to gram sabha processes could help make sure panchayat-level preparedness reflects community priorities and has local ownership.

5.2 Village disaster management committees must be strengthened as local leaders for disaster risk reduction and management

To ensure that panchayat emergency response centres function effectively, VDMCs must be constituted to bridge early warning systems with local anticipatory action. However, to realise their full potential, systematic capacity-building of gram panchayat leaders and VDMC members is essential, particularly in risk interpretation, risk communication, emergency operations, coordination with higher tiers of government, and activation of forecast-based protocols (IMPRI 2025).

Positioned closest to vulnerable populations, VDMCs are designed to play a critical role in translating early warnings into timely action, coordinating preparedness measures, and supporting last-mile response during disasters. Headed by the gram pradhan or local leader at the gram panchayat level, the VDMC would act as a point of convergence in rural governance. Strengthening VDMCs through regular training and capacity-building is therefore crucial to ensure alignment with disaster management and development goals at the subnational and national levels.

To advance the state's initiatives, we have prepared a **Gram Panchayat Climate Resilience Calendar**, a tool designed to help VDMCs anticipate seasonal climate risks, plan mitigation and preparedness activities while accounting for local socio-cultural priorities such as festivals and fairs, and achieve co-developed outcomes annually. Initiatives of the VDMC can also be integrated into GPDPs to strengthen local risk assessments, evacuation planning, and resource mobilisation. Institutionalising VDMCs will enhance community preparedness, mitigate losses, and ensure that disaster risk reduction is integrated into everyday local governance.

5.3 Gram panchayat development plans must be positioned as institutional anchors of climate-resilient rural development

While gram panchayats can lead climate adaptation efforts, standardised methods must guide their actions to translate fragmented efforts into standard practice. As the primary statutory instrument for village-level planning and budgeting, GPDPs can be strategically positioned as a convergence platform to achieve this outcome. Designed to adopt a participatory, cross-sectoral approach and facilitate interministerial convergence, GPDPs serve as a foundational tool for decentralised planning and resource allocation (MoPR 2018). This makes GPDPs an appropriate platform for mainstreaming climate risks into rural development (GIZ and GoHP 2023; NIDM 2020).

Evidence from initiatives in Uttar Pradesh and Himachal Pradesh demonstrates that aligning GPDPs with state action plans on climate change (SAPCCs) and national missions can improve the effectiveness of flagship schemes such as MGNREGA[17] and NRLM when they are designed with climate co-benefits in mind (UNDRR 2023; DEST 2021; GIZ and GoHP 2023). Further, GPDPs can act as vehicles for directing Finance Commission grants towards local

17 As of 2026, refer to Box 3.

risk-reduction priorities (GIZ and GoHP 2023). However, several systemic reforms are required to institutionalise climate-resilient GPDPs:

- First, climate risk assessments must be mandated as a prerequisite in GPDP guidelines to ensure that local planning is informed by a scientific understanding of hazards, exposure, and vulnerabilities (GIZ 2019; UNDRR 2023).

- Second, adaptation indicators should be embedded in the GPDP monitoring and evaluation framework. This will enable periodic tracking of resilience outcomes and ensure accountability in the use of untied Finance Commission funds available for location-specific adaptation interventions (GIZ 2023).

- Third, dedicated climate adaptation cells should be institutionalised at the block level to provide gram panchayats with technical support, facilitate coordination across line departments, and integrate adaptation priorities with sectoral schemes (NIDM 2020). These cells could hold an annual review meeting with gram panchayats and line departments before the GPDP planning cycle, to assess the past year's climate impacts, update risk information and agree on adaptation priorities. The meeting could be timed to feed into the special gram sabhas held every year under the People's Plan Campaign (MoPR 2021; PIB 2024).

- Fourth, VDMCs should be trained to lead participatory hazard, risk and vulnerability assessments (HRVAs) and to prepare village disaster management plans (VDMPs), so that their findings feed directly into GPDPs. Gram panchayats can then use these assessments to identify hazard-prone and no-development zones and to prioritise risk-reduction works in their annual plans.

Considering the above, we have developed a **Gram Panchayat Climate Resilience Calendar** (refer to Annexure A) to guide gram panchayats in integrating adaptation actions into year-round processes, in line with their co-developed adaptation vision.

Reimagining the GPDP as the institutional anchor for climate-resilient development would ensure that adaptation becomes embedded in the routine functioning of rural governance rather than treated as a stand-alone intervention. Finally, the Ministry of Panchayati Raj, in collaboration with state governments, must lead the integration of climate resilience metrics into the national GPDP framework (MoPR 2021). This should be complemented by promoting interdepartmental coordination at the district level and offering performance-based incentives to panchayats that demonstrate innovation and effectiveness in advancing local climate resilience (GEAG and GIZ 2023; NIDM 2020).

Box 3. Scope of works for climate adaptation within the VB-G RAM G Scheme

As of December 2025, the *Mahatma Gandhi National Rural Employment Guarantee Act* has been replaced by the *Viksit Bharat – Guarantee for Rozgar and Ajeevika Mission (Gramin) Act, 2025 (VB-G RAM G)*, reflecting a shift in India's rural employment architecture in line with Viksit Bharat 2047 (PIB 2025). While MGNREGA institutionalised a rights-based, demand-driven framework guaranteeing 100 days of wage employment, VB-G RAM G transitions to a centrally sponsored, allocation-based model, with an expanded provision of 125 days.

Where MGNREGA, 2005, absorbed climate and disaster-related works into broader natural resource management and infrastructure development heads, VB-G RAM G, 2025, gives them a category of their own, with an opportunity to define specific permissible works for climate adaptation and disaster risk reduction within this broader classification. Employment creation is integrated with infrastructure development through four priority verticals: water security through water-related works, core rural infrastructure, livelihood-related infrastructure, and special works to mitigate extreme weather events (PIB 2025).

All infrastructure assets thus created through VB-G RAM G are envisioned to be integrated into the **Viksit Bharat National Rural Infrastructure Stack**. Planning is decentralised through **viksit gram panchayat plans, which are prepared locally** and spatially **integrated with national systems such as *PM Gati Shakti*** (n.d.). The viksit gram panchayat plans will therefore become the central pipeline for adaptation solutions previously undertaken through MGNREGA, to be actualised within the priority verticals, and will subsequently be fed into the **Viksit Bharat National Rural Infrastructure Stack** to coordinate with the national development strategy.

Further, under Section 22(4), the central government determines state-wise allocations based on prescribed criteria, signalling a move away from demand-responsive provisioning. Additionally, the revised fund-sharing pattern of **90:10 for north-eastern and Himalayan states and union territories (UTs), and 60:40 for other states with legislation**, underscores this shift.

Source: Authors' compilation based on Press Information Bureau 2025.

5.4 Research institutions must leverage the latest technologies to improve climate risk assessments and disaster forecasts

As climate risks grow increasingly erratic and localised, particularly in ecologically fragile regions such as Himachal Pradesh, there is an urgent need to enhance forecast precision, lead time, and usability. Emerging technologies, including artificial intelligence (AI), machine learning, and high-resolution geospatial analytics, offer transformative potential to improve early warning systems and inform forecast-based financing (FbF) mechanisms. For instance, AI-based ensemble forecasting models may improve forecasts of cloudbursts and flash floods in mountainous terrain (Lal et al. 2023). These models can also help determine impact thresholds and danger levels, allowing authorities to define precise, locally relevant trigger points for anticipatory action (UNDRR 2022).

Further, integrating AI-driven satellite imagery with community-based vulnerability mapping enables the identification of exposure hotspots at granular scales. This hybrid approach, tested in parts of South Asia, ensures that scientific forecasts are contextualised with local knowledge, improving both accuracy and community trust (UNDRR 2022; Lal et al. 2023).

In Himachal Pradesh, such integration could empower VDMCs to activate locally predefined standard operating procedures (SOPs) based on AI-assisted forecasts, especially when supported by automated early warning systems and mobile-based alert dissemination. Nationally, India's investments in AI under the *Digital India* programme and the IMD's Doppler radar network provide a strong foundation for this evolution.

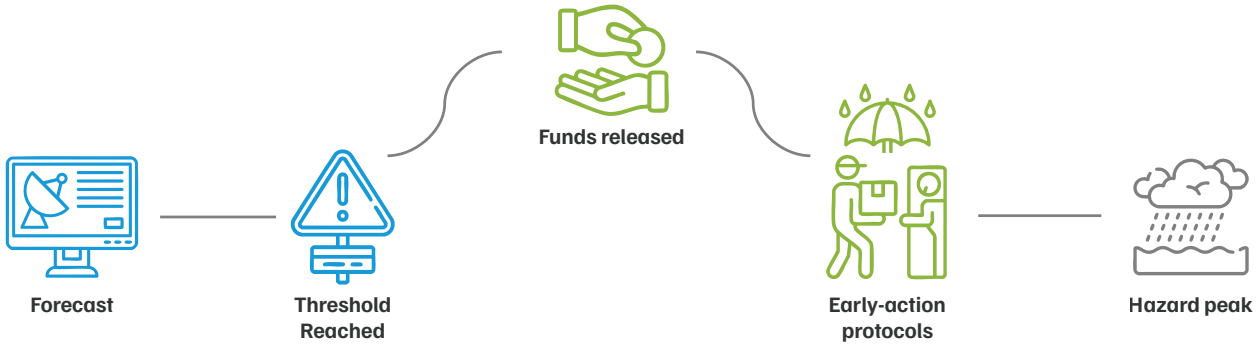
To fully realise this potential, institutional partnerships among meteorological agencies, AI research institutions, and state disaster authorities are essential. These must be coupled with training for local actors to interpret digital forecasts, ensuring inclusive and anticipatory climate risk governance.

5.5 Disaster management authorities must adopt forecast-based financing models to fund anticipatory adaptation actions

The increasing exposure of mountain communities to climate-induced disasters, such as cloudbursts, flash floods, and glacial lake outburst floods, demands a paradigm shift from response and relief to anticipation and preparedness. **Forecast-based financing (FbF)**[18] offers a scientifically grounded mechanism to operationalise this shift by enabling fund releases based on forecast thresholds for pre-emptive action. Recent instances of extreme climate events in Himachal Pradesh, particularly during the 2023 monsoon season, underscore the urgent need for FbF (WGR-NIDM and III 2023). If institutionalised, FbF mechanisms could support actions such as pre-emptive evacuation, stockpiling relief supplies, or clearing debris-prone routes, based on forecast triggers such as predicted rainfall intensity or river-level rise (Figure 17).

18 Forecast-based financing (FbF) is a proactive disaster risk management tool that funds pre-agreed anticipatory actions triggered by credible seasonal or weather forecasts, thereby reducing the scale of humanitarian needs before a hazard materialises. FbF complements traditional humanitarian responses by activating pre-positioned funds and implementing interventions, such as asset protection, cash transfers, or food support, during the forecast lead time, typically days to weeks ahead of the peak of a climatic disaster (Anticipation Hub 2024).

Figure 17. Forecast-based financing releases pre-agreed funds for early action before a hazard strikes



Source: Adapted from IFRC 2024.

A key element of FbF is agreeing in advance on the allocation of financial resources, along with the specific forecast threshold that triggers the release of those resources to implement early actions. The roles and responsibilities of all actors involved in implementing these actions are defined in an early action protocol (EAP). International pilots in Uganda, Togo, and Bangladesh demonstrate that FbF can enhance cost-effectiveness, reduce losses, and build local trust in early warning systems (IFRC 2017). In India, integration can begin with state disaster management plans and gram panchayat disaster management plans (GP-DMPs), following India's community-based disaster risk reduction (CBDRR) guidelines (NIDM 2024).

Institutionalising FbF will strengthen India's anticipatory adaptation potential, saving lives and reducing post-disaster recovery costs while advancing the goals of the *Sendai Framework* and the *National Disaster Management Plan*. However, interdepartmental coordination will be crucial to define forecast triggers for key climatic hazards, establish pre-agreed action protocols with state and local bodies, and allocate dedicated contingency funds accessible at the district and panchayat levels.

5.6 India should establish a national foresight cell within disaster governance systems

To effectively integrate foresight into governance, India should establish a dedicated foresight cell at the national level, particularly within key institutions such as the NDMA. This is especially important for disaster management and climate adaptation, given the increasing scale, frequency, and uncertainty of climate risks. Traditional disaster management approaches remain largely reactive, with action often taken only after damage has occurred, leading to higher human and economic losses. A foresight-based approach can help shift governance from reacting to disasters towards anticipating risks and acting early.

A foresight cell within government systems can support ministries and departments by scanning emerging risks, analysing future trends, and translating these insights into clear, actionable inputs for policies, plans, and budgets. Its role would be to bring together data, local knowledge, and expert insights to support scenario development and ensure that uncertainties are considered in long-term planning. The cell can also act as a coordination platform linking different ministries, research institutions, and state governments.

A dedicated foresight cell within NDMA can focus specifically on climate risks by identifying priority hazards, developing risk scenarios, identifying triggers, and aligning forecasts with predetermined early actions. The cell can work closely with agencies such as IMD to translate early warnings into early action. It can also support states and districts in applying foresight tools to preparedness planning, monitoring emerging risks, and strengthening future responses. Such institutional arrangements are not untested: several countries across the HKH region have already taken concrete steps to institutionalise anticipatory action and foresight within their governance systems.

Several neighbouring countries in the HKH region have already taken steps to institutionalise foresight and anticipatory action within their disaster governance systems. In Nepal, an anticipatory action clinic was established in October 2024 within the National Disaster Risk Reduction and Management Authority (NDRRMA) under the Ministry of Home Affairs. The clinic serves as a technical hub that coordinates government agencies, humanitarian organisations, development partners, and the private sector to foster innovation, exchange ideas, and advance anticipatory action. It also focuses on capacity-building through targeted training and is leading the development of Nepal's *National Anticipatory Action Framework and Roadmap,* helping embed proactive decision-making into national disaster policies (NRCS 2025; Anticipation Hub 2025).

In Bangladesh, anticipatory action has been formally integrated into national disaster governance through its inclusion in the *Standing Orders on Disaster* (SOD) in 2019. The Ministry of Disaster Management and Relief, along with the World Food Programme, has actively supported anticipatory action programming and published the *State of Anticipatory Action 2024* report, highlighting its transformative potential in disaster risk management. A Multi-stakeholder Anticipatory Action Technical Working Group (AA TWG), hosted by

the Bangladesh Red Crescent Society, coordinates efforts across agencies. In 2024 alone, anticipatory action programmes mobilised USD 10.4 million (INR 99.84 crore), supporting over 430,000 people across 20 districts through early financial assistance ahead of floods and cyclones. While funding and coverage challenges remain, Bangladesh demonstrates how anticipatory action can be operationalised at scale (UN 2025; ReliefWeb 2024).

Pakistan has adopted a structured, policy-driven approach. In 2024, Pakistan's National Disaster Management Authority (NDMA) released a *Comprehensive Guide on Anticipatory Action in Disaster Management*, outlining key aspects of anticipatory action and a plan of action to streamline efforts through multi-level collaboration. The document clearly defines anticipatory action, differentiates it from long-term adaptation, and outlines hazard-specific triggers, timelines, and responsibilities. The guide also emphasises close coordination between disaster authorities and the Pakistan Meteorological Department to translate forecasts into early action. Further strengthening this shift, the Sustainable Development Policy Institute (SDPI) is developing a *National Anticipatory Action Policy* to formalise and scale the approach across sectors and institutions (NDMA 2024; SDPI 2024).

In Bhutan, the Centre for Bhutan and GNH Studies (CBS) is planning to establish a foresight unit within government systems. This unit is expected to inform five-year plans, national policies, and sectoral strategies by embedding long-term thinking and future risks into development planning and facilitating a shift away from reactive responses.

These regional examples demonstrate that institutionalising foresight and anticipatory action is feasible when anchored within disaster governance systems. Drawing lessons from neighbouring HKH countries, India has an opportunity to establish a foresight cell within NDMA that can coordinate across ministries, build institutional capacity, and strengthen early decision-making. Such a step could enhance India's ability to manage climate risks and build long-term resilience.

6. Way forward

Mobilising for systems change





Community members from Gram Panchayat Sharchi, Kullu, brainstorming on CEEW's Gram Panchayat Climate Resilience Calendar.

The final stage of the strategic foresight approach, mobilising for systems change, focuses on translating analytical insights into institutionalised, scalable action. In Himachal Pradesh, this transition is already underway, with the state taking active steps to institutionalise community-based disaster risk reduction (CBDRR) by decentralising governance mechanisms (Chand and Gupta 2025). Building on this momentum, this study operationalises foresight-derived insights into actionable tools, institutional frameworks, and policy linkages that can enable anticipatory adaptation at the grassroots level.

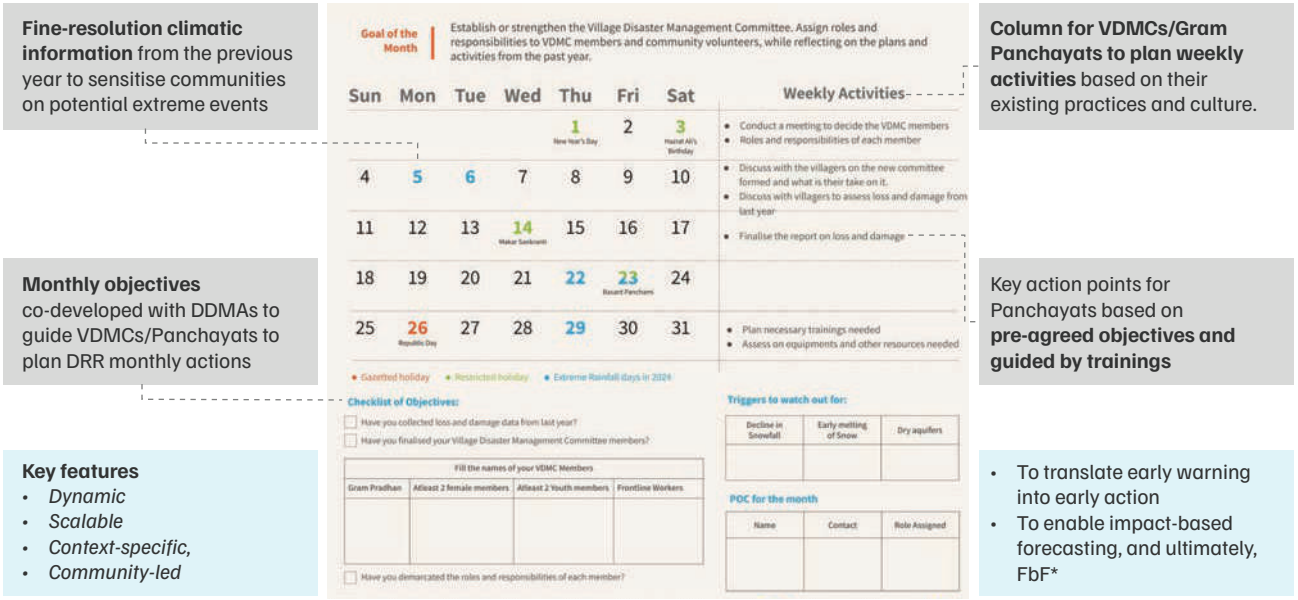
A key entry point for systems change is strengthening village disaster management committees (VDMCs), envisioned as the smallest unit for local preparedness and response. While the state is establishing panchayat emergency response centres (PERCs) (HPSDMA 2025), this study contributes by defining the ideal composition and institutional mechanism for these VDMCs (see Annexure A). Specifically, drawing on inputs from district disaster management authorities (DDMAs) and rural development departments, it outlines the roles of VDMCs across hazard types and disaster management phases: preparedness, response, recovery, and mitigation. It also proposes a functional institutional mechanism and coordination ppathways for VDMCs to interact with DDMAs and block development offices (BDOs) before, during, and after a climate-induced disaster.

Second, to institutionalise year-round activities by local disaster management actors, a hazard-wise, **year-round disaster preparedness checklist** was co-developed with district disaster management officials (see Annexure A). The checklist enables systematic tracking of community-level actions, aligning local preparedness efforts with broader disaster governance objectives. By embedding accountability and continuity into routine governance, the checklist addresses persistent gaps in last-mile implementation, particularly those arising from fragmented institutional coordination and limited technical capacity identified during the study.

Third, the study introduces the **Gram Panchayat Climate Resilience Calendar**, (Figure 18) a dynamic, community-led micro-planning tool designed to embed anticipatory action into everyday local governance (see Annexure A). The calendar is designed around three key features:

- It displays seasonal climate risk information alongside the community's agricultural and cultural calendar to sensitise communities to potential extreme climate events.
- It identifies a disaster preparedness goal for each month, along with monthly objectives aligned with the disaster preparedness checklist.
- It provides a designated space for the VDMC to map anticipatory adaptation actions against mutually agreed objectives. By aligning these actions with locally relevant practices and institutional priorities, the tool enables a shift from reactive disaster response to proactive risk management.

Figure 18. The calendar links seasonal climate risks to monthly preparedness actions for panchayats



Authors' illustration.

Importantly, the calendar is designed to scale and interoperate with existing planning instruments, particularly the GPDP. It also incorporates metrics to track community actions and proposes incentive mechanisms to sustain engagement. Its uptake by the HPSDMA, with plans for statewide dissemination, signals strong policy alignment and potential for institutional scaling.

At the policy level, these outputs are being embedded within the PERC scheme, launched in October 2025 to establish a structured, community-based framework for disaster preparedness, response, and recovery. As technical partners, the research team is supporting capacity-building efforts by developing training modules and strengthening the application of foresight tools among government officials. To date, over 60 officials have been directly trained, and an additional 40 stakeholders have been engaged through consultations, indicating early progress in mainstreaming anticipatory governance.

The study's broader contribution lies in demonstrating a gender-responsive, scalable framework for integrating futures thinking into decentralised planning. Grounded in consultations with over 200 community members across 12 gram panchayats and the identification of 25 anticipatory adaptation solutions with defined implementation pathways, it provides an evidence base for policy integration.

Looking ahead, planned collaboration with national agencies aims to develop model gram panchayats focused on hazard-specific risks, alongside exploring mechanisms such as forecast-based financing to bridge early warning and early action. Together, these efforts position Himachal Pradesh as a potential leader in institutionalising anticipatory adaptation within the IHR, demonstrating how foresight can catalyse systemic, bottom-up climate resilience.

Acronyms

AA TWG	Anticipatory Action Technical Working Group
ACWADAM	Advanced Center for Water Resources Development and Management
ADRA	Adventist Development and Relief Agency
AI	artificial intelligence
APMCs	agricultural produce market committees
ASHA	accredited social health activist
ATMA	Agricultural Technology Management Agency
BBMB	Bhakra Beas Management Board
BDC	block development committee
BDO	block development officer
CAFRI	Climate Adaptation and Finance in Rural India
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CBA	community-based adaptation
CBDRM	community-based disaster risk management
CBDRR	community-based disaster risk reduction
CBS	Centre for Bhutan and GNH Studies
CEDAR	Centre for Ecology, Development and Research
CEEW	Council on Energy, Environment and Water
CLDs	causal loop diagrams
CSOs	civil society organisations
CSR	corporate social responsibility
DCRs	development control regulations
DDMA	district disaster management authority
DDMP	district disaster management plan
DEST	Department of Environment, Science and Technology
DM	disaster management
DPR	detailed project report
DRR	disaster risk reduction
DST	Department of Science and Technology
EAP	early action protocol
ECCE	early childhood care and education
EWS	early warning system

FAO	Food and Agriculture Organization of the United Nations
FAR	floor area ratio
FbF	forecast-based financing
FC	Finance Commission
FLCRPs	financial literacy community resource persons
GDP	gross domestic product
GESI	gender equality and social inclusion
GIDM	Gujarat Institute of Disaster Management
GIS	geographic information system
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GNH	Gross National Happiness
GoHP	Government of Himachal Pradesh
GP	gram panchayat
GP-DMP	gram panchayat disaster management plan
GPDP	gram panchayat development plan
HIMCOSTE	Himachal Pradesh Council for Science, Technology and Environment
HKH	Hindu Kush Himalaya
HPCCC	Himachal Pradesh State Centre on Climate Change
HPFD	Himachal Pradesh Forest Department
HPMC	Himachal Pradesh Horticultural Produce Marketing and Processing Corporation
HPPWD	Himachal Pradesh Public Works Department
HP-READY	Himachal Pradesh Resilient Action for Development and Disaster Recovery
HPRIDCL	Himachal Pradesh Road and Other Infrastructure Development Corporation Limited
HPROW-23	*Himachal Pradesh Right of Way Policy, 2023*
HPSAMB	Himachal Pradesh State Agricultural Marketing Board
HPSDMA	Himachal Pradesh State Disaster Management Authority
HPSEBL	Himachal Pradesh State Electricity Board Limited
HPSRTP	Himachal Pradesh State Roads Transformation Project
HRVA	hazard, risk, and vulnerability assessment
IbF	impact-based forecast
ICAR	Indian Council of Agricultural Research
ICIMOD	International Centre for Integrated Mountain Development
IDP	Integrated Development Project for Source Sustainability
IFS	integrated farming system
IHR	Indian Himalayan Region

IIHS	Indian Institute for Human Settlements
IMD	India Meteorological Department
IPCC	Intergovernmental Panel on Climate Change
IPH	Irrigation and Public Health
IPH-IDP	Irrigation and Public Health Integrated Development Project
IWRM	integrated water resources management
JICA	Japan International Cooperation Agency
JJM	*Jal Jeevan Mission*
KILA	Kerala Institute of Local Administration
KVKs	Krishi Vigyan Kendras
MGNREGA	*Mahatma Gandhi National Rural Employment Guarantee Act*
MGNREGS	*Mahatma Gandhi National Rural Employment Guarantee Scheme*
MoU	memorandum of understanding
MSP	minimum support price
NABARD	National Bank for Agriculture and Rural Development
NCC	National Cadet Corps
NCR	National Capital Region
NDMA	National Disaster Management Authority
NDRF	National Disaster Response Force
NDRRMA	National Disaster Risk Reduction and Management Authority
NGOs	non-governmental organisations
NHPC	NHPC Limited (formerly National Hydroelectric Power Corporation)
NIDM	National Institute of Disaster Management
NOC	no-objection certificate
NRLM	*National Rural Livelihoods Mission*
NRSC	National Remote Sensing Centre
NSS	National Service Scheme
NTFP	non-timber forest produce
ODA	official development assistance
PDNA	post-disaster needs assessment
PERC	panchayat emergency response centre
PGWM	participatory groundwater management
PIHPFEM&L	Himachal Pradesh Forest Ecosystems Management and Livelihoods Improvement Project
PK3Y	Rajiv Gandhi Prakritik Kheti Khushhal Kisan Yojana
PMAY	Pradhan Mantri Awas Yojana
PMGSY	Pradhan Mantri Gram Sadak Yojana
PMKSY	*Pradhan Mantri Krishi Sinchayee Yojana*
PPP	public–private partnership
PRIs	panchayati raj institutions
PSI	People's Science Institute
PWD	Public Works Department

RAFTAAR	*Rashtriya Krishi Vikas Yojana – Remunerative Approaches for Agriculture and Allied Sector Rejuvenation*
RKVY	*Rashtriya Krishi Vikas Yojana*
RWH	rainwater harvesting
SAHARA	Society for Scientific Advancement of Hilly and Rural Areas
SAPCC	state action plan on climate change
SDMA	state disaster management authority
SDMF	State Disaster Mitigation Fund
SDPI	Sustainable Development Policy Institute
SDRF	State Disaster Response Fund
SHGs	self-help groups
SIRD and PR	State Institute for Rural Development and Panchayati Raj
SOD	*Standing Orders on Disaster*
SOP	standard operating procedure
SPNF	Subhash Palekar Natural Farming
TCP	town and country planning
UNDRR	United Nations Office for Disaster Risk Reduction
UNESCO	United Nations Educational, Scientific and Cultural Organization
UT	union territory
VB-G RAM G	*Viksit Bharat – Guarantee for Rozgar and Ajeevika Mission (Gramin)*
VDMC	village disaster management committee
VDMP	village disaster management plan
VO	village organisation
ZBNF	Zero Budget Natural Farming

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SELECT POLICY ENGAGEMENTS

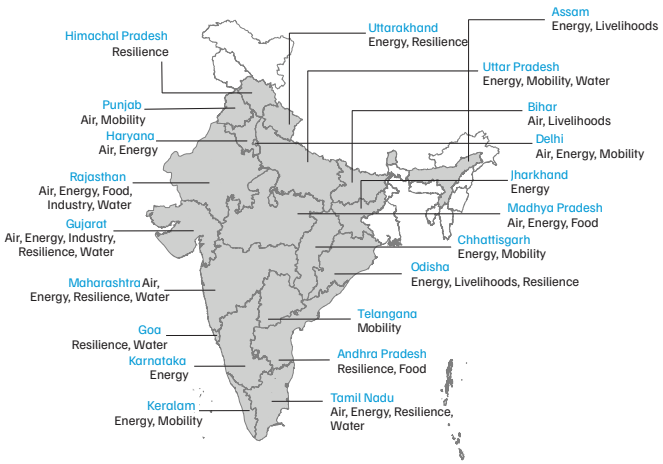
NATIONAL/INTERNATIONAL

2011 | National Water Resources Framework
2014 | 175 GW renewables target
2015 | International Solar Alliance
2016 | PM *Ujjwala Yojana*
2017 | *Saubhagya Scheme*
2019 | *India Cooling Action Plan*
2021 | Net Zero by 2070
2022 | *Mission LiFE*
2022 | *National Bioenergy Programme*
2022 | E-waste (Management) Rules
2023 | G20 Green Development Pact
2023 | *National Green Hydrogen Mission*
2024 | Green Steel Taxonomy
2024 | *PM Surya Ghar Yojana*
2025 | *National Critical Mineral Mission*
2025 | Rajya Sabha Guidelines on Crop Residue Burning
2025 | India's Carbon Credit Trading Scheme (CCTS)
2025 | IFSCA's Framework for Transition Bonds
2026 | Disaster Risk Index for 16th Finance Commission
2026 | India's NDC 3.0
2026 | India's Scenarios towards Viksit Bharat and Net Zero

STATE

2022 | *Rajasthan Organic Farming Mission*
2022 | *Jharkhand State Solar Policy*
2022 | *Uttar Pradesh Vidyut Sakhi programme*
2023 | *Rajasthan Renewable Energy Policy and Green Hydrogen Policy, 2023*
2023 | *Uttarakhand Solar Policy*
2025 | Green Odisha Initiative
2025 | *Maharashtra Climate Action Plan 2.0*
2025 | *Delhi Clean Air Action Plan*
2026 | *Delhi EV Policy 2.0*
2026 | Bihar Promotion of New and Renewable Energy Sources
2026 | Gujarat Integrated Renewable Energy Policy and Green Hydrogen Policy
2026 | *Uttarakhand Mukhyamantri Saur Swarojgar Yojana*
2024-26 |
Directives of Commission on Air Quality Management
Net Zero Roadmaps (BH, GJ, TN, UK)
Agroforestry Roadmaps (AS, MH, OD)
140+ Heat Action Plans (GJ, MH, OD, TN)
Treated Used Water Reuse Plans (MH, UP)
Flood Risk Mitigation Plans (GJ, MH)

21 STATES SUPPORTED



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