CAPACITY BUILDING STRATEGIES FOR MANAGING COMPLEX DISASTERS IN THE FACE OF CLIMATE CHANGE

ANNUAL REPORT 2018-2019

Indian Institute of Public Administration, New Delhi

Photograph: © SEEDS/ Siddharth Behl

Project Sponsor by

सत्यमेव जयते

NMHS, MoEF&CC

Project Lead

Indian Institute of Public Administration

Project Partner

SEEDS INDIA

SEEDS Technical Services

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Section I

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Acknowledgement

The project entitled "Capacity Building Strategies for managing Complex Disasters in the face of Climate Change" sponsored by National Mission on Himalayan Studies, Ministry of Environment, Forest and Climate Change, Government of India completed its second year successfully owing to the support and help of many hands.

We would like to express our deepest gratitude towards National Mission on Himalayan Studies, Ministry of Environment, Forest and Climate Change, Government of India for entrusting us for an exclusive and worthy project and simultaneously guiding and supporting us throughout the year.

Our deepest thanks to Dr. T. Chatterjee, Former Director IIPA; Prof. C. K. Varshney, Former Dean, JNU; Shri Kamal Kishore, NDMA and Dr. Manu Gupta, Director, SEEDS; for accepting our request to be part of the Project Advisory Committee and steering the activities all through the study. We are thankful to National Data Supply of Metrological Data, IMD Pune for providing assistance on time.

We are extremely grateful to Dr. T. Chatterjee, Former Director Indian Institute of Public Administration, New Delhi for his inimitable guidance which stirred the pace of the project. Our sincere thanks to Mr. Amitabh Ranjan, Registrar, IIPA for helping us arrange the logistics for the project activities in the difficult terrains of Sikkim.

We convey our sincere gratitude, to Shri Tsegyal Tashi, State Relief Commissioner cum Secretary, Land Revenue and Disaster Management Deartment, Sikkim; Shri Ringzing Chewang, Special Secretary, Land Revenue and Disaster Management Deartment, Sikkim and Shri G. C. Khanal, Additional Director, Land Revenue and Disaster Management Deartment, Sikkim for coordination for trainings and *Maghey Mela* participation in Sikkim. Our thanks, also to Mr. Data Ram Pandey, Sarpanch, Luing Perbing and Mr. Gyalbo Lepcha, Sarpanch, Poklok Denchung for providing their untiring support for Capacity Building Workshop in the districts of East and South Sikkim. Special thanks to Imran Khan for field photgraphy and our project field officer, Mrs. Ongmula Bhutia who contributed for the field

data collection by covering difficult terrains of various gram panchayats for community risk register.

We are thankful to the Administration Department, Finance and Accounts Department, Photocopy department and staff of Computer Centre for providing the necessary facilitites and investing their time and efforts as and when required. Last but not the least, we would like to thank Ms. Rini Reejonia, Research officer, IIPA and Mr. Sunny Kumar, Planning lead, SEEDS Technical Services, Delhi for their support and assistance in completing the second year of this project. We are indebted to Black Panther Advertising Ltd. for all their support in printing and designing.

Our acknowledgement would be incomplete if we fail to mention the contribution of the people of Sikkim for participating and engaging in the project with extreme enthusiasm.

Prof. Vinod K. Sharma Dr. Shyamli Singh Dr. Anshu Sharma

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Executive Summary

Sikkim is a small state that lies in the North eastern Himalayas with sharply defined and extremely steep slopes. The state has a long history of meteorological and hydrological disasters which has affected the state. The state witnesses high rainfall, extreme weather events, natural calamity and winter droughts to name a few. The geography, climate and elevation with haphazard development and urbanization make the State vulnerable to the multiple risks and hazards.

IIPA in collaboration with SEEDS Technical Services is implementing a project on "Capacity Building Strategies for managing Complex Disasters in the face of Climate Change". The goal is to design safe and sustainable capacity building strategies in ecologically fragile Himalayas in the face of climate change. It also aims to capacitate the different stakeholders ranging from schools, local Panchayats and the various line departments in the state to develop strategies reflecting potential plans for Complex Disaster management, implementation of Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). As Climate has a huge influence on complex disasters, analysis of climatic parameters and establishing their linkages with disasters was conducted. For this, climate data was collected mainly from IMD, Pune besides other local and regional research centres. Various climatic parameters such as mean maximum temperature, mean minimum temperature, total rainfall in a month, number of rainy days, wind speed etc. were analysed to study climatic variations . The trends which reflect the potential risks in the future would also be analysed.

The annual report is divided into two parts. The first section contains a chapterised introduction on Climate Change and Complex Disasters in the context of Sikkim Himalaya and an overview of the study state. Chapters follow with project objectives including developing, designing and identifying suitable mode of sustainable development in the face of Climate Change threat. The methodology includes both primary and secondary data collection for the research base. The activities, approaches and outcomes have then been mapped accordingly. The annual report also elaborates on the timeline, the project execution and implementation is depicted through a Gantt chart. The annual deliverables and outcomes are in the form of training of state department officials, state level workshops, and

community fairs, awareness generation of local Panchayats, students and handholding with others related stakeholders.

The second section contains chapters on strategic framework development, the assessment on the community risk registers and the digital story maps to track the CRR. A pilot model school risk register is started as an initial outline for school safety. A chapter on the pilot project "Climate School" is described in the report. The school selected for this pilot project is the Govt. Junior High School, Upper Syari, Deorali, Gangtok. The school is located in the main city and has proximity to amenities.

The deliverables for the second year consisted of imparting our findings and involvement of government official and PRI members and local people in the state. This has been achieved by the state level workshop conducted in May, the one day seminar on disaster risk reduction in September and the two local level trainings conducted in the East and South districts of Sikkim in the month of October. The dissemination of knowledge among locals at large scale is efficiently done in the *Maghey Mela* in the month of January, 2019. Besides this the project also published papers on the research work done under the project and new innovative ways to track the community risk registers filled by the locals as a part of the project's key policy interventions required for redesigning development for a sustainable future.

1. Project Information

Project ID:	NMHS/2016-17/MG11/04	**Sanction Date:**	28.05.2018

Project Title:	Capacity Building Strategies for Managing Complex Disasters in the face of Climate Change
BTG:	Awareness and Capacity Building Environmental Assessment and Management

PI and Affiliation (Institution):	Dr. Shyamli Singh Indian Institute of Public Administration (IIPA), I P Estate, New Delhi
Name & Address of the Co-PI, if any:	Prof. Vinod K. Sharma Indian institute of Public Administration I P Estate, New Delhi

Structured Abstract - detailing the current year progress [Word Limit 250 words]:	As per mandate, Regional Seminar, State Seminar, Training Workshops, and Community Fair were organized under the project. The regional workshop titled "Mainstreaming Climate change in disaster risk with respect to GLOFs and Forest fires" was a two day event organized at Gangtok, Sikkim with focus on GLOFs and Forest fires. The state seminar titled "Change in Disaster Risk: State Disaster Risk Reduction Day" was organized on 19th September, 2018 with focus on Risk Reduction. Two trainings titled "Capacity Building Programme" were conducted in the state with focus on the local community. Capacity Building programme was conducted in the East and South districts of the state on 29th and 30th October respectively. The GPU selected in the East district was Luing-Perbing GPU and South district was Poklok-Denchung GPU. The programme also focused on high school students along with the local rural folk. The second part of the project focused on the ongoing community connects at local level and complex disaster risk

	research work. 57 community risk registers were completed (East and South district). School Risk assessment was done for an identified school in Gangtok as an initial SRR exercise. As a pilot project a "Climate School" was established in a school in Syari, Gangtok. The aim of this initiative is to generate/ sensitize the school children about the effects of climatic parameters and to instil a curiosity in the young minds to know about the various facets of climate science. The research conducted includes two papers written under the project titled "Water Resource management in Hill settlements: Case study of Soreng, Sikkim" which deals with water crisis during winter season and impact on agriculture, and "Case study of Rangpo in the eastern region of the Himalayan" dealing with flood risk of the region.

Project Partner Name	Affiliations	Role & Responsibilities
Partner 1	Indian Institute of Public Administration (IIPA)	• Leading the project and coordinating all project activities. • Engagement, assessments and capacity building of policy level institutions • Project management monitoring and reporting.
Partner 2	SEEDS Technical Services Pvt. Ltd. (STS)	• Providing input to detailed project design • Data collection, field research and analysis • Implementation of field activities including pilot projects and capacity building at community level. Detailed documentation of these activities

2. Project Site Details

Project Site	Sikkim- all 4 districts
IHR States Covered	Sikkim
Long. & Lat.	27.5330° N, 88.5122° E
Site Maps	Annexed in page no. 6
Site Photographs	Attached in report with each section

3. Project Activities Chart w.r.t. Timeframe [Gantt or PERT]

PROJECT ACTIVITIES	WORK UNDERTAKEN				OUTPUT
	Year 2018-19				
	Qt 1	Qtr 2	Qtr 3	Qtr 4	
Project Activity 1	Regional workshop		Ground truthing and research		Develop clear understanding of hazards, vulnerabilities and capacities to cope with complex disasters in the current development patterns in face of climate change
Project Activity 2		State seminar			
Project Activity 3			Capacity Building programme, East Sikkim		
Project Activity 4			Capacity Building programme, South Sikkim		
Project Activity 5	Establishing Climate School				Awareness generation among school students
Project Activity 6				*Maghey Mela*	Disseminating and mainstreaming sustainable development practices with

					local communities and policy level stakeholders
Project Activity 7	CRRs East Sikkim	CRRs East Sikkim	CRRs South Sikkim	CRRs South Sikkim	Formulate and test developmental strategies with key local stakeholders to cope with complex disasters for a sustainable future
Project Activity 8			SRR East	SRR Reporting	
Project Activity 9	ESRI story maps- North				
Project Activity 10	Research work	Research work	Research work	Research work	Develop clear understanding to cope with complex disasters
Project Activity 11				Project Advisory and project Evaluation	

4. Financial and Resource Information

Total Grant:	Rs. 25,43,935/-	Grant Received Date:	28.05.2018

Project Partner	Affiliations/ Institution	Budget Allocated to	Work Done
Partner 1	Indian Institute of Public Administration (IIPA)	Rs. 25,43,935/-	• Training of State govt. officials • Conducted State level Seminar at Sikkim • Strategic framework development for disaster preparedness • Training of PRI members and local resident of East Sikkim • Training of PRI members

			and local resident of South Sikkim • *Maghey Mela* activities- GLOF Model, Disaster awareness game for children. • CRR Soreng GPU • Developing GIS data base • Developing CRR on digital platform
Partner 2	SEEDS Technical Services Pvt. Ltd. (STS)	Rs. 8,00,000/- (Deducted from budget allotted to Partner 1 i.e. IIPA)	• Establishing Climate School • School Risk Register • *Maghey Mela* activities- shake table and emergency kit demonstration • CRR Soreng GPU • CRR Poklok Denchung

Project Staff Information:

S. No.	Name	Qualification	Designation	Fellowship/ Wages paid	Remarks
1.	Rini Reejonia	M.Plan, B. Arch	Research Officer	Rs. 29,000/-	-
2.	Ongmula Bhutia	M Sc.	Field Officer	Rs. 15,000/-	-

5. Project Beneficiary Groups

Beneficiary Groups [Capacity Building]	**Target**	**Achieved**
No. of Beneficiaries with income generation:	Community focused targets- 120	136
No. of stakeholders trained, particularly women:	40	40
No. of capacity building Workshops/ trainings:	6	4
No. of Awareness & outreach programmes:	1 (community fair/ *Maghey Mela*)	1
No. of Research/ Manpower developed:	2 research papers	2

6. Project Progress Summary (as applicable to the project)

Description	Total (Numeric)	Description
IHR States Covered	1	• Attached in report
Project Site/ Field Stations Developed:	*Attached*	• Attached in report
No. of Patents filed (Description):	N/A	-
Article/Review/Research Paper/ Publication:	2	• Annexure- WMR- Soreng • Annexure- Flood Risk- Rangpo
New Methods/ Modellings Developed (description in 250 words):	1	• Annexure- Climate school
No. of Trainings (No. of Beneficiaries):	136 participants	• Annexure- CBP east and south
Workshop:	256 participants	• Annexure- State workshops
Demonstration Models (Site):		• Attached in report
Livelihood Options:	*N/A*	-
Training Manuals:	*Scheduled for subsequent year*	-
Species Collection:	*N/A*	-
Species identified:	*N/A*	-
Database:	8	• Temperature data • Rainfall data • Climate school data
Images:	All events	• Attached with event description
GIS Maps:	5	• ESRI maps- North • Census assessment • Rangpo town elevation map

7. Project Linkages (with nearby Institutions/ State Agencies)

S. No.	Institute/ Organization	Type of Linkages	Brief Description
1	IMD	Research	IMD is an agency of the Ministry of Earth Sciences from where climate related data has been collected for analyzing the trend in different climatic factors influencing climate change.
2	SSDMA	Capacity Building	Sikkim State Disaster Management Authority (SSDMA) is a part of State Government and is a nodal institution for planning, co-ordination and monitoring for disaster prevention, mitigation, preparedness and management. SSDMA lays down policies on disaster management

			for the state. Co-ordination for local officials is facilitated by SSDMA for capacity building programmes.
3	ENVIS Sikkim	Research	Established in 1982 Environmental Information System (ENVIS) is a planned programme with focus on providing environmental information to decision makers, policy planners, scientists and engineers, research workers, etc. Data from ENVIS is collected for further research work.
4	UNDP	Capacity Building	UNDP has worked in India in almost all areas of human development from democratic governance to sustainable energy and environmental management by aligning their programmes with national priorities.
5	NDMA	Academic	NDMA, is an agency of the Ministry of Home Affairs whose primary purpose is to coordinate response to natural or man-made disasters and for capacity-building in disaster resiliency and crisis response. Members from NDMA are included in the Project advisory committee.
6	FRI	Academic	FRI is an institute of the Indian Council of Forestry Research and Education and is a premier institution in the field of forestry research in India. FRI is an important member of the project advisory committee.
7	DST	Research	DST in Sikkim has been created for Research and Development in various indentified areas relevant to the state, generation of scientific awareness and also for transfer of appropriate technologies. Sikkim related data has been collected for data analysis and further research.

8. Additional (publication, recommendations, etc.)

Time Period	**Publications** (Research Papers, Information Material, Policy drafts, Patents, etc.)
Annual [Year 2018-19]	Water Resource management in Hill settlements: Case study of Soreng, Sikkim

9. Project Concluding Remark

Project Objectives	**Project Output against each objective**	**Progress made against Monitoring Indicators (specifiedinSanctionLetter)**
Develop clear **understanding of hazards, vulnerabilities** and **capacities to cope** with *complex disasters* in the current development patterns in face of climate change	1. Secondary data collation 2. Formulation of Advisory Committee	1. Data collected from – IMD, ENVIS Sikkim, UNDP, NDMA, SSDMA 2. GIS mapping of collected data and tracking of CRRs
Formulate and test **developmental strategies** with **key local stakeholders** to cope with complex disasters for a sustainable future	1. State workshop on mainstreaming Climate Change in Disaster Risk: 8th and 9th May 2018 2. State level workshop: State Disaster Risk Reduction Day 19th September 2018 3. Capacity Building Training workshop, Luing Perbing, East Sikkim 4. Capacity Building Training workshop, Poklok Denchung, South Sikkim	4 training/ workshops/ seminars 1. Awareness generation of PRI members 2. Awareness generation of school students 3. Awareness generation of local govt. officials
Identify key **policy interventions** required for redesigning development for a sustainable future	1. 57 CRRs completed. (1 CRR for 1 ward) 2. Risk Assessment of Govt. Junior High School, Upper Syari, Deorali, Gangtok . 3. Establishment of Climate School in Govt. Junior High School, Upper Syari, Deorali, Gangtok.	1. CRR completed for 57 wards – 8 GPUs in East and South Sikkim 2. School risk register filled for one school
Disseminating and mainstreaming sustainable **development practices** with local communities and policy level stakeholders	1. *Maghey Mela* 14th -15th January 2019 Papers: • Case study of Rangpo in	2 Research papers and 1 community fair organized

	the eastern region of the Himalayan • Water Management- Soreng, West Sikkim Reports: • Filling of CRRs – North Sikkim • Filling of CRRs – South Sikkim • Capacity Building Training Workshop – East and South Sikkim • *Maghey Mela*, 2019- Jorethang	

Methodology (in brief):	The research methodology adopted is both qualitative and quantitative in nature and depends on both primary and secondary sources of data. Besides the research there is a substantial element of outreach covering local communities, duty bearers, policy decision makers, researchers, and civil society organizations. Exhaustive primary data is being collected through questionnaires, surveys, prepared especially for Government officials, teachers, general masses and the like. Panel discussions and brainstorming sessions with people directly helps in evolving better strategies suited to local traditional practice and adaptability. Secondary data is being collected from different organizations, host ministries and institutions. From all the available literature and assessment of secondary data, the knowledge base for the research is being developed. The data thus analysed is an output a Comprehensive Community Risk Registers for the region. Pilot projects were designed through Participatory Appraisals (PA) and tested in the state. Such pilot projects includes setting up of Climate schools and also linking with various sector

	players like in tourism and farming for effective impact. Exhaustive desktop review and secondary data assessment helps to develop strategies for different impact scenarios.
Major Research Achievements:	• Bagged first place in *Maghey Mela*-2018 as "best stall" • Pilot project "Climate School" to be featured in All India Radio Science watch programme.
Brief Conclusion - the current year progress – during the reporting period (point-wise):	• Training of state government officials • 2 State seminars • 1 Research paper published • 1 Research paper submitted • CRR covered in 57 wards and 8 GPUs • Pilot SRR completed • Data collected from IMD Pune, ENVIS Sikkim, DST
Progress Achieved (%):	100%
Remaining work to be done:	• Completed all mandated activities

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Abbreviations

AIBP	Accelerated Irrigation Beneficiary Programme
ATREE	Ashoka Trust for Research in Ecology and the Environment
AWS	Automatic Weather Station
AHLFVSD	Animal Husbandry, Livestock, Fisheries and Veterinary Services Department
BAC	Block Administrative Centre
CCA	Climate Change Adaptation
CRR	Community Risk Register
DRR	Disaster Risk Reduction
DMMC	Disaster Mitigation and Management Center
DST	Department of Science and Technology
EDC	Eco Development Committee
ENVIS	Environmental Information System
EWS	Early Warning System
FEWMD	Forest Environment and Wildlife Management Department
FSI	Forest Survey of India
FMP	Flood Management Programme
GHGs	Greenhouse Gases
GLOFs	Glacial Lake Outburst Floods
GPU	Gram Panchayat Unit
GBPNIHESD	G.B. Pant National Institute of Himalayan Environment & Sustainable Development
HDPE	High-density polyethylene
HWC	Human-Wildlife Conflict
IBSD	Institute of Bioresources & Sustainable development
ICIMOD	International Centre for Integrated Mountain Development
IHR	Indian Himalayan Region
IIPA	Indian Institute of Public Administration
IMD	Indian Meteorological Department

IWMP	Integrated Watershed Management Programme
IPCC	Intergovernmental Panel on Climate Change
JFMC	Joint Forest Management Committee
KLCDI	Kangchenjunga Landscape Conservation and Development Initiative
MHA	Ministry of Home Affairs
MoEF&CC	Ministry of Environment, Forest and Climate Change
MoWR	Ministry of Water Resources
NDMA	National Disaster Management Authority
NRSC	National Remote Sensing Centre
NSSP	National School Safety Programme
PA	Participatory Appraisal
PAC	Project Advisory Committee
PCCF	Principal Chief Conservator Forest
PHE	Public health engineering
PI	Project Investigator
PRIs	*Panchayati* Raj Institutions
R&D	Research and Development
RRR	Rejuvenation, Restoration and Repair
RMDD	Rural Management & Development Department
SRR	School Risk Register
SSDMA	Sikkim State Disaster Management Authority
STS	Seeds Technical Services
SU	Sikkim University
UN	United Nations
UNDP	United Nations Development Programme
UNISDR	United Nations International Strategy for Disaster Reduction
UNICEF	United Nations International Children's Emergency Fund.
WUGs	Water User Groups
WWF	World Wildlife Fund

1. Implementing partners

1.1 Project Lead: Indian Institute of Public Administration (IIPA)

The Indian Institute of Public Administration (IIPA) was established by Pandit Jawaharlal Nehru on March 29, 1954. He placed a great responsibility on the IIPA to enhance the frontiers of knowledge in public policy and governance through applied research and education as well as training of administrators to serve the people of India. It's faculty is involved with research work mainly to simplify procedures and suggest policy changes to ensure improved delivery of public services.

The Institute nurtures close academic association with universities, research centres, training institutions and governmental departments. IIPA houses a full- fledged Centre for Environment, Climate Change and Drought Administration and has the expertise to conduct capacity building programs related to Climate Change and other environmental phenomenon. IIPA connects with a range of clientele of different ministries including MoWR, River Development & Ganga Rejuvenation, MHA, MoEF& CC, DST, and NDMA besides World Bank, UN, UNDP, UNICEF and other international agencies.The major activities of the Institute are: Training, research, advisory and consultancy services, information dissemination and exchange.

1.2 Project Partner: SEEDS Technical Services (STS)

SEEDS Technical Services is a professional organisation that seeks to protect the lives and livelihoods of people exposed to natural disasters and living in disaster prone areas by providing technical services to governments, non-profit organisations, corporate agencies and communities. It is an affiliate of the non-profit organisation SEEDS that primarily engages in shelter reconstruction and adopts locally based approaches to reduce the impact of future disasters on communities at risk.

SEEDS Technical Services with its small team of committed individuals has reached out to families affected by earthquakes, floods and cyclones; restored schools and homes; and has invariably put its faith in education to build long term resilience. It continues to advocate for and involve with communities across Asia to ensure a safer and sustainable world.

IIPA and **SEEDS Technical Services** have been working in the state of Sikkim on issues of disaster management and climate change over the past few years. Number of studies and outputs have been compiled and assessed for identifying and planning the project and framing objectives and methodologies. These includes training needs assessment, strategic plans on rivers, school safety programmes, community risk reduction plans etc.

2. Background

Climate change is a change in the distribution of weather patterns when that change lasts for an extended period of time (i.e., decades to millions of years). Climate change may refer to a change in average weather conditions, or in the time variation of weather within the context of longer-term average conditions. Climate change is caused by factors such as biotic processes, variations in solar radiation received by Earth, plate tectonics, and volcanic eruptions**.** Certain human activities have been identified as primary causes of ongoing climate change, often referred to as global warming.

There is no general agreement in scientific, media or policy documents as to the precise term to be used to refer to anthropogenic forced change; either "global warming" or "climate change" may be used. Climate change was incorporated in the title of the Intergovernmental Panel on Climate Change (IPCC) and the UN Framework Convention on Climate Change (UNFCCC). The most general definition of climate change is a change in the statistical properties of the climate system when considered over long periods of time, regardless of the cause. Accordingly, fluctuations over periods shorter than a few decades, such as El Niño, do not represent climate change.

Complex disasters can be identified as human impacts and human induced disasters rather than physical triggers as there is no single root cause besides there are many causes which are difficult to measure. Both man-made and natural hazards have increased over the past decades. One type of hazard triggers or spawns a secondary disaster which in turn triggers another disaster and thus enhancing the cascading overall impact. For example, **an earthquake can induce landslide, drought may led to subsidence and soil acidification, which in turn lead to migration and complex disasters become more evident than single-point events**. As very few studies have looked into the various dimensions of Complex disasters; an assessment is required from both secondary and primary data regarding when extreme events are expected to occur in the face of climate change.

In recent disasters of the Himalayas, damages occurred due to multiple factors and responding to a single factor was not sufficient for early warning, effective response and recovery. Kedarnath disaster of Uttarakhand in 2013, Nepal earthquake in 2015 etc. were disasters of the complex kind. This study aims to assess the nature, vulnerability and capacity building of communities to cope with complex disasters in the face of climate change. Climate Change vulnerability of India ranks high at the global level. Although within India, Sikkim

state shows high resilience as compared to other states (Tambe et al. 2011), many vulnerabilities and risks are deeply ingrained in the existing nature of development, haphazard urbanization and industrialization even in Sikkim

Sikkim is located in eastern Himalayan ranges of India and shares international boundary with China, Bhutan and Nepal. It is geographically a small state and constitutes merely 0.22 per cent of the total geographical area of India and total population of 6, 07,688 as per census of 2011 (Barua et. al 2012). Due to its topography and geographical location, it is vulnerable to earthquakes, landslides, forest fire; glacial lake outburst floods (GLOFs) and biodiversity degradation. With climate change, the impacts are more pronounced.

The Indian Himalayan Region has 7000 glaciers covering 8000 sq. km area. Sikkim is a very small Himalayan state having three main glaciers, Rathong, Zemu and Lhonak glaciers. Glacial lake outburst floods (GLOFs) are another major Complex disaster posing a threat to all Himalayan States. With the impact of Climate Change, there are possibilities of increasing volumes of glacial lakes from retreating/melting glaciers. The International Centre for Integrated Mountain Development (ICIMOD) provides a first level assessment of Glaciers in the Indian Himalayan region which shows 266 glacial lakes in Sikkim Himalaya. The Normalized difference water index shows 320 (Govinda Raj et al. 2013) glacial lakes. Recently the volume of Lhonak Lake has increased substantially. Government of Sikkim siphoned the water to mitigate the possibility of GLOF from Lhonak Lake. Department of Science and Technology, Sikkim is taking assistance from National Remote Sensing Agency (NRSA)/Indian Space Research Organization (ISRO) and other national organization to monitor each glacier and glacial lake, which may create Complex disasters. As Sikkim falls in Zone IV and V of Indian Seismic zone making it earthquake prone, this may further enhance the chances of GLOFs formation.

This study would also aim to review and identify modes of developments that suit the local environments for a sustainable future. The project site has been selected based on the vulnerability potential of the landscape.

2.1 SIKKIM: Study State

This project is based on the Himalayas with particular focus on developmental strategies to cope with increasing occurrence of complex disasters related to Climate Change.

The Himalaya is considered as the youngest mountain chain on earth and is tectonically and seismically active because of the convergence of two continental plates, i.e. the Eurasian plate from the North and Indo-Australian plate from the south. The glaciers of Himalayas cover about three million hectares or 17% of the mountain area, and are the source of water to the innumerable rivers in the Indo-Gangetic plains which is a home to over 500 million people (Parry et al. 2007).

According to Intergovernmental Panel on Climate Change (IPCC) projection the average annual mean warming of the Asian land mass will be about 3°C by the 2050 and about 5°C in the 2080 (Parry et al. 2007). Himalaya, being the youngest mountain chain and active geological conditions poses multiple threat like earthquake, earthquake induced landslides, snow avalanches, melting and thinning of glaciers over the last 50 years which again is posing a risk as glacial lake outburst flood (GLOF) (Kumar and Prabhu, 2011) to the downstream and lowland area and forest fires which have become recurring phenomenon are common threat as well as long dry winters in Sikkim (Sharma, Joshi, & Chhetri, 2014). Erratic rainfall is widespread in the area causing loss to human lives and infrastructure. Rising temperature may shift the crop seasons and affect food security of the communities thriving in the mountain terrain. Drying up of natural spring has been observed in the hills of Sikkim which adversely affect water security during the dry seasons (Rahman et al. 2012). Climate related intensity and frequencies of such hazards is increasing manifold in the Himalayas and related disasters are likely to happen. The developing countries in general and poor communities in particular are more vulnerable to such extremes because of the geographic location, poor state of adaptation and scarce resources.

Sikkim is very vulnerable to natural calamities because of its geographic location as it is located on a thrust boundary between two continents. It also falls under the Seismic Zone IV and V and records one of the highest annual rainfalls in the country. Every year a number of people, land, road connectivity and infrastructure are affected by natural disasters among which

landslides, floods, snowmelts, river bank erosion, unreliable connectivity and forest fires and long dry spells in winter are the most prominent.

The Himalayan glaciers in general and the Teesta basin in particular have made Sikkim a disaster prone region in the eastern Himalaya. Sikkim is surrounded by potentially dangerous glacial lakes which can burst anytime and it is often a ticking time bomb and threat to the people residing downstream. The alarming growth of population, haphazard development, changes of land use for monoculture agricultural practices have led to disaster like situation. Sedimentary and low grade metamorphic rocks of Phyllites, Gneiss and Schist make the region prone to landslide. Earthquake induced landslides makes it more vulnerable to the rural communities. Further development and urbanisation in the high risk zones need to be readdressed. Redesign of policy is necessary to suit the fragile local environment of Himalaya for a sustainable future, continuous capacity building is needed at all levels not only for academics and research but also in schools, government departments and local Panchayats/local bodies to cope with disaster and Climate Change.

Sikkim has the honour to be declared as the first Organic state in the country in the year 2015. It has 47.80% (FSI, 2015) of the total state geographical area under forests. It is one of the most environment friendly states with population of about 6, 10,577 as per 2011 census.

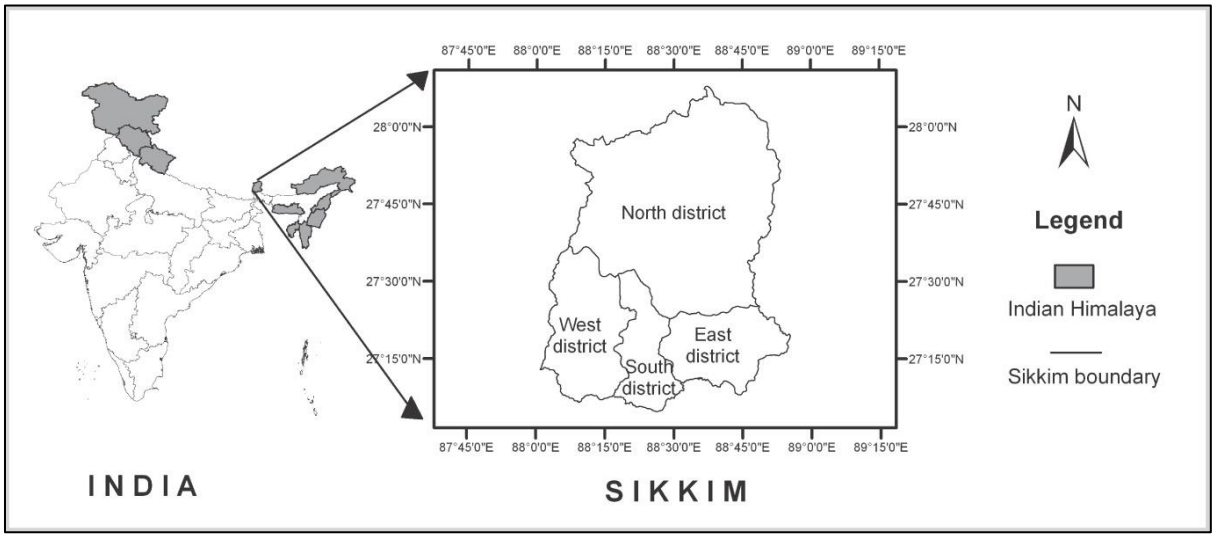
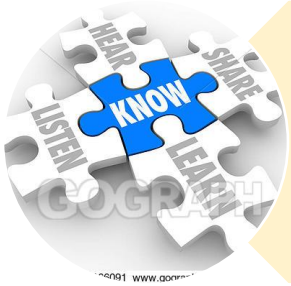


Figure 2.1.1: Inset map of Sikkim showing its location in India and as a part of the Indian Himalayan region.

3. Objectives

Primary objectives of the project are to develop, design, scrutinize and identify a mode of development that suits local requirements for a sustainable future and a way forward for a sustainable development in the ecologically fragile Himalayan state of Sikkim and also understand the gaps in development and response of state and assess the nature, vulnerability and capacity of communities to cope with Complex disasters in the face of Climate Change.



Develop clear understanding of hazards, vulnerabilities and capacities to cope with complex disasters in the current development patterns in face of climate change

Formulate and test developmental strategies with key local stakeholders to cope with complex disasters for a sustainable future

Identify key policy interventions required for redesigning development for a sustainable future

Disseminating and mainstreaming sustainable development practices with local communities and policy level stakeholders

4. Methodology

The research methodology of the project depends on both primary and secondary sources of data. The primary survey is taken up by an appointed field officer who helps the PRI members and local community in filling of CRRs and the secondary data is aquired with the help of line departments associated with the project. The data is both qualitative and quantitaive in nature. Exhaustive primary data is being collected through questionnaires, surveys, prepared especially for Government officials associated with the forest department, agriculture department, diasater management authority, land and revenue department etc., teachers, general masses and the like. Panel discussions and brainstorming sessions with people directly helps in evolving better strategies suited to local traditional practice and adaptibility. Secondary data is being collected from different organizations, host ministries and institutions. From all the available literature and assessment of secondary data, the knowledge base for the research is being developed. The data thus analysed is an output as Comprehensive Community Risk Registers for the region.

Apart from this substantial element of outreach covering local communities, duty bearers, policy decision makers, researchers, and civil society organizations also is incorporated into the project deliverables. Pilot projects are designed through Participatory Appraisals (PA). Such pilot projects will included setting up of Climate schools and also linking with various sector players like in tourism and farming for effective impact.

Exhaustive desktop review and secondary data assessment will help to develop strategies for different impact scenarios.

4.1 Activities, Approaches and Outcomes of the Methodology

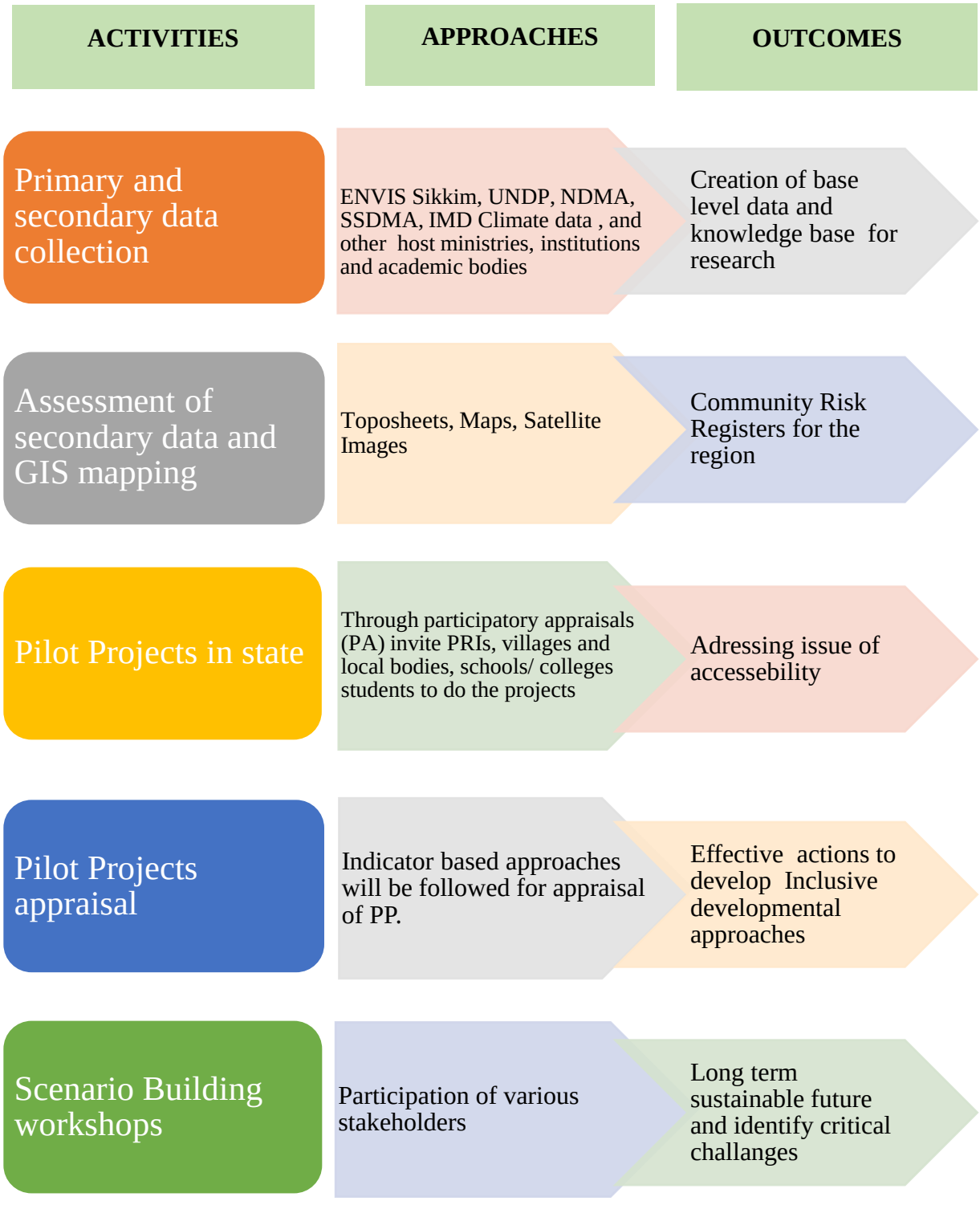


Figure 4.1: Activities, Approaches and Outcomes of the Methodology

5. Project Advisory Committee

A Project Advisory Committee (PAC) was formed for the project "Capacity building strategy for managing complex disasters in the face of climate change" in the month of June 2017. Members are from different fields of work, with expertise and experience that shall benefit the project in various dimensions. The main aim of the PAC is generally to provide strategic guidance and support to the project coordinators and project team to ensure that the results meet the project's objectives. The responsibilities and duties of the PAC members are:

- Reviewing the project outcomes
- Identify the strong/weak points with respect to the objectives of the projects and
- Applications of the results

1	Dr. T. Chatterjee, (Chairman) 	Former Director, IIPA
2	Prof. C. K. Varshney, (Member) 	Former Dean, JNU
3	Mr. Nirankar Saxena (Member) 	Assistant Secretary General, FICCI
4	Dr Akhilesh Gupta (Member) 	Head / Scientist - G DST

5	Shri Kamal Kishore, NDMA (Member) 	Member, NDMA
6	Dr. Manu Gupta, Director, SEEDS (Member) 	Director, SEEDS
7	Dr. Savita (Member) 	Director, FRI
8	Dr. Jaya Kumar (Member)	Principal Secretary, S&T, Sikkim

Project Advisory Committee (PAC) had one meeting during the project year 2018-2019. The first meeting was on 27th July 2018 at IIPA, Delhi at 11.30 am. The minutes of the meeting are annexed in Annexure I.

6. Data Collection and Analysis

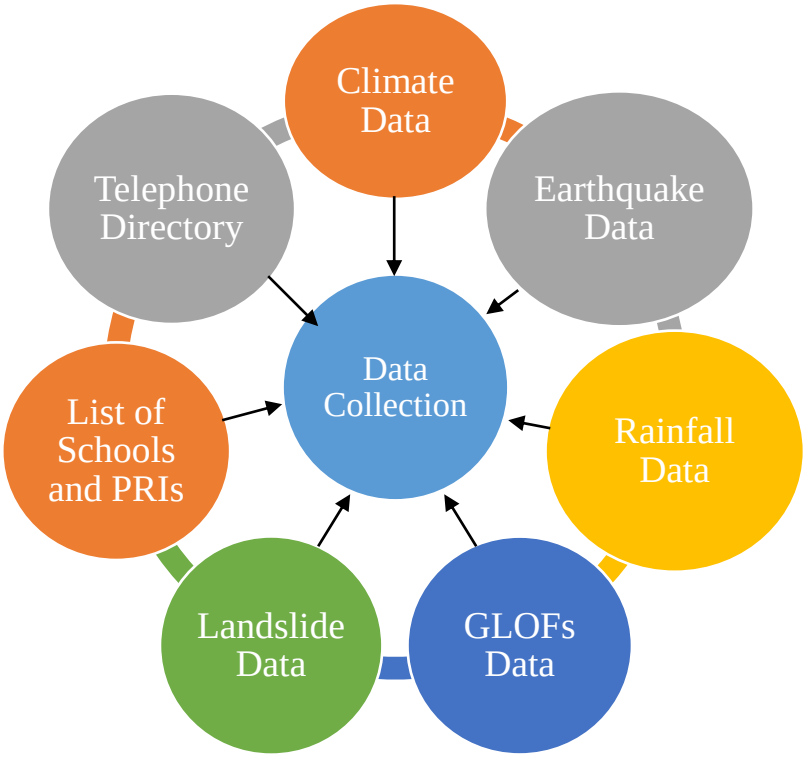


Figure 6.1: Data Collection sources

Past climatic data having the variables mean maximum temperature, mean minimum temperature (°C), rainfall (mm), number of rainy days etc. was collected which reflected the changes in Climatic variations and the trend which might have occurred over the years. Further scientific data was complemented by traditional ecological knowledge through questionnaires, interviews with different target groups collated through field visits in different towns of Sikkim.

Monthly rainfall (mm) data in Gangtok was analysed and found that June and July are the months with highest rainfall; one of the major reasons of landslide in the steep area. Along with it the road construction, rain fed agriculture leads to the soil instability and slope failure. Though there is a decrease in seasonal rainfall of the monsoon seasons and pre-monsoon.

7. Timeline: Gantt Chart

The activities under the research are detailed for the project period. A time bound implementation was carried out for each of the project activities. Work progress of the project activities along with implementation was set tentatively for the project as tabulated and depicted below, starting with the start, end and duration of the project respectively with the help of Gantt Chart. Though there were changes in the actual activities according to the feasibility of the time.

Deliverable Year (2017-18)	**Start**	**End**	**Status**
Desktop Review	01-05-2018	-	Ongoing
Secondary data collection (climate data of last 30 years)	01-05-2018	-	completed
Assessment of secondary collected data	20-07-2018	20-08-2018	completed
Assessment of hazards, vulnerability and capacities	25-08-2018	15-09-2018	Ongoing
Primary data collection	01-09-2018	15-09-2018	completed
Community risk assessment	20-09-2018	15-10-2018	completed
Community risk registers	20-10-2018	-	completed
Community fairs and outreach programs	01-09-2018	15-01-2018	completed
State seminars	01-12-2018	15-01-2019	completed
Annual report	01-03-2019	15-04-2019	completed

Figure 7.1: Execution and Implementation First Year (2017-18)

Deliverable (2018-19)	**Start**	**End**	**Status**
Desktop Review	01-05-2018	-	Ongoing
Secondary data collection (climate data of last 30 years)	01-05-2018	-	completed
Assessment of secondary collected data	20-07-2018	20-08-2018	completed,
Assessment of hazards, vulnerability and capacities	25-08-2018	15-09-2018	Ongoing
Primary data collection	01-09-2018	15-09-2018	completed
Community risk assessment	20-09-2018	15-10-2018	completed
Community risk registers	20-10-2018	-	completed
Community fairs and outreach programs	01-09-2018	15-01-2018	completed
State seminars	01-12-2018	15-01-2019	completed
Annual report	01-03-2019	15-04-2019	completed

Figure 7.2: Execution and Implementation Second Year (2018-19)

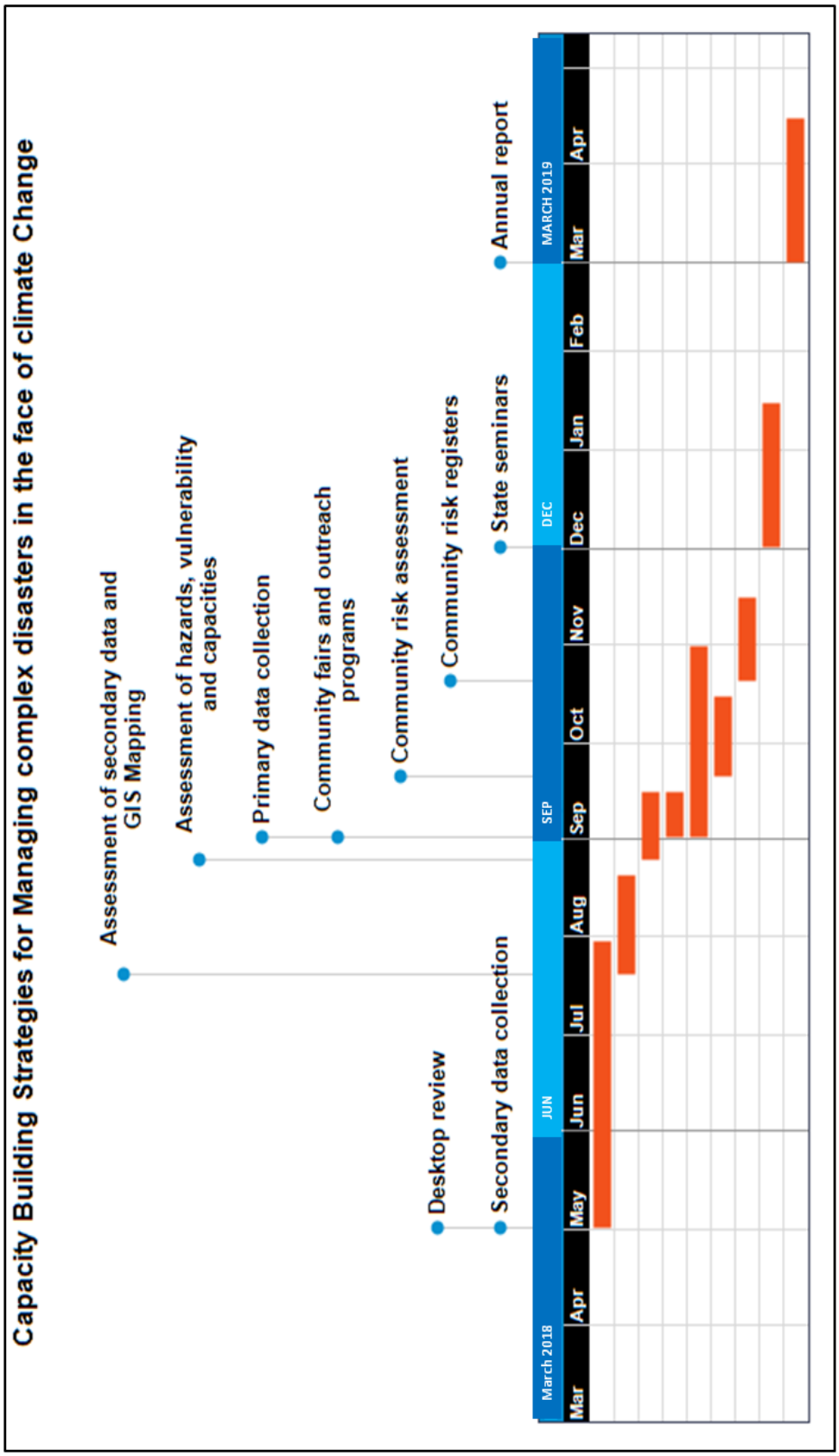


Figure 7.3 Project timeline: Gantt chart

8. Deliverables and Outcomes

The research followed the holistic approach for capacity building by including all sections of society. The beneficiaries of the project included schools, local community, panchayat/ local bodies and government officers.

The quantifiable deliverables of the project are listed below:

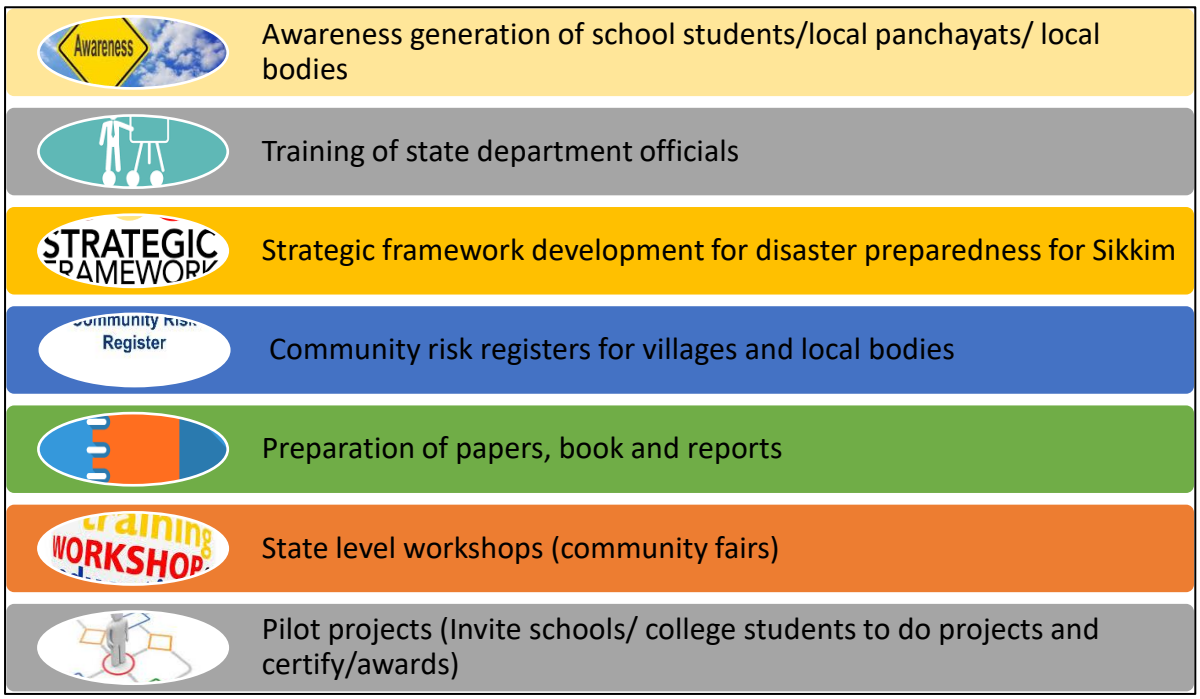


Figure 8.1: Deliverables

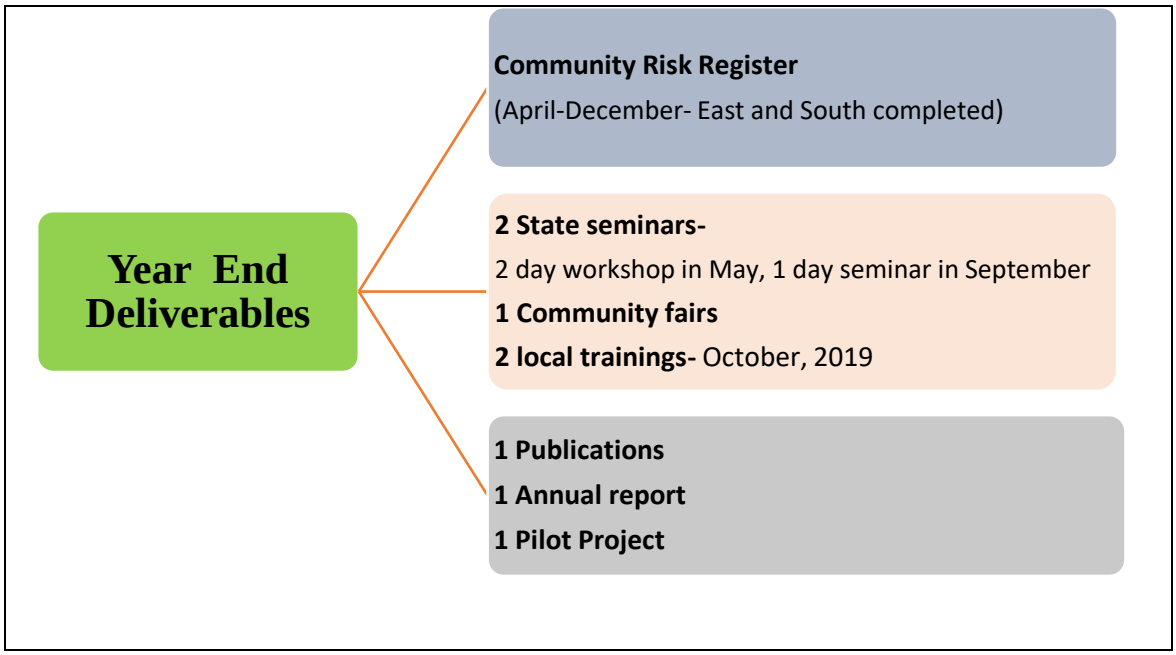


Figure 8.2: Annual deliverables (2018-19)

Outcomes of the project include Community Risk Register of hazards, vulnerabilities and capacities for the state by creating the base level data after assessing the current development patterns and complex disasters in Sikkim. It also includes scenario building and training module preparation, policy briefs on intervention required for redesigning development for a sustainable future. Publication of books and annual report at the culmination of the project will be the deliverable.

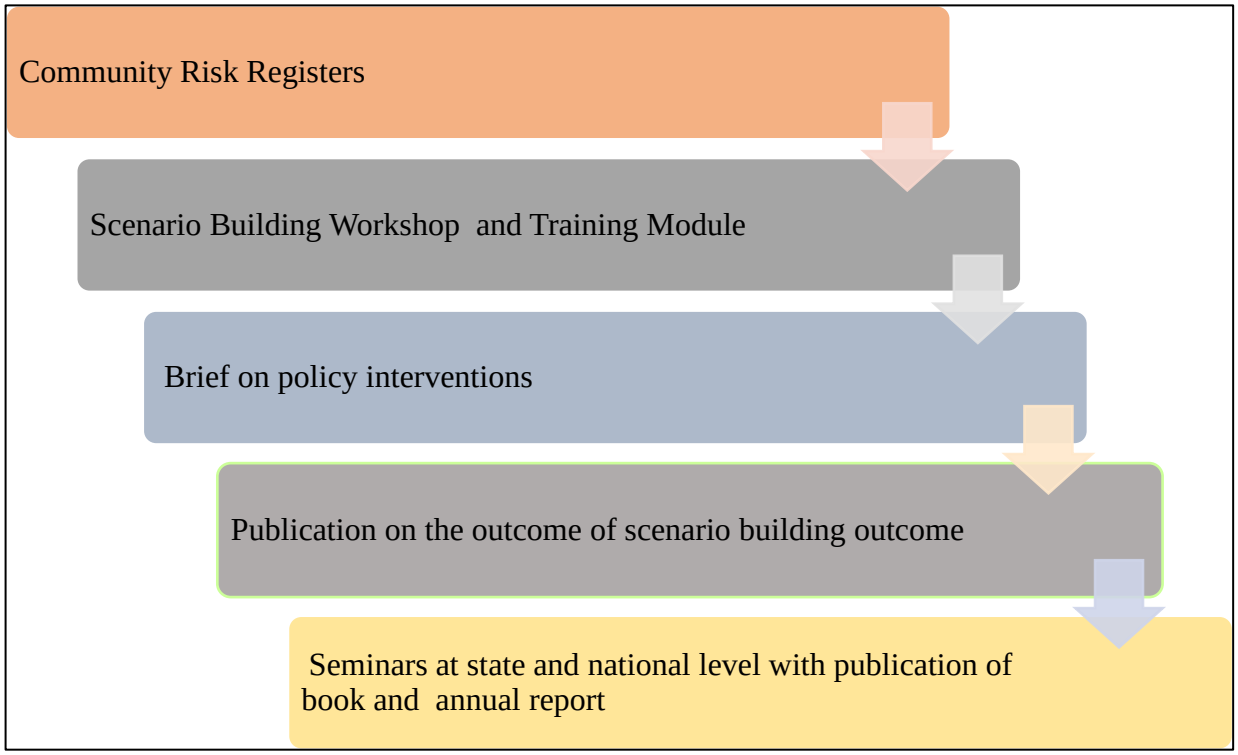


Figure 8.3: Outcomes

STATE LEVEL WORKSHOP –

Regional workshop on mainstreaming Climate Change in Disaster Risk with focus on GLOFs and Forest Fires

9. Regional workshop on mainstreaming Climate Change in Disaster Risk with focus on GLOFs and Forest Fires

Picture 9.1: The panel heading the workshop

Indian Institute of Public Administration (IIPA) along with Sikkim State Disaster Management Authority (SSDMA), Land Revenue and Disaster Management Department and UNDP conducted a two day seminar on the 8th and 9th May, 2018. The theme of the workshop focused on the natural events caused due to the phenomenon of Climate Change, mainly Glacial Lake Outburst Floods (GLOFs) and Forest Fires. The workshop addressed the senior and middle level officers of all the line departments dealing with climate change, disaster risk and related issues. The sessions were organised in Chintan Bhawan, Gangtok, Sikkim.

On the first day of the workshop i.e. 8th May 2018, at 10:30am, the workshop started with the inaugural session. The welcome address was given by Shri. Tsegyal Tashi, State Relief Commissioner cum Secretary Land Revenue and Disaster Management Department. It was followed by the keynote address by the project co-PI and Vice Chairman SSDMA, Prof. V.K. Sharma where he introduced the project to the assembly. Shri. Denis Curry, Deputy

Country Director, UNDP then gave an overview of UNDP works in the state of Sikkim. This was followed by three special Guest addresses by Ms. Marylaure Crettaz, Director, SDC India, Dr. V. Thiruppugazh, IAS, Joint Secretary, (P&P) NDMA, and Chief Guest, Shri Tshering Wangdi Lepcha, Hon'ble Minister Forest, Environment WMD, DMMG, DST & CC, Government of Sikkim. The inaugural session concluded with the vote of thanks by Shri Rinzing Chewang, Special Secretary, Land Revenue and Disaster Management Department and the assembly breaking for tea break.

Picture 9.2: Panel for the first Technical session

The workshop resumed with the technical session being headed by Dr. V. Thiruppugazh as the speaker. He addressed the issue of Disaster Risk and the need to incorporate and mainstream the Climate Change Action and Disaster Risk Reduction into developmental planning. This gave way to the Technical session I, which focussed on the GLOF threat, chaired by Prof. V. K. Sharma, Co-PI and Dr. Shyamli Singh, Project Investigator. The first speaker of the session was Shri. Keshav Koirala, Technical Expert, UNDP who explained the SDC-UNDP project based on reducing the GLOF threat at South Lhonak Lake, in the Lhonak glacier, North district. The next speaker Shri Sangay Tenzing,

Engineer, Hydrology and Water Resources Services Division, Royal Government of Bhutan, spoke about the Early Warning System (EWS) for GLOF at Puna Tsang Chuu Basin.

The next session had Shri. Sonam Wangchuk, Director, Students' Educational and Cultural Movement of Ladakh and Shri Deepak KC, Senior Programme Officer, Climate Change adaption and DRR, UNDP, Nepal as speakers. They reinforced the importance of EWS for GLOF threat towards saving lives and livelihood by the case study of Nepal. Dr. D.P. Dhobal, Scientist- 'F', Center for Glacialogy, Wadia Institute of Himalayan Geology, Uttarakhand, spoke about the GLOF threat with special reference to *Chorabari* Glacial Flood, June 2013. Dr. Andrew Kos, Helvetas, briefed the session about the proposed EWS for Glacial Lakes in Sikkim. The first day of the workshop ended with the chair discussing about the technical session I.

Picture 9.3: Prof. V. K. Sharma delivering the keynote address

The second day of the workshop began with Technical session II which was chaired by Shri Thomas Chandy, PCCF cum Secretary FEWMD, and co-chaired by Dr. S. Satapathy, Technical advisor UNDP. The object of this session was to develop a forest fire mitigation strategy by bringing in the experts to interact with the stakeholders to come up with an

augmentation plan for the forest fire task force. The presentations and deliberations in this session focused on the mapping of fire prone regions with early detection.

The speaker of the session was Shri Ombir Singh, Scientist-'E', and he briefed about Climate Change and it's impacts causing increased occurrences of forest fires. Shri N.W. Tamang, CE (T), FEWMD, Government of Sikkim, focused the discussion on role of the forest task force in the mitigation of the disaster and its inclusion at the Policy level in the Forest Fire Policy. A JFMC member shared traditional knowledge on forest fire management. Shri Vineet Pangtey, Additional PCCF, Dehradun, discussed management of forest fires in Uttarakhand and challenges involved in its mitigation. Krishna Bhujel, Researcher from the Tribhuvan University spoke about the forest fires in the Eastern Himalayas. Dr. Maneesha V Ramesh, Director, Amrita Centre for Wireless Networks and Applications explained the role of ITC in management of forest fires. The chair held discussion on the session before summarising the discussions and breaking for lunch.

The Technical session III was chaired by Shri A.K. Shrivastava, Chief Secretary, Govt. of Sikkim and co-chaired by Shri. Tsegyal Tashi, State Relief Commissioner cum secretary Land Revenue and Disaster Management Department, Shri Ravi Shankar, Chief Engineer, Central water Commission, the speaker briefed the workshop about the threat of glacial lake outburst flooding on the Teesta Basin through modelling the disaster. The next session was taken up by the speaker, Dr. S. Satapathy, Technical advisor UNDP, where he spoke about the opportunities for accessing Climate finance. The session chairs on "GLOF" and "Forest Fire" gave their recommendation to the government on mitigation on forest fires and Early warning System (EWS) for GLOF threat. The session concluded with Prof. V.K. Sharma summing up the way forward.

In the Valedictory Session, Tsegyal Tashi, State relief commissioner cum secretary Land Revenue and Disaster Management Department summed the proceeding of the two day workshop. A.K. Shrivastava, Chief Secretary gave the valedictory address which was followed by the vote of thanks by Additional Secretary Land Revenue and Disaster Management Department. The previous year's annual report of the project was also released by the dignitaries on dias.

Schedule of the programme in Annexure II

STATE LEVEL SEMINAR –

Disaster Risk Reduction Day

10. DRR Day

Picture 10.1: Chief Secretary, Sikkim Chief Minister, State relief commissioner and Project Investigator

Indian Institute of Public Administration (IIPA) along with Sikkim State Disaster Management Authority (SSDMA) and Land Revenue and Disaster Management Department observed the State Disaster Risk Reduction Day with the theme, **"Volunteerism in Disaster Management"** on 18th September 2018 at Chintan Bhawan.

The Chief Minister, Shri. Pawan Chamling who was the Chief Guest for the occasion applauded the initiatives of Sikkim State Disaster Management Authority and various projects in the state related to disaster management for taking active part in various activities for mitigation of disasters. He highlighted about how the brand of Sikkim has increased throughout the state and commended the various programmes like trainings of stakeholders, capacity building, awareness and sensitization programmes etc. which has helped the state towards a disaster resilient and prepared society.

The following announcement was made by Hon'ble Chief Minister during the occasion:

- All prominent helpers/NGOs/SHGs involved in disaster management will be felicitated during Republic Day.
- By 2020, Sikkim to be made a model state in disaster management.
- He talked about self-development and said that during earlier times Sikkimese people were more close and helpful towards one another. The bond was substantial and community participation during such times were foremost, he called upon all to enhance resilience and take up sense of ownership.
- Chief Minister also stressed on taking preventive measures and doing elementary checking so that the end goal is more concrete and fruitful.
- He directed the Chief Secretary, Shri A.K. Shrivastava to oversee that all new infrastructures be made earthquake resistant.
- Disaster Management as a subject at the Primary level from next academic session.

The Chief Guest stated that global warming is the main cause of natural destruction in the world and ban on pesticides and use of bio-degradable products hamper the environment to a great extent.

Coexistence of people and nature is the main goal and he highlighted about the various environmental policies which the state government has implemented in the state. The brand "Organic Sikkim" has garnered appreciation and validation throughout the world and he encouraged people use it in further promoting the image of the state. He announced introduction of Disaster Management as a subject at the Primary level from next academic session. He also stressed on importance of education in disaster management and said that awareness programmes should start from GPU level itself.

At the end he urged all the stakeholders, students and people in general to make best use of information, awareness programmes which will help build resilience towards impact of disasters emerging from natural calamities.

Chief Secretary, Shri A.K. Shrivastava talked about the state's journey from past to the present as a disaster resilient state. He suggested that since we stay in an earthquake prone area, we must equip ourselves to face any challenges and difficulty since when it comes to natural calamities. He said that sustainable development initiatives are a must and

preparedness, risk reduction, post rehabilitation and preparedness efforts are as crucial during times of distress.

The seminar concluded with the Project Investigator and Vice Chairman (SSDMA), Prof. V.K.Sharma's address. In his address said that Sikkim is always associated with development. He stated about the importance of studies related to disaster management and talked about how the state was acknowledged in Kyoto University for its progressiveness in disaster management arena.

Picture 10.2: Felicitation of Sikkim Chief Minister by Head of Department Land Revenue and Disaster Management and Project Investigator

LOCAL LEVEL TRAINING – Capacity Building Programme

11. Local Level Training – Capacity Building Programme

Figure 11.1: Capacity Building Workshop, East and South District

The project "Capacity Building strategies for managing Complex Disasters in the face on Climate Change"(Sponsored by NMHS- MoEF & CC, GoI), conceived by IIPA, New Delhi and is partnered with SEEDS, India focuses on the state of Sikkim. As mentioned earlier, due to the state being a part of the Eastern Himalayan global biodiversity hotspot and lying in seismic zone IV and V the terrain of the area makes it vulnerable to geophysical and hydro-meteorological disasters. Characterized by weak geology comprising of low grade metamorphic rocks the slopes are prone to landslides. Thus the state faces a multi-hazard risk and is prone to loss of ecosystem services along with livelihoods.

The duration of the project is for 3 years. In its second year of completion the project focuses on the capacity building of the community as a whole and targets different stakeholders across the state. Under the project, training of officials from various line departments in the state and national seminar, as well as capacity building programmes for the local community has been conducted.

Under the project a Capacity Building programme was conducted in the East and South districts of the state on 29th and 30th October respectively. The GPU selected in the

East district was Luing-Perbing GPU. The programme also focused on high school students along with the local rural folk. About 25 residents of the Gram Panchayat attended the training and 55 high school students were part of it. The programme in the south was conducted in Poklok-Denchung GPU and panchayat members from the neighbouring GPU, Barfung-Jarrong also participated. A total of 44 community members and 16 selected high school students attended the programme. The capacity building programme focused on the making the locals understand the concept on climate change and disaster risk in their own context. Activities such as mapping of hazards and earthquake simulation table were performed.

About the GPUs

Luing Perbing

The GPU is one of the 16 selected GPUs for the study. It lies in the East District of the state of Sikkim. The GPU consists of 5 wards, namely Perbing Ward, Khara Gaon, Themi Dara, Bhotey Gaon and Changrong.

Luing village is located in Gangtok Tehsil of East District in Sikkim, India. It is situated 8km away from Gangtok, which is both district & sub-district headquarter of Luing village. The total geographical area of village is 416.42 hectares. Luing has a total population of 2,019 people. There are about 413 houses in Luing village. Gangtok is nearest town to Luing. Agriculture is the main occupation of the village.

In a special *Gram Sabha*, held on 2nd October 2016, attended by ADC (development) A.B. Karki, *Zilla panchayat* Surya Kumar Rai, officials from line departments and local residents, the GPU was declared plastic free and organic by the Panchayat President, Meera Rai.

Details of the GPU:

Panchayat Head name: Shri Data Ram Panday

District name: East

State name: Sikkim

Total households: 498

Total population: 2,478 Male population: 300 Female population: 291

Literacy: 89%

Educational facilities: Primary School, Sr Sec School, Junior High School

Medical facilities: Nearest General Hospital: Gangtok

Water sources: Local Source, Streams And River

Sanitation facilities: 100%

Recreation and cultural facilities: Yes

Approach facility to panchayat: At Panchayat Bhawan

Electricity facility: Good

Communication facility: Good

Nearest market: Gangtok

Major source of livelihood: Agriculture

Banking and credit facility: No

Availability of evacuation points / identified safe locations: No

Poklok Denchung

The GPU is one of the 16 selected GPUs for the study. It lies in the South District of the state of Sikkim. The GPU consists of 6 wards, namely Denchung, Doncy Ward, Harrabotey, Nandugaon, Samtar and Sirisey. The Sambong forest lies in the south of the GPU. Most of the people in the GPU belong to the Rai and Lepcha community.

Agriculture is the main occupation of the village. Also since Mount Kanchenjunga can be clearly and closely seen from the GPU, tourism has flourish and most of the youth of the village are now exploring the tourism sector. Numerous home stay have come up recently.

The GPU faces water scarcity during the winter months and since the majority of the population depends on agriculture for its livelihood water scarcity poses as major threat since it causes a loss in production. The GPU also faces poor connectivity in terms of road infrastructure and residents of the area travel by foot as there is no approach road for vehicular movement. Therefore in cases of emergency it poses as a serious problem.

Details of the GPU:

Panchayat Head name: Shri Gyalbo Lepcha

District name: South

State name: Sikkim

Total households: 575

Total population: 2,748 Male population: 300 Female population: 291

Literacy: 82%

Educational facilities: Primary School, Sr Sec School, Junior High School

Medical facilities: PHSC at Nandugaon

Water sources: Local Source, Streams And River

Sanitation facilities: 100%

Recreation and cultural facilities: Yes

Approach facility to panchayat: At Panchayat Bhawan

Electricity facility: Good

Communication facility: Good

Nearest market: Namchi, Jorethang

Major source of livelihood: Agriculture

Banking and credit facility: No

Availability of evacuation points / identified safe locations: Yes

Visiting GPU: Barfung-Jarrong

Barfung Jarrong is a GPU in Ravong Tehsil in South District District of Sikkim State, India. It is 28 km from State capital Gangtok. Kalimpong , Darjeeling , Mal are the nearby cities. This Place is in the border of the South District and East District. The Local Language here is Nepali. The population of the GPU is 3910 and total number of households are 927.

About the Programme

The training workshop was conducted on 29th and 30th October, 2018 in the districts' of East and South of Sikkim. The training workshop, Capacity Building Workshop, was directed at the local residents of the selected GPUs, their panchayat members and the school students alike. The GPUs for which the Capacity Building Workshop was conducted have already been subjected to the Community Risk Registers and the programme focused on the issues highlighted by the community for their own respective GPUs.

The focus of the Training in these GPUs was complex disaster caused by climate change. The community should be aware of the effects of Climate Change in context of Sikkim and their own area.

Objective of the programme:

(i) Understanding the concept of Climate change and the occurrences of Complex Disasters in the world and in their local context.

(ii) Training focused on the key issues and challenges of community related to Complex Disasters

(iii) Discussions with the community regarding their perception of Disaster Risks and way forwards.

Picture 11.1: Banner Capacity Building Workshop, East and South District

Programme Schedule (Luing Perbing GPU)

Session 1	Welcome address and Inaugural Session	Dr. Shyamli Singh	11:00 – 11:10
Session 2	Address by the GPU president	Mr. Data Ram Panday	11:10 – 11:30
Session 3	What are Climate Change and Complex Disasters?	Dr. Shyamli Singh	11:30 – 12:00
Session 4	Complex Disasters in Sikkim	Mr. G.C Khanal	12:00 – 12:50
Session 5	Earthquake simulation shake table demonstration and school safety kit discussion. Participation by school students	SEEDS	12:50 – 01:30
Session 6	Documentary (short Sikkimese film) depicting effects of climate change and our role in disaster management.	IIPA, SSDMA	01:30 – 02:10
Session 7	Disaster Preparedness and Mitigation And way forward	Dr. Shyamli Singh	02:10 – 02:20
Session 8	Vote of thanks	Dr. Shyamli Singh	02:20 – 02:30

LUNCH (02:30 ONWARDS)

The workshop was attended by twenty five local residents of the GPU and fifty five high school students of the Senior Secondary School Luing along with their teachers. (Annexure III)

The workshop began when all the community and schools students had been seated in the Luing Perbing GPU Administrative block meeting room. The inaugural session was conducted by Dr. Shyamli Singh, who addressed the gathering and welcomed the participants. The participants were made aware of the project under which the workshop was taking place and were briefed about the upcoming sessions and overall general idea of the objectives of the project.

The GPU President, Mr. Data Ram Panday, addressed the assembly and welcomed the participants and the project team alike. He then specified some issues face by the GPU due to unexpected climate variation and how it affected the GPU in the past years.

In the next session a presentation was made by Dr. Shyamli Singh on the basics of Climate. She explained what causes climate to change and why it is a global threat. The session also described how climate change causes disasters. Once the basics were established the topic of complex disasters was taken up complex disasters explained to the participants in pictorial fashion along with verbal description from the speaker.

Picture 11.2: Dr. Shyamli Singh discussing complex disasters

The fourth session was taken by, Mr. G.C.Khanal, Additional Director, Sikkim State Disaster Management Authority. He gave a presentation on the Hazards, Vulnerability & its Response in Sikkim. After a broad view of demographic and geographic statistics of the state, he explained the general working of the tectonic plates, mountain formation process, creation of the Himalayas and weak geology of Sikkim. He then moved on to explain the disasters affecting Sikkim. A brief of history of major disaster state the state was given, and landslides

was focused on. Causes were discussed and vulnerability maps were presented. After the landslides, the topic of flash floods was discussed. Natural drain maps, of each district along with vulnerable locations were pointed out. Mr. G.C.Khanal also discussed fire hazard in his presentation. He then moved on to state the activities of SSDMA and preparedness measures of the state. He also showing various Pictures of mock drills and school safety programmes conducted in Gangtok. He concluded by giving some examples of best practices and some recommendations.

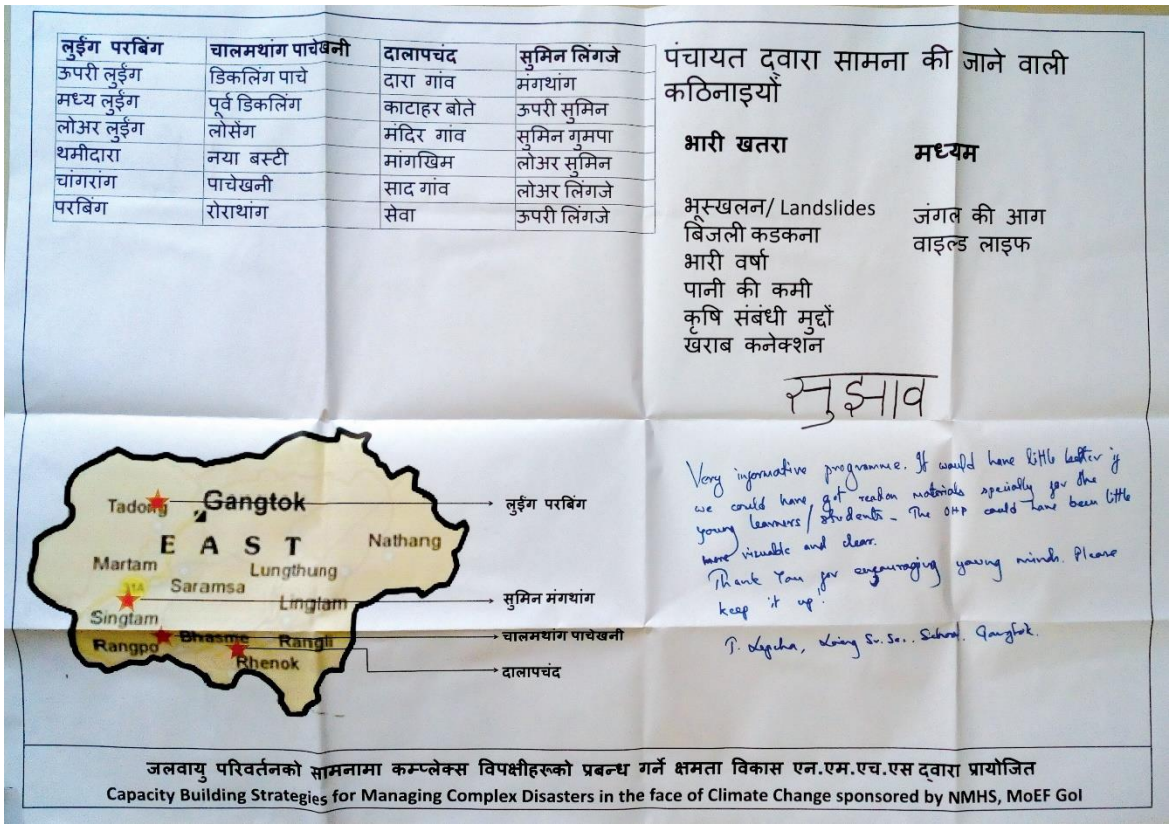
Picture 11.3: Discussing landslides

Since the workshop was attended by many high school students a session was taken on the demonstration of the school safety kit created under the project which consists of a booklet of Do's and Don'ts (School safety junction), information guide on remote sensing benefits in disaster prediction, play cards for earthquake, fire, road and flood safety, activity book and a snake and ladder game tweaked as disaster risk game. Apart from the kit demonstration, an earthquake simulation model, a "shake table" was brought and an

experiment was performed by a volunteer student on the shake table to show the result of weak structures during earthquake.

A Sikkimese short film 'Sachetna (Awakening)', production of the SSDMA, was screened for the participants. The film depicts the change in the Sikkim state in past few years. Increased economic growth, reduction in agricultural activities and shift to tourism based occupations and most importantly the changing weather that the people face in the state. Shift in winter months and reduction in the number of winter days and increases in number of rainy days have affected the common population of Sikkim. Moreover increased number of landslides has the infrastructure paralyzed for any emergency evacuation activity. The film focuses on the steps to be taken in an event of disaster and how to cope with climate change.

The last session taken by Dr. Shyamli Singh was to conclude the workshop. She addressed the issues of the GPU identified by them in the CRR and related them to the presentations and film shown in the workshop. The members from the community were asked for suggestions and their comments on the workshop. The vote of thanks was delivered by Dr. Shyamli Singh.



Picture 11.4: Comments by the community

Picture 11.5: Luing - Perbing GPU and the project team

Programme Schedule (Poklok Denchung GPU)

Session 1	Welcome address and Inaugural Session	Mr. Gyalbo Lepcha	11:30 – 11:40
Session 2	Address by the GPU president	Dr. Shyamli Singh	11:40 – 11:40
Session 3	What are Climate Change and Complex Disasters?	Dr. Shyamli Singh	11:50 – 12:15
	TEA BREAK (12:30 – 12:45)		
Session 4	Complex Disasters in Sikkim	Mr. Abhishek Kharel	12:45 – 01:30
Session 5	Documentary (short Sikkimese film) depicting effects of climate change and our role in disaster management.	IIPA, SSDMA	01:30 – 01:50

Session 6	• CRR discussion • Hazard Mapping exercise and Risk Matrix by the community • Earthquake simulation shake table demonstration and school safety kit discussion.	SEEDS	01:50 – 02:50
Session 7	Disaster Preparedness and Mitigation and way forward	Dr. Shyamli Singh	02:50 – 03:00
Session 8	Vote of thanks by GPU President (Barfung - Jarrong)	Mr. Anil Rai	03:00 – 03:15
Session 9	Vote of thanks by GPU President (Poklok –Denchung)	Mr. Gyalbo Lepcha	03:15 – 03:30

LUNCH (03:30 ONWARDS)

The workshop began, when all the community members from Poklok – Denchung GPU and Barfung – Jarrong GPU and schools students from Nandugaon High School, Denchung had been seated in the Poklok Denchung GPU Administrative block seminar hall. The inaugural session was taken by the GPU President, Mr. Gyalbo Lepcha. He addressed the assembly and welcomed the participants and the project team alike. He gave a brief knowledge about the GPU and the issues of the GPU. (Annexure IV)

The next session was conducted by Dr. Shyamli Singh, who addressed the gathering and welcomed the participants. The participants were made aware of the project under which the workshop was taking place and were briefed about the upcoming sessions and overall general idea of the objectives of the project. She also made a presentation on the basics of Climate. She explained the effects of climate change as they were explained in the previous workshop to the participants.

The next session after the break was taken by Mr. Abhishek Kharel, DPO, SSDMA, South Sikkim. He discussed the basics of Climate Change, Disaster Risks and mitigation techniques. The discussion was aided by many examples from the South District. In the next session the short film ‘Sachetna (Awakening)’ was screened for the participants.

Picture 11.6: Discussion on Complex Disasters, Poklok Denchung

The next session was conducted by Sunny Kumar, SEEDS. He discussed the CRR which was submitted to the GPUs and the issues identified by them. A hazard mapping was conducted with the help of 'Vulnerability Maps' provided by the SSDMA and UNDP, SIKKIM. The community participated in the activity and mapped the risk areas. They also help create a risk matrix for their respective GPUs. A demonstration of the school safety kit was done and the students were encouraged to participate. An experiment on the shake table was also conducted in this session.

The concluding session was taken by Dr. Shyamli Singh, where she summed up the workshop learnings and way forwards. The members from the community were asked for suggestions and their comments on the workshop. The vote of thanks was delivered by Dr. Shyamli Singh.

The GPU president of Barfung – Jarrong GPU, Mr. Anil Rai, addressed the gathering and thanked the team and Poklok – Denchung GPU for inviting their panchayat members for the workshop.

Picture 11.7: School Kit

The vote of thanks was made by Mr. Gyalbo Lepcha, President Poklok – Denchung GPU.

Picture 11.8: GPU President, Poklok - Denchung discussing the issues

Picture 11.9: GPU members Poklok - Denchung and project team

COMMUNITY FAIR-

JORETHANG MAGHEY MELA

12. Community Fair- *Maghey Mela*

Jorethang *Maghey Mela* is one of the largest community fair in Sikkim celebrated in the month of January every year and is one of the state level events. Countless tourists from every corner of the globe gather at this festival and are a part of it. The varied Cultural programmes, ethnicity, traditional dance, cuisines, arts and handicrafts of Sikkim are showcased at the *Mela*. Thus the event provides the project an exposure of a large level where data and information dissemination becomes easy. The event, in the second year of the project, took place on 15th January 2019. The Chief Guest of the event was Shri Satish Rai, Advisor, Food Civil Supplies & Consumer Affairs Department, Government of Sikkim.

Picture12.1: Jorethang *Maghey Mela*, 2019

The Project "Capacity Building Strategies for Managing Complex Disasters in the face of Climate change" funded by NMHS-MoEF&CC, GoI led by IIPA and STS collaborated with the Sikkim State Disaster Management Authority (SSDMA) to represent the project at the community fair with a stall where Climate and Disasters related simulation models, GLOF simulation model and Shake table for earthquake demonstration besides readying for emergency kit demonstrations were disseminated to the public. Information, education and communication (IEC) materials on Safety tips during a disasters, leaflets,

booklets were distributed to the general masses. The exhibit presented Earthquake preparedness and what safety measures should be taken. Dr. Shyamli Singh, Project Investigator, Rini Reejonia, Research officer, IIPA, and Sunny Kumar, Planning Lead, STS along with Ongmula Bhutia, Flied Officer, IIPA and Ms. Navita Pradhan, Under Secretary, SSDMA were present in the Mela to facilitate and generate awareness. The Stall also showcased a banner on Sikkim as first Organic State and treading towards first Climate Smart State in the country. The posters also highlighted the major objectives of the project, community risk assessment and policy intervention.

Picture 12.2: Project Stall

Models on display

Early Warning System in case of Glacial lake Outburst Floods

The model was a representation of a settlement near the banks of the river *Teesta* with full fledged working of a town. The model was divided into two separate parts. The first part was a depiction of a lake at higher altitude whereas the lower part was modelled as the town.

Working

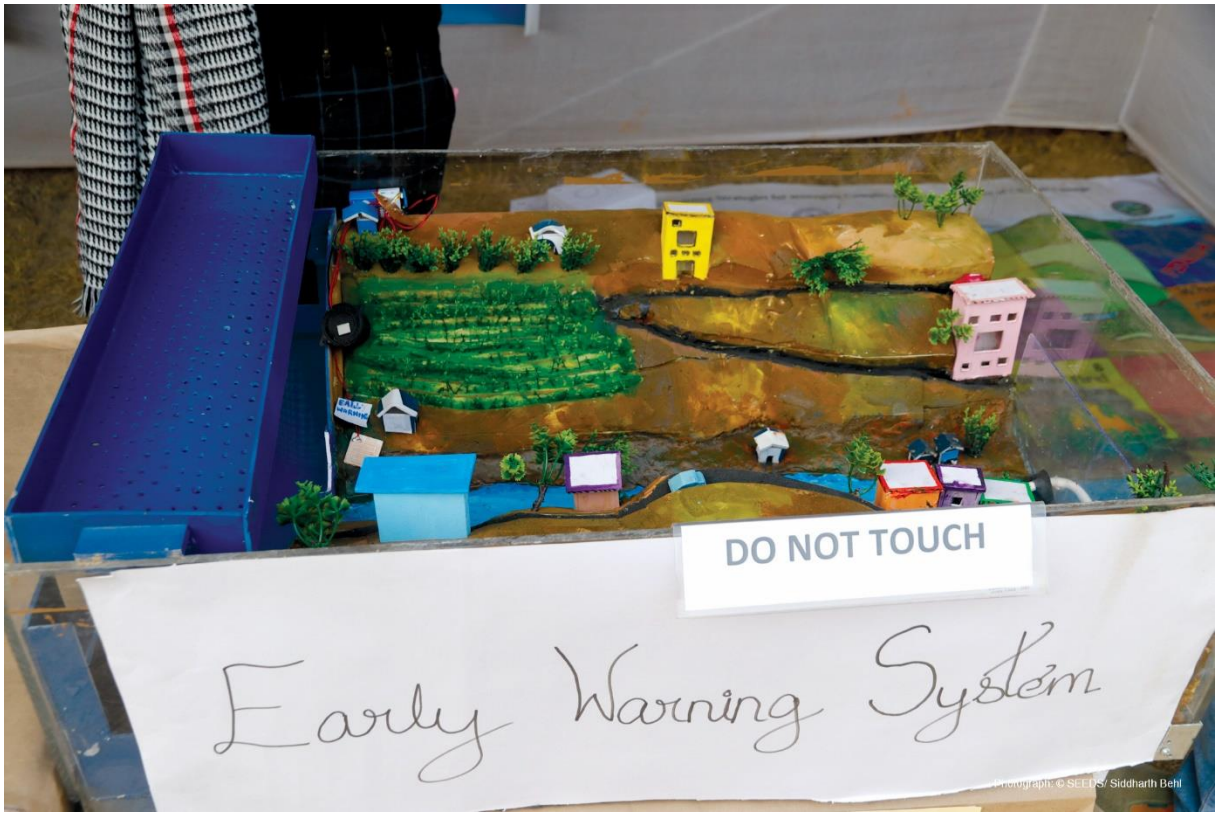
The lake, situated in the north of the settlement faces an event of torrential rainfall, therefore to depict this; the Container was filled with excess water by pouring water from a perforated sheet. The excess water overflows from the lake and raises the level of water in the

river, thus flooding the settlements downstream. Therefore an early warning system is attached near the upstream, to alert the settlements' residents of the oncoming floods.

Early Warning System

A water sensitive buzzer was attached near the lake (upstream) therefore when the water overflows and touches circuit setup the water detecting sensor starts the buzzer which raises an alarm noise. This represents the early warning system. Thus the model explains the importance of having installed an early warning system near a GLOF vulnerable lake.

Picture 12.3: Early warning System Display



Picture 12.4: Early warning System Model

Picture 12.5: Shake Table Display

Earthquake Simulation

The model represents of a typical house with interiors and furniture. The entire structure is mounted on a table known as "shake table". The shake table can be operated by pulley system and earthquake of various magnitudes on Richter scale can be simulated. The effect causes the observer to witness damage caused by varying amount of earthquake shocks. The model encourages the observer to use non-structural mitigation measures for safekeeping their house.

Working

Two miniature houses are designed which show typical household interiors such as drawing room, kitchen, dining and bedroom. The first model of a house is not fixed with any non structural mitigation. The house is then mounted and exposed to an earthquake of magnitude 4 on the Richter scale. The magnitude here is measured by a phone application, Vibration Meter which is a virtual Richter scale. Vibration Meter measures vibrations using the device's sensors on all 3 axes: X, Y, Z and shows reference to earthquake vibrations as classified by internationally used Mercalli intensity scale for seismic activities such as earthquakes. The Mercalli intensity scale is used for measuring the intensity of an earthquake.

On magnitude 4 the furniture, is displaced slightly, in magnitude 6 to 7 wall hangings, paintings and utensils on shelves fall, in magnitude 8-9 the shelves in the house fall and major displacement of furniture occurs. The second model all fixture of a house are secured with L-brackets rivets and screwed to places as a form of non-structural mitigation. The house is then mounted and exposed to an earthquake of magnitude 4 on the Richter scale in which no visible damage, in magnitude 6 to 7 non secured items such as bed shake vigorously, in magnitude 8-9 also there is vigorous shaking but very little displacement occurs. Hench the model represents the importance of non structural mitigation in homes which are located in earthquake vulnerable areas.

Picture 12.6: Shake Table Model

Picture 12.7: Earthquake simulation display

Disaster Management Awareness Game

The disaster management awareness game is designed especially for kids. This game is fashioned after some famous games like "Business and Ludo". The two player game is played with dice and has several steps between "Start and Finish" which are designed to have several questions regarding disaster management, encouraging players to fine tune into their knowledge of Disaster risks and escape strategies.

Picture 12.8: Community engrossed in Disaster Management game

Picture 12.9: Onlookers observing the game

Disaster Ready Kit- "Go Bags"

"Go bag" is designed as an emergency kit in case of any evacuation event. The kit holds supply for one to two days in case the person stranded cannot be rescued immediately. The kit supplies are as follows:

1. Drinking water
2. Dry snacks/ Food items
3. Waterproof sheet (to be wrapped around or used as shed)
4. Medical kit (First aid box)
5. Pen and book
6. Emergency contact numbers
7. Safety Jacket
8. Whistle
9. Rope
10. Photo copy of important documents
11. Sanitary napkins
12. Bleaching powder (for disinfecting surroundings)
13. Torch or candle and matchbox
14. Army knife
15. Compass
16. Toiletries

Picture 12.10: "Go Bag"

Information, education and communication (IEC) materials

Disbursal of information is one of the main project objectives. One strategy to achieve this is the distribution of Information, education and communication (IEC) material. In the *Maghey Mela* IEC materials on safety tips during a disaster, leaflets, booklets were distributed to the general masses which included school children besides all age groups of people. Apart from this the stall displayed posters and banner of the project objectives and the organic status of the state of Sikkim.

Picture 12.11: Risk Ready Kit

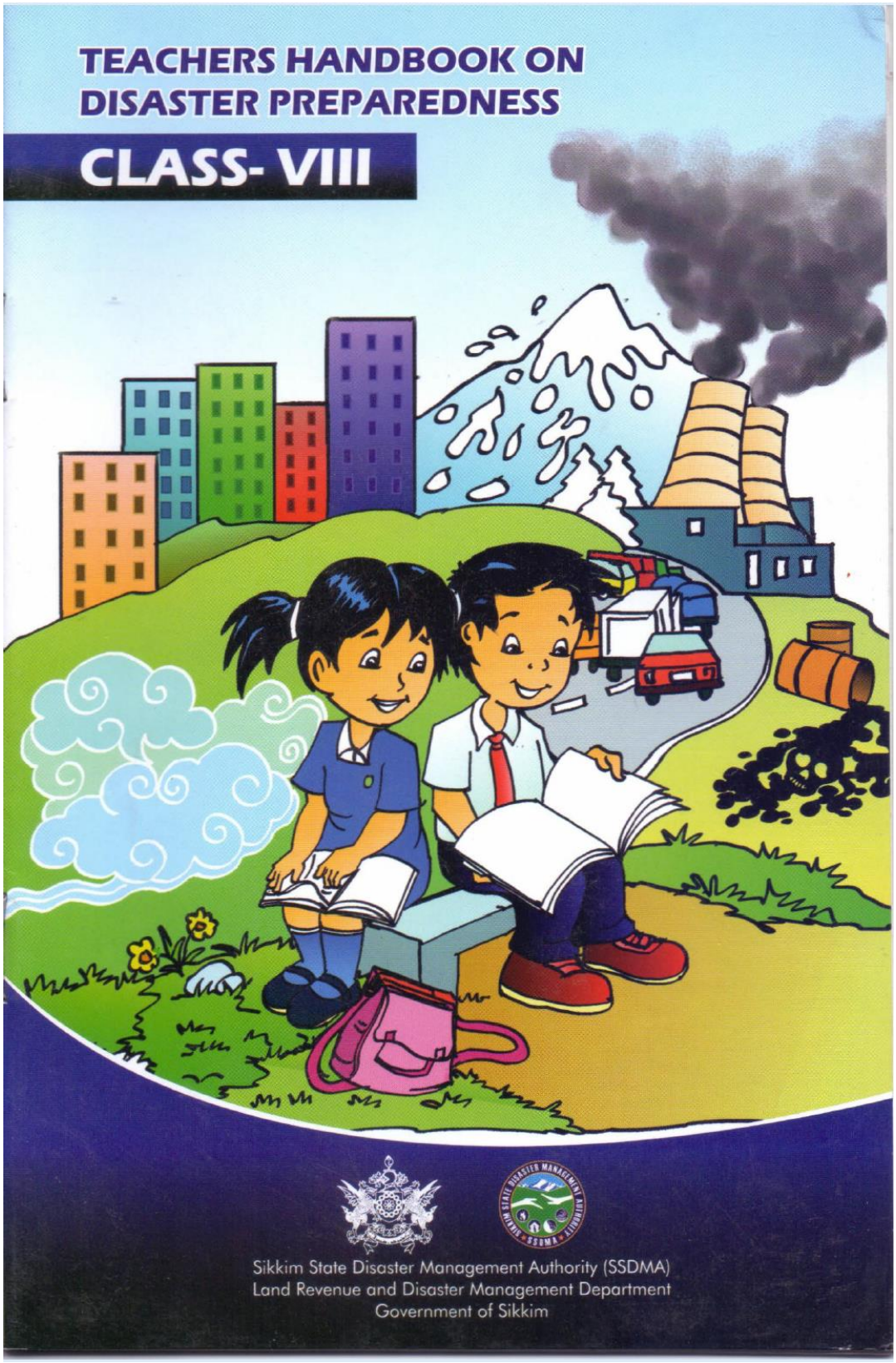
Risk Ready Kit

The risk ready kit is designed for school students and includes a board game similar to the one being played in the stall. The kit also includes flash cards for road safety, Water Sanitation and Hygiene (WaSH), non structural mitigation, earthquake safety, floods, bullying and Fire safety. The kit consists of a hand-book which in very descriptive and pictorial form describes the Do's and Don'ts in case of emergencies**.**

Picture 12.12: Posters on School Safety

Picture 12.13: Posters on the State Disaster Management

Teachers Handbook on Disaster Preparedness Class VIII



Picture 12.14: Handbook for Teachers

The teachers' handbook contains information on some of the hazards that pose a threat to the state of Sikkim and basic safety measures to be followed accordingly. The book contains four chapters

1. Industrial/ Chemical Disaster

2. Uncontrolled/ Unplanned Urbanization

3. Climate Change

4. List of Important Telephone numbers

Chemicals play a major role in our everyday life. They are part of what we eat, where we work, and how we live. Despite their prevalence in our lives, many chemicals are hazardous, or toxic. Toxic chemicals can be found in our soil, water, air, and bodies. This contamination has seriously affected the health of humans and wildlife everywhere.

Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. These substances are most often released as a result of transportation accidents or because of chemical accidents in manufacturing plants. Hazardous materials: Chemical substances, which if released or misused, can pose a threat to the environment. Chemicals that are used in the home every day, for e.g. Bleach, sprays, toilet cleaners, glues, paints, oils, pesticides, medicines, etc can sometimes be harmful if not used in the right way. A home chemical emergency arises when chemicals are used improperly at home. Some chemicals that are safe, and even helpful in small amounts, can be harmful in larger quantities or under certain conditions e.g. it is dangerous to combine two common household cleaners – chlorine bleach and ammonia - as this mixture forms a highly toxic gas. Most chemical accidents that occur in our own homes can be prevented.

A major chemical emergency is an accident that releases a hazardous amount of a chemical into the environment. Such a major chemical accident may lead to a chemical disaster. Chemical disaster caused by industries is termed as industrial disaster. There are many kinds of industrial disasters. The fast ones that result in many deaths make the news all over the world when they happen and the slow ones that kill or cripple people over long periods of time take a lot more work to discover, and to research e.g. Bhopal and Chernobyl disasters. Accidents can happen underground, on railroad tracks or highways, and at manufacturing plants. These accidents sometimes result in a fire or explosion, but many times you cannot

see or smell anything unusual. You may be exposed in three ways:

1. Breathing the chemical.

2. Swallowing contaminated food, water, or medication.

3. Touching the chemical, or coming into contact with clothing or things that have touched the chemical.

Chemicals are everywhere. They are an important part of life. The most common chemical accidents occur in our own homes, and they can be prevented. The best way to avoid chemical accidents is to read and follow the directions for use, storage, and disposal of the product. Mixing products can be hazardous. The best way to protect yourself and your family is to be prepared. Knowing what to watch for and how to respond will keep you alert to chemical hazards.

SOME PREVENTIVE MEASURES

BEFORE

1. Make an emergency kit.

2. Make an emergency plan.

3. Learn about your community's risk from major chemical emergencies.

4. Find out evacuation plans for home, public places and schools. o Learn about industry and community warning signals.

5. Discuss chemical emergencies with your family.

DURING

If you hear a siren or other warning signal, turn on a radio or television for further emergency information.

Strictly follow instructions. Your life could depend it.

Seek information on:

1. Type of health hazard

2. The area affected

3. How to protect yourself

4. Evacuation routes (if necessary) Shelter locations

5. Type and location of medical facilities

6. The phone numbers to call if you need extra help

Call 100 only for a possible life-threatening emergency. Telephone lines are frequently overwhelmed in disaster situations. They need to be clear for emergency calls to get through.

If you are at the scene of a chemical accident:

1. Call the local police / fire department to report the nature and location of the accident as soon as possible.

2. Move away from the accident scene and help others away.

3. Stay away from the spilled substance and avoid touching it.

4. Try to avoid inhaling gases, fumes, or smoke. If possible, cover your mouth with a cloth while leaving the area.

5. Stay away from accident victims until the hazardous material has been identified.

6. Try to stay upstream, uphill, and upwind of the accident site.

7. If recommended, properly ventilate the area by opening windows. Wear gloves, long sleeves and mask.

How to Shelter-in-Place

1. One of the basic instructions you may be given in a chemical emergency is to shelter-in-place.

2. While gathering your family, you can provide a minimal amount of breathing protection by covering your mouth and nose with a damp cloth.

3. Immediately after the shelter-in-place announcement is issued, fill up bathtubs or large containers for

an additional water supply, and turn off the intake valve to the house.

4. If gas or vapours could have entered the building, take shallow breaths through a cloth or a towel.

5. Avoid eating or drinking any food or water that may be contaminated.

6. Take your Disaster Supplies Kit with you.

7. Stay in the room and listen to your radio or television until you are told all is safe, or you are told to evacuate.

8. If you are told there is danger of explosion, close the window shades, blinds, or curtains. To avoid injury, stay away from the windows.

AFTER

1. Return home only when authorities say it is safe.

2. Follow local instructions concerning the safety of food and water.

3. Clean up and dispose off residue carefully. Follow instructions from emergency officials concerning cleanup methods. Local officials will best know proper procedures for your particular situation.

WHAT IS URBANIZATION?

Rapid and massive growth of, and migration to large cities.

WHAT HAPPENS

Urbanization usually occurs when a country is still developing. Historically, it has been closely connected with industrialization. Following industrialization, surpluses increased in both agriculture and industry. Larger and larger proportions of a population could live in cities. Economically, cities became the ideal places to locate factories and their workers.

Causes of Urbanization

- Industrialization.
- Job opportunities.

- Availability of easy transportation.
- Availability of more/better services (health, education, etc).
- Absence of enough land for agricultural production in rural areas.
- Migration.

Positive Effects of Urbanization

1. Reduced transport costs, exchange of ideas and sharing of natural resources.

2. Cities act as beacons for the rural population because they represent a higher standard of living.

3. Cities offer opportunities to people not available in the country side.

4. Social and religious taboos / sanctions disappearing.

5. Education is a tool to eradicate social evils.

6. Industrialization, Urbanization, Education, Legislation, Secularization - sequence of development.

7. Diffusion of urban culture to rural areas.

8. Urbanization is a sequence of development. However, if urbanization is not planned or controlled then it could have negative impacts as well.

Negative Effects of Unplanned Urbanization

1. Public health issues

2. Sanitation - settlements ill-equipped to handle large populations and their sanitation needs.

3. Pollution- caused by effluents, smoke and smog.

4. Fire hazards - due to use of flammable materials and proximity / congestion.

5. Epidemics - due to spread of communicable diseases caused by contaminated water and air and overcrowding.

6. Unemployment and under- employment.

WHAT IS CLIMATE CHANGE?

Our world is always changing. Look out from your window long enough and you might see the weather change. Look even longer, and you'll see the seasons change. The Earth's climate is changing too, but in ways that you cannot easily see. When scientists talk about global climate change, they are talking about the global climate and a pattern of change that has been happening over many years.

WHAT HAPPENS

One of the most important trends that scientists look at is the average temperature of the Earth which has been increasing for many years. This is called global warming

Global climate: The average climate around the world

The Greenhouse Effect

The Earth is getting warmer because people are adding heat-trapping gases to the atmosphere, mainly by burning fossil fuels (coal, oil, natural gas). These heat-trapping gases are called greenhouse gases. Greenhouse gases keep the Earth warm through a process called the greenhouse effect.

Rising global temperatures lead to other changes around the world, such as stronger hurricanes, melting glaciers, and the loss of wildlife habitats. That is because the Earth's air, water, and land are all related to one another and to the climate. This means a Change in one place can lead to other Changes somewhere else. These changes affect people, plants, and animals in many ways. The Earth's climate has changed before also but this time it is different. People are causing these changes, which are bigger and happening faster than any climate changes that modern society has ever seen before.

Impacts

The signs of global climate change are all around us:

Higher temperatures and more heat waves Changing rain and snow pattern

More droughts and wildfires

Warmer oceans

Rising sea level

Wilder weather

Stronger storms

Increased ocean acidity

Damaged corals

Shrinking sea ice

Melting glaciers

Less snow and ice

Thawing permafrost

Changes in plant life cycles

Changes in animal migration and life cycles

Disaster Safety Handbook

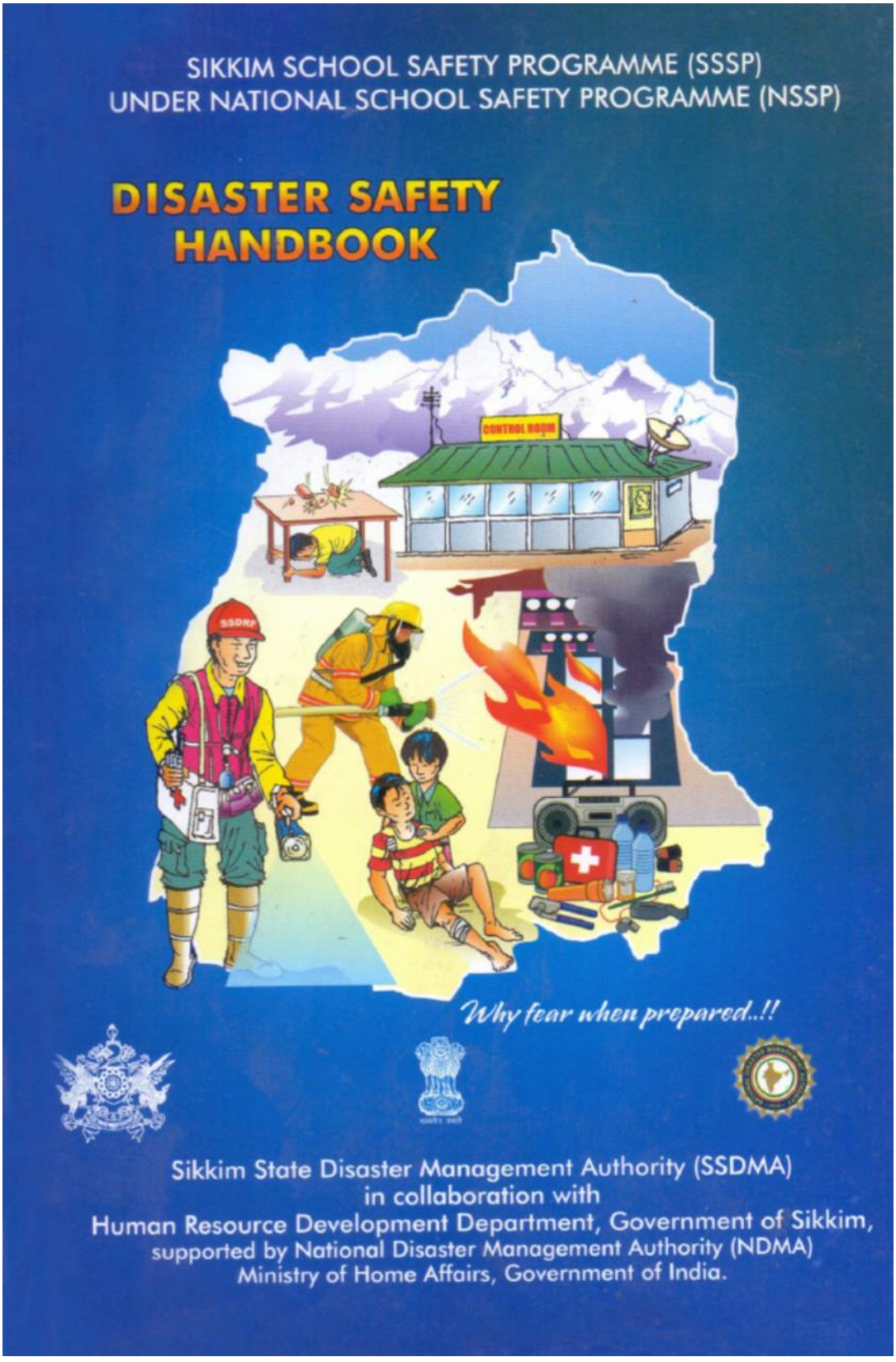


Figure 12.15: Handbook for students

INTRODUCTION

What are Hazards?

Hazards are dangerous conditions or events with the potential of causing death, injury to life and damage to property, agriculture and environment. Hazards can be grouped into two broad categories:

Natural Hazards: Natural Hazards occur when nature forces create havoc on a particular area causing damage to manmade structures, as well as the environment. The varieties of natural disasters are as numerous as the reasons that cause them.

Unnatural Hazards (man-made hazards) Unnatural Hazards are de a t h san d damages which result from human acts of omission or commission.

What is disaster?

Disaster is defined as a crisis situation causing wide spread damage which far exceeds our ability to recover.

What is the difference between Hazard and Disaster?

A hazard is a situation which poses a level of threat to life, health, property or environment. Most hazards are dormant or potential, with only a theoretical risk of harm, however, once a hazard becomes active, it can create an emergency situation causing disaster.

A disaster is the impact of a natural or human-made hazard that negatively affects society or environment. The root of the word disaster

comes from an astrological idea that when the stars are in a bad position a bad event will happen.

EARTHQUAKE

An earthquake movement of the earth's surface. It can sometimes be a small shaking or a strong shock which can be felt over a large area

How do earthquakes occur?

Earthquakes are usually caused when rock underground suddenly breaks along a fault. This sudden release of energy causes the seismic waves that make the ground shake.

When two blocks of rock or two plates are rubbing against each other, they stick a little. They don't just slide smoothly; the rocks catch on each other. The rocks are still pushing against each other, but not moving. After a while, the rocks break because of all the pressure that's built up. When the rocks break, the earthquake occurs.

Effects of earthquake

 Death and injuries due to building collapse and falling debris from the slops

 Loss of livelihood.

 People are more likely to be injured or die where buildings are not designed to resist earthquakes.

 Damages to property Agriculture, Animals etc.

 Flash flood occurs which may damage to the establishment located down slopes.

LANDSLIDE

What is a landslide?

The term "landslide" (or landslip) describes the downward movement of rock, earth or debris due to gravity, especially in the rainy season.

What causes a landslide?

There are various reasons for landslides to occur. Landslides are usually caused by human activities that disrupt the area. Landslides also occur during volcanic eruptions, earthquakes, and flash floods. However, there are two reasons that can cause landslides.

1. Natural causes

2. Man made causes (Anthropogenic)

FIRE ACCIDENT

A number of fire accidents occur every year whether at home or outside.

SAFETY TIPS:

 Pull the fire alarm near the closet exit, if available, or raise an alarm by warning others.

 Leave the building taking the staircase. Never use the elevator during a fire.

 Call the emergency fire number and give them your apartment number and let them know you are trapped by smoke and fire. It is important that you listen to them and do what they tell you.

 Stay calm. Never run if your clothes are on fire; instead, drop and roll back and forth covering your face. This will make the fire go out.

FOREST FIRE

About 50% of the forest areas in the country are fire prone.

Natural Causes: During summer, when there is no rain for months, forests become littered with dry leaves and twigs that could burst into flames by the slightest ignition. High temperature and dryness provides favorable conditions in which a forest fire can start. Many forest fires start from natural causes like lightening, which set trees on fire.

Man-made Causes: Fires are also caused when sources like naked flames, cigarettes

GLACIERS AND GLACIAL LAKES Glaciers are mass of ice composed of compact snow that flows under its own weight on land. When these glaciers melt, the water accumulates and forms lakes known as glacial lakes. The water of these lakes is retained by natural dams formed out of glacial moraines. These moraines are composed of different sized particles ranging from fine silt to large boulders.

GLOFs are floods that occur when the moraine dam of a glacial lake collapses displacing massive volume of water. It can cause severe damage to property and the loss of lives.

Some factors that trigger GLOF are:

• Avalanche

• Heavy rains

• Climate Change

• Landslides or rock fall

• Glacier falling into lakes

• Earthquake

• Water pressure on weak moraines

The Central Water Commission (CWC) has identified and is monitoring 11 vulnerable lakes having size of more than 44 hectares.

Sikkim State Disaster Management Authority in collaboration with United Nations Development Program through the Department of Science & Technology and Climate Change, Government of Sikkim, which is the state nodal department is implementing a pilot project on "Reducing Climate Change induced vulnerabilities and risks from GLOF at South Lhonak Lake".

The various activities for this mitigation programme are:

- The drainage of the excess water from South Lhonak Lake by the process of "siphoning".
- Spreading awareness to the general public living in the low lying areas of the rivers that could get affected by GLOF.
- Preparation of Disaster Management Plan for flood prone areas.
- Preparation of Safe Evacuation Maps for flood prone areas.

Dos and don'ts in the event of a GLOF threat

Dos:

Be aware that flash flood can occur.

If there is any possibility of a flash flood, move immediately to higher ground.

Plan ways to evacuate the old and the differently able children (if any)

Disconnect electrical appliances.

Inform the authorities.

Don'ts:

Walk or drive through flood water.

Use any damaged electric goods.

Pamphlets

Picture 12.16: IEC on GLOF in local language

Project Brochure

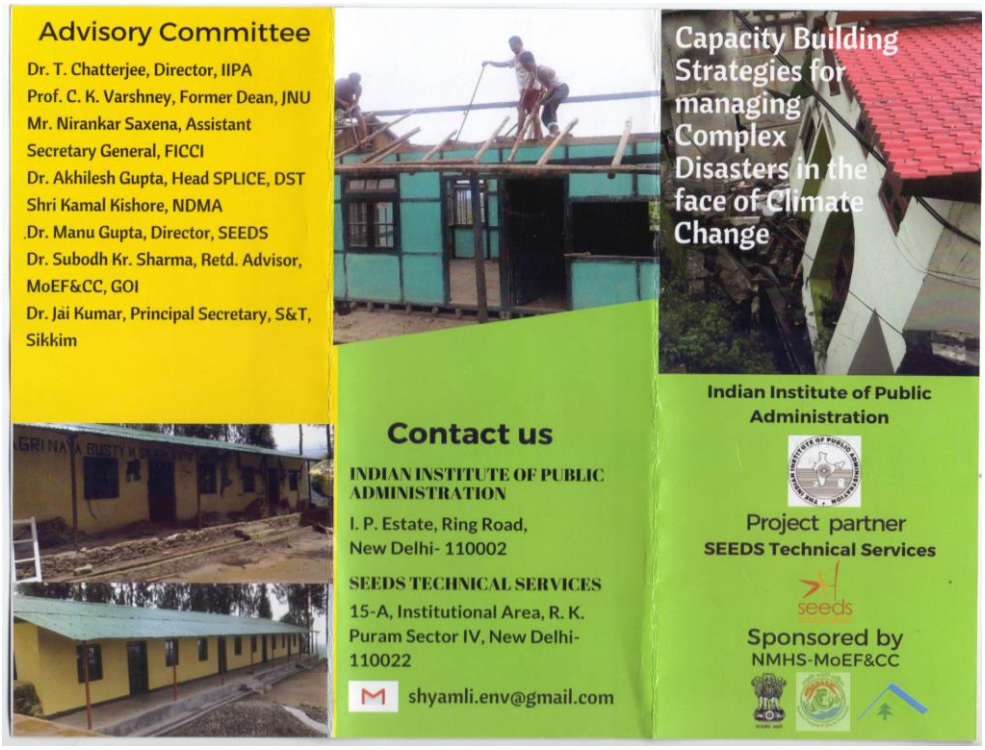
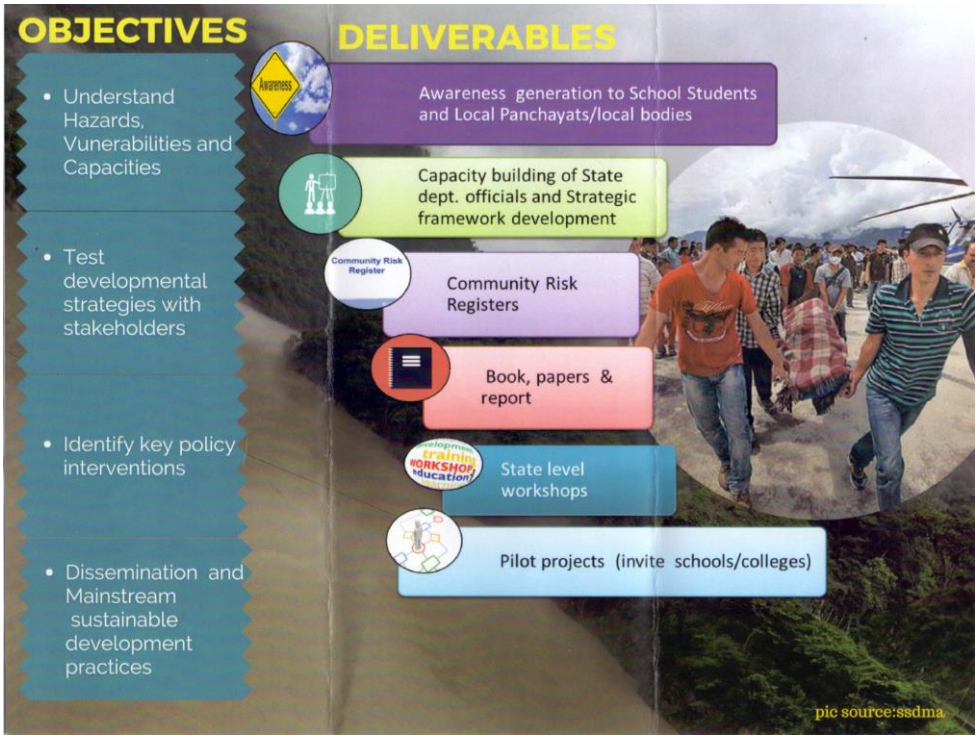
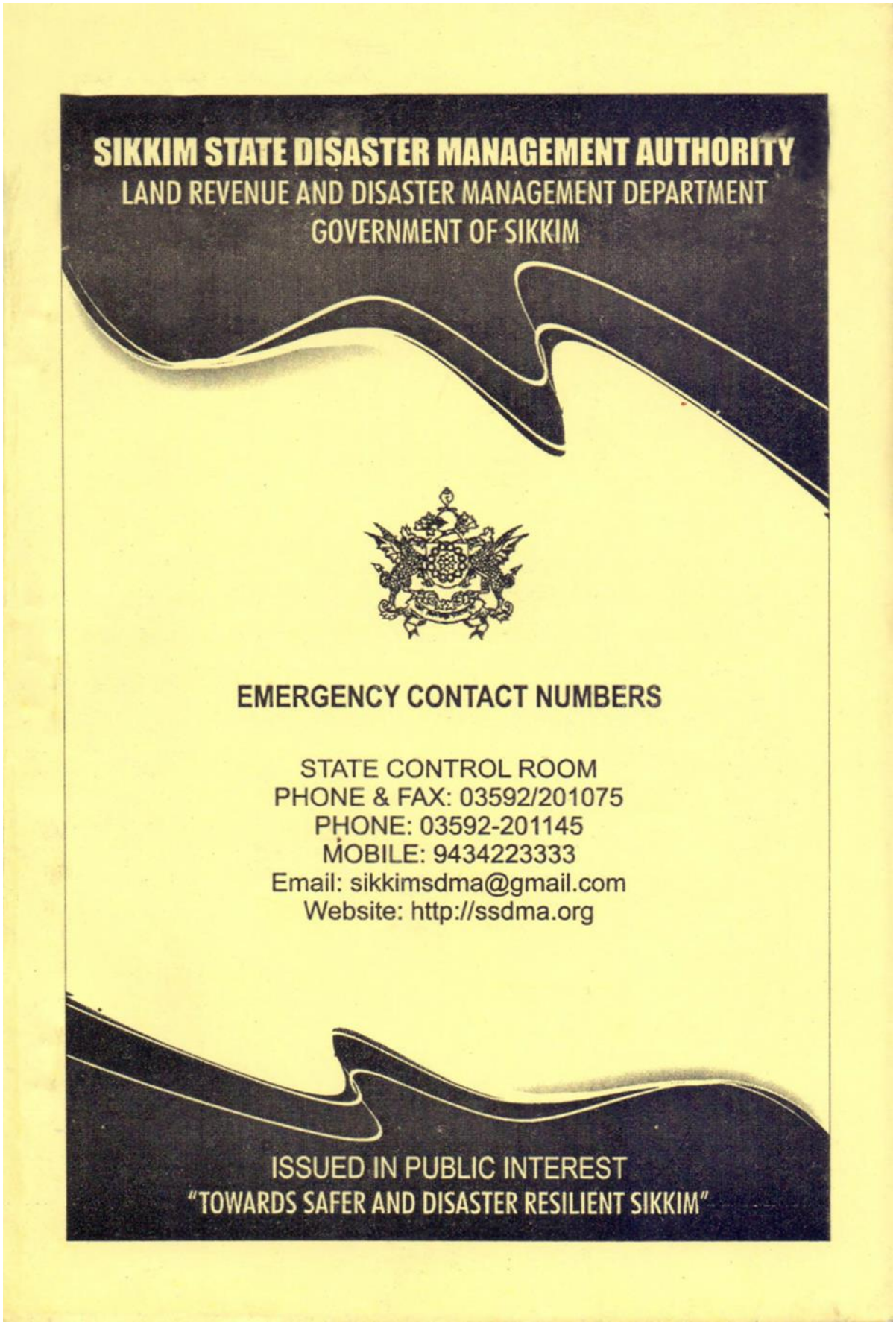


Figure 12.17: Project Information



Picture 12.18: Project Objectives



Picture 12.19: Emergency Contact List

References

Acharya, B. K. and B. Chettri (2012). Effect of Climate Change on Birds, Herpetofauna and Butterflies In Sikkim Himalaya: A Preliminary Investigation. In Arrawatia, M. L., Tambe, S. (Eds). *Climate Change in Sikkim Patterns, Impacts and Initiatives*. Information and Public Relations Department, Government of Sikkim, Gangtok, India

Barua, A., Katyaini, S. and B. Mili (2012). Reducing the vulnerability of the poor by building resilience: A case study from South Sikkim. In M. L. Arrawatia and Sandeep Tambe (ed.) *Climate Change in Sikkim: Patterns, Impacts and Initiatives*. Information and Public Relations Department, Government of Sikkim. Gangtok, India.

FSI (2015). India state of forest report 2015. Ministry of Environment, Forest and Climate Change, Government of India.

Govindha Raj, B. K., Kumar, V. K. and S. N. Remya (2013). Remote sensing-based inventory of glacial lakes in Sikkim Himalaya: semi-automated approach using satellite data. *Geomatics, Natural Hazards and Risk*, 4(3), 241-253.

Kumar, B. and T. S. Murugesh Prabhu (2012). Impacts of Climate Change: Glacial Lake Outburst Floods (GLOFs). In Arrawatia, M.L., Tambe, S. (Eds). Climate Change in Sikkim Patterns, Impacts and Initiatives. Information and Public Relations Department,Government of Sikkim, Gangtok.

Parry, M. L., Canziani, O., Palutikof, J., van der Linden, P. and C. Hanson (Ed.) (2007). Climate change 2007: Impacts, Adaptation and Vulnerability. Working group II contribution to the fourth assessment report of the IPCC (Vol. 4). Cambridge University Press.

Rahman, H., Karuppaiyan, R., Senapati, P. C., Ngachan, S. V., and A. Kumar (2012). An analysis of past three decade weather phenomenon in the mid-hills of Sikkim and strategies for mitigating possible impact of climate change on agriculture. In M. L. Arrawatia and Sandeep Tambe (ed.) *Climate Change in Sikkim: Patterns, Impacts and*

Initiatives. Information and Public Relations Department, Government of Sikkim. Gangtok, India, 19-48.

Sharma, S., Joshi, V., and R. K. Chhetri (2014). Forest fire as a potential environmental threat in recent years in Sikkim, Eastern Himalayas, India. *Climate Change and Environmental Sustainability*, 2(1), 55-61.

Tambe, S., Arrawatia, M. L., Bhutia, N. T., & Swaroop, B. (2011). Rapid, cost-effective and high resolution assessment of climate-related vulnerability of rural communities of Sikkim Himalaya, India. Current Science, 165-173.

ANNEXURES

ANNEXURE I

MINUTES OF MEETING

Project: "Capacity Building Strategies for Managing Complex Disasters in the face of Climate Change" sponsored by NHMS- MoEF&CC.

The fourth Advisory Committee meeting was held on 27/07/2018 at 3:00 pm at the Multipurpose Hall, IIPA, New Delhi.

Agenda of the meeting

- About the project - Objectives and Key beneficiaries
- To discuss the Year 1 (2017-18) Annual Report and taking a look at last year's achievements and project progress so far.
- To discuss the Year 2 (2018-19) work plan and the event schedule/ timelines for the current year.
- Research work under the project.

The following members attended the meeting

1. Dr. T. Chatterjee, (Chairman), Director, IIPA
2. Prof. C. K. Varshney, (Member), Former Dean, JNU
3. Shri Kamal Kishore, (Member), Member, NDMA
4. Dr. Manu Gupta, Director, (Member), Executive Director, SEEDS INDIA
5. Mr. Loy Rego, (special invitee), SEEDS INDIA
6. Dr. Anshu Sharma (Project Investigator), Director, SEEDS INDIA
7. Ms. Shalini Jain, Senior Director, Training, SEEDS INDIA
8. Mr. Sunny Kumar, Lead Planning, SEEDS INDIA
9. Prof. V. K. Sharma (Project Investigator), Senior Professor, IIPA
10. Dr. Shyamli Singh (Project Investigator), Faculty, IIPA
11. Ms Akanksha, Research Officer, IIPA
12. Ms. Rini, Research Officer, IIPA

Leave of absence was granted to the following members: Dr Akhilesh Gupta, Dr. Jaya Kumar, Dr. K. J. Ramesh, Shri Nirankar Saxena, Dr. Savita, Dr. Shashi Kumar, Dr. Subodh Kr. Sharma (PAC Members) who had already expressed their non-availability on the said date.

Prof. V. K. Sharma, Project Investigator, IIPA, welcomed all the members with a conceptual briefing of the project and introduced the new PAC member Dr. Savita, , IFS, Director FRI, Dehradun. The meeting progressed with a presentation of project progress and planned activities.

The presentation made at the PAC meeting reflected the objectives of the project, the achievement of first year (2017-18) and plan for the current year (2018-19).

The committee acknowledged the achievements of the first year (2018-19) and the accomplishment of National Seminar conducted on 8^{th} – 9^{th} May, 2018 (at Sikkim) of the second year (2018-19) of the project.

Dr. T. Chatterjee, Director, IIPA commented that the success of the project will depend if the state owns the project and that each district should build on the project's experience to create an action plan for the next five years, so that the learnings from the training can be internalized/ institutionalized and can be continued by the state authorities. For this, a template of these action plans should be given with the indicators of success defined. He also recommended that there should be a continuous revision of the action plan and changes, if any, should be duly incorporated. The Community Risk Register (CRR) should be customised for each bio-geographic zone and other peculiarities of the GPUs should be incorporated to make them locally usable.

State must ensure proper maintenance of the equipments being given to the 'Climate Schools' and train the teacher-in-charge in operation and maintenance of these equipment for efficiency in data collection. Student involvement would be a bonus as parents can then be indirectly involved.

There should be a recommendation from the project to the funding agency that the action plan should be monitored by them.

Dr. C. K. Varshney, Former Dean, JNU, raised questions regarding the CRR as to how will the community know about the existence of the CRRs? What is the longevity of these CRRs and who is the custodian? Accessibility to these registers, and how can it be continued? It was stated that all above points should be included in the Action Plan.

He also acknowledged the work done so far and added that the purpose of the exercise is to excite the state authorises so that they imbibe the idea.

Dr. Anshu Sharma, Project Investigator, SEEDS INDIA, added that there should be a provision for revisiting the state after the project is completed to review the sustainability of the project.

Shri Kamal Kishore, Member, NDMA, raised the question as to what extent is the CRR a perception of the risks and to what extent is it an evaluation of the risk? Who is looking over the CRR and what changes does it cause?

In response, Dr. Manu Gupta, Executive Director, SEEDS INDIA, added that the idea of the CRR is to create a repository. He suggested examining how the CRR is influencing the local GP plans and recommended a visit to the GPUs to have a brush check on these at the community level.

Mr. Loy Rego, special invitee, SEEDS INDIA, suggested a public display of the weather data collected in the specific locations, like schools etc. The public should be trained in reading and understanding the data.

The PAC members were also of the view that the projects ("Capacity Building Strategies for Managing Complex Disasters in the face of Climate Change" sponsored by NHMS-MoEF&CC and "Climate Smart Governance" sponsored by DST) should share their collective data with each other.

The presentation also covered the research being done under the project concerning relationship between the built-up area in Rangpo and rainfall trends leading to vulnerability to floods or other such hazards.

Dr. C. K. Varshney, Former Dean, JNU, suggested that the frequency of heat waves and rainfall pattern should be related to configure locally related climate change effects. Mere replacement of forest areas by built up areas may not directly reflect a climate phenomenon. It may increase the heat effects but must be proved relate to climate change scientifically.

The Project Advisory Committee approved the current year's (2018-19) deliverables and it's time schedule

Event Calendar for year 2018-2019

S.no.	Training/workshop	Month/ Year	Dates	Duration
1	**State Seminar**	September 2018	18.09.2018	1
2	**Training Workshop**	October-November, 2018	To be decided	To be decided
3	**Community Fair + Training of state officials**	January 2019	14.01.2019 (Maghey Mela)	1

Current year (2018-19) deliverables are as follows:

1. 18th September, 2018 State seminar: action to be taken up by IIPA and SEEDS.
2. October - November, 2018 Training workshop to be conducted as decided

	District	Possible participants	Aspects to be covered
1	North	Government officials	CRR
2	South	PRI members	SRR
3	East	School teachers, University students	Transect Walk to identify shocks and stresses and document case studies
4	West	Locals, etc.	Traditional knowledge and innovations

Probable draft already submitted by IIPA, SEEDS for follow up action

3. 14th January, 2019 Maghey Mela: Action for community preparedness by SEEDS
4. January, 2019 Training programme for state officials: action to be taken up by IIPA
5. Research work rainfall trend and vulnerability of an area case study of Rangpo town: Research action to be taken up by IIPA
6. Other administrative works by IIPA

Dr. Shyamli Singh, Project Investigator, IIPA, concluded the meeting with a vote of thanks.

ANNEXURE II

Schweizerische Eidgenossenschaft
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Swiss Agency for Development and Cooperation SDC

Regional Workshop on Mainstreaming Climate Change in Disaster Risk with special reference to Glacial Lake Outburst Flood (GLOF) and Forest Fire in the Himalayas

Date:8th & 9th May, 2018

Venue: Chintan Bhawan, Gangtok, Sikkim

Inaugural Session, 8th May 2018		
10:30 – 10:40	Welcome Address	Shri. Tsegyal Tashi, State Relief Commissioner cum Secretary, Land Revenue & DM Dept., Government of Sikkim
10:40 – 10:50	Keynote Address	Shri. V.K. Sharma, Vice Chairman, Sikkim State Disaster, Management Authority, Government of Sikkim
10:50 – 11:00	Overview of UNDP support to Government of Sikkim	Mr. Dennis Curry, Deputy Country Director, a.i., UNDP, India
11:00 – 11:10	Address by Special Guest	Ms. Marylaure Crettaz, Director, SDC India
11:10 – 11:20	Address by Special Guest	Dr. V.Thiruppugazh, IAS, Joint Secretary, (P&P) NDMA
11:20 - 11:30	Address of the Chief Guest	Shri. Tshering Wangdi Lepcha, Hon'ble Minister Forest, Environment WMD, DMMG, DST & CC, Government of Sikkim
11:30 – 11:35	Vote of Thanks	Shri. Rinzing Chewang, Special Secretary, Land Revenue & DM Dept., Government of Sikkim
Tea Break		
11:55 – 12:30	Mainstreaming DRR & CCA in Developmental Planning	Dr. V.Thiruppugazh, IAS, Joint Secretary, (P&P) NDMA

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Technical Session I, 8th May 2018 : GLOF Impacts and Early Warning System in Eastern Himalayas

In this session the focus will be on Mitigation of GLOF risks with developing a workable and dynamic EWS with integrated weather station for GLOF in the state. Bhutan and Nepal have made progress on development and installation of Early Warning System and the same will be shared with the stakeholders of the state.

Chair – Prof. V.K. Sharma, Vice Chairman, SSDMA **Co-Chair – Dr. Shyamli Singh, IIPA**		
12:30 – 12:45	SDC-UNDP Project on Reducing GLOF threat at South Lhonak Lake	Keshav Koirala, Technical Expert, UNDP
12:45 – 13:00	Early Warning System (GLOF) at Puna Tsang Chhu Basin	Shri. Sangay Tenzin, Engineer, Hydrology & Water Resources Services Division, Royal Government of Bhutan
LUNCH BREAK		
14:00- 14:20	GLOF and Early Warning System to Save Lives and Livelihood: Nepal Experience	Mr. Deepak KC, Senior Programme Officer- Climate Change Adaptation and DRR, UNDP, Nepal
14:20-14:40	Himalayan Glacial Lakes and GLOF threat with special reference to Chorabari Glacial Flood, June,2013	Dr. D.P.Dobhal, Scientist-'F', Centre For Glaciology, Wadia Institute of Himalayan Geology, Uttrakhand
14:40- 15:00	Proposed EWS for Glacial Lakes in Sikkim	Dr. Andrew Kos, Helvetas
15:00 – 15:20	Discussion	Chair

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Technical Session II, 9th May 2018: Forest Fire and Challenges in Mitigation

The objective of this session will be to develop a forest fire mitigation strategy by bringing in experts to interact with stakeholders to come up with an augmentation plan for the forest fire task force. The presentations and deliberations in this session will focus on mapping of fire prone regions with early detection.

Chair – Shri. Thomas Chandy, PCCF cum Secretary, FEWMD, Government of Sikkim **Co-Chair – Dr. S. Satapathy, Technical Advisor, UNDP**		
10:00 – 10:15	Climate Change and it's impacts on forest fire	Shri. Ombir Singh, Scientist –"E"
10:15 – 10:30	Role of Forest Task Force in Mitigation – Forest Fire policy	Shri. N.W.Tamang, CF (T), FEWMD, Govt. of Sikkim
10:30 – 10:45	Sharing of traditional knowledge on forest fire management	Joint Forest Management Committee Member
10:45 – 11:00	Management of Forests Fires in Uttrakhand and Challenges Involved in Mitigation of Forests Fires	Shri. Vineet Pangtey, Addl. Principal Chief Conservator of Forests, Research, Management and Training, Uttrakhand, Dehradun
11:15 – 11:30	Forest Fire in the Eastern Himalayas	Krishna Bhujel, Researcher, Tribhuvan University
11:30 – 11:45	Role of ICT in management of Forest Fire	Dr. Maneesha V. Ramesh, Director, Amrita Centre for Wireless Networks and Applications
11:45 – 12:00	Discussion	Chair
12:00 – 12:15	Summary	SSDMA/MHA/NDMA
LUNCH		

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Technical Session III, 9th May 2018: Summary & Way Forward

Chair- Shri. A.K.Srivastava, Chief Secretary, Govt. of Sikkim Co-chair- Shri.Tsegyal Tashi, IAS, Secretary cum State Relief Commissioner.		
13:15 – 13:30	Modelling of GLOF Threat on Teesta Basin	Shri. Ravi Shankar, Chief Engineer, Central Water Commission
13:30 – 13:45	Opportunities for accessing climate finance	Dr. S. Satapathy, Technical Advisor UNDP
13:45 – 14:00	Recommendation to the Government on Mitigation of Forest Fire	Chair – Forest Fire
14:00 – 14:15	Recommendation to the Government on EWS for Glacial Lakes	Chair – GLOF
15:15 – 15:30	Way Forward and Discussion	Prof. V.K.Sharma Vice Chair, SSDMA & Dr. Preeti Soni, Assistant Country Director, UNDP

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Valedictory Session (GLOF and Forest Fire)

15:45 – 16:00	Summary of Proceedings of the Two Days' Workshop	State Relief Commissioner cum Secretary, Land Revenue & Disaster Management Department, Government of Sikkim
16:00 – 16:15	Valedictory Address	Chief Secretary, Government of Sikkim
16:15 – 16:30	Vote of Thanks	Additional Secretary, Land Revenue & Disaster Management Department, Government of Sikkim

ANNEXURE III

CAPACITY BUILDING STRATEGIES FOR MANAGING COMPLEX DISASTERS IN THE FACE OF CLIMATE CHANGE.

sponsored by NMHS

CAPACITY BUILDING WORKSHOP, EAST SIKKIM

29th OCTOBER 2018 — LUING - PERBING GPU

Sl No	PLACE	NAME	SIGNATURE	CONTACT No.
(1)	Upper Luing	Tila chettri	Chettri	8918155350
2)	~~Rupa Chettri~~ "	Rupa Chettri		
3	Middle Luing	young Thamu Lepcha	T. Lepcha	8145711384.
4	Middle Luing	Chewang Donca Bhutia	C.D. Bhutia	
5	Middle Luing	Tshering Diki Lepcha	T Lepcha.	8348[illegible]7 41
6	~~Middle~~ Luing	Lakpha Dilee		8906074993
7.	Middle Luing	Donca Bhutia	L.D Bhutia	7719168373
8	M. Luing	Tshering Kipa Lepcha	Lepcha	938291882
(9)	Middle Luing	Phu Chamu Sherpa	Sherpa	9933803468
(10)	M. Luing	Nhunna Samang		8167074276
(11)	Upper Luing	Damber Dahal		8768629390
12	Perbing	Chabi Lall Chettri		9593788709
13	Upper Luing	Dhan maya Chettri		7318688877
14	Perbing	Kamala Rai	Rai	8768994287
15	L. Luing	Rohit Pd Neopaney		8768512019

	PLACE	NAME.	SIGNATURE	CONTACT No.
16	Middle Living	Gyusmey Bhutia		9474837898
17	~~Dagyal Bhutia~~	Dagyal Bhutia		
18	Living S.S. School	Ashim Subba		9933770904
19.	~~Tanmit Lepcha~~ Living S.S. School	Tanmit Lepcha		8116008859
20.	Living S.S. School	Saajan Gurung		8670422578.
21.	~~Sonam Dathup Lepcha~~ Living SSS.	Sonam Dathup Lepcha		9734757596

→ Senior Seco. School Luing.

Capacity Building Strategies for managing Complex Disasters in the face of Climate Change

Sponsored by- NMHS, MoEF&CC

Date: 29-10-2018 Venue: Luing- Perbing

Sr. No.	Name	Signature
1	Hem Kumari Karki	
2	Depen Rai	
3	Pusan Rai	
4	Buddha Raj Rai	
5	Annu chettri	
6	Rupa/ Chettri	Rupa chettri
7	Deepa Thapa	
8	Anbita chhetri	
9	Puja chettri	
10	Sancha Maya Rai	
11	Tshering Lhazom Bhutia	
12	Sejana Pandey	
13	Roshan Gautam	
14	Bikash Chettri Dahal	B Dahal
15	PUKAR CHETTRI	
16	Suraj Subba	
17	Bidkan chettri	
18	Roshan Dahal	
19		
20	Ram Kumar malik	RAM KUMAR MALIK
21	Pranjal Bhattarai	PRANJAL BHATTARAI
22	Rakesh Subba	RAKESH SUBBA
23	Sabina Rai	Sabina Rai
24	Babita Karki	Babita KARKI
25	Sangita Rai	Sangita Rai
26	Pramila Subba	Pramila Subba.
27	Chitra kala Pandey	C.Ls Pandey
28	Prativa Bhandari	
29	Sarita pandey	Pandey
30	Manisha pandey	Manisha
31	Yamuna Sharma	Yamuna...
32	Pratiksha Tamang	Pratiksha Z.
33	YAMKUMARI BHANDARI	YAMKUMARI
34	Ashmita Dajee	Dajee
35	Bindra Tamang	
36	Kenjana Sharma	
37	Srijana Tamang	
38	Puja Rai	
39	Ujal Gautam	
40	Ashok chettri	
41	AMRIT CHETTRI	
42	Bivek Gurung	
43	ASHOK GURUNG	

44	Dhasmendra Sharma	
45	Sahil Rai	Rai
46	Sonam Thendup Bhutia	
47	Harka Chettri	Harka Chettri.
48	BIRJU GURUNG	
49	BOHAN TAMANG	Bohan
50	Bikas Subba	Bikas.
51	Kumari Rai	Kumari
52	Apsara Gurung.	
53	Anjali Gurung	Anjali.
54	Anita Chettri	
55	Sanjana Tamang	Sanjana
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ANNEXURE IV

CAPACITY BUILDING STRATEGIES FOR MANAGING COMPLEX DISASTERS IN THE FACE OF CLIMATE CHANGE

Sponsored by NMHS

30th October, 2018 — Poklok - Denchung

Sr. No.	NAME	SIGNATURE	PLACE	CONTACT No.
1.	Sabina Rai	[signature]	Dong	9735927034.
2.	Sanikha Rai	[signature]	Sirisey	9593768223
3.	Mira Rai	[signature]	Nandugaon	8768824836
4.	D.K. Rai	[signature]	Samalen	7076252794
5.	B.K. Chhetri	[signature]		
6.	Elisheba Gurung	Elisheba	Nandugaon Sr. Sec. school.	9735087498.
7.	Deo Bar Rai	[signature]	Samaler	9564101795
8	Amril Rai	[signature]	Sirisey	9609776359
9	Suk Raj Rai	[signature]	Dong	8016800613.
10	Prabin Dhungel	[signature]	Sirisey.	9593975334
11	Asif Dhungel	[signature]	Sanglay.	9593014982
12	Yam. P. Sharma	[signature]	Manabotey	7872880367
13	Pramod Dahal	[signature]	"	9593979889.
14)	Jhar man Rai	[signature]	"	987654213 / 9609860887
15	Sudeep Subba	[signature]	Hanabotey	9593021791
16.	Sameer Subba	S. Subba	Nandugoan	8250747705
17.	Richard Rai	[signature] R	"	9775154909
18.	Binod Rai	[signature]	Denchung	9547333432.

No.	NAME	SIGNATURE	PLACE	CONTACT No.
19	Hemanta Rai	[signature]	Samsay Bong	7872980199
20	Palden Lepcha	[signature] 30/10/18	Denchung	7972880871
21	Bim lepcha	[signature]	Denchung	9635468008
22	Ranraj Rai	[signature]	Nandugown	9732062119
23	Saroj Rai	Samseybong	Samseybong	9083710790
24	Ponda Maya Rai	[signature]		
25		[signature]	Sentay	9002775545
26	Purna maya Gurung		Samalal	9593583123
26	Naclu Tamang	P.M. A w c.	Denchung	9800673448
27	C. P Rai	[signature]	Nandugown	9002380402
28	Binod Subba	[signature]	Denchung	8967993703
29	Alok Kamal Rai	[signature]	Dong	8348130742
30	Sangay Tamang	[signature]	Denchung	8348735992
31	Nima Lamu Bhutia	N Bhutia	Dong	9083071127
32	Urgen Rai	[signature]		
33	Santosh Rai	[signature]	Dong	9734040619
34	Bikram Subba	[signature] 30.10.18	Sirisey (Dong)	9735978579
35	Suk man Rai	[signature]	Dong	9609873722
36	C. B. Mukhia	[signature]	L/Jarrong	7584881758
37	Krishna Maya Chettri	[signature]	Harrabotey	9593777087
38	Kul Dip Chettri	[signature]	46-Barfung-Jarrong GPU	9593777802
39	Durga Pd Rai	[signature]	"	9609850997
	Ulgen			9733063693 Ulge
30	Rahim Kr. Rai	[signature]	Biring (Barfung Zarrong G.P.U.	8168073083
31	Indrash Chettri	[signature]	Jarrong (Bayung Zarrong G.P.U)	9733181401
32	Ganesh Chettri	[signature]	46-Barfung-Jarrong GPU	8768338787
33	Yogendra Chettri	[signature]	— do —	7797891459

NAME	SIGNATURE	PLACE	CONTACT No.
37. Rupan Chettri	[signature]	Borfung Zorong G.P.U	9734332818
38 Dhan Raj Chettri	[signature]	"	9593036065
39 Man Kri. Rai	[signature]	"	9733358429
40 Sharmila Chettri	Chettri	"	7547969908
41 Kalpa Zangmo Bhutia	Bhutia	"	9593266915
42 Madan Kr Rai	[signature]	"	97349-94660
43. Anil Rai	[signature]	"	9735038592
44 Gyalpo Lepcha	[signature] Gyalpo Lepcha PANCHAYAT PRESIDENT 35-Poklok-Denchung GPU South Sikkim	P.D.G.P.U.	9593734626

School.

Nandugaon Sr. Secondary School.

Capacity Building Strategies for managing Complex Disasters in the face of Climate Change

Sponsored by- NMHS, MoEF&CC

Date: 30-10-2018

Venue: Poklok - Denchung

Sr. No.	Name	Signature
1	Manita Selma Tamang	Manita
2	Puram Biswakarma	Puram
3	Unish Rai	Unish Rai
4	Sriya Rai	Sriya Rai
5	Sangita Subba	Sangita Subba
6	Abidal Darjee	Abidal
7	Priya Rai	Priya
8	Asika Thapa	Asika
9	Rohica Rai	Rohica
10	Ongchu Bhutia	Ongchee
11	Abishek Pradhan	Abishek
12	Anuj Darjee	Anuj
13	Aditya Sanyasi	Aditya
14	Tugal Rai	Tugal
15	Arpan Togi	Arpan
16	Ritesh Togi	Ritesh
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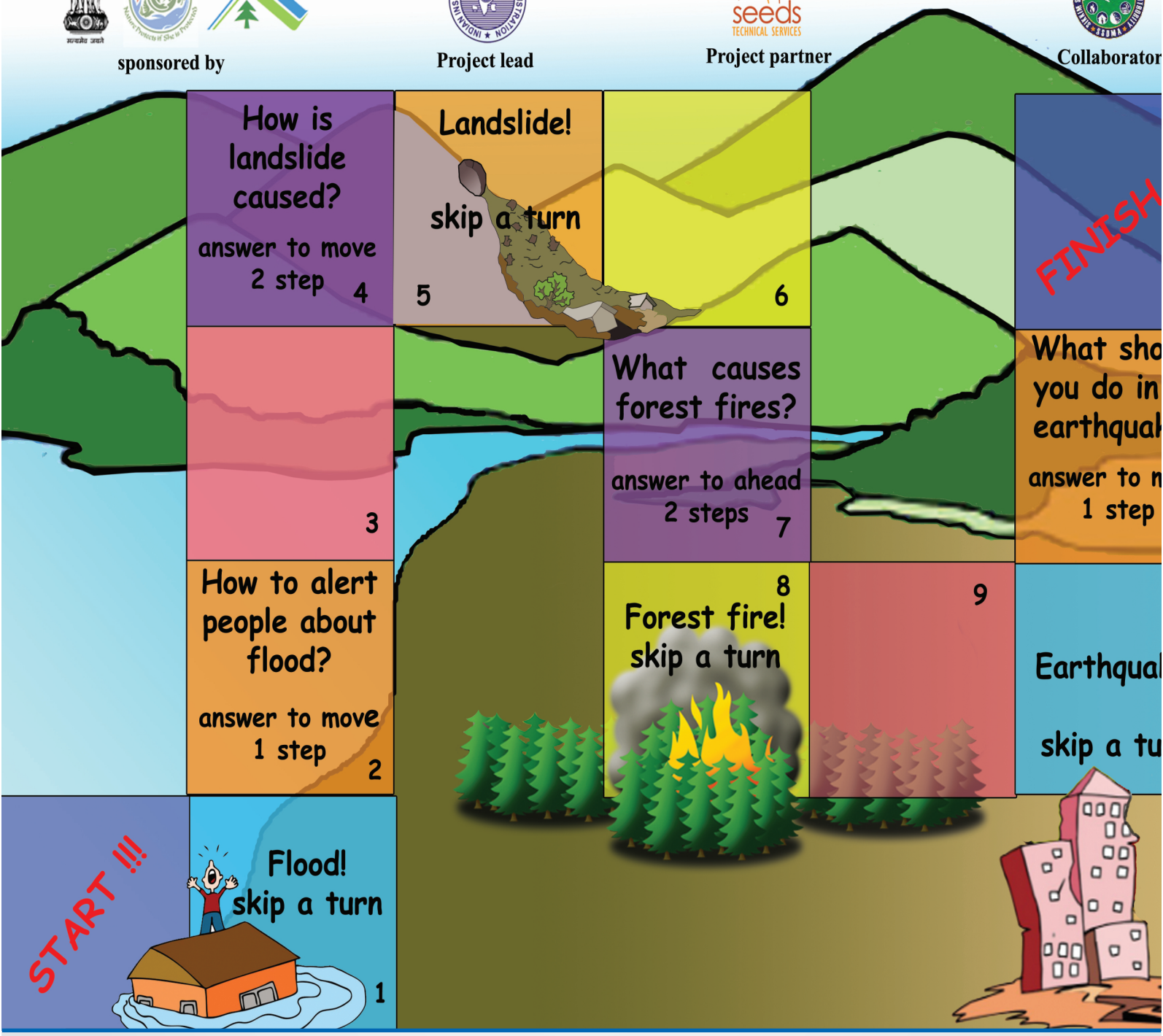

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