

# DEVELOPING DISASTER RESILIENCE ACTION PLAN FOR SHILLONG AND GANGTOK

## STAKEHOLDER WORKSHOP PROCEEDINGS



## Developing Disaster Resilience Action Plan through GIS and Prioritizing Actions for Natural Disaster Risk Reduction in Urban Agglomerations of Shillong and Gangtok

6<sup>th</sup> February, 2018

At

Summit Denzong, Renaissance Hotel & Spa, Kazi Road,  
Near Power House, Gangtok

Project Proponent:



Supported by:



Consortium Partners:



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## BACKGROUND

Himalayan cities are particularly vulnerable to disasters and extreme events like earthquakes, landslides, flash floods, thunderstorms and cold waves. The magnitude of hazards and extreme events in the region may vary depending on the risk exposure of the city.

Physical risks and vulnerabilities in the Himalayan cities are often accompanied by difficult terrain, lack of necessary resources – financial, human and institutional – as well as lack of access to relevant scientific information on the coping mechanism. This necessitates a thrust on improving the knowledge base and adaptive capacity of the cities by integrating disaster risk reduction measures in the urban planning.

In addition, rapid urbanization and climate change could exacerbate environmental stress in the region. Thus, there is a need to collect and review evidence to assess the vulnerability and likely impact of disasters in the region. IRADe with support from Ministry of Environment, Forests & Climate Change (MoEFCC) under National Mission on Himalayan Studies (NMHS) aims to develop Disaster Resilience Action Plans for Shillong and Gangtok cities.

## AIM

To provide decision-supporting tools for disaster risk reduction in the urban areas of the North East Region. It includes development of cadastral maps for micro zonation of hazard and action plan for disaster resilience for Shillong & Gangtok.

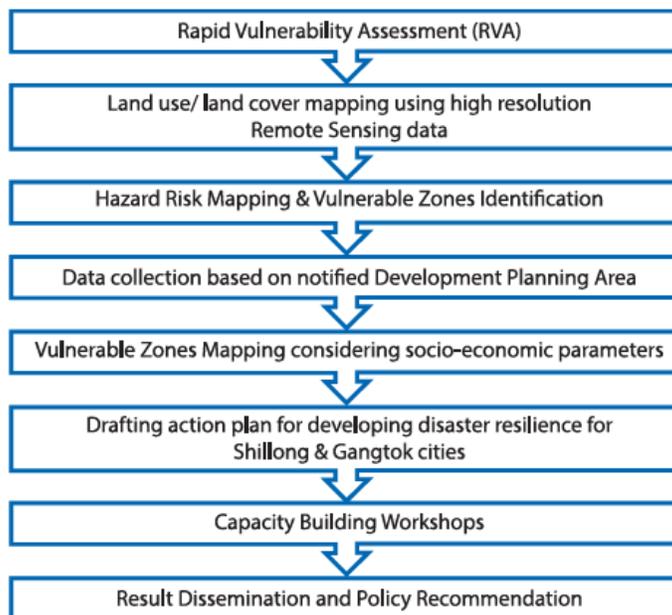
## OBJECTIVES

- Develop cadastral maps at the scale of 1:4000 and map hazard/ risk wise vulnerable zones of Shillong and Gangtok urban agglomerations.
- Conduct ground survey to Identify and map critical infrastructure – telecommunication installations, emergency operation centers, shelter homes, slums, hospitals & schools,
- Develop disaster resilience action plan for the identified cities and prioritize actions for disaster risk reduction through multi-stakeholder consultations involving citizens, government, public and private sector.
- Spread awareness and raise capacity of the citizens as well as city, district and state authorities.

## PARTNERS

The research is led by Integrated Research and Action for Development (IRADe), a leading research institute and think tank with consortium members including North-Eastern Space Applications Centre (NESAC), Meghalaya and Institute G.B. Pant National Institute of Himalayan Environment & Sustainable Development, ( GBPNIHESD ), Almora.

## PROJECT APPROACH



## EXPECTED OUTPUTS

- Land use/land cover maps for Shillong & Gangtok cities at cadastral scale 1:4000.
- Hazard wise vulnerable zone maps of the cities.
- Vulnerability assessment of Shillong & Gangtok cities to natural disasters.
- Critical infrastructure risk mapping for the cities.
- Disaster resilience plans for the Shillong & Gangtok.
- Capacity building of city, district and state authorities on disaster resilience.

## OUTCOMES

The outcomes of the project will help in developing policies for reducing the risk of losses in the events of natural disasters in the two cities.

- Generate awareness amongst stakeholders such as policy makers, state government, local governing bodies, government departments, NGOs, communities/citizens about the disaster risk reduction to reduce losses.
- Address lack of coordination and bring all stakeholders to one platform, leveraging IRADe's experience, expertise and strong local network.
- Craft and prioritize city-specific actions for disaster risk reduction.
- The project will lead to capacity building of the local mountain communities in disaster risk reduction by imparting them the necessary knowledge and information through social networking and public participation in workshops.

## STAKEHOLDER WORKSHOP

A stakeholders' workshop on "Developing disaster resilience action plan through GIS and prioritizing actions for natural disaster risk reduction in urban agglomerations of Shillong and Gangtok" was organized by the project proponent, Integrated Research and Action for Development (IRADe) in collaboration with North-Eastern Space Applications Centre (NESAC), Meghalaya and G.B. Pant National Institute of Himalayan Environment and Sustainable Development (GBPNIHESD), Sikkim Regional Center at Summit Denzong, Gangtok. The project is supported by the Ministry of Environment, Forests and Climate Change (MoEF&CC), Government of India under the NMHS Programme.

The primary objective of the workshop was to bring together the stakeholders at the Gangtok city level at the same platform to understand the aim of the project, which is to provide decision-supporting tools for disaster risk reduction in the urban areas of the North East Region of India, development of maps at the scale of 1:4000 scale for micro zonation of hazard and action plan for disaster resilience for Shillong and Gangtok.

The workshop was attended by participants from various departments of the urban local bodies and organizations viz., Land Revenue and Disaster Management Department, Govt. of Sikkim; Gangtok Municipal Corporation; Geological Survey of India, Sikkim Unit; Met Centre, Gangtok; Urban Development and Housing Department, Govt. of Sikkim; United Nations Development Programme; Save the Hills; Department of Geology, Sikkim University and Department of Geography, Sikkim University.

## WORKSHOP PROCEEDINGS

### INAUGURAL SESSION

The Workshop was inaugurated by **Mr. Shakti Singh** Choudhary, Mayor, Gangtok Municipal Corporation **Mr. Alok Kumar Srivastava**, IAS, Chief Secretary, Govt. of Sikkim, **Prof. Ajit Tyagi**, Former Director General of IMD & Senior Advisor, IRADe and **Dr. Jyoti Parikh** Executive Director, IRADe.

**Prof. A. Tyagi**, while addressing the stakeholders, he emphasized that the Himalayan cities are prone to number of hazards which eventually result in disasters effecting the large scale development of the cities, along with rapidly growing urban population. He indicated that there has been a paradigm shift in disaster resilience over the years in 3Rs (Rescue, Recover, Restoration) and IRADe being a Center of Excellence of MoEF&CC, has a good track record in developing urban resilience plans for cities. He briefed about the project which will be an action oriented project, wherein stakeholders' consultation and coordination in developing action plan, capacity building and implementation of the plan will be given due importance.

**Dr. J. Parikh**, inaugurating the session stressed on the primary objective of the workshop, which was to bring together all the stakeholders at the same platform and developing common understanding about the project and aim and expected outcomes. She gave an insight to IRADe's thematic areas and the various issues being addressed as a Center of Excellence of MoEFCC. She stressed on the work carried out by the organization in the field of urban and climate change programmes. The HIGS frame work developed by IRADe to assess the vulnerability profile of the cities was also briefed upon, along with its implementation in the work of 20 and 10 cities across India was showcased.

**Mr. S. S. Choudhary**, in his opening remarks briefed about the different hazards and disaster the city has faced over the years. He recalled the various earthquake events from history that shook the city and its adjacent areas, specially the 2011 earthquake which has been the pivotal point for the city and urban local bodies to take bold steps towards developing city resilience. He indicated that various govt. departments & urban local bodies like Building & housing, Electricity, road development departments have taken initiatives to reduce the loss of life and property due to hazards and disasters.

Chief Guest, **Mr. A.K. Srivastava**, pointed out that this was the first of its kind of stakeholders workshop being organized in Gangtok, and emphasized that proper planning and advanced tools like GIS and remote sensing along with increased social networking are required for proper disaster resilience. He pointed out that initially (15yrs back), disaster management was more relief oriented, which has now diverted to mitigation and adaption and along with the Kharif & Rabi seasons the hills comes across the season of Relief (after flooding). He indicated that climatological patters in the hills have changed over the times, with changing rainfall & precipitation pattern (decreased winter rainfall/ retreating monsoons), changing course of river, increase in vector borne diseases, increase in annual average temperature, poor quality and quantity of crops and fruits (apple, cardamom, etc.). He also mentioned some of the places in Gangtok which are prone to disasters like landslides along the hard rock area of Nathula, access road for north & south Sikkim, 9 mile area (sinking area), forest fires at 13-mile area etc. Emphasis was laid on immediate response system and long term planning for developing disaster resilient smart cities.

The Vote of Thanks was given by **Mr. Mohit Kumar**, Senior Research Associate, IRADe.

## **SESSION I - DEVELOPING DISASTER RESILIENCE IN GANGTOK: ISSUES AND SOLUTIONS**

**Chair: Mr. Rinzing Chewang**, Special Secretary, Land Revenue and Disaster Management Department, Govt. of Sikkim

**Co-Chair: Mr. G C Khanal**, Additional Director, Land Revenue & Disaster management Department, Govt. of Sikkim

Introducing the discussants Mr. Rinzing Chewang welcomed the participants to the workshop and assured full support and collaboration towards developing disaster resilience action plan for the city.

Mr. G C Khanal, Additional Director pointed out that the main issue faced by Gangtok is the frequent occurrences of landslide, which are triggered by torrential rainfall, shallow slopes, increased deforestation etc. Earthquake and landslide have caused devastation and claimed numerous lives over the years (1997 Landslide, destroyed over 300 HHs, 1995 mudflow, 32 lives lost and 8 housed damages). The city being prone to disaster is essentially due to its geological and geotectonic structure and in recent changes in climatology (changing rainfall patterns, rise in average temperature, etc.)

To address such issues, he indicated that stress needs to be given in developing new building codes, seismic resistant construction is required. Even disaster like forest fires have caused damages to households, eg. Nam Nam village was as affected by forest fires as plastic was used as roof sheds. Disaster like flashfloods causes havoc due to illegal land encroachments and constructions. Evacuation plans and mock drills and early warning systems are being developed in this respect.

### **Discussants**

**Mr. Vijay V Mugal**, Director, Geological Survey of India, Sikkim Unit, discussed about the work that is being carried out by his department in recognizing and demarcating areas which are prone to disasters like landslides and earthquakes. The department has recently developed National landslide susceptibility mapping, wherein the state of Sikkim is classified at the scale of 1: 50, 000 and 10,000, however micro-scaling is required and willingly agreed to provide all the geological solutions from the department. He claimed that a number of factors other than rainfall triggers the landslides/ mudslides in hilly regions. The structure and huge trees often exert pressure on the top soil causing down-hill movement of the soil. Areas like 8mile, 9mile and 10mile and transport corridors around Sikkim are majorly effected by landslides.

**Dr. G. N. Raha**, Director, Met Centre, Gangtok, focused his discussion on vulnerability of Sikkim to various hydrological and geological hazards. He stated that Gangtok lies in a very fragile environment and is prone to hazards like flashflood, thunderstorms, hailstorms, ground frost and drought like situations in lean seasons.

## SESSION II - PROJECT APPROACH AND METHODOLOGY

**Chair: Dr. Anil Kumar Mishra**, HOD, Dept. of Geology, Sikkim University

**Co-Chair: Mr. Rohit Magotra**, Assistant Director IRADe

Dr. Anil Kumar Mishra initiated the session on the discussion about the project approach and methodology

Mr. Rohit Magotra briefed the stakeholders and the participants about the Project, discussed about its aim, objectives and expected outcomes of the project. He discussed about the broad methodology being adopted in the project to attend the desired outputs, and as a part of the project released the project brochure and a background paper on Rapid Climate Vulnerability Assessment of Gangtok.

### Discussants

**Ms. Moumita Shaw**, Senior Research Associate, IRADe, discussed in length regarding Climate Vulnerability Assessments for the city of Gangtok. The assessment was carried out in light of the HIGS framework developed by IRADe, depicting the hazard vulnerability of the city (hazard time-line, extreme events, future projects of temperature and precipitation pattern), Infrastructure status (water supply, solid waste management, drainage, transportation, housing etc.), Governance (governance structure for disaster management, willingness to act etc.) and Socio-economic status (population density, slum population etc.)

The assessment indicated that the city is prone to major disaster events claiming lives and property. Frequent flashfloods and landslides during monsoons causes disruption in communications and road blockages. Temperature projection reveal that a rise in temperature by 1.8-2.1°C is expected by 2030, with decreased rainfall by 3%.

The basic infrastructure is not adequate and prone to disruption during hazard events. The per capita water supply is low at 60-70 lpcd and river water being the only source of water for the city. Only 24% of the city has storm water drainage connection with incidence of sewerage and storm water mixing high at 25%-30%. However, Government agencies at various level are taking initiatives to address Disaster Management.

**Dr. Diganta Barman**, Scientist / Engineer, NESAC, presented on the Remote Sensing and GIS approaches for mapping at 1:4000 Scale. He focused on the various geospatial approaches for high resolution urban hazard mapping. He explained the methodology for creation of geospatial database (1:4000), hazard mapping, landslide hazard mapping and seismic hazard mapping. He also presented briefly on the hazard, risk and vulnerability assessment of Guwahati and presented the plans for Gangtok and Shillong

During this session it was discussed that empowering local communities in disaster management is vital. Disaster management communities at the ward level, gram panchayat level has already been initiated by state government of Sikkim. For the mapping of the disaster like landslides, community level surveys are required, wherein information related to issues such as run-off, relocation/ rehabilitation can be stressed on. It was also put forward that the Met. department of Gangtok have installed several weather stations, yet real time weather data is not readily available in public domain.

**Dr. Devendra Kumar**, Scientist 'C', GBPNIHESD, SRC presented on the topic – "Mapping socio-economic vulnerability to disasters in North-East". He presented briefly on the vulnerability of India especially the Indian Himalayan Region to catastrophes. The impact of climate change on rainfall pattern, biodiversity and food security was also stressed upon. He also focused on the definition of resilient city, benefits of building resilient cities and a way forward for building resilient city.

## SESSION III- ENGAGING STAKEHOLDERS FOR DEVELOPING DISASTER RESILIENCE ACTION PLANS

**Chair: Prof. Ajit Tyagi**, Senior Advisor, IRADe

**Co-Chair: Mr. Shakti Singh Chaudhary**, Mayor, Gangtok Municipal Corporation

## Discussants

The discussants of this session were **Mr. Vijay V. Mugal** (Director, Geological Survey of India, Sikkim Unit), **Dr. G.N. Raha**, (Director, Met Centre, Gangtok), **Dr. Surajit Baruah** (State Project Manager, UNDP), **Wing Commander Praful Rao** (Founder and CEO, Save the Hills) and **Dr. Ishwarjit Singh** (Assistant Professor, Department of Geography, Sikkim University).

Mr. Mugal spoke briefly on base map preparation and road corridor mapping. He further focused on natural disaster especially on glacial lake outburst floods (GLOFs) and suggested remedies for mitigating it. Dr. Raha gave details on real time monitoring of various climatic phenomena. Dr. Baruah provided suggestions for developing disaster resilience action plans. Mr. Rao pointed out the various aspect viz. landslides, changing rainfall pattern, vanishing springs to be taken into consideration for the preparation of the action plan. He also suggested the involvement of local community for enhancing the aforementioned work. Dr. Singh spoke briefly about the steps involved in developing disaster resilience viz. preparedness, ways to act during the time of disaster and how to cope after the disaster.

Dr Mithilesh Singh, Scientist-In charge, GBPNIHESD, Sikkim Regional Centre presented the Vote of Thanks to all the dignitaries.

## Way Forward

Some of the points discussed are:

- There lies a requirement for integration of all the departments and other completed or on-going projects, so that duplication of data can be avoided
- Community participation and stakeholder consultation is required at all stages
- For the landslide micro-zonation mapping, base maps with delineated area and contour maps are required, there is need for data availability, integrated approach of field investigation, geospatial analysis is pre-requisite.
- For adaption and mitigation measure, remedies for major hazard events needs to be worked out, along with monitoring (3 phase action plan), developing telecommunications and developing mock drills.
- Though there are issues with maintenance of AWS, real time data are required for developing early warning systems (132 AWS stations are planned to be installed in entire Sikkim)
- UNDP, India, Swiss Agency and DST climate change Dept. of Sikkim had previously worked to strengthen the Sikkim climate resilience and community resilience.
- UNDP has also initiated 16 model vulnerable village study with SSDMA.
- Convergence and upscaling of the existing information is required.
- The Urban Development & Housing Department, Gangtok also indicated that they are currently working on developing the city Master Plan and aims to develop land-use maps at the 1:4000. However, their focus is on planning and not on disaster.
- It was suggested that the departments and organizations involved in the project as stakeholder should work in close collaboration and share the information with each other, to avoid duplication of task.

**ANNEXURE**

**ANNEXURE A: AGENDA OF THE WORKSHOP**

**PROGRAMME SCHEDULE**

Stakeholders' Workshop

on

**Developing Disaster Resilience Action Plan through GIS and Prioritizing Actions for Natural Disaster Risk Reduction in Urban Agglomerations of Shillong and Gangtok**

Date: 6th February, 2018

Venue: Summit Denzong, Renaissance Hotel & Spa, Kazi Road, Near Power House, Gangtok

Time	Sessions	
10.00-10:30 am	Registration	
10.30 - 11.35 am	Inaugural Session	
10.30 - 10.45 am	Welcome Address	Prof. Ajit Tyagi, Former Director General of IMD & Senior Advisor, IRADe
10.45- 11.00 am	Inaugural Address	Dr. Jyoti Parikh, Executive Director, IRADe
11.00-11.15 am	Opening Remarks	Mr. Shakti Singh Choudhary, Mayor, Gangtok Municipal Corporation
11.15 -11.30 am	Special Address by The Chief Guest	Mr. Alok Kumar Srivastava, IAS, Chief Secretary, Govt. of Sikkim
11.30 – 11.35 am	Vote of Thanks	Mr Mohit Kumar, Senior Research Associate, IRADe
11.35 am – 12.00 pm	Tea Break	
12.00 – 1.15 pm	Session I: Developing Disaster Resilience in Gangtok: Issues and Solutions	
	Chair	Mr. Rinzing Chewang, Special Secretary, Land Revenue and Disaster Management Department, Govt. of Sikkim
	Co-Chair	Mr. G C Khanal, Additional Director, Land Revenue & Disaster management Department, Govt. of Sikkim
Discussants		
12.00 – 12.30 pm	Mr. Vijay V Mugal, Director, Geological Survey of India, Sikkim Unit	
12.30 – 1.00 pm	Dr G N Raha, Director, Met Centre, Gangtok	
1:00– 2:00 pm	Lunch	
2.00 - 3.00 pm	Session II : Presentation of Project Approach and Methodology	
	Chair	Dr. Anil Kumar Mishra, HOD, Dept. of Geology, Sikkim University
	Co-Chair	Mr. Rohit Magotra, Assistant Director IRADe
Technical Presentations on:		

Time	Sessions	
2.00 - 2.20 pm	<b>Rapid Vulnerability Assessment of Gangtok</b> Mrs. Moumita Shaw, Senior Research Associate, IRADe	
2.20 - 20.40 pm	<b>RS and GIS approaches for mapping at 1:4000 scale, NESAC</b> Dr. Diganta Barman, Scientist / Engineer, NESAC	
2.40 - 3.00 pm	<b>Mapping socio-economic vulnerability to disasters in North-East, GBPNIHESD</b> Dr. Devendra Kumar, Scientist 'C', GBPNIHESD	
3.00 – 4.30 pm	<b>Session III : Engaging stakeholders for developing Disaster Resilience Action Plans</b>	
	<b>Chair</b>	Prof. Ajit Tyagi, Senior Advisor, , IRADe
	<b>Co-Chair</b>	Mr. Shakti Singh Chaudhary, Mayor, Gangtok Municipal Corporation
<b>Discussants</b>		
3.00 -3.10 pm	Mr. Vijay V Mugal, Director, Geological Survey of India, Sikkim Unit	
3.10- 3.20 pm	Dr G N Raha, Director, Met Centre, Gangtok	
3.20- 3.30 pm	Mr Surajit Baruah, State Project Manager, UNDP	
3.30 – 3.40 pm	Dr A K Swain, Senior Geologist, GSI	
3.40-3.50 pm	Wing Commander Praful Rao, Founder and CEO, Save the Hills	
3.50-4.00 pm	Dr Rakesh Ranjan, Assistant Professor, Dept. of Geology, Sikkim University	
4.00-4.10 pm	Dr Ishwarjit Singh, Assistant Professor, Department of Geography, Sikkim University	
<b>4.00 – 4.30 pm</b>	<b>Recommendations of the stakeholders - Open Floor</b>	
4.30 - 5 pm	<b>Way forward</b> – Dr Ajit Tyagi, Dr Jyoti Parikh, Mr Rohit Magotra, Dr Diganta Barman and Dr Mithilesh Singh	

ANNEXURE B: LIST OF PARTICIPANTS



Attendance sheet

Date: 6<sup>th</sup> February, 2018

**Developing Disaster Resilience Action Plan through GIS & Prioritizing Actions for Natural Disaster Risk Reduction in Urban Agglomerations of Shillong and Gangtok**

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28	Yangchen Tongden Gyepchen	Sikkim Helping Hands	7063406344	

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34	KARMA THEMUPHUKA	SIKKIM UNIVERSITY	8348106247	
35	Jalpa Tamang	SIKKIM UNIVERSITY	8001408325	
35	Dilshrajit Singh	S.K.Kim	7407829223	
36	Seeborn Tamon	S.K.Kim. HOME	9424164690	
37	KARMA	S S D M A L R D M D	7797889853	
38	Deeke. D. Tamang	G.B. Pant, Rangthang	9547301162	
39	R. C. Bhatnagar	Spl. Secy / ICRD	9434186234	
40	Sandhya Rai	GBPNIHESD	7407067820	
41	Dr. D. Khan		8001375435	
42	Tshering Tselilepden	G.B. Pant, Rangthang	7872040556	
43	Dr. Aashu Kumar	G.B. Pant Nahar Nahar Singh	745204052	
44	Yeden Bhatia	G.B. Pant " " "	9795325908	
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47	ALOK K. Shrivastava	Chief Secretary Govt. of Sikkim	03592-202315	
48	Dr. B. Jyoti Parshad	Secy. Div. IRADe		
49	Dr. A.K. Misra	Dept. of Geology, Sikkim University	9873122054	
50	Dr. Rakshita Ranjan	Dept. of Geology, Sikkim University, Gangtok	8100420032	
51	R.K. Das	University, Gangtok		
52	Dr. M. Singh	GBPNIHESD, SRC	9593380708	

**ANNEXURE C: PHOTOGRAPHS FROM THE WORKSHOP**



*1 Delegates on the dais in the Inaugural Session*



*2 Group photograph of participants of the workshop*