DMS HIMALAYA
JOURNEY TO SCALE

PRAGYA

HAZARDS PROFILES SURVEY

DMS HIMALAYA
JOURNEY TO SCALE

Initiative of

PRAGYA
www.pragya.org

Pragya is a NGO working for appropriate development of vulnerable communities and sensitive ecosystems since 1995. It works through its head office in Delhi NCR and 28 field offices across 8 states/UTs.

Pragya is recognized as a Scientific and Industrial Research Organisation (SIRO) by the DSIR, Ministry of Science & Technology, GoI and has Special Consultative Status with UN Economic and Social Council (ECOSOC).

Supported by

HIF Humanitarian innovation fund | elrha | Ministry of Foreign Affairs

DMS Himalaya is funded and supported by **Elrha**'s **Humanitarian Innovation Fund (HIF)**, a grant making programme which improves outcomes for people affected by humanitarian crises by identifying, nurturing and sharing more effective and scalable solutions.

Elrha's HIF is funded by the **Netherlands Ministry of Foreign Affairs**.

INTRODUCTION

BACKGROUND

Pragya is scaling up a citizen-based Disaster Management System (DMS) for improving disaster preparedness and response at grassroots level in the Indian Himalayas, building on a recently concluded 4-years pilot phase in Uttarakhand in the Central Himalayas. The **DMS Himalaya** model empowers communities for participatory disaster management at the local level, spanning both pre and post disaster stages, in seamless collaboration with the government.

DMS Himalaya is customised to the specific hazard profile of each zone in the Himalayan region, with pre-defined indicators and markers for top hazards, to enable continual surveillance and early warning system for timely damage prevention and evacuation measures.

While there are certain core similarities, the Himalayan region has intra-regional variations with related differences in hazard profiles across three altitudinal belts (foothills; hills; high mountains) in each of three zones (east, central, west). The hazard profiles for central Himalayas has been verified via piloting the innovation during 2016-2020. For scaling, the hazard profile of eastern and western Himalayas had to be confirmed, along with the indicators. Customisation to the hazard profiles of the eastern and western Himalayas was carried out involving consultations with local and regional stakeholders to validate previous research and the inputs would be incorporated for modifications to the DMS-Himalaya App.

SURVEY OBJECTIVES

The consultation for identifying hazard profiles and markers for the two new contexts (Western and Eastern Himalayas) was undertaken in consultation with nodal disaster management (DM) institutions, Himalaya experts and local DM actors.

Objectives for the consultations were as follows:

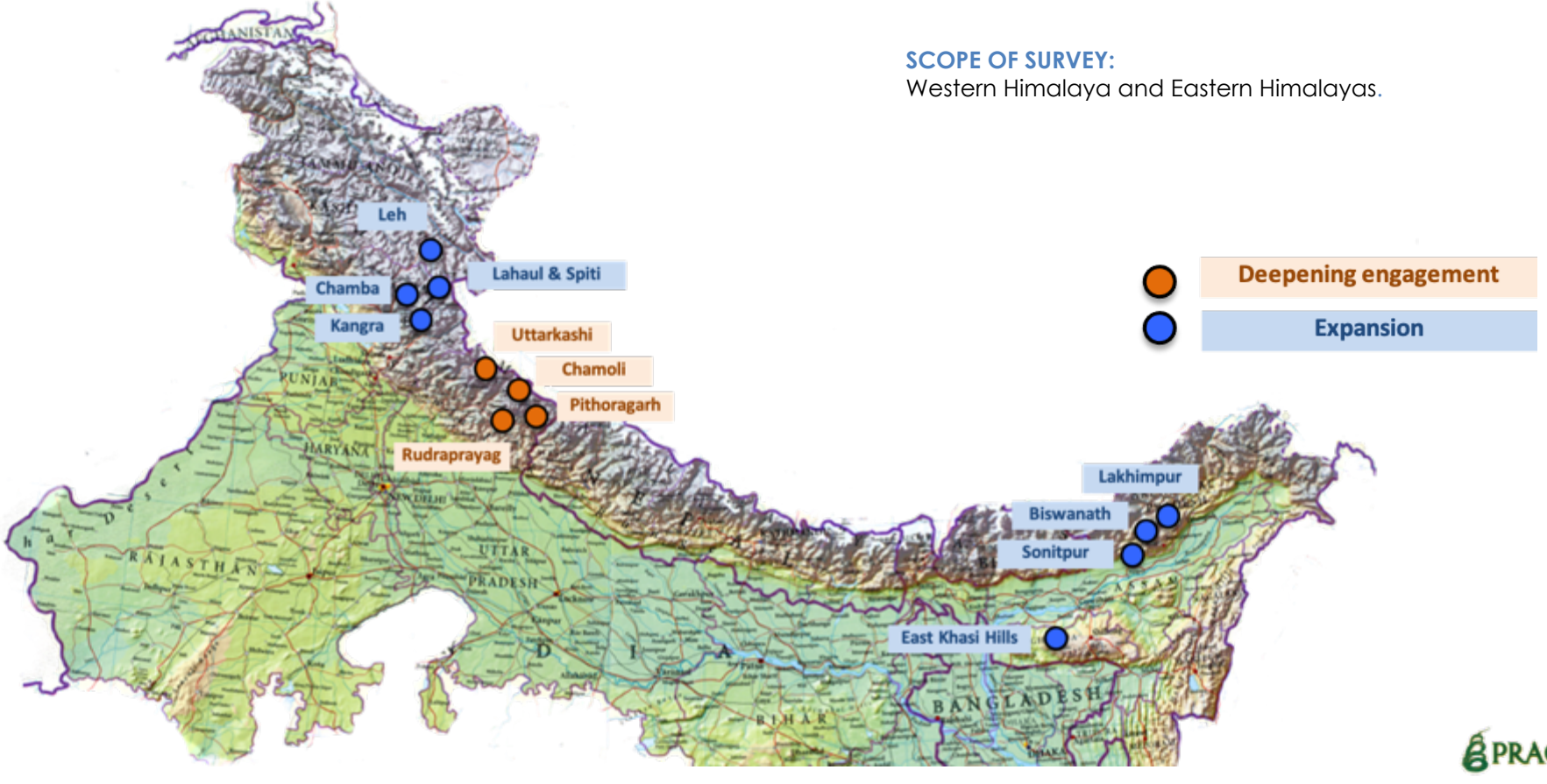
- To conduct consultations with nodal DM institutions, Himalaya experts and local DM actors on the hazard profiles of the two new contexts (Western and Eastern Himalayas)

- To conduct research to finalise/ recalibrate measurement parameters and thresholds for the specific hazards for the new contexts.

- To map requirement for technology variations based on the local context.

SCOPE OF SURVEY

SCOPE OF SURVEY:
Western Himalaya and Eastern Himalayas.



PRAGYA

PARTICIPANTS – Western Himalayas

WESTERN HIMALAYAS

CATEGORIES	TARGET	ACHIEVED	DETAILS
Nodal DM institutions	3	3	**Western Himalayas** (3) - District Disaster Management Authorities (DDMA – Chamba, Kangra, Leh)
Himalaya Experts	3	3	**Western Himalayas** (3) – Department of Civil Engineering - IIT Mandi, Centre for Geoinformatics Research and Training - CSK Himachal Pradesh Krishi Viswavidyalaya (agricultural university), SCA-Himalayas – Swiss Cooperation Office
Local DM actors	9	9	**Western Himalayas** (9)– Police, Fire Department, NGOs

PARTICIPANTS – Eastern Himalayas

WESTERN HIMALAYAS

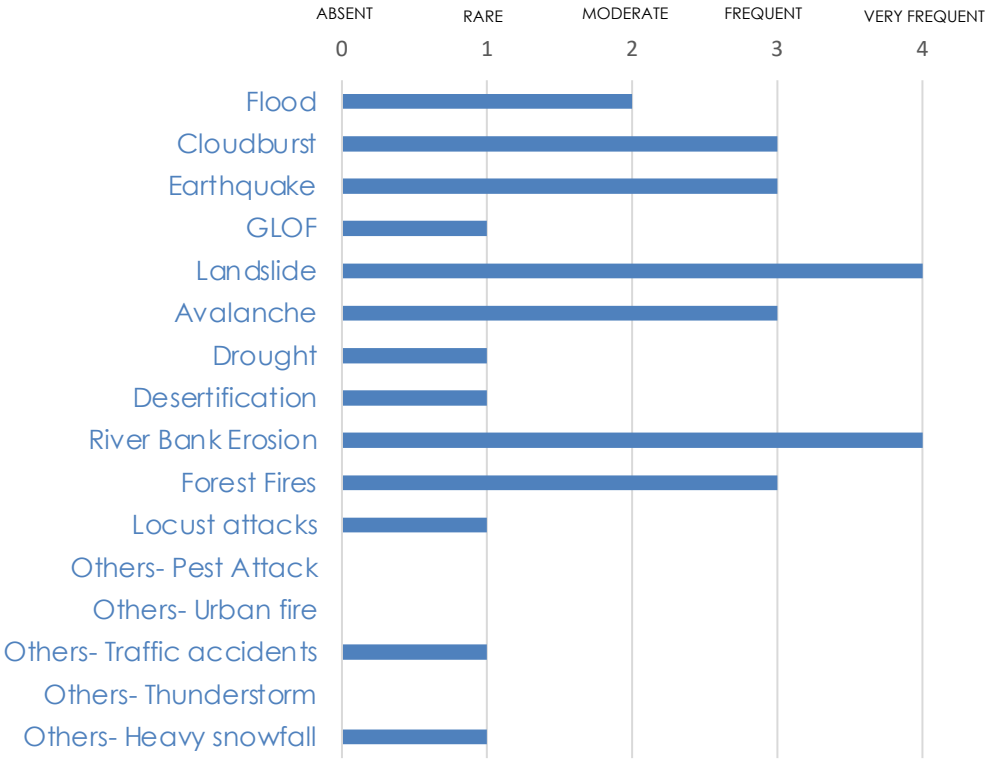
CATEGORIES	TARGET	ACHIEVED	DETAILS
Nodal DM institutions	3	3	**Eastern Himalayas** (3) – State Disaster Management Authority (SDMA – Meghalaya), District Disaster Management Authorities (DDMA – Sonitpur, Biswanath)
Himalaya Experts	3	3	**Eastern Himalayas** (3) – Centre for Disaster Management -Tezpur University, Department of Environmental Science – Shillong College, Department of Civil Engineering - IIT Guwahati
Local DM actors	9	10	**Eastern Himalayas** (10) – Police, Fire Department, Forest Department, Block Development Officer, Sub-Divisional Officer, Revenue Department, NGOs

HAZARDS PROFILE – Western Himalayas

PRAGYA

HAZARDS – Western Himalayas

FREQUENCY OF OCCURENCE



** Compiled based on inputs from respondents*

The nodal DM institutions, Himalaya experts and local DM actors reported highest frequency for landslides and river-bank erosion in the western Himalayas, indicating that they occur every 1-3 years, often more than once a year.

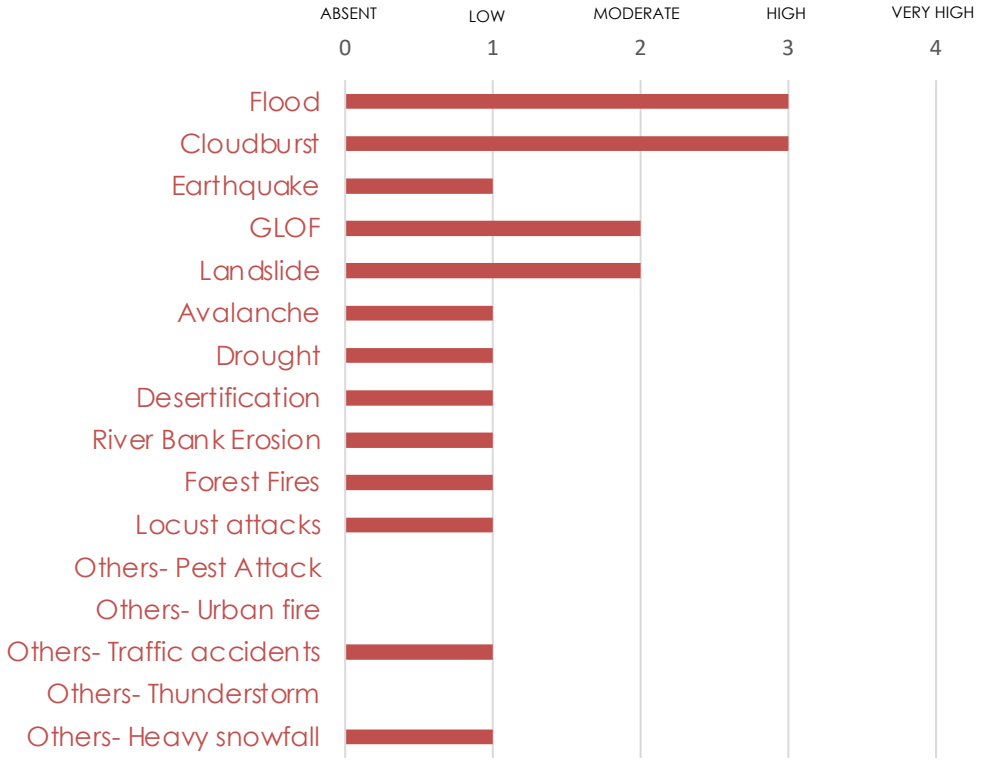
Cloudburst, earthquake, avalanche and forest fires were next in terms of high frequency. Avalanches were observed more in Leh (Ladakh) and Lahaul & Spiti (Himachal Pradesh) districts as they receive higher amount of snowfall. Forest fires on the other hand was less frequent in these districts as they constitute the cold desert region and have sparse vegetation cover. Higher frequency of cloudbursts were reported by DM actors from Chamba and Kangra (Himachal Pradesh).

The respondents also noted occurrences of GLOF, Drought, Desertification, Locust attacks as well as traffic accidents and heavy snowfall, however, they were rare and reported by fewer respondents.

PRAGYA

HAZARDS – Western Himalayas

IMPACT



** Compiled based on inputs from respondents*

The respondents reported high impact for floods and cloudbursts in the western Himalayas noting that they result in isolated cases of deaths, injuries; temporary food / water shortage which can be met through local support; considerable damage to livelihood assets, partial damage to infrastructure; and disruption in communication and power or water supplies in a large area which needs significant time and effort for rebuilding. In Leh (Ladakh) and Lahaul & Spiti (Himachal Pradesh) that had suffered human losses due to floods and cloudbursts in recent decades, the impacts were reported as very high.

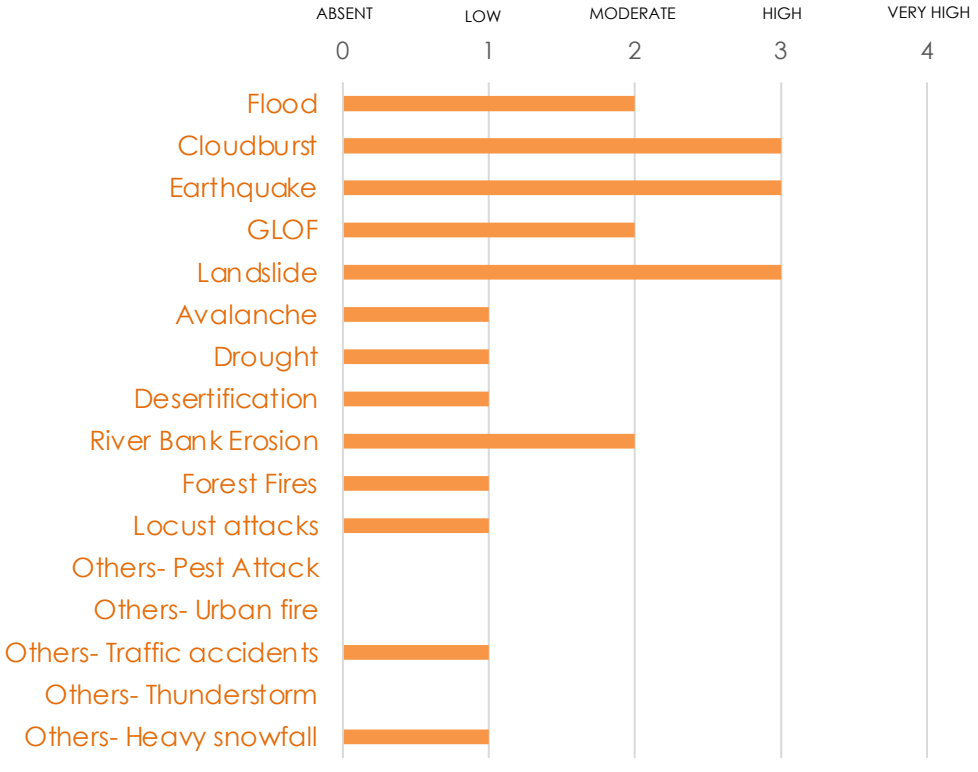
GLOFs and landslides were observed to have moderate impact, with no loss of lives. GLOFs were reported in Leh (Ladakh) and Lahaul & Spiti (Himachal Pradesh) districts in the cold deserts and not in the other districts.

Impacts of other hazards were reported as low.

PRAGYA

HAZARDS – Western Himalayas

VULNERABILITY



** Compiled based on inputs from respondents*

The consultation identified that the communities in the western Himalayas were highly vulnerable to the rapid onset disasters from cloudbursts, earthquakes and landslides due to poor or no early warning systems for these hazards and lack of community capacity to deal with these.

The communities had moderate levels of vulnerability from Floods, GLOFs and riverbank erosion as early warning measures were present but inadequate. For GLOF, the community also did not have pre-existing traditional knowledge to draw upon.

Vulnerabilities to other hazards were reported as low. Avalanches and forest fires in the western Himalayas were usually observed in remote stretches away from habitation, while drought and desertification were slow onset and allowed the communities and government to implement various measures to reduce the negative impacts.

PRAGYA

HAZARDS – Western Himalayas

OVERALL HAZARD PROFILE

Hazards	Frequency	Impact	Vulnerability	Top Hazards
Flood	MODERATE	HIGH	MODERATE	Rank 3
Cloudburst	HIGH	HIGH	HIGH	Rank 1
Earthquake	HIGH	LOW	HIGH	Rank 4
GLOF	LOW	MODERATE	MODERATE	
Landslide	VERY HIGH	MODERATE	HIGH	Rank 2
Avalanche	HIGH	LOW	LOW	
Drought	LOW	LOW	LOW	
Desertification	LOW	LOW	LOW	
River Bank Erosion	VERY HIGH	LOW	MODERATE	Rank 5
Forest Fires	HIGH	LOW	LOW	
Locust attacks	LOW	LOW	LOW	
Others- Pest Attack	ABSENT	ABSENT	ABSENT	
Others- Urban fire	ABSENT	ABSENT	ABSENT	
Others- Traffic accidents	LOW	LOW	LOW	
Others- Thunderstorm	ABSENT	ABSENT	ABSENT	
Others- Heavy snowfall	LOW	LOW	LOW	

Based on the consultation, the top 5 hazards for the western Himalayan region emerged to be - Cloudburst (Rank 1), Landslide, Flood, Earthquake and River Bank Erosion (Rank 5).

The ranks were calculated based on overall contribution by each of the components – frequency, impact and vulnerability of a hazard. Cloudburst scored high across all three components and thereby ranked no. 1, whereas Riverbank Erosion, in spite of having very high frequency, was ranked as no. 5 because of low impact and moderate vulnerability scores.

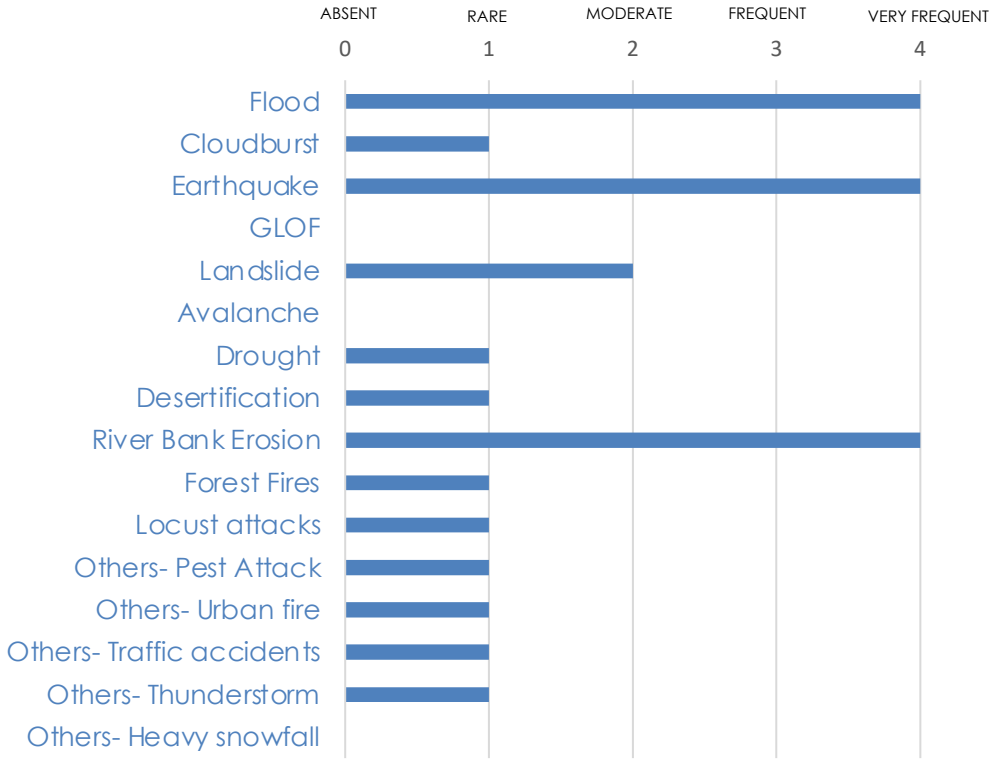
** Compiled based on inputs from respondents*

PRAGYA

HAZARDS PROFILE – Eastern Himalayas

HAZARDS – Eastern Himalayas

FREQUENCY OF OCCURENCE



** Compiled based on inputs from respondents*

The nodal DM institutions, Himalaya experts and local DM actors unanimously reported very high frequency for floods. They also reported very high frequency of earthquake and river-bank erosion in the eastern Himalayas, indicating they occur every 1-3 years, often more than once a year.

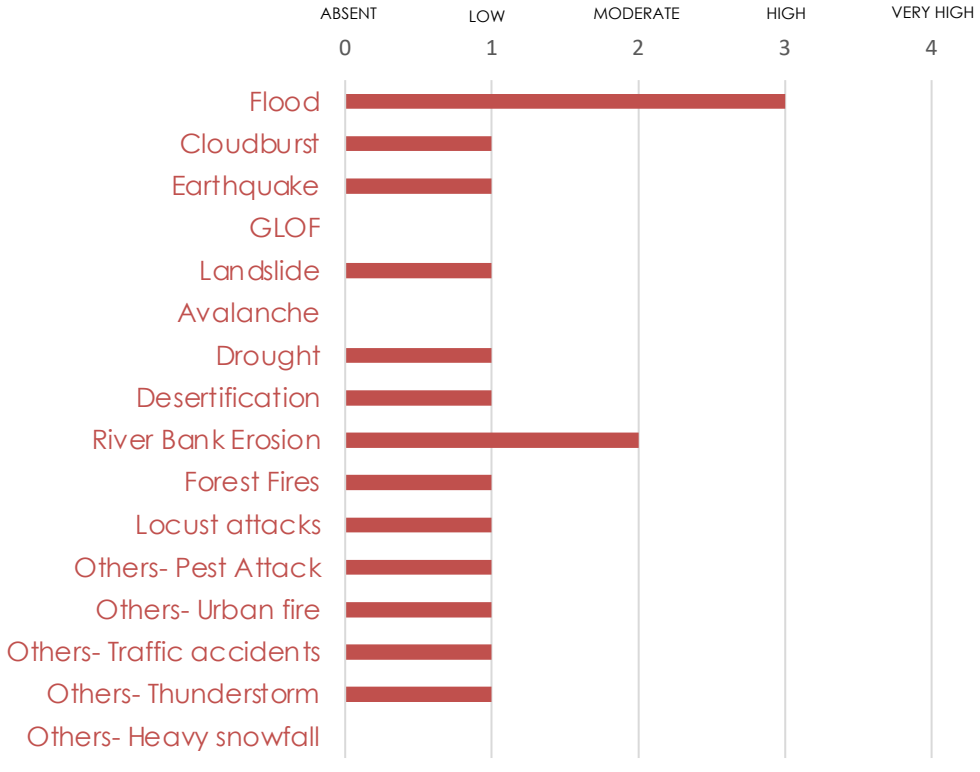
Landslides were next, having overall moderate frequency in the region, with very high frequency in the East Khasi Hills (Meghalaya). Other hazards were reported to have low frequency in the region. Forest fires were mostly reported for East Khasi Hills (Meghalaya). Thunderstorms were reported to be frequent in Sonitpur and Biswanath districts (Assam).

The respondents noted absence of GLOF and avalanches in the target areas of the Eastern Himalayas owing to their low altitudes, lack of snowfall, absence of/significantly high distance from glaciers.

PRAGYA

HAZARDS – Eastern Himalayas

IMPACT



** Compiled based on inputs from respondents*

The respondents reported high impact for floods especially in Biswanath and Sonitpur districts (Assam) in the eastern Himalayas, indicating that they result in isolated cases of deaths, injuries; temporary food / water shortage which can be met through local support; considerable damage to livelihood assets, partial damage to infrastructure; and disruption in communication and power or water supplies in a large area which needs significant time and effort for restoration.

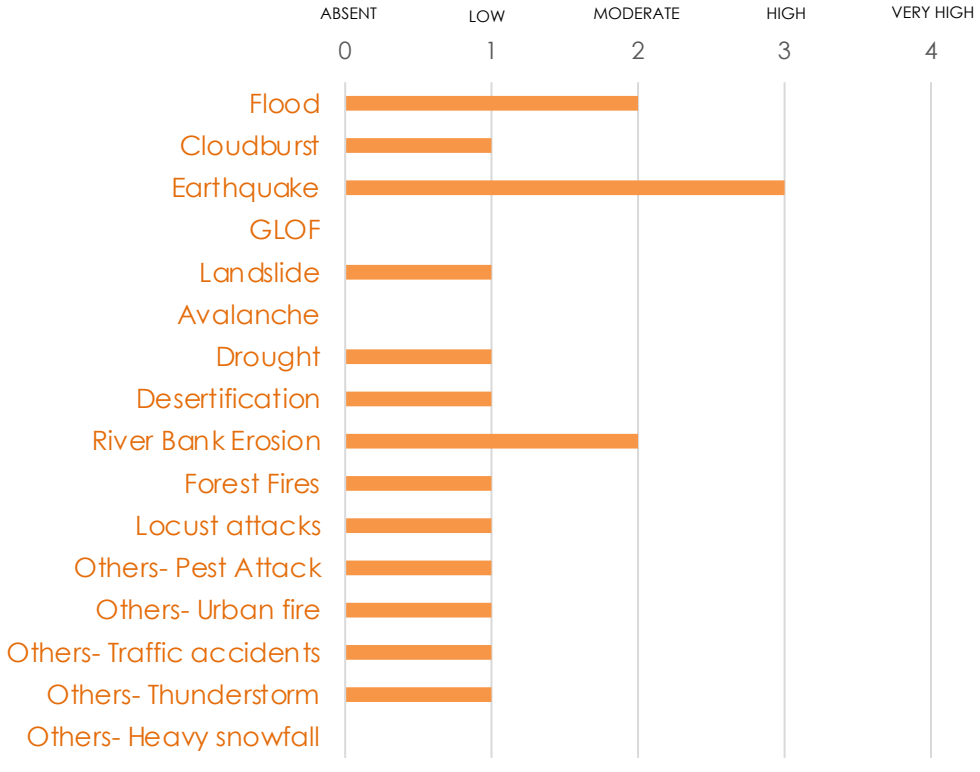
River Bank Erosion was reported to have moderate impact, with no loss of lives, but high impacts mostly reported from Biswanath and Lakhimpur districts (Assam). Impact of thunderstorms was reported as high in Biswanath and Sonitpur districts (Assam), but other parts of the region did not report such experience.

Impacts of other hazards were reported as low.

PRAGYA

HAZARDS – Eastern Himalayas

VULNERABILITY



** Compiled based on inputs from respondents*

The consultation identified that the communities in the eastern Himalayas were highly vulnerable to earthquakes due to no early warning system for this hazard.

The communities had moderate levels of vulnerability from Floods and riverbank erosion as early warning measures were present but inadequate. Since the communities in Assam were mostly based in floodplains, and the region receives high rainfall, with the Brahmaputra river known for its regular flooding, bank erosion and shifting of the channel; the communities experience these hazards regularly. However, they also possess traditional knowledge to deal with them.

Vulnerabilities to other hazards were reported as low. Impact of cloudburst, landslides and thunderstorms was moderate to high in some pockets, but due to their rare occurrence and limited spread, overall vulnerability to these hazards was low.

PRAGYA

HAZARDS – Eastern Himalayas

OVERALL HAZARD PROFILE

Hazards	Frequency	Impact	Vulnerability	Top Hazards
Flood	VERY HIGH	HIGH	MODERATE	Rank 1
Cloudburst	LOW	LOW	LOW	
Earthquake	VERY HIGH	LOW	HIGH	Rank 3
GLOF	ABSENT	ABSENT	ABSENT	
Landslide	MODERATE	LOW	LOW	Rank 4
Avalanche	ABSENT	ABSENT	ABSENT	
Drought	LOW	LOW	LOW	
Desertification	LOW	LOW	LOW	
River Bank Erosion	VERY HIGH	MODERATE	MODERATE	Rank 2
Forest Fires	LOW	LOW	LOW	
Locust attacks	LOW	LOW	LOW	
Others- Pest Attack	LOW	LOW	LOW	
Others- Urban fire	LOW	LOW	LOW	
Others- Traffic accidents	LOW	LOW	LOW	
Others- Thunderstorm	LOW	LOW	LOW	
Others- Heavy snowfall	ABSENT	ABSENT	ABSENT	

Based on the consultations, the top hazards for the eastern Himalayan region emerged to be - Flood (Rank 1), River Bank Erosion, Earthquake and Landslide (Rank 4).

The ranks were derived based on overall contribution by each of the three components – hazards frequency, impact and vulnerability. Flood, Earthquake, River Bank Erosion - all scored very high on frequency and the ranks were thus determined by their level of impacts and degree of vulnerability to the hazards.

** Compiled based on inputs from respondents*

PRAGYA

RECOMMENDATIONS – Parameters & Technologies

RECOMMENDATIONS

RECOMMENDATIONS

Hazards	Parameters to be monitored	Suggested technology
Flood	• Rainfall / precipitation / thunderstorms • Water level • Stream flow • Sediment load, erosion • Human interference • Other weather parameters (Continuous monitoring)	• Remote sensing and GIS • Network of automated weather stations / Meteorological observation stations • Barometer • River gauge • Nowcasting • Flood-modelling
Cloudburst	• Rainfall • Humidity • Density of cloud • Valley regions mapping • Other weather parameters (Continuous monitoring)	• Radar network • Network of automated weather stations / Meteorological observation stations • Barometer • River gauge • TRMM Satellite Image
Earthquake	• Mapping earthquake prone regions based on long term database • Magnitude, frequency	• Seismograph
GLOF	• Rainfall • Snowfall • Stream Flow • Moraine dams, avalanches in glacial lakes • Changes in glacial structures	• Remote sensing and GIS • Moraine dam sensors • GLOF acoustic sensors • Wind velocity sensors

** Compiled based on inputs from respondents – western and eastern Himalayas*

PRAGYA

RECOMMENDATIONS

RECOMMENDATIONS

Hazards	Parameters to be monitored	Suggested technology
Landslide	• Rainfall / precipitation • Visual parameters – movement of stones and trees • Slope mapping - soil characteristics, slope angle, rate of deforestation • Slope movement	• Remote sensing and GIS • Slope movement sensors / low cost early warning technology from IIT Mandi • Pore water pressure monitoring • Automated weather stations
Avalanche	• Snow depth	• Remote sensing and GIS
Drought	• Normalized difference vegetation index (NDVI) maps	• Remote sensing
Desertification	• Normalized difference vegetation index (NDVI) maps	• Remote sensing
River Bank Erosion	• Stream flow • Silt deposition / soil loss • Spill over zone / floods buffer zone mapping	• River gauge • Remote sensing and GIS
Forest Fires	• Mapping calorific values of trees • Wind speed • Visible fire	--

** Compiled based on inputs from respondents – western and eastern Himalayas*

PRAGYA

WAY AHEAD

WAY AHEAD

NEXT STEPS

• New hazards - Forest fires, Locust menace, River Bank Erosion were added to the 'Go Risk' tool.

• Noting the variation in occurrences of different hazards across the region and across districts within a specific region, the 'Go risk' reporting platform on app was modified to show selected hazards by a state or district, with options for state and district level authorities to configure the same as needed.

• Based on the consultations on the hazard profiles of the two new contexts (Western and Eastern Himalayas), the technology requirement for monitoring weather parameters was updated. The new automated weather stations to be installed in the region includes the technology to monitor lightning strikes, which came up during discussions on thunderstorms in Assam.

• Following the consultations, further secondary research was done on measurement parameters for – forest fires, locust menace, River Bank Erosion and these are being integrated in regular monitoring and reporting framework for 'Go Risk' tool of DMS Himalaya.

THANK YOU