

Enhancing Disaster-related Statistics in Nepal

Mapping Population Exposure to Flood and Landslide Hazards

National Statistics Office, Office of the Prime Minister and
Council of Ministers, Government of Nepal

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Preface

I am pleased to present disaster related report "Enhancing Disaster-related Statistics in Nepal, Mapping Population Exposure to Flood and Landslide" which will serve as a pilot case study on hazard risk assessment and exposure to hazards using census and administrative data. In the case of disaster, accurate and reliable data can help and allow policymakers to undertake more precise analysis in determining the disaster impact to the affected populations, vulnerable groups, and infrastructure exposed to hazards in the affected area. In addition, statistics on social, environmental, and economic conditions play a crucial role in understanding disaster risks, while various sources of data, for example, censuses, surveys, and administrative and earth observation data can be integrated to produce baseline statistics for risk assessments and post-disaster impact assessments.

This report was prepared under the Economic and Social Commission for Asia and the Pacific (ESCAP) project: "enhancing disaster-related statistics in Nepal". Under this project, activities were carried out to clarify national priorities, improve technical capacity of the National Statistics Office (NSO) and relevant stakeholders, and produce disaster-related statistics based on integrated sources of data. The report also consists of national policy priorities and plans, institutional arrangements and mechanisms, data holdings as well as issues with respect to data quality and data gaps related to disaster-related statistics.

I would like to express my sincere thanks to Deputy Chief Statisticians for their leadership and guidelines provided in the preparation of the report. In the same way, the Directors of the Environment Statistics Section deserve special thanks for their hard work in preparing the report. Likewise, my thanks goes to the Statistical Officers and Statistical Assistance for their contribution to the report. I heartily appreciate the ESCAP team for their technical support. I also thank all members of the task force for their valuable input in the process.

April 2024

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Contents

1	Introduction	7
2	Disaster-related statistics in Nepal	9
2.1	Introduction	9
2.1.1	Disasters in Nepal.....	9
2.1.2	Provisioning and the mandate for data management within policies and institutions.....	10
2.1.2.1	Policy Frameworks	10
2.1.2.2	Institutional mechanism for climate change and disaster risk reduction and management	12
2.1.3	Disaster-related statistics in Nepal	18
2.1.4	Hazard types and disaster classification	20
2.1.5	Data collection tools and coordination mechanism: emergency response, relief and recovery .	21
2.1.5.1	Data collection tools.....	21
2.1.5.2	Data collection mechanism and institutions involved	22
2.1.5.3	District disaster management committee (DDMC), Local Disaster Management Committee (LDMC) and Nepal Red Cross Society (NRCS)	22
2.1.5.4	Role of NDRRMA, Nepal Police Force, Nepal Red Cross, and Local Level Government in Disaster Data Collection and Verification.....	23
2.2	Disaster related data	25
2.2.1	Risk assessments	25
2.2.2	Hazard data and statistics	26
2.2.3	Exposure statistics.....	28
2.2.4	Vulnerability statistics.....	29
2.2.5	Coping capacity statistics.....	30
2.3	Disaster occurrence and impacts	31
2.3.1	Disaster occurrence.....	31
2.3.2	Disaster impacts	32
2.3.2.1	Human impact.....	32
2.3.2.2	Material impact	34
2.3.2.3	Economic impacts	35
2.3.2.4	Environmental impact	36
2.4	Disaster-risk reduction expenditure.....	37
2.4.1	Risk reduction	39
2.4.2	Response and recovery	39
2.4.3	Disaster-related development.....	40

2.4.4	Disaster-related transfers	40
2.5	Economic losses.....	41
2.5.1	Valuation of economic losses and damage.....	41
2.5.2	Agriculture losses statistics.....	41
2.5.3	Impact on productive assets, housing and infrastructure statistics.....	43
2.5.4	Impact on environment and cultural heritage.....	45
3	Hazard Exposure Mapping	46
3.1	Background.....	46
3.2	Concepts and definitions.....	47
3.3	Scope.....	48
3.4	Data sources	48
3.5	Methodology	49
3.5.1	Perception of risk based on the community questionnaire in NPHC 2021	50
3.5.2	Population exposure to hazards based on the BIPAD reported incidents and NPHC- 2021	50
3.5.2.1	Hazard frequency grouping	50
3.5.2.2	Population grouping.....	51
3.5.2.2.1	Exposure statistics	52
3.5.2.2.2	Mapping population exposure to hazards	52
3.5.2.2.3	Exposure statistics table	52
3.6	Key findings and analysis	52
3.6.1	Perception of risk based on the community questionnaire in NPHC 2021	52
3.6.1.1	Statistics	52
3.6.1.2	Perceived risk maps based on data from NPHC 2021 community questionnaire	54
3.6.1.2.1	Perceived flood risk maps	55
3.6.1.2.2	Perceived landslide risk maps.....	59
3.6.2	Population exposure to hazards based on the BIPAD reported incidents and NPHC 2021	63
3.6.2.1	Statistics	63
3.6.2.1.1	Incidence of flood and landslide (during last 12 years).....	63
3.6.2.1.2	Population exposure to hazards	63
3.6.2.2	Population exposure to hazards maps based on data from BIPAD portal and NPHC 2021.....	65
3.6.2.2.1	Flood exposure maps.....	65
3.6.2.2.2	Landslide exposure maps.....	67
3.7	Challenges.....	68
	Summary	70

References	72
Annexes	73
Annex 1: Task force on disaster-related statistics in Nepal.....	73
Annex 2: Policy Framework on Climate and Disaster Risk	74
Annex 3: Operationalization of disaster response to the recent disaster: Jajarkot earthquake.....	80
Annex 4: Community questionnaire of the National Population and Housing Census (NPHC) 2021 (unofficial translation).....	82
Annex 5: Perceived hazard risk maps (district level).....	87
Perceived risk maps: districts with highest proportion of wards reporting highest risk to flood	87
Perceived risk maps: districts with highest proportion of wards reporting highest risk to landslide	91

List of Tables

Table 1: Disaster-related data collection and management in Nepal	15
Table 2: Basic ranges of disaster-related statistics before, during and after a disaster.....	18
Table 3: Disaster-related data and responsible institutions	23
Table 4: Hazard statistics and data sources	26
Table 5: Exposure statistics and data sources	28
Table 6: Vulnerability statistics and data sources	29
Table 7: Coping capacity statistics and data sources	30
Table 8: Impact data and data sources	34
Table 9: Disaster risk reduction expenditure data and data sources	38
Table 10: Criteria for grouping flood and landslide frequency level.....	51
Table 11: Criteria for grouping population	51
Table 12: Criteria for grouping population exposure to flood and landslide	52
Table 13: Numbers of wards with highest risk rating (1st) to different hazard types, Nepal.....	53
Table 14: Top five hazards with perceived risk by provinces, Nepal	53
Table 15: Districts with highest proportion of wards reporting highest risk to flood by province	54
Table 16: Districts with highest proportion of wards reporting highest risk to landslide by province	54
Table 17: Number of hazard incidents reported in Nepal.....	63
Table 18: Population exposure to flood (number).....	64
Table 19: Population exposure to flood (percentage).....	64
Table 20: Population exposure to landslide (number)	65

Table 21: Population exposure to landslide (percentage).....	65
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List of Figures

Figure 1: Institutional mechanism for the climate action in Nepal	12
Figure 2: Institutional mechanism for disaster risk reduction and management in Nepal.....	14
Figure 3: Coordination mechanism during mega disaster.....	16
Figure 4: Institutional mechanism for executing the disaster response at various government levels.....	18
Figure 5: Material impact data on Nepal's DRR Portal	34
Figure 6: Share of earthquake effects across sectors.....	35
Figure 7: Loss and Damage Assessment Methodology (FAO, 2020)	43
Figure 8: Impact on various infrastructure and their measurement units.....	44
Figure 9: Trend of Climate-induced Hazards (MoFE, 2021).....	46
Figure 10: A question on disaster risk in the NPHC community questionnaire.....	49
Figure 11: Perceived flood risk map, Nepal.....	55
Figure 12: Perceived flood risk map, Koshi Province	55
Figure 13: Perceived flood risk map, Madesh Pradesh	56
Figure 14: Perceived flood risk map, Bagmati Province	56
Figure 15: Perceived flood risk map, Gandaki Province	57
Figure 16: Perceived flood risk map, Lumbini Province.....	57
Figure 17: Perceived flood risk map, Karnali Province.....	58
Figure 18: Perceived flood risk map, Sudurpacchhim Province.....	58
Figure 19: Perceived landslide risk map, Nepal	59
Figure 20: Perceived landslide risk map, Koshi Province	60
Figure 21: Perceived landslide risk map, Bagmati Province	60
Figure 22: Perceived landslide risk map, Gandaki Province	61
Figure 23: Perceived landslide risk map, Lumbini Province.....	61
Figure 24: Perceived landslide risk map, Karnali Province.....	62
Figure 25: Perceived landslide risk map, Sudurpacchhim Province.....	62
Figure 26: Flood hazard frequency (annual average occurrences).....	66
Figure 27: Population exposure to flood hazard, Nepal.....	66
Figure 28: Landslide hazard frequency (annual average occurrence)	67
Figure 29: Population exposure to landslide hazard, Nepal	68

List of Boxes

Box 1: Mobilization and responsibilities of different stakeholders during mega disaster	17
Box 2: Disaster related information management systems	20

1 Introduction

The 6th Intergovernmental Panel on Climate Change (IPCC) assessment on climate change impacts, adaption and vulnerability cautions that human-induced climate change, including intensifying weather and climate extreme events, has led to considerable negative impacts to nature and people, whom have been disproportionately affected (IPCC, 2022). Modelling by the World Bank Group and the Asian Development Bank has projected that impacts from riverine flooding in Nepal will double by 2030 in terms of numbers of people annually affected and could triple in terms of economic impacts (WBG, 2021).

Disaster-related data, such as disaster event details and information from Post-Disaster Needs Assessments (PDNAs), can be organized, aggregated, analyzed and interpreted in meaningful ways to produce disaster-related statistics to support all phases of the disaster management cycle. In addition, statistics on social, environmental, and economic conditions play a crucial role in understanding disaster risks, while various sources of data, for example, censuses, surveys, and administrative and earth observation data can be integrated to produce baseline statistics for risk assessments and post-disaster impact assessments.

The National Statistics Office (NSO), with a mandate to collect, consolidate, process, analyze, publish and disseminate official statistics, recognizing the importance of comparable and standardized disaster-related data for statistical production is implementing a project to enhance disaster-related statistics in Nepal, with technical support from the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). The project aims to strengthen technical and institutional capacities of the country's national statistical system in the production and use of disaster-related statistics, and to improve collaboration between agencies to integrate and make use of available disaster-related data from a variety of sources to inform disaster risk management policy priorities. The work under this project follows the guidance provided in the Disaster-Related Statistics Framework (DRSF)¹.

Under this project, activities have been carried out to clarify national priorities, improve technical capacity of the NSO and relevant stakeholders, and produce disaster-related statistics based on integrated sources of data. In April 2023, a multi-stakeholder workshop was conducted to discuss the data needs for disaster risk reduction and management from national planning and disaster management perspectives. The workshop identified priorities to work on mapping hazard exposure by geographical region and valuating economic damage and loss due to disasters. After this consultation workshop, a taskforce² was established to work on the two focused areas and a technical workshop was organized in October 2023 to improve the capacity of the taskforce members, highlighting the methodologies for hazard exposure mapping and economic loss estimation. Subsequently, due to resource constraints in the NSO, the project focused mainly on hazard exposure mapping. The resulting statistics and maps on population exposure to flood and landslide are discussed at the second multi-stakeholder workshop in March 2023 and presented in Chapter 3 of this report.

The project also documented national policy priorities and plans, institutional arrangements and mechanisms, data holdings as well as issues with respect to data quality and data gaps related to disaster-related statistics. The disaster-related data landscape of Nepal is presented in Chapter 2 of this report.

¹ https://www.unescap.org/sites/default/files/ESCAP.CST_2018.CRP_2_Disaster-related_Statistics_Framework.pdf

² The terms of reference of the task force and its members are listed in Annex 1.

This report was prepared by the National Statistics Office, Government of Nepal, the project consultant and the ESCAP Statistics Division.³ Chapter 2 was authored by Madhu Sudan Gautam (Consultant) and Chapter 3 was prepared by Pramod Raj Regmi (Director, National Statistics Office, Nepal), with technical support from Hakan Yazicioglu (Associate Statistician, ESCAP Statistics Division), Piyapat Nakornchai (Research Assistant, ESCAP Statistics Division) and Teerapong Praphotjanaporn (Statistician, ESCAP Statistics Division). The project was implemented under the supervision of Hem Raj Regmi (Deputy Chief Statistician, National Statistics Office, Nepal), Dilli Raj Joshi (Deputy Chief Statistician, National Statistics Office, Nepal), and Rikke Munk Hansen (Chief of Economic and Environmental Statistics Section, ESCAP Statistics Division). The authors extend their gratitude to Sushil Kumar Sharma (former Director, National Statistics Office, Nepal), the taskforce members and the NSO team for their invaluable inputs and contributions.

³ **Disclaimer:** *The designations employed and the presentation of the material in the present report do not imply the expression of any opinion whatsoever on the part of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. Where the designation “country or area” appears, it covers countries, territories, cities or areas. Bibliographical and other references have, wherever possible, been verified. The United Nations bears no responsibility for the availability or functioning of URLs. The opinions, figures and estimates set forth in this publication should not necessarily be considered as reflecting the views or carrying the endorsement of the United Nations. The mention of firm names and commercial products does not imply the endorsement of the United Nations.*

2 Disaster-related statistics in Nepal

2.1 Introduction

2.1.1 Disasters in Nepal

Nepal is highly susceptible to a wide range of natural disasters, and it grapples with numerous disaster-related challenges due to its geographic location, topography, and climatic conditions. The country's vulnerability is stark, with rankings of 4th, 11th, and 30th in terms of relative vulnerability to climate change, earthquake hazards, and flood hazards, respectively (Baruwal, 2014), making it one of the most disaster-prone nations globally.

Situated within the seismically active Himalayan region, Nepal is particularly exposed to seismic events, with earthquakes posing a significant threat. The devastating 2015 Gorkha earthquake, registering a magnitude of 7.8, resulted in substantial loss of life and widespread damage to infrastructure. Additionally, the annual monsoon rains and rapid snowmelt from the Himalayan peaks lead to recurrent flooding, while landslides, especially during the monsoon season, frequently obstruct roads and isolate communities. The melting of Himalayan glaciers heightens the risk of Glacial Lake Outburst Floods (GLOFs), potentially triggering flash floods downstream. Avalanches further endanger mountainous areas, particularly during the winter season.

In recent years, Nepal has witnessed an increase in drought incidents, adversely impacting agriculture and water supply. Extreme weather patterns, including heavy rainfall, snowfall, and hailstorms, have also inflicted damage on crops and infrastructure. Climate change exacerbates these issues by altering weather patterns, resulting in more frequent and intense extreme weather events, as well as modifying precipitation patterns.

The rapid urbanization of major cities like Kathmandu has led to haphazard construction and inadequate infrastructure, rendering populations more vulnerable to disasters, especially earthquakes, inundations, and floods. Furthermore, a significant portion of the population resides in remote and hilly areas that can be challenging to access during disasters, complicating relief efforts. Vulnerable communities, including marginalized ethnic groups and those living in poverty, bear a disproportionate burden of the impact of disasters.

Nepal has made concerted efforts to enhance disaster preparedness and management. Initiatives such as the development of early warning systems, community-based risk reduction programs, and the establishment of disaster management committees at various levels have been undertaken. During major disasters, Nepal often relies on international support and aid, with countries and organizations providing crucial relief and assistance.

Nepal's disaster context is dynamic, with continuous efforts to bolster resilience against these challenges. Ongoing initiatives focus on improving disaster risk reduction measures, enhancing early warning systems, and strengthening disaster response coordination to mitigate the adverse effects on both the population and infrastructure. Additionally, recognizing the significance of climate change adaptation measures, Nepal is increasingly incorporating them into its disaster management strategies.

In the past, Nepal has faced numerous calamities, resulting in significant loss of lives and property. More recently, the extent of this loss and damage has been exacerbated by human activities such as road

construction, natural resource extraction, and environmental degradation. From 2015 to 2022, Nepal has been recurrently affected by various hazards, including fires, lightning strikes, landslides, windstorms, and floods.

Nepal's unique geography adds to its vulnerability to a wide range of geological and hydro-meteorological hazards. Stretching approximately 800 kilometers from east to west and 200 kilometers from north to south, with a vast altitude range spanning from 60 meters to the world's highest peak at 8,848 meters, the country lies in a seismically active region. Additionally, its climate exhibits significant variation, further increasing its susceptibility to disasters such as landslides, debris flows, floods, glacial lake outbursts, droughts, and epidemics.

The interplay between climate and disaster risk is a multifaceted, cross-cutting issue that has both direct and indirect impacts on various aspects of society. These impacts extend to agriculture, infrastructure and buildings, public health, education, and natural resources, among others. It is essential to recognize that different communities and sectors within Nepal have varying levels of exposure and vulnerabilities to these hazards, often resulting in a disproportionate impact.

The vulnerability and exposure of Nepal's population to disasters are influenced by a complex interplay of socioeconomic conditions, policies, and disaster governance at both the national and sub-national levels. As Nepal strives to enhance its resilience and disaster preparedness, addressing these factors becomes paramount in safeguarding the well-being and livelihoods of its people.

2.1.2 Provisioning and the mandate for data management within policies and institutions

2.1.2.1 Policy Frameworks

Constitution of Nepal (2015): According to the constitution of Nepal⁴, the state pursues the policy to make provisions of early warning, preparedness, rescue, relief and rehabilitation in order to mitigate risks from natural disasters. The federation, province and local level share the concurrent power to disaster management while local level exercises the exclusive power to disaster management.

Schedule 7 -	Common powers of Central and province
Schedule 8-	Local level power
Schedule 9-	Concurrent power of Central, province and local

Disaster Risk Reduction and Management Act (2017): According to this law⁵, National Disaster Risk Reduction and Management Authority (NDRRMA) has been established under the Ministry of Home Affairs (MoHA) to carry out the disaster related activities. The authority is mandated collect, analyze, store and disseminate information and data on disaster management by **developing and operating a national disaster management information system**.

National DRR Policy (2018): The policy mandates **‘to make disaster preparedness and response effective by improving disaster information management system and developing and expanding multi-hazard**

⁴ <https://lawcommission.gov.np/en/wp-content/uploads/2021/01/Constitution-of-Nepal.pdf>

⁵ https://bipad.gov.np/uploads/publication_pdf/DRRM_Act_and_Regulation_english.pdf

early warning system⁶. The policy⁶ aims to increase the information related to disaster risk, preparedness, response and recovery up to the community level by establishing disaster information and communication system. The mapping and dissemination of disaster risk in the areas of education, health, agriculture, industry, tourism, energy, housing, transportation, water supply & sanitation, infrastructure, and historical and cultural heritages. The disaster information will be based on the remote sensing system, geographic information technology, and open source technology and will be easily available to the public and stakeholders.

Local Government Operation Act (2017): As per this law, disaster risk reduction and management is one of the main responsibilities of the local level government. Local levels are required to manage the disaster data and undertake research studies on disaster related issues.

Disaster Risk Reduction National Strategic Plan of Action (2018—2030) (DRRNSPA): The strategic plan of action⁷ aims to provide open and easily available data to all levels of government and stakeholders through short term (2018-2020), medium term (2018-2025) and long term (2018-2030) strategic activities. The plan is aligned with the DRRM Act of 2017 and the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030. As disaster management is the responsibility of all three levels of government, the planned activities are to be implemented by the local, provincial, and national governments. An integrated disaster risk information and dissemination system will be developed with multi-hazard approach and inclusive risk-informed decision making based on the disaggregated data, including by sex, age, disability, as well as on easily accessible, up-to-date, comprehensible, science-based, non-sensitive risk information, complemented by traditional knowledge. It aims to 'use and promote mass modern science and technology (Web portal, Mobile Apps, SMS, IVR) to improve the effectiveness of communication and dissemination system for disaster preparedness and responses.

Climate Change Policy 2019: Climate change policy⁸ acknowledges that Nepal currently lacks essential data regarding the impacts of climate change and the potential losses or damages resulting from climate-induced disasters. The 2019 climate change policy is a national policy. It comprises a total of 12 sectoral policies, strategies, and working policies, all of which will be implemented by integrating them into the plans and programs of the respective line ministries and agencies at the national, provincial, and local government levels.

Its primary objective is to create and disseminate knowledge-based materials containing data, information, learning resources, and best practices tailored to various stakeholder groups.

Furthermore, this policy also sets the goal of establishing a national database that records both economic and non-economic losses or damages attributed to climate change, focusing on different geographic regions and thematic areas.

Concurrently, an advanced system for the collection, analysis, and real-time transmission of data will be developed. This will involve expanding the network of weather stations to effectively identify and monitor the impacts and trends associated with climate change.

Environment Protection Act 2019: The legislation⁹ is crafted with the intent of tackling climate change challenges by establishing a comprehensive framework for climate change management. This is achieved through the formulation of policies and strategies, the establishment of institutional mechanisms, the allocation

⁶ <https://reliefweb.int/report/nepal/national-policy-disaster-risk-reduction-2018-enne>

⁷ [https://bipad.gov.np/uploads/publication_pdf/DRR_National_Plan_of_Action_2018-2030_\(Nepal\).pdf](https://bipad.gov.np/uploads/publication_pdf/DRR_National_Plan_of_Action_2018-2030_(Nepal).pdf)

⁸ https://www.icimod.org/wp-content/uploads/2021/07/National-Climate-Change-Policy_english_2019_compressed.pdf

⁹ <https://www.lawcommission.gov.np/en/wp-content/uploads/2021/03/The-Environment-Protection-Act-2019-2076.pdf>

of financial resources, and the enhancement of capacity building. To monitor the effects of climate change on local communities, ecosystems, and biodiversity, regular assessments will be conducted. However, there are no data related clauses exclusively mentioned in the act.

Under the purview of this legislation, the government is tasked with crafting and implementing adaptation plans at the national, provincial, and local levels. There is a specific emphasis on safeguarding the well-being of vulnerable groups, including women, persons with disabilities, children, senior citizens, and economically disadvantaged communities. Additionally, the legislation mandates the adoption of requisite measures to mitigate the adverse impacts and risks associated with climate change.

More information on policy framework on climate and disaster risk in Nepal is provided in Annex 2.

2.1.2.2 Institutional mechanism for climate change and disaster risk reduction and management

Nepal has distinct institutional mechanisms for addressing climate change and disaster risk reduction. The Ministry of Forest and Environment (MoFE) serves as the central ministry responsible for formulating climate change-related policies and plans at the federal level. This institutional framework for climate action in Nepal is depicted in Figure 1. It encompasses the active involvement of various branches of government, including the judiciary, executive, legislative, and constitutional bodies in climate action.

Furthermore, the climate action mechanism is firmly institutionalized at the sub-national government level, spanning provinces and local authorities. Likewise, it anticipates the engagement of intergovernmental organizations, bilateral/multilateral partners, civil society organizations (CSOs), donors, and the private sector in climate-related initiatives, aligning their efforts with the government's climate change policies and plans.

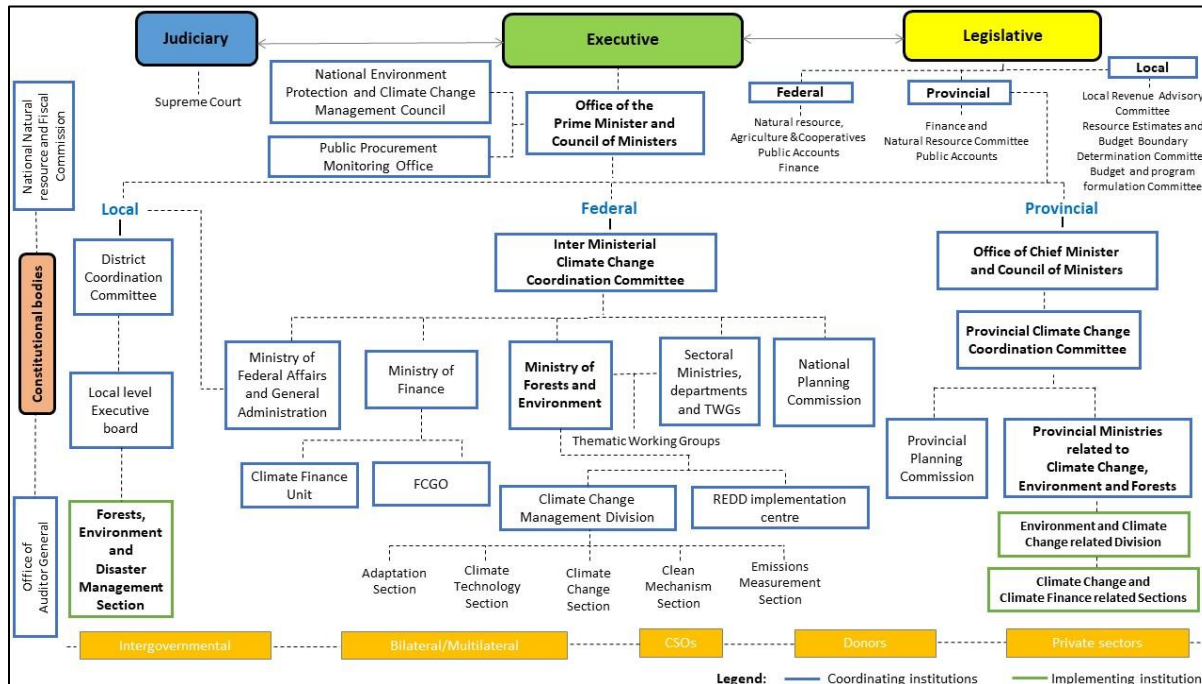


Figure 1: Institutional mechanism for the climate action in Nepal

Similarly, Nepal has established various institutional mechanisms for Disaster Risk Reduction and Management (DRRM).

National Disaster Risk Reduction and Management Authority (NDRRMA): The National Disaster Risk Reduction and Management Authority (NDRRMA) in Nepal is a key government agency responsible for coordinating disaster risk reduction and management efforts in the country. It is primarily responsible for policy formulation and implementation, coordination and collaboration, capacity building and training, risk assessment and monitoring, early warning systems, disaster preparedness and response, public awareness and education, research and data management, resource mobilization, and legal and regulatory framework.

Ministry of Home Affairs (MoHA): The MoHA plays a significant role in disaster management. It is responsible for coordinating disaster response and relief efforts, and it works closely with the NDRRMA to ensure a comprehensive approach to DRRM.

National Planning Commission (NPC): The NPC plays a crucial role in integrating disaster risk reduction and management into the country's development planning processes. It ensures that DRRM is mainstreamed into the national and local development plans.

District Disaster Management Committees (DDMCs): At the local level, DDMCs are responsible for coordinating disaster risk reduction and response efforts within their respective districts. These committees consist of representatives from various government agencies, local authorities, and community organizations.

Local Disaster Management Committees (LDMCs): These committees operate at the municipal and village levels and play a crucial role in implementing DRRM activities at the grassroots level. They engage with local communities to raise awareness, develop preparedness plans, and coordinate response efforts during disasters.

National Society for Earthquake Technology-Nepal (NSET): NSET is a non-governmental organization that has been instrumental in earthquake risk reduction efforts in Nepal. It works on various initiatives related to seismic safety, including building retrofitting and community-based earthquake risk management.

Nepal Red Cross Society (NRCS): The NRCS is actively involved in disaster response and recovery efforts in Nepal. They provide humanitarian assistance during disasters and engage in community-based disaster risk reduction programs.

Meteorological and Hydrological Services: The Department of Hydrology and Meteorology (DHM) provides weather and real time flood-related information and forecasts. Timely and accurate weather information is crucial for early warning and preparedness.

International Agencies and NGOs: Various international organizations and non-governmental organizations (NGOs) work in partnership with the Nepalese government to support disaster risk reduction and management efforts. They provide technical expertise, funding, and capacity building.

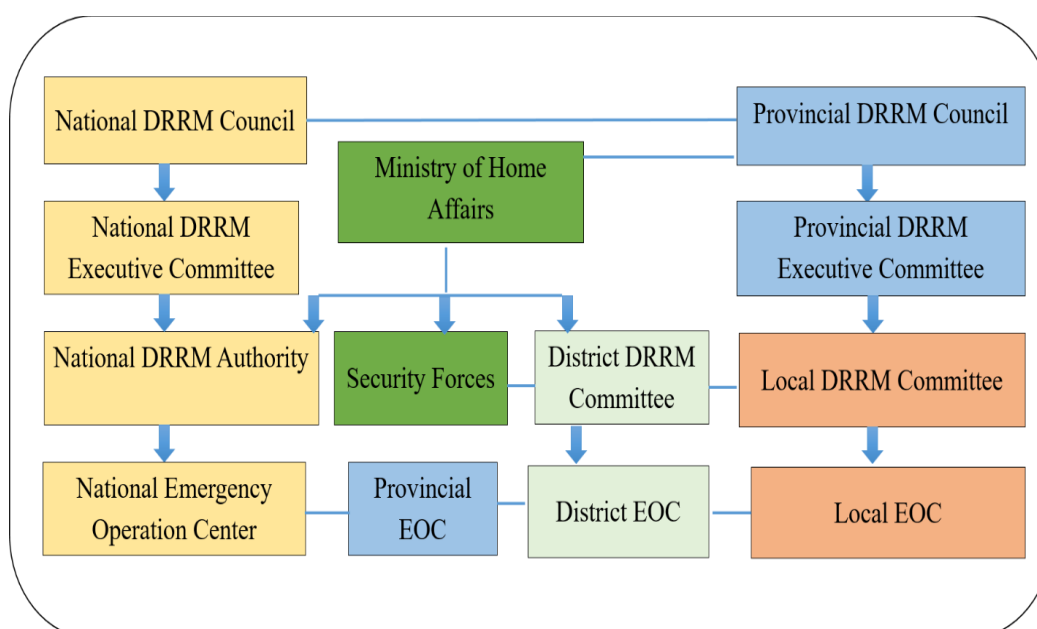


Figure 2: Institutional mechanism for disaster risk reduction and management in Nepal

There is a well-defined National Disaster Response Framework (NDRF)¹⁰ to carry out in Nepal at the federal, provincial, district and local levels where relevant disaster management committees collaborate with one another along with national and international actors if necessary. The first Amendment of the NDRF 2075¹¹ outlines the procedure for foreign disaster aid and emergency response. The Government of Nepal (GoN) (council of ministers) appeals to the UN Humanitarian Coordination Team, countries, the Red Cross Movement, the regional organizations, donor communities, INGOs, international professional groups/organizations, and non-resident Nepalese for assistance in response, and the NDRRMA in coordination with the MoHA carries out the necessary action for emergency response.

Based on appeal of GoN, United Nations and Red Cross Movement can appeal for international assistance. Such assistance if received will be implemented based on the GoN's approved standard. GoN activates the cluster functioning in Nepal in conjunction with UN HCT, and NDRRMA mobilizes the cluster for disaster response activities. The table below outlines the national and international coordination and interaction during the time of mega disasters.

The table outlines the management of disaster-related data in Nepal across various phases: before, during, and after a disaster, along with the responsible institutions for each category. It highlights the distributed responsibilities among various governmental and non-governmental institutions in Nepal throughout the disaster management cycle. Roles range from initial preparation and risk assessment to response, recovery, and reconstruction phases.

¹⁰ <http://drrportal.gov.np/uploads/document/113.pdf>

¹¹ <https://moha.gov.np/en/post/national-disaster-framework-2075-frist-amend-2075>

Table 1: Disaster-related data collection and management in Nepal

Before disaster		During disaster		After disaster-recovery and reconstruction	
Categories	Institution(s) responsible	Categories	Institution(s) responsible	Categories	Institution(s) responsible
Institutional mapping working in DRR	Local level	Daily disaster incidence	Nepali police (morning and evening reporting) at DEOC	Detail loss and damage assessment	NDRRMA
Provisioning of search and rescue materials	-Local level/LEOC, Nepal army, armed police force, district disaster relief committee/DEOC, Province/PEOC,	Initial damage assessment	Local level, Nepal police, and Nepal red cross	Recovery and reconstruction	data maintained and updated by NDRRMA
Hazard mapping	NDRRMA, development partners, province, and local level government				
Exposure information (e.g. household level)	NDRRMA, local level				
Open spaces	local level				
Airports, helipad,	NDRRMA				
Land use mapping	NDRRMA, development partners, province and local level				
Volunteer management system	NDRRMA/BIPAD				

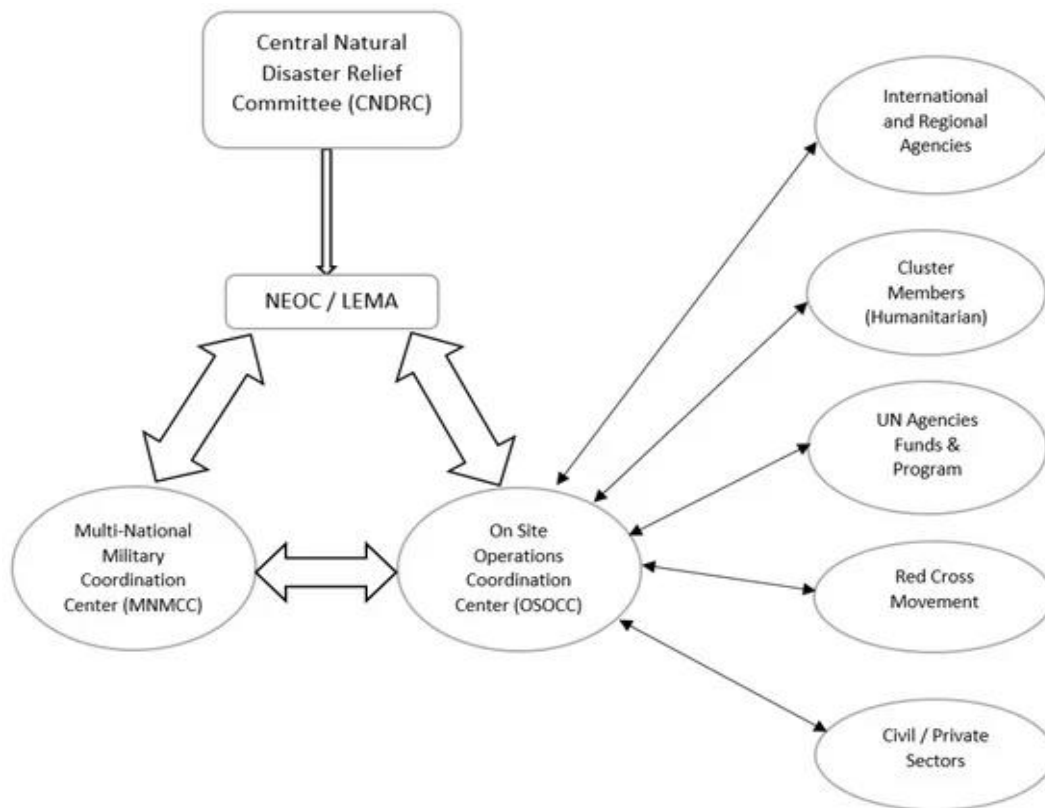


Figure 3: Coordination mechanism during mega disaster

The mobilization and responsibilities of different stakeholders during **mega disaster** is presented in Box 1 below:

Box 1: Mobilization and responsibilities of different stakeholders during mega disaster

- *The national disaster risk reduction and management authority (NDRRMA), the UNDAC's onsite operation coordination center (OSOCC), and the Multinational Military Coordinates Center (MNMCC), according to the NDRF, automatically establishes the mechanisms for disaster response under the supervision and direction of the executive committee.*
- *The National Disaster Risk Reduction and Management Authority (NDRRMA) serves as the National Council's secretariat and executive disaster control during a catastrophe response. United organizations engaged in search, rescue, and aid activities in Nepal are invited to a meeting and discussion by the NDRRMA. Through NDRRMA's collaboration and coordination with the OSOCC, communications between the OSOCC and MNMCC will take place.*
- *The chief executive of the NDRRMA will coordinate national and international humanitarian and aid provider agencies, create a forum for help, exchange information, and support international relief activities in the disaster-affected region.*
- *During a disaster, the Government of Nepal will negotiate any required bilateral or multilateral agreements with friendly and nearby countries to apply the established protocols for search and rescue operations. In the event that foreign military aid is necessary, the procedures for accepting foreign military aid are adhered to.*
- *Foreign military assistance and medical teams are coordinated by the Nepal Army and the Ministry of Health, respectively. The MNMCC will facilitate coordination between the Nepal Army, Nepal Armed Police Force, and the assisting foreign military forces in the event that the scale of the disaster necessitates the deployment of foreign military forces from the regional and international level in order to speed up response times, ensure effectiveness, and promote teamwork.*
- *Separate focal persons are required, and these focal points must meet often to discuss, analyze, and assess the issue. Each ministry's and department's disaster focal person is required to get in touch with NEOC and travel there as soon as a crisis occurs.*
- *The connection between international responders and the Nepali government offers a system for organizing the activities of international relief efforts at a disaster site as well as a platform for cooperation, coordination, and information management among national and international humanitarian agencies.*
- *The focal point for overall OSOCC coordination must have approval from the UN humanitarian coordinator.*
- *Army personnel will be mobilized as needed by MNMCC, which is overseen by the minister of home affairs, in collaboration with NEOC and OSOCC and under the control of the Nepalese Army.*

Figure 4 below illustrates the institutional framework for disaster response across different tiers of government. Emergency Operation Centers (EOCs) are established at the local, district, provincial, and national levels. While local-level EOCs are currently in the process of establishment, those that have been set up are not yet fully operational.

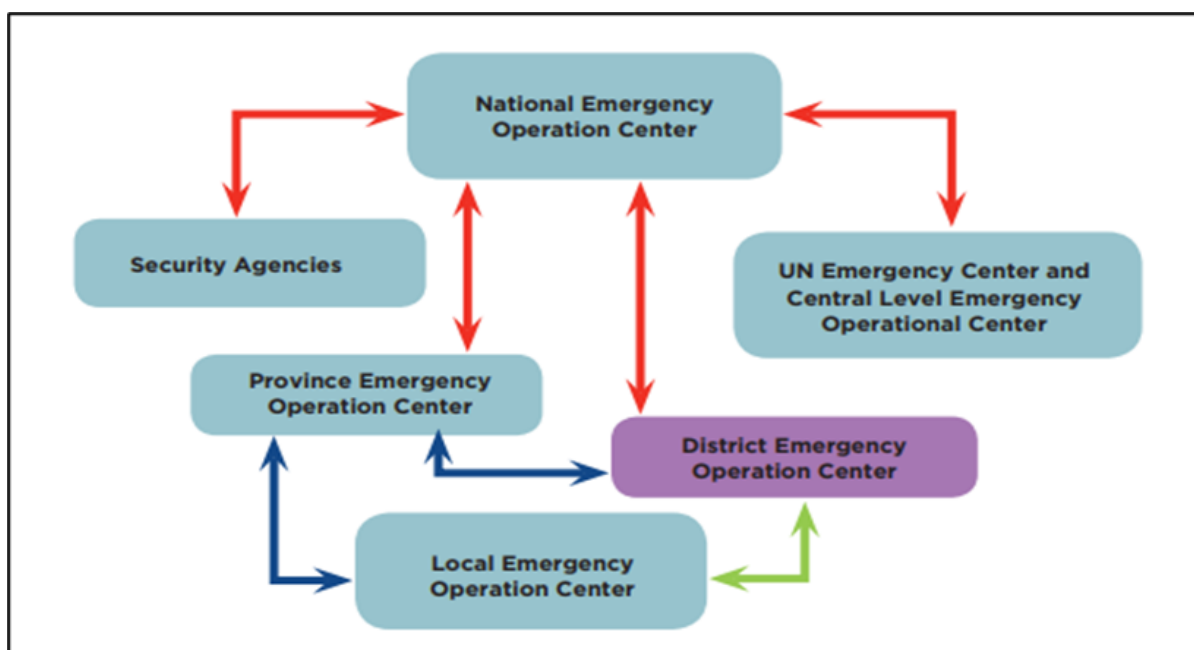


Figure 4: Institutional mechanism for executing the disaster response at various government levels

An example for the operationalization of disaster response is elaborated in Annex 3 which describes Nepal's recent catastrophe of Jajarkot earthquake on November 3, 2023.

2.1.3 Disaster-related statistics in Nepal

Disaster-related statistics comprises numerical data and information that are collected, analyzed, and used to understand various aspects of disasters and their impacts. It encompasses a wide range of data points related to natural and human-made disasters. The disaster-related statistics may include the following, but not limited to:

Table 2: Basic ranges of disaster-related statistics before, during and after a disaster

Before disaster	Disaster-related statistics
Sudden onset (e.g. Flood, landslide, fire, earthquake, etc.)	Frequency and occurrence of disasters, severity and magnitude of disasters, etc.
Slow onset (desertification, biodiversity loss, glacial retreat, etc.)	
Exposure	Geographical distribution (e.g. maps and spatial data that show affected areas), temporal patterns (e.g. data on timing and seasonality of disasters), climate and environmental data,
Vulnerability	Causes and triggers, maps, historical data on temperature, precipitation, age distribution, income level, etc.
Coping capacity	Response and recovery, training, search and rescue materials, public awareness and preparedness,
During and after a disaster	
Direct impacts to environment and cultural heritage	Water sources, land degradation, buildings and monuments,
Direct human impacts	Fatalities, injuries, displaced populations, diseases

Direct material impacts and economic loss	Damage to buildings, roads, bridges, and utilities; disruption to transportation and communication networks; impact on agriculture; cost of damage & recover; loss of businesses; data on recovery & reconstruction, etc.
Indirect impact	Migration, impact of GDP, death from illness, etc.

It should be noted that these data and statistics may be of multiple uses in analysis, hence they may appear in different components of the Disaster Related Statistics Framework (DRSF).

These statistics are typically gathered and managed by a variety of entities, including government agencies, international organizations, research institutions, and non-governmental organizations in Nepal. The data collected by the government or government-led data, as approved by the government, is considered official in Nepal. International organizations, research institutions, and non-governmental organizations utilize the government-approved data for disaster management. However, they may also collect additional data for their own purposes. These statistics serve multiple critical purposes, including disaster risk reduction, emergency response planning, policy development, research, public awareness campaigns, and long-term resilience building. Thorough analysis and interpretation these statistics are essential for making informed decisions and implementing effective disaster management strategies, ultimately safeguarding lives and property.

Accessing specific data related to Disaster Risk Reduction and Management (DRRM) can vary depending on the location, the type of disasters, and the specific information required. Disaster-related statistics play a critical role in both implementing disaster risk reduction measures and monitoring the progress of the Sendai Framework for Disaster Risk Reduction (SFDRR). Accurate statistics on past disasters offer valuable insights into their patterns, enabling authorities to enhance preparedness effectively. It is crucial to have precise and high-quality disaster-related statistics that have been consistently compiled over time to plan and execute successful DRR initiatives. As a party to the SFDRR, Nepal is obligated to provide periodic progress reports on its implementation.

Currently, in Nepal, comprehensive disaster-related statistics are not accessible through a unified integrated platform. These statistics are not readily available in user-friendly formats for various stakeholders, including government entities at different levels (such as local, district, province, and national), private sectors, NGOs, civil society organizations, and development partners, among others.

Official disaster-related data in Nepal originate from various sources. Key government agencies responsible for generating such data include:

- National Disaster Risk Reduction Authority (NDRRMA) under the Ministry of Home Affairs (MoHA),
- Department of Hydrology and Meteorology (DHM),
- Ministry of Forest and Environment (MoFE) and
- National Statistics Office (NSO)
- Local level governments

The following box lists out the disaster related information systems for Nepal from different sources:

Box 2: Disaster related information management systems

- [BIPAD portal](#) is the major information management platform that is designed to include to manage information on historic disaster and its impact (damage and loss), household level vulnerability, availability and vulnerability of critical infrastructure (road, hospitals), real time information on disaster event. At federal level this is managed at NDRRMA and is being localized at local level. The portal is developed by pooling all credible digital and spatial data that are available within different government bodies, non-governmental organizations, academic institutions and research organizations on a single platform. It covers preparedness, warning, communication, coordination, response, and historical database. The local levels and provinces with their user login details can update disaster related data. However, the government is facing challenges to localize the BIPAD portal across Nepal.
- [DRR portal](#) is a repository of disaster events and its impact along with key documents such as Acts, Strategic Action Plan, Rules and regulations, decision on DRR at different level (palika to federal level), among other. This is managed by National Emergency Operation Centre (NEOC) where local data are fed by Local Emergency Operation Centre and security units from the district.
- International Centre for Integrated Mountain Development (ICIMOD): It is an intergovernmental organization that focuses on sustainable mountain development in Hindu Kush Himalayan region, including Nepal. It maintains a comprehensive database of various geospatial data including disaster risk of [Koshi Basin](#).
- The risk information, humanitarian related data is also available in <https://data.humdata.org/dataset?q=Nepal>
- **Early warning System:** It is a system that informs the community about the pertaining risk of any hazards before it occurs and potentially impact the community. This helps in protecting lives and property of Nepal. Flood Early warning system is better developed in Nepal with having hydro meteorological and flood gauging stations in major river of Nepal. This allows to inform about potential floods to people living in downstream. The real time data of flood in these rivers can be monitored through, following websites,
 - <http://www.hydrology.gov.np/#/basin? k=fjeved> (Real time data)
 - http://www.hydrology.gov.np/#/river_watch? k=puqkja (River watch)
 - http://www.hydrology.gov.np/#/rainfall_watch? k=3u10y8 (Rainfall Watch)

2.1.4 Hazard types and disaster classification

The incidence data listed on the Disaster Risk Reduction (DRR) portal covers a wide range of natural and man-made events. These incidents encompass various forms of natural disasters, including **earthquakes, landslides, fires, heavy rainfall, thunderbolts, wind storms, hailstorms, flash floods, and snowstorms**. Additionally, the data accounts for **accidents involving animals, snake bites, and animal-related incidents**. It also includes **high-altitude challenges, sinkholes, leaks, sedimentation, and structural collapses**. Man-made incidents such as **air crashes, bridge collapses, boat capsizes, explosions, and bus accidents** are part of the dataset. Furthermore, biological events like **epidemics and plagues, as well as environmental concerns like pollution, famine, and frost**, are tracked.

The Ministry of Forest and Environment has released a report titled 'The Vulnerability and Risk Assessment and Identifying Adaptation Options: Summary for Policymakers.'¹² This report identifies 14 distinct climate-induced hazards. These encompass a wide spectrum of environmental challenges, including **fire¹³, thunderbolts, windstorms, epidemics, heavy rainfall, landslides, floods, avalanches, hailstorms, heatwaves, cold waves, snowstorms, forest fires, and drought**. The comprehensive compilation of these climate-induced hazards serves as a valuable resource for policymakers and stakeholders, aiding in the development of effective strategies to address and mitigate the impacts of these events.

Likewise, a climate change survey¹⁴ conducted in 2016 by the National Statistics Office (NSO) has provided valuable insights into the impact of 18 climate-induced hazards. These encompass a diverse array of challenges, including **drought, forest fires, settlement fires, floods, inundations, windstorms, thunderstorms, hailstorms, heavy rain, sporadic rainfall, soil erosion, landslides, snowstorms, avalanches, glacial lake outburst floods (GLOF), heatwaves, cold waves, and disease or insect-related issues**. The findings from this survey offer a comprehensive understanding of the multifaceted effects of climate change on various aspects of the environment and human life, thus guiding future mitigation and adaptation efforts.

In the 'National Adaptation Plan (NAP) 2021-2050: Summary for Policy Makers',¹⁵ climate hazards are systematically categorized into two distinct groups: **acute** and **chronic or slow-onset** challenges. The acute hazards encompass a range of **sudden** and intense climatic events, including **extreme weather phenomena, heatwaves, landslides, avalanches, and forest fires**. On the other hand, the chronic or slow-onset hazards encompass long-term shifts and changes in climate patterns, such as **drought, alterations in precipitation patterns, fluctuations in snow cover, glacier retreat, and the occurrence of glacial lake outburst floods (GLOFs)**¹⁶. This categorization provides a comprehensive framework for addressing climate-related risks and aids in the development of targeted strategies for both immediate response and long-term adaptation.

2.1.5 Data collection tools and coordination mechanism: emergency response, relief and recovery

2.1.5.1 Data collection tools

A consensus prevails among government agencies and development partners concerning the classification of disaster types and the precise definition of disaster terms and terminologies. It is imperative for development partners to rely on data collected and verified by the government. Following a disaster, the responsibility for data collection shifts to the local level, with essential support provided by organizations such as the Nepal Red Cross and other development partners. Various data collection tools, including the initial rapid assessment (IRA), multi-sector initial rapid assessment (MIRA), and cluster-specific detailed assessment (CSDA), are employed to gather critical information. The initial rapid assessment (IRA) is a collaborative effort involving the Local Government, Nepal Red Cross, and Nepal Police. The data from IRA is jointly verified by local level, Nepal police and Nepal Red Cross. Verified data from the IRA is recorded in the Disaster Risk Reduction (DRR) portal

¹² <https://reliefweb.int/report/nepal/vulnerability-and-risk-assessment-and-identifying-adaptation-options-summary-policy>

¹³ Forest fires are directly linked to climate conditions, among other factors. On the other hand, settlement fires are indirectly associated with climate-induced incidents like drought and high temperatures.

¹⁴ https://climate.mohp.gov.np/downloads/National_Climate_Change_Impact_Survey_Report_2016.pdf

¹⁵ https://unfccc.int/sites/default/files/resource/NAP_Nepal.pdf

¹⁶ The GLOF risk builds-up slowly as glacial lakes formed by the melting of glaciers continue to enlarge due to the accumulation of meltwater.

by Nepal Police. The local government is held accountable for disaster impact data. The local level is required to contribute to the recovery and reconstruction fund. Consequently, there is minimal possibility of data misreporting, as it is tied to the local level's contribution to the financing of recovery and reconstruction. The local government must utilize its own budget in conjunction with the provincial and national government budgets. However, the detailed assessment is conducted by the NDRRMA in collaboration with the local government. The data from this detailed assessment is utilized for the recovery and reconstruction efforts following the disaster impact.

Despite the availability of different data collection tools for various phases of the disaster cycle, Nepal has predominantly utilized the **IRA** and **detailed assessments** for practical disaster-related data collection.

Once the disaster data has been collected and validated by the government, collaborative efforts with development partners come into play, marking the initiation of emergency response, relief operations, and recovery. A one-door policy streamlines these support efforts, with development partners coordinating closely with the District Administrative Office (DAO) and local government authorities. Nonetheless, the lack of trained human resources and suitable software for disaster-related data collection often leads to delays, affecting the overall effectiveness of response, relief, and recovery initiatives. Addressing this resource gap is essential for improving disaster management in Nepal.

Completing an Initial Rapid Assessment (IRA) within 24 hours of a disaster is often not feasible in many cases due to geographical challenges, transportation and communication disruptions. Paper-based or Computer-Assisted Personal Interview (CAPI) methods may be employed during the IRA. Typically, CAPI-based data collection is carried out during detailed assessments, which involve trained technical personnel such as engineers.

2.1.5.2 Data collection mechanism and institutions involved

The Local Emergency Operation Center (LEOC) and District Emergency Operation Center (DEOC) function as the secretariats for the Local Disaster Management Committee (LDMC) and District Disaster Management Committee (DDMC) at the local and district levels, respectively. The principal organizations engaged in disaster data collection encompass the DDMC, LDMC, and the Nepal Red Cross Society (NRCS). The policy provisions and the roles of these institutions in data collection are briefly outlined in the following subsections.

2.1.5.3 District disaster management committee (DDMC), Local Disaster Management Committee (LDMC) and Nepal Red Cross Society (NRCS)

As per the NDRRM Act 2074 BS, disaster data collection and information system development is the responsibility of the national, province, and local level governments. According to the National Disaster Response Framework¹⁷, within 24 hours of disaster, government has to make an assessment of the loss and damage. The responsibility of this initial rapid assessment (IRA) has been given to the Local Disaster Management Committee, District Disaster Management Committee, and Nepal Red Cross Society (NRCS). The local level representative leads the IRA team. The IRA form¹⁸ shall be used for any kind of disaster. The local level can take help and coordinate with the province and national government.

¹⁷ <http://drrportal.gov.np/uploads/document/113.pdf>

¹⁸ https://nrscs.org/wp-content/uploads/2021/07/IRA-Guideline_Nepali.pdf

The **methods of IRA** include key informant interview (KII) & group interview, observation of impact area, and analysis of secondary sources. The IRA form can be adapted as per the local context. It is implemented in the location where 10 households or more are impacted. The IRA guideline and other government documents do not offer direction on the specific type of assessment to be conducted when fewer than 10 households are affected by disasters. Typically, for minor disasters impacting a small population, local government authorities handle disaster risk management efforts, often with assistance from NGOs and civil society groups.

The **Initial Rapid Assessment (IRA)**¹⁹ and the **Assessment and Coordination Team (ACT)** are two vital tools that assist the government of Nepal and humanitarian actors to respond immediately and effectively to post disaster needs. The information generated through IRA helps to assess the impacts and identify immediate needs within 24 hours of a disaster, which is crucial for planning immediate response. While in parallel, a swift deployment of the ACT members means that there is efficient coordination amongst government authorities at all levels.

The National Disaster Risk Reduction Management Authority (NDRRMA) has approved the IRA guideline on 16 June 2021. The Red Cross led the process of formulating the guideline and mechanism and provided technical assistance in collaboration with the NDRRMA. As per the Disaster Assessment Guideline, the government has given the responsibility of conducting IRA to the Nepal Red Cross Society. IRA guideline provides the definition of the data (e.g. dead, missing, impacted, displaced, partial loss, etc.) to be collected.

District emergency operation center (DEOC) is established in district administrative office (DAO). DAO is district level entity of Ministry of Home Affairs (MoHA). It is responsible for peace and security in the district. The DAO is headed by the Chief District Officer (CDO). The DEOC acts as a secretariat of District Disaster Management Committee (DDMC). The DDMC is chaired by the CDO. The DDMC has representatives from DAO, local levels, district coordination office, security forces, health, education, journalist, and industry & commerce among others. DEOCs are responsible for coordinating and managing emergency and disaster-related activities within their respective districts.

2.1.5.4 Role of NDRRMA, Nepal Police Force, Nepal Red Cross, and Local Level Government in Disaster Data Collection and Verification

The following table presents disaster-related data along with the institutions responsible for maintaining and managing this information. This offers a clear and concise overview of the various types of disaster data available and the organizations that play a pivotal role in collecting, analyzing, and disseminating this vital information. By understanding the key data sources and their custodians, stakeholders, policymakers, and emergency response teams can better collaborate and make informed decisions to mitigate the impact of disasters and improve disaster preparedness and response efforts.

Table 3: Disaster-related data and responsible institutions

SN	Data	Data maintained by	Database
A	Historical data		
1	Number of dead persons	DAO/DEOC-Verify and upload in DRR portal by Nepal police	DRR portal

¹⁹ <https://sheltercluster.org/nepal/documents/initial-rapid-assessmentsnepali>

SN	Data	Data maintained by	Database
2	Number of missing persons	DAO/DEOC-Verify and upload in DRR portal by Nepal police	DRR portal
3	Number of injured persons	DAO/DEOC-Verify and upload in DRR portal by Nepal police	DRR portal
4	Government houses damaged	DAO/DEOC-Verify and upload in DRR portal by Nepal police	DRR portal
5	Private houses damaged	DAO/DEOC-Verify and upload in DRR portal by Nepal police	DRR portal
6	Displaced families	DAO/DEOC-Verify and upload in DRR portal by Nepal police	DRR portal
7	Cattle loss and displaced shed	DAO/DEOC-Verify and upload in DRR portal by Nepal police	DRR portal
8	Estimated economic loss	DAO/DEOC-Verify and upload in DRR portal by Nepal police	DRR portal
9	Volunteer information management	NDRRMA	BIPAD portal
10	Early warning	DHM/NDRRMA	BIPAD portal/DHM
11	Exposure mapping	NDRRMA	BIPAD portal

In cases where a hazard results in substantial loss and damage that surpasses the capabilities of local authorities and districts to assess comprehensively, thus turning into disaster, the National Disaster Risk Reduction and Management Authority (NDRRMA) steps in to conduct a thorough damage assessment. This process involves deploying a team of experts, engineers, and other technical personnel who are well-equipped to evaluate the extent of the devastation. The data gathered through this detailed assessment plays a pivotal role in guiding recovery and reconstruction efforts, helping authorities prioritize resources and formulate effective strategies to restore affected areas and communities to a state of normalcy. This critical information not only facilitates timely response but also contributes to the long-term resilience and rehabilitation of disaster-impacted regions.

An illustrative example of effective disaster response and recovery can be seen in the aftermath of the 2015 earthquake. At that time, the National Disaster Risk Reduction and Management Authority (NDRRMA) did not yet exist, prompting the creation of a dedicated entity called the 'National Reconstruction Authority' to oversee the extensive reconstruction efforts. To gather essential data from the earthquake-affected districts, the National Statistics Office (NSO) played a crucial role in data collection. Approximately one million entries of damage assessment were meticulously documented and organized through the development of the Earthquake Housing Reconstruction Management Information System. This initiative demonstrated the importance of structured data management and collaboration among government bodies to streamline the recovery process in the face of significant natural disasters.

2.2 Disaster related data

2.2.1 Risk assessments

Risk assessment is a process that involves determining the nature, extent, and location of risks by analyzing exposure, vulnerability to hazards, and existing coping capacities in the face of various disaster impacts (ESCAP, 2018). The primary goal of risk assessment is to collect data and generate insights that can guide decision-making effectively in reducing or managing risks. It involves evaluating the likelihood of specific hazards occurring and their potential impact on a given location, neighborhood, or system. To conduct an accurate risk assessment, it is essential to gather statistics on hazards, exposure, vulnerability, and coping capacity.

In 2021, the Ministry of Forest and Environment (MoFE) conducted a comprehensive vulnerability and risk assessment in eight thematic areas and one cross-cutting area as stipulated by the National Climate Change Policy²⁰. This assessment provided critical data on climate change impacts, exposure, sensitivity, adaptation capacity, susceptibility, and risk (MoFE, 2021). It covered information from every district, municipality, and province in the country. However, due to data limitations, a comprehensive assessment was conducted for 293 urban municipalities and a basic assessment for 460 rural municipalities. The assessment followed a nine-step methodological process, including scoping vulnerability and risk, revising and refining the framework, identifying key factors for hazards, exposure, and vulnerability, exploring data sources and nature, data collection, tabulation, filtration, and normalization, weighting and creating composite values, data analysis, identifying climate change impacts, vulnerability, and risk, and identifying adaptation options.

Based on data from municipal and district levels, a risk assessment was conducted, utilizing temperature and precipitation data. Daily temperature data from 93 climatic stations and DHM rain gauge data for precipitation were used (MoFE, 2021). National-level vulnerability and risk analysis were carried out based on verifiable and quantifiable primary and secondary data. The assessment utilized data on district-level seasonal and climate patterns from the Department of Hydrology and Meteorology (DHM), climate scenarios from MoFE/ICIMOD, and information from other regional and international organizations. Secondary data sources included the National Statistics Office (NSO), the Department of Survey (DoS), various ministries, development agencies, and foreign organizations. For quantitative datasets, metric measurements were applied, while for qualitative datasets, geospatial information was collected. Data collection techniques included interviews, one-on-one discussions, exploratory surveys, and meetings with experts and stakeholders. Google Forms and survey software were employed for questionnaire surveys. On-site visits were conducted across all seven provinces, the federal government, and select municipal administrations to verify information obtained from secondary sources. Data were filtered, cleaned, and normalized to ensure accuracy, thoroughness, relevance, clarity, proper formatting, and consistency.

Data analysis was performed, and the results were presented in various formats, including trends, scenarios, patterns, hazards, and risks. Descriptive and inferential statistical techniques were used to analyze socioeconomic, demographic, and sector-specific data to determine which groups are most vulnerable to climate change and which regions or communities have the greatest potential for adaptation. The assessment

²⁰ <https://www.mofe.gov.np/uploads/documents/vulnerability-repnew1630571413pdf-2940-766-1658827788.pdf> (see the annexes for the consolidated exposure, sensitivity, adaptive capacity, vulnerability and risk index)

provided baseline data, prospective trends for various hazards, their vulnerability and risk, and potential adaptation strategies over short, medium, and long terms."

2.2.2 Hazard data and statistics

A hazard is defined as any process, event, or human activity with the potential to have adverse effects on the environment, property, and human health, including injuries. Hazard statistics are a valuable source of information that provides insights into the frequency, severity, and geographical distribution of various risks and potential dangers. By examining historical data and trends, hazard statistics aid in identifying patterns and assessing the risks associated with specific hazards, as well as their potential impacts. Natural hazards, such as earthquakes, floods, landslides, and droughts, often arise due to the interplay of geological factors and heavy rainfall (ADPC, 2010). Data related to hazards are collected by different organizations, each following its own set of protocols.

Table 4: Hazard statistics and data sources

Hazards	Type of Data	Data custodian	Data Source
Earthquake	Geological Map, Seismic Zoning, Seismo-tectonic map	Department of Geology and Mines	https://dmgnepal.gov.np/en/resources/geological-maps-150000-4749
	Earthquake Risk Map	Durham University	BIPAD Portal, https://bipadportal.gov.np/risk-info/#/risk
	Seismic Hazard map	METEOR Project, ADPC	BIPAD Portal, https://bipadportal.gov.np/risk-info/#/hazard Nepal hazard risk assessment (NHRA) Report ²¹ , p33-36
Floods	Flood Hazard Map of major rivers	DoWRI, ADPC	BIPAD Portal, https://bipadportal.gov.np/risk-info/#/hazard NHRA Report, p47-53
	Flood Inundation Map	WFP, ADPC	BIPAD Portal, https://bipadportal.gov.np/risk-info/#/hazard NHRA Report, p44-45
Landslides	Landslide Risk Map	Durham University	BIPAD Portal, https://bipadportal.gov.np/risk-info/#/risk
	Landslide Inventory Map	Geneva University	BIPAD Portal, https://bipadportal.gov.np/risk-info/#/hazard
	Landslide Susceptibility Map	METEOR Project, Durham University ADPC	BIPAD Portal, https://bipadportal.gov.np/risk-info/#/hazard NHRA Report, p40-41
Drought	Drought susceptibility maps for different seasons	ADPC	NHRA Report, p56-59

²¹ https://www.adpc.net/igo/category/ID276/doc/2013-b27lym-ADPC-NHRA_Report.pdf

Earthquake: Various factors, including historical data, seismic zoning, soil profiles, intensity mapping, and earthquake catalogs, play a pivotal role in shaping earthquake hazard statistics (ADPC, 2010). This wealth of information is primarily sourced from the Department of Geology and Mines. However, the Asian Disaster Preparedness Center (ADPC) and the METEOR project have additional data resources at their disposal, encompassing earthquake susceptibility maps and seismic hazard maps. These data are compiled from a wide range of sources, including satellite imagery, records, gauges, and various data inputs, combined with both qualitative and quantitative assessments. It's worth noting that despite the reliability of the data, gaps can emerge due to the complex interplay of numerous factors. Issues such as lower-quality satellite imagery and inaccuracies in recorded data may lead to potential data manipulation and reduced accuracy. As a safeguard, data validation is carried out by comparing it with historical events, enhancing its overall reliability.

Floods: The collection and analysis of flood-related statistics in Nepal involve the collaboration of multiple ministries and government departments. The Department of Water Induced Disaster Prevention specializes in gathering specific information concerning hydrological characteristics, rainfall patterns, and flood-related data for major catchment areas (ADPC, 2010). Flood hazard maps are provided by both the Department of Water Resources and Irrigation (DoWRI) and the Asian Disaster Preparedness Center (ADPC). Furthermore, the International Center for Integrated Mountain Development (ICIMOD) conducts extensive studies and generates flood maps. To compile data on flood hazards, satellite imagery, hydrological and meteorological data, and field observations along riverbanks are harnessed and integrated using GIS software. While the data extracted is highly precise, its accuracy can be impacted by limitations in the spatial resolution of aerial imagery and both avoidable and unavoidable errors in the flood modeling process. To ensure reliability, the data is validated through comparisons with historical events.

Landslides: In Nepal, vital landslide-related data encompasses soil maps, landslide risk maps, landslide inventory maps, and landslide susceptibility maps. These critical datasets are accessible to Durham University, Geneva University, and the Asian Disaster Preparedness Center (ADPC). The process of landslide mapping draws upon satellite imagery and data sourced from local agencies and communities. Much like the previously mentioned hazard data, the quality of this information is characterized by a high level of precision, although some minor gaps may exist. To validate the data's accuracy, a collaborative approach is adopted, involving consultation with local communities and other stakeholders, while also conducting thorough checks and analyses against historical landslide records.

Drought: The Department of Agriculture and the Department of Water Induced Disaster Prevention are equipped with data pertaining to drought events and rainfall patterns, while the Asian Disaster Preparedness Center (ADPC) contains valuable information regarding drought susceptibility. To compile this data, meteorological stations uniformly distributed across the region have been collecting information for over three decades. This data is utilized to generate the Standard Precipitation Index (SPI) and Soil Moisture Index (SMI), which facilitate the calculation of monthly rainfall and monthly temperature. Consequently, this process yields statistics on soil moisture and water deficits, offering detailed insights into drought occurrences and their susceptibility levels. The acquired data is deemed reliable for subsequent applications. It's worth noting that, when using the SPI and SMI, the use of monthly average data may not provide the same level of precision as daily data.

In 2010, a hazard assessment was conducted in Nepal by the collaborative efforts of the Asian Disaster Preparedness Center (ADPC), the Norwegian Geotechnical Institute (NGI), and the Center for International Studies and Cooperation (CECI). The Ministry of Home Affairs was responsible for gathering data related to a

wide range of hazards and assessing their economic impacts. To analyze the trends in various climatic hazards, data spanning 49 years (1971-2019) from the DesInventar database and the National Disaster Risk Reduction Portal was utilized (MoFE, 2021). Hazard maps were then created for different return periods, providing a visual representation of the intensity and distribution of these disasters across the country.

2.2.3 Exposure statistics

Exposure refers to the condition in which individuals, structures, residences, and other tangible human assets are located in areas prone to hazards. It is quantified by assessing the potential impact on lives and the value of assets or properties that could be vulnerable to risks. Exposure constitutes a fundamental component in defining disaster risk. These exposure statistics are often employed as a baseline dataset for evaluating the consequences of a disaster, including the calculation of financial costs (ESCAP, 2018). The data on exposure encompasses various aspects such as the frequency, intensity, geographical spread of the disaster, the number of affected individuals, and the extent of damage incurred. The assessment of exposure to hazards comprises two essential elements: a probabilistic hazard map and a complementary map delineating the distribution of population and critical infrastructure (ESCAP, 2018). The sectors covered by exposure statistics encompass significant areas such as agriculture, industry, transportation, communication, electricity, housing, education, and healthcare facilities. This vital information is continually updated through various reliable sources, primarily provided by agencies like the National Statistics Office, the Survey Department, the Department of Roads, and other focal departments.

Table 5: Exposure statistics and data sources

Type of Exposure Data	Who has the data	Data Source
Building Exposure by Typologies	METEOR Project	BIPAD Portal, https://bipadportal.gov.np/risk-info/#/exposure
District wise population exposure of different groups of people to earthquake	ADPC	NHRA Report, p83-84, p130-131
District wise infrastructure exposure of different types to various return period of earthquake, flood	ADPC	NHRA Report, p85-89, p125-129.
Exposure of crops of various types to droughts and losses in various seasons due to drought	ADPC	NHRA Report, p143-152

Regarding natural hazards, exposure statistics focus on the characteristics of geophysical processes that present risks, encompassing factors such as their magnitude, frequency, spatial distribution, duration, initiation speed, and temporal patterns. As per the NHRA report, the primary data for earthquake exposure assessment were sourced from a variety of reliable outlets. This data was collected at the district level and structured in a GIS format. It includes district-wide population exposure in high-risk zones, housing exposure in these zones, the count of education infrastructure at risk, and other pertinent statistics, all visually represented in graphs and maps for a more comprehensive analysis of hazard exposure.

Examples of exposure data statistics encompass risk maps, population distribution maps, maps of critical infrastructure, population density maps, land cover maps, and household income maps. At the national level, the availability of comprehensive data is somewhat limited. The Survey Department is entrusted with the task

of collecting and consolidating data at local, district, and provincial levels. While the 2021 census provided valuable information, several databases maintained by provincial and district administrations remain outdated.

Until the next census, accurate data collected during the census will be utilized across various sectors. Nevertheless, the potential for misunderstandings, misinterpretations, and erroneous responses exists, potentially introducing data quality discrepancies. Employing integrated software tools like mapping, tracking, photography, and other methods helps verify the authenticity of the survey process. The validation of exposure statistics is intertwined with the validation of hazard maps and the credibility of the survey methodology. In the realm of national-scale exposure statistics, the demand for up-to-date and comprehensive data remains a critical requirement.

2.2.4 Vulnerability statistics

Vulnerability is the condition in which individuals, communities, assets, or systems become more prone to the impacts of hazards due to various physical, social, economic, or environmental factors. Vulnerability statistics focus on the characteristics of physical and social elements concerning the severity of hazards, providing insights into the strengths and weaknesses of these assets (ADPC, 2010). An evidence-based approach to disaster risk reduction (DRR) necessitates the use of vulnerability statistics.

In the context of Nepal, there has been relatively limited research on how to assess the vulnerability of homes, populations, and other physical infrastructure (ADPC, 2010). Vulnerability statistics are articulated in terms of building components, facilities, population groups, or economic sectors. This approach facilitates the assessment of the susceptibility of specific structures, industries, or geographic areas to the impact of hazards.

Table 6: Vulnerability statistics and data sources

Type of Vulnerability Data	Who has the Data	Data Source
Population Vulnerability by personal attributes	National Planning Commission	BIPAD Portal, https://bipadportal.gov.np/risk-info/#/vulnerability
Population Vulnerability by access to facilities	National Statistics Office	BIPAD Portal, https://bipadportal.gov.np/risk-info/#/vulnerability

Vulnerability statistics encompass four main categories: Human-social, physical, economic, and environmental data. These statistics include information related to the economic and personal well-being of vulnerable populations, such as the Human Development Index (HDI), life expectancy, poverty indices, per capita income, and access to communication, clean water, sanitation, and education. Additionally, vulnerability statistics comprise data concerning housing conditions, healthcare, population demographics, as well as industrial and transportation sectors. These vital datasets are systematically collected by the National Statistics Office (NSO), operating under the National Planning Commission (NPC), and are accessible through the BIPAD Portal. Links to these datasets can be found in the provided table.

In Nepal, a network of trained surveyors is employed to gather data through questionnaire surveys conducted nationwide. The data collected during the 2021 national census is considered reliable and will be used across various sectors until the subsequent census. However, it's important to acknowledge the possibility of misunderstanding, misinterpretation, and inaccuracies in the responses during these surveys. To ensure data

accuracy, integrated software approaches, including mapping, tracking, imagery, and other methods, are utilized for data verification.

2.2.5 Coping capacity statistics

Coping capacity refers to the capacity of individuals, groups, and systems to effectively handle challenging circumstances, disasters, and adverse conditions. It encompasses factors such as possessing knowledge, having access to resources, and the ability to manage effectively during both routine and challenging periods. An example of a coping mechanism includes the act of relocating to a safer location, whether on a temporary or permanent basis.

Population census data can serve as a valuable tool for tracking population movements in response to disasters. Additionally, coping capacity can be quantitatively assessed using statistical methods, which may involve data from open sources or surveys assessing the preparedness of households and businesses in areas that are potentially exposed to risk (ESCAP, 2018).

Table 7: Coping capacity statistics and data sources

Type of Data	Who has the Data	Data Source
Capacity and Resource Assessment	BIPAD Portal	BIPAD Portal, https://bipadportal.gov.np/risk-info/#/capacity-and-resources
National Adaptability Plan multi sectoral future programs	UNFCC	NAP Report, p19-37

Socio-economic indicators such as the Human Development Index (HDI), Gender Inequality Index (GII), Gross Domestic Product (GDP), and savings are utilized to measure coping capacity. Institutional capacity, the adoption of policies and programs, regulations and standards, involvement of actors and agencies, access to goods and services, access to early warning systems, and climate-resistant infrastructures are all examples of physical and technological factors (MoFE, 2021). The resilience of homes, businesses, communities, social systems, and even nations against external shocks in the form of disasters is represented in several dimensions, including coping capacity (ESCAP, 2018). Moreover, there are coping methods that can be statistically measured using data from public sources, such as expenditure or polls assessing the level of preparedness of homes or companies in potentially vulnerable areas.

The aspects of recovery can be depicted through statistics derived from a blend of direct observations by affiliated institutions and estimations based on trends in economic and social data, including population movement and construction activities collected before and after the disaster (ESCAP, 2018).

These data are available from census carried out by the National Statistics Office (NSO) and the Bipad Portal under the Ministry of Home Affairs (MOHA). The received data gives an overview of the situation, but might not give complete and reliable data all the time due to various constraints. Difficulty and error in identification of dead bodies, time lag in receiving information, manipulation of data and inaccurate assessment leads to lowering the data quality in case of coping capacity statistics. Lack of access to information, inadequate infrastructure, and poor governance are the main factors weakening the quality of coping capacity data. The verification of data is done through comparison of data from multiple sources.

2.3 Disaster occurrence and impacts

2.3.1 Disaster occurrence

The preamble of the NDRRM Act 2019 states that:

*“reduction of disaster risks and management to protect human lives and properties of the public, private and individual, to preserve natural and cultural heritage, and to keep physical infrastructures safe from **natural** and **non-natural disasters** by effectively coordinating and managing all activities on reduction of disaster risk and management”.*

And chapter 1-clause 2 states:

***“Non-natural disaster”** means an epidemic, famine, wild fire, insects or anthrax attack, animal and bird flu, pandemic flu, snake bite, animal attack, mine, aviation, road, water or industry related accident, fire, toxic gas, chemical or radiation leakage, gas explosion, consumption of toxic foods, environmental pollution, deforestation, or damage to physical infrastructure, and accidents in time of disaster rescue or similar other disasters occurred from non-natural disasters.*

***“Natural disaster”** means snowfall, hailstone, avalanche, glacial lake outburst flood (GLOF), extreme rainfall, low rainfall, flood, landslide and soil erosion, inundation, storm, drought, cyclone, cold wave, heat wave, lightening, earthquake, volcanic eruption, wild fire or similar other disasters occurred from natural causes.*

***“Disaster”** means a natural or non-natural disaster causing a threatening situation in any place that results in loss of lives and properties and makes severe impacts on livelihood and the environment.*

The Ministry of Home Affairs (MoHA) and the National Disaster Risk Reduction Center (NDRRMA) bear the primary responsibility for managing and maintaining data related to disaster occurrence and its impact. Throughout different phases of a disaster, data collection becomes a critical undertaking. Various tools are employed during distinct stages, encompassing initial rapid assessment (IRA), multi-sector initial rapid assessment (MIRA), cluster-specific detailed assessment (CSDA), detailed survey (DS), and post-disaster need assessment (PDNA). The collective disaster occurrence data find their repository in the DRR²²/BIPAD²³ portal, managed by MoHA and NDRRMA. This centralized portal serves as a comprehensive platform for organizing and disseminating critical information related to disaster occurrences and their associated impacts.

In Nepal, there are challenges in reporting and documenting all disasters, especially small-scale ones, leading to data gaps and hindering an accurate understanding of their incidence and distribution. The lack of a central database makes it difficult to consolidate information from various sources, resulting in potential discrepancies. Real-time data collection faces obstacles in rural and remote areas due to limited access to technology. Additionally, making disaster data accessible to the public proves challenging, impacting transparency and

²² <http://www.drrportal.gov.np/>

²³ <https://bipadportal.gov.np/>

accountability. Despite these issues, efforts have been made to enhance data gathering techniques, strengthen catastrophe reporting systems, and encourage collaboration among diverse stakeholders.

2.3.2 Disaster impacts

According to the UNDRR (United Nations Office for Disaster Risk Reduction), the assessment of losses and impacts resulting from disasters encompasses various dimensions, including human, material, economic, and environmental aspects.

Human Impact is the tragic loss of lives, as disasters can lead to a significant number of deaths, leaving families and communities devastated. Additionally, there are often individuals who are reported missing, compounding the anguish and uncertainty faced by their loved ones. Those fortunate enough to survive may still suffer injuries, ranging from minor to severe, necessitating medical attention and rehabilitation. Disasters also frequently result in the displacement of people from their homes, either temporarily or permanently, as well as the evacuation of entire communities to safer areas. These displacements can exacerbate existing vulnerabilities and create new challenges for individuals and societies. Furthermore, the disruption of livelihoods is a common consequence of disasters, as economic activities are interrupted, infrastructure is damaged, and resources become scarce. This disruption can have long-lasting effects on individuals and communities, compounding the already significant challenges posed by the disaster itself. Overall, the impacts of disasters on human lives are multifaceted and far-reaching, underscoring the importance of effective preparedness, response, and recovery efforts.

Material impacts are measured through the total or partial destruction of production/outputs, damage to productive assets, and other physical losses.

Economic impacts encompass both direct and indirect losses, where direct losses are evaluated by the monetary value of destroyed productive assets, while indirect losses include decreased demand for goods and services, fluctuations in crop prices, increased debt or dependence on imports, disruptions to supply chains for products or for services like education etc.

Environmental impacts, another critical dimension, manifest in various ways, such as the depletion of soil nutrients in agricultural areas or contamination of freshwater resources near affected plantations. Understanding and quantifying these diverse impacts are crucial for effective disaster risk reduction and recovery strategies.

2.3.2.1 Human impact

In Nepal, earthquakes and floods often lead to significant casualties, injuries, and displacement, compelling people to seek temporary shelters after losing homes and possessions. The extent of fatalities and injuries serves as crucial indicators of the severity of a disaster's impact on human lives. Beyond physical consequences, disasters also inflict emotional distress, trauma, and psychological challenges. Understanding and addressing these psychological effects involve utilizing data and surveys on mental health to effectively manage the mental well-being of individuals affected by disasters. Data on the psychological effects in Nepal are collected by various supporting agencies engaged in mental health recovery efforts following disasters. Such data are collected only after severe disasters by different development partners such as I/NGOs, UN agencies and other development partners.

Gaining insight into the enduring impact of diverse disasters on individuals' ability to sustain themselves necessitates comprehensive data and statistics on the repercussions of disasters on human. These statistics encompass a broad spectrum of variables, including financial losses, job displacement, asset depletion, and the status of food security. They also shed light on the coping mechanisms adopted by affected individuals and households, revealing adaptive strategies employed in challenging circumstances. Disasters can inflict damage on homes, tools, equipment, and other essential assets crucial for maintaining livelihoods. A significant portion of Nepal's population heavily relies on agriculture for income, and disasters can result in crop failure, destruction of cropland, and loss of livestock, leading to both immediate and prolonged agricultural setbacks.

Measuring the impact on employment aligns with gauging disruptions to essential services, using parameters such as the number of affected individuals and the duration of the impact. Nevertheless, additional data, including income and expenditure figures, employment rates, livestock assessments, property damage, food security, and livelihood recovery data, is vital for a comprehensive understanding of the effects of disasters on livelihoods. The National Statistics Office (NSO) provides yearly updated employment rate data, while the Ministry of Finance (MoF) gathers information on income and expenditure. Data on crops and livestock is maintained by the Ministry of Agriculture and Livestock Development, and other disaster-related loss data is accessible on the Disaster Risk Reduction (DRR) Portal. These datasets are compiled through field visits, surveys, and the use of Geographic Information System (GIS) mapping. Although challenges persist in data collection and underreporting, ongoing initiatives to enhance data availability and accuracy are imperative for supporting sustainable livelihoods in disaster-prone areas and informing evidence-based decision-making.

Nepal has grappled with substantial challenges related to livelihood impacts resulting from disasters. Livelihood impact assessments are integral components of both the Initial Rapid Assessment (IRA) and detailed assessments conducted during emergencies. In response to crises, eleven [clusters](#), including recovery, food security, and nutrition, are activated to livelihood recovery efforts.

Following the 2015 Gorkha earthquake, Nepal undertook a comprehensive detailed assessment that facilitated the Post Disaster Needs Assessment (PDNA)²⁴. This assessment played a pivotal role in estimating per-capita disaster effects and informed strategies for recovery.

National Climate Change Impact [Survey](#) in 2016, conducted by the National Statistics Office (NSO)/Central Bureau of Statistics (CBS). The survey highlighted the loss of jobs and disruptions to daily life, including days absent from schools and work, due to climate-induced disasters. Notably, households reported significant workdays missed as a consequence of various climate-related incidents such as droughts, floods, fires, heatwaves, cold waves, and wind storms. These findings underscore the multifaceted challenges that communities face in the aftermath of disasters, necessitating comprehensive and targeted livelihood recovery measures.

The following table shows the human impact data and their sources.

²⁴ https://www.npc.gov.np/images/category/PDNA_volume_BFinalVersion.pdf

Table 8: Impact data and data sources

Type of Data	Who has the Data	Data Source
District wise casualties' projection (dead, injured and missing) of various scenarios in various return period of earthquake, flood	ADPC	NHRA Report, p98-101
Disaster Incident data and maps	DRR Portal, Nepal Police	DRR Portal, http://drrportal.gov.np/publication BIPAD Portal, https://bipadportal.gov.np/incidents/
Human lives by groups and region	DRR Portal, Nepal Police	BIPAD Portal, https://bipadportal.gov.np/damage-and-loss/

2.3.2.2 Material impact

In the context of disaster risk reduction (DRR) in Nepal, direct material impacts play a significant role, encompassing the destruction and damage of crucial structures and infrastructures. This includes buildings and critical facilities that may be fully or partially destroyed (see figure hereunder copied from DRR portal). The DRR portal serves as a valuable resource, reporting on the conditions of government and private houses, detailing the extent of damage sustained. This reporting extends to property losses and the displacement of sheds. Notably, however, the DRR portal does not encompass other disaggregated damage data pertaining to productive assets and additional physical losses.

Govt. Houses Fully Damaged	Govt. Houses Partially Damaged	Private House Fully Damaged	Private House Partially Damaged
0	0	1	0

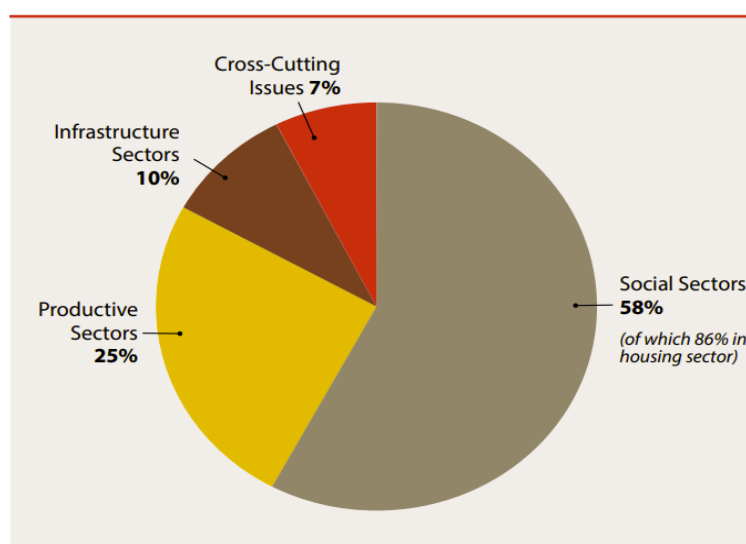
Figure 5: Material impact data on Nepal's DRR Portal

A crucial component in the aftermath of disasters is the detailed needs assessment survey, which gathers essential data for the reconstruction and rehabilitation efforts. Notably, this survey yields information on material impacts that is integral to the planning and execution of reconstruction initiatives. However, it is noteworthy that the detailed needs assessment survey data are not publicly available; instead, they are meticulously maintained within the Management Information System (MIS). This system serves as a strategic tool for coordinating and implementing effective reconstruction strategies in the wake of natural disasters in Nepal.

2.3.2.3 Economic impacts

Disasters exert significant economic impacts, encompassing various dimensions. Infrastructure damage and the subsequent costs of reconstruction pose immediate financial challenges, while business interruptions result in productivity loss and potential closures. Employment disruptions contribute to rising unemployment rates, affecting the financial stability of individuals and communities. The agricultural sector faces severe consequences, including crop failures and livestock losses, impacting food production and livelihoods. Governments bear the financial burden of disaster response and recovery efforts, leading to fiscal strain and potential impacts on public services. Additionally, disasters disrupt tourism and trade, affecting transportation routes and the economic viability of regions reliant on these sectors. These interconnected economic consequences highlight the need for comprehensive disaster preparedness and mitigation strategies.

In the aftermath of a disaster, understanding the economic impact becomes crucial, and this is often achieved through systematic assessments such as Initial Rapid Assessments (IRA) and comprehensive evaluations. A compelling example of this methodology is observed in the aftermath of the **Gorkha earthquake in 2015**, where a Post-Disaster Need Assessment (PDNA)²⁵ was conducted. According to the PDNA findings, the total estimated value of the disaster's effects amounted to a staggering US\$7 billion. This assessment led to a significant revision in the annual growth projection, dropping from an initial 4.8 percent to a mere 0.8 percent. The stark economic figures highlighted the profound consequences of the Gorkha earthquake, underscoring the importance of efficient and timely post-disaster assessments in guiding recovery efforts.



Source: Estimations by PDNA Team

Figure 6: Share of earthquake effects across sectors

The **earthquake** on November 3, 2023 in the **Jajarkot** district affected Jajarkot, Rukum West, Salyan, Bajhang, and Bajura. Official figures regarding the total economic loss from this earthquake have not yet been made public. According to the situation report²⁶, approximately US\$ 690 million would be required for reconstruction. Currently, the construction of temporary shelters is underway, with an estimated 80,000 beneficiaries expected to be eligible for government assistance in housing reconstruction.

²⁵ https://www.npc.gov.np/images/category/PDNA_volume_BFinalVersion.pdf

²⁶ [https://dpnet.org.np/uploads/files/Quad-Day_Jajarkot_EQ_Report_\(21-24%20Dec\)%202023-12-25%2015-38-37.pdf](https://dpnet.org.np/uploads/files/Quad-Day_Jajarkot_EQ_Report_(21-24%20Dec)%202023-12-25%2015-38-37.pdf)

2.3.2.4 Environmental impact

Variables describing environmental consequences are based on a nationally recognized classification of land cover categories. Moreover, functional land cover categories, such as designated biological reserves and World Heritage sites (ESCAP, 2018), hold particular significance in determining direct effects. The impacts on ecosystems, natural resources, and the overall state of the environment can be far-reaching and enduring. Major consequences include landslides, soil erosion, deforestation, habitat loss, as well as water and air pollution.

The various types of hazards—geophysical, hydrological, meteorological, and biological—exert an immediate effect on the environment and are evaluated using diverse criteria. These criteria encompass direct effects on ecosystems based on land cover types, the depletion of vital ecosystems, the degradation of natural water resources in terms of quantity and quality, direct effects on the atmosphere, and contributions to climate change (ESCAP, 2018). The data on affected area, deforestation, water quality, air quality and biodiversity assessment is considered to evaluate the environmental impact. Collaboration between national monitoring agencies for land cover, water resources, and atmospheric conditions, together with first impacts evaluations of NDMAs following a disaster, is the main data source for statistics on environmental impacts.

The Ministry of Forest and Environment (MoFE) does not directly engage in providing data or taking actions during and after a disaster. However, MoFE is involved in conducting stock-taking activities related to natural resources, such as forest cover, wetlands, and biodiversity. Additionally, it estimates the risk, exposure, and vulnerability indices for provinces, districts, and local levels.

The environmental repercussions of a disaster are meticulously documented through a detailed impact assessment process overseen by the National Disaster Risk Reduction and Management Authority (NDRRMA). This thorough evaluation delves into the multifaceted effects on the environment, ranging from ecological disturbances to resource depletion and habitat destruction. The data gathered from this comprehensive assessment serves as resource for crafting the Post-Disaster Needs Assessment (PDNA) report. This report plays a pivotal role in strategizing and formulating recovery plans, ensuring that environmental rehabilitation and preservation efforts are integrated into the broader framework of post-disaster recovery initiatives.

The necessary data on forest and soil are provided by the Ministry of Forest and Environment. Idealistically, data collection and monitoring programs of national and regional water authorities should be expanded to include impacts on water resources. Typically, organizations in charge of official scientific monitoring of atmospheric conditions estimate the carbon emissions from wildfires and the sulfur emissions linked to volcanic eruptions. International scientific organizations or national space agencies are keeping an eye on these emissions all across the world. Comprehensive data gathering can be hampered by difficult topography due to its wide geographic variation. To ensure data integration, coordination and collaboration among several authorities is required. Accessibility issues can limit transparency and there may be gaps in the data since not all environmental consequences are properly documented, especially in remote and difficult-to-reach locations.

2.4 Disaster-risk reduction expenditure

Disaster expenditure typically includes funds allocated for disaster preparedness, response, recovery, and mitigation. The government of Nepal, in collaboration with international organizations and donors, has been working on disaster risk reduction and management initiatives. Expenditure in this area covers areas such as early warning systems, infrastructure resilience, and emergency response.

Nepal is also vulnerable to climate change impacts, including glacial melting, changing rainfall patterns, and increasing temperatures. Climate expenditure focuses on adapting to and mitigating the effects of climate change. Climate-related expenditure may encompass investments in sustainable agriculture, water resource management, renewable energy, and forest conservation, among other areas.

Expenditure related to disasters and climate change initiatives in Nepal often comes from a combination of sources. These include the national government's budget, international aid and grants, funding from bilateral and multilateral organizations, and contributions from non-governmental organizations (NGOs).

The Government of Nepal, through its Ministry of Home Affairs and Ministry of Forests and Environment, among others, plays a key role in coordinating disaster and climate-related expenditures and initiatives.

The government of Nepal introduced 'Climate Change Budget Code' in 2012 which helped to track the budget allocated to implement climate change related activities. To access precise and up-to-date information on disaster and climate expenditure in Nepal, we have to refer to reports and publications from organizations such as the Consolidated Financial Statements²⁷ or from the development cooperation report²⁸. However, these reports do not provide the expenditure related to the response, relief, and recovery from the impact of disasters in Nepal. The table below provides the sources of the fund for the disaster or climate related expenditure in Nepal which are useful to track the total expenditure in disaster and climate related activities.

A primary reservoir of financial resources for addressing the aftermath of disasters is the Disaster Management (DM) fund, established and administered at various tiers of government. This fund structure is distributed across different levels, with entities such as the Prime Minister Disaster Relief Fund at the national level, the Provincial Disaster Management Fund at the provincial level, and Local Disaster Management Funds at the local level. Annually, allocations are made from the government's budget to replenish these funds, ensuring a consistent and proactive approach to disaster response. Importantly, in instances where portions of the fund remain unused, a mechanism is in place to facilitate the transfer of these unutilized resources. This allows local or provincial levels with surplus funds to contribute to the emergency expenditures of other regions, fostering a collaborative and supportive framework for disaster management. This flexible reallocation mechanism ensures that resources are efficiently utilized to address the diverse needs arising from unexpected events. Officials from the National Disaster Risk Reduction and Management Authority (NDRRMA) have disclosed that the government's Disaster Management Fund currently holds a substantial deposit of NPR 6 billion²⁹. This fund is earmarked exclusively for disaster-related initiatives and cannot be diverted for other purposes. Its designated use encompasses critical areas such as rescue operations, the establishment of temporary settlements, provisioning of food supplies, and extending financial assistance to communities affected by

²⁷ https://www.fcgo.gov.np/storage/uploads/publications/20230619133028_CFS%20Report%20For%20Website.pdf

²⁸ <https://www.mof.gov.np/site/publication-detail/3293>

²⁹ <https://myrepublica.nagariknetwork.com/news/disaster-management-fund-has-rs-6-billion-in-deposit/>

disasters. Stringent legal provisions mandate that the allocated amount in the fund must be directed solely towards addressing the immediate and long-term needs arising from disasters, emphasizing the importance of maintaining the fund's integrity and adherence to its specified purposes. This ensures that the financial resources are dedicated to supporting timely and effective responses to disaster events, safeguarding the well-being of communities in times of crisis.

A critical component of disaster financing is the allocation within the national budget designated for the NDRRMA. Illustrating this commitment, in the fiscal year 2022/23, the government allocated a substantial sum of NPR 1.61 billion³⁰ to NDRRMA.

Table 9: Disaster risk reduction expenditure data and data sources

Sources	Description	Remarks
Disaster management fund		
Prime minister disaster relief fund (contributed by individuals, private sectors, national government, donors, etc.)	Provide financial resources for immediate disaster response and relief efforts. It is used to support relief operations, assist affected communities, and provide financial assistance to disaster victims.	Bureaucratic complications and might delay in fund distribution
Provincial disaster management fund	Provide financial resources for immediate disaster response and relief efforts. It is used to support relief operations, assist affected communities, and provide financial assistance to disaster victims.	Bureaucratic complications and might delay in fund distribution
Local disaster management fund	Municipalities and rural municipalities often maintain their own disaster funds. These funds are used for disaster response at the local level. Local authorities can mobilize these funds to provide immediate relief to affected communities.	Bureaucratic complications and might delay in fund distribution
DRR/CC projects		
DRR projects by INGOs	Every INGOs working in Nepal need to take approval from social welfare council (SWC) for the project implementation	The records can be obtained from the social welfare council
DRR/CC projects by bilateral agencies (e.g. FCDO, EU, JICA, USAID, etc.)	The projects are approved by the ministry of finance and implemented by consulting firms, INGOs and local partner NGOs in Nepal	The allocations can be accessed from the aid management platform of Nepal maintained by Ministry of Finance (MoF).
Green Climate Fund (GCF) under UNFCCC	Currently three projects are approved by the GCF and are under implementation. The project activities are funded for	Ministry of Finance acts as national designated authority (NDA) and ministry of forest and environment

³⁰ <https://nepalindata.com/insight/BUDGET-2022-23---DISASTER-MANAGEMENT/>

Sources	Description	Remarks
	climate change adaptation and mitigation of emissions	(MoFE) is the technical ministry for the GCF projects
Adaptation fund (AF), global environment facility (GEF) under UNFCCC	Ministry of Finance approves the projects and are implemented	
UN agencies	Various projects are implemented by different UN based agencies in Nepal for DRR and CC activities	
Multilateral agencies (e.g. WB, ADB, etc.)	Different loan and grant projects on DRR and CC are implemented	
Government budget allocation		
National budget: Climate change budget code	Annual budget records of national, provincial and local level governments	
Expenditure data		
Annual audit report	FCGO Financial Comptroller General Office	Audit reports

2.4.1 Risk reduction

Across all levels of government and through collaboration with various development partners, there is a concerted effort to invest in early warning systems, training programs, and capacity-building initiatives. These endeavors are pivotal for enhancing preparedness and resilience in the face of potential risks and disasters. However, the challenge lies in effectively tracking the allocations and expenditures associated with these risk reduction initiatives. The multifaceted nature of such investments, distributed among diverse sectors and stakeholders, makes it intricate to ascertain precise figures under the risk reduction umbrella. Establishing transparent and streamlined monitoring mechanisms becomes imperative to ensure that the financial resources invested in early warning and capacity-building initiatives yield the intended outcomes and contribute meaningfully to the overall resilience of communities and regions.

2.4.2 Response and recovery

Considerable resources are dedicated to the critical phases of response and recovery in the aftermath of disasters. The government plays a pivotal role in these efforts by activating the Disaster Management (DM) fund and facilitating inter-governmental transfers commensurate with the scale of the disaster's impact. This ensures an immediate infusion of financial resources to address pressing needs during the response and recovery stages. In addition to government contributions, various international non-governmental organizations (INGOs), private sector, and individual donors also contribute resources to support response and recovery initiatives. Despite the collaborative nature of these contributions, pinpointing the exact amount expended on response and recovery proves challenging due to the diverse array of funding sources. Establishing comprehensive tracking mechanisms becomes imperative to capture and analyze the collective impact of

these financial resources, fostering transparency and accountability in the allocation and utilization of funds during the critical phases of disaster management.

2.4.3 Disaster-related development

In the wake of the devastating earthquake in 2015, the government of Nepal has undertaken substantial measures to enhance the national building code, signaling a proactive commitment to fortifying infrastructure against seismic risks. A key aspect of this initiative involves comprehensive training programs for engineers, contractors, and construction workers, aiming to bolster their capacity for the effective implementation of the updated building code. Noteworthy strategies include the widespread application of fire-resistant materials in construction, elevating plinth levels in flood-prone areas, and the construction of structures specifically designed for disaster risk mitigation. These concerted efforts underscore a conscientious approach to integrating resilience into development projects, with a focus on mitigating the impact of future disasters. By prioritizing these measures, Nepal endeavors to create a more robust and disaster-resistant built environment, reflecting a forward-thinking stance in the face of potential challenges.

2.4.4 Disaster-related transfers

Disaster-related transfers are a frequent occurrence in Nepal, reflecting a proactive approach to addressing the aftermath of natural or man-made calamities. In this practice, funds, resources, or aid are systematically channeled from the national government to provincial and local-level governments. The primary objective is to provide essential support for emergency response initiatives, facilitate the recovery process, and contribute to the reconstruction efforts in areas profoundly impacted by disasters. The flexibility of these transfers allows for a dynamic response, with funds moving from the national level to regional or local governments, and in some cases, from one affected region to another. This strategic allocation of resources is contingent upon the scale and severity of the disaster, ensuring that the assistance is targeted where it is most urgently needed. Such disaster-related transfers exemplify a coordinated and responsive approach to managing crises, fostering resilience and aiding in the restoration of affected communities.

2.5 Economic losses

2.5.1 Valuation of economic losses and damage

The economic impact of climate-induced disasters in Nepal is starkly reflected in the average annual economic loss, amounting to Nepalese Rupees (NPR) 2,778 million³¹. This figure accounts for approximately 0.08 percent of the total Gross Domestic Product (GDP) for the Fiscal Year 2018/19, measured at current prices. The nation faces a spectrum of formidable climate-related challenges, with floods, landslides, epidemics, and fires emerging as the most devastating disasters. These events not only pose immediate threats to human life and safety but also exact a significant toll on the country's economic landscape. The quantification of annual losses underscores the urgency of bolstering resilience measures and implementing effective disaster risk reduction strategies to mitigate the socioeconomic impact of these recurring climate-induced adversities in Nepal.

Understanding the true financial impact of disasters on economies and communities requires valuing economic losses and damage attributed to disasters. Experts calculate the direct physical harm brought on by the disaster by a thorough examination, including the destruction of buildings, infrastructure, and productive assets. Because some of these economic effects are challenging to link directly to the disaster and may go unnoticed, it is crucial to take into account the many ways that disasters influence economies. Economic loss statistics must be based on a precise and regularly applied notion of measurement to prevent duplicate counting or mixing of data (ESCAP, 2018).

Disaggregated statistics are essential for conducting specific analyses focused on reducing risks, particularly for vulnerable populations at national or local levels. This involves breaking down human impact statistics by income, especially for households affected by damaged homes or assets, and meticulously mapping vulnerabilities both pre- and post-disaster. In this context, emphasis is placed on "direct material impacts," encompassing impacts on dwellings, buildings, machinery, critical infrastructure, valuables, etc.

Governmental organizations in charge of the relevant types of infrastructure may conduct an assessment as part of the immediate disaster response and recovery, which could include an estimation of replacement costs based on current data on the typical per-unit costs for each type of infrastructure in the affected area. Some people can have access to direct observations of recovery costs through reports or surveys of enterprises, reports of expenses by government agencies, such as the Ministry of Transportation in the case of roads, or reports from records of insurance claims related to a disaster. Statistics on economic damage as a result of disasters are certified through a rigorous procedure involving investigation, cross-referencing, and verification by a diverse group of stakeholders.

2.5.2 Agriculture losses statistics

The impact of disasters on food security and agriculture is profoundly significant in Nepal, with agriculture standing as one of the most vulnerable sectors to natural disasters such as earthquakes, landslides, floods, and droughts. The aftermath of these events often leaves a trail of devastation, necessitating substantial resources for the post-disaster agricultural transition. In 2021, the repercussions of non-seasonal rainfall in October were particularly severe, adversely affecting ready-to-harvest paddy crops across 85,580 hectares,

³¹ https://mofe.gov.np/old/downloadfile/National%20framework%20on%20Loss%20and%20Damage%20-%20Approved%20Document-%202021_1653988842.pdf

which were either swept away or submerged by floodwaters in all seven provinces. The Ministry of Agriculture reported a staggering loss of 325,258 tons of paddy, valued at approximately NPR. 8.26 billion, underlining the substantial economic impact and the urgent need for targeted interventions to mitigate the adverse effects on food security and the agricultural sector in Nepal³².

Agriculture frequently has some of the most dramatic economic effects following disasters. This is partially due to the fact that agriculture has a high risk exposure due to it being a land-intensive business. Statistics on agricultural losses are assessed using a variety of techniques and data sources. Assessing how disasters or particular incidents affect agricultural productivity and associated economic losses is a step in the process. For an accurate assessment of agriculture loss, damage assessment surveys, satellite imagery and remote sensing, crop cutting experiments, agricultural statistics, economic analysis, household surveys, crop damage models, crop insurance data, and market data are gathered and assessed.

According to the Food and Agriculture Organization (FAO) Loss and Damage Assessment Methodology (FAO, 2020) in Agriculture, production damage encompasses the loss of stored inputs (seeds, fertilizer, feed, and fodder etc.) and outputs within agricultural systems. Additionally, production loss refers to the difference between the anticipated yield and the actual yield of a given production. This loss represents the shortfall or decrease in output compared to what was initially expected or forecasted, indicating the impact of various factors on agricultural productivity, ranging from natural disasters to fluctuations in environmental conditions. Asset damage is calculated based on the worth of the destroyed machinery, facilities, and other equipment and essential infrastructure for agricultural productivity of the magnitude and cost of loss and damage for all components in each subsector.

The figure hereunder shows the damage and loss assessment methodology in agriculture.

³² <https://kathmandupost.com/money/2021/10/24/october-rains-damage-record-rs8-26-billion-of-paddy-crop>

		DAMAGE	LOSS
Crops Livestock Fisheries Aquaculture Forestry	PRODUCTION	Pre-disaster value of destroyed stored production and inputs * <u>Items: seeds, fertilizer, pesticides, fodder, fish feed, stored crops, stored meat, dead animals, etc.</u>	Difference between expected and actual value of production and Short-run disaster expense * <u>Items: crop yield reduction, animal production reduction, destroyed timber, lost fish capture, cost of re-planting, etc.</u>
	ASSETS	Replacement or repair value of destroyed machinery, equipment, tools * <u>Items: tractors, harvesters, silos, barns, milking machines, boats, fishing gear, pumps, aerators, etc.</u>	

Figure 7: Loss and Damage Assessment Methodology (FAO, 2020)

The Ministry of Home Affairs (MoHA), Department of Forest and Soil Conservation, Department of Agriculture and National Disaster Risk Reduction and Management Authority (NDRRMA) has access to all the data related to agriculture loss. The NHRA report also includes information on the projected loss of agricultural land at various levels due to floods over a variety of return periods.

Using satellite imaging and ground assessments, agricultural specialists and economists estimate crop yield declines and determine the area of the damaged land. To comprehend the post-disaster adjustments, market data on agricultural prices are reviewed. Input costs, livestock losses, and harm to agricultural infrastructure are also taken into account in the economic analysis. Data on agricultural output, earnings, and costs are gathered through household surveys both before and after a disaster. The effect on the entire agricultural value chain, including processing, shipping, and distribution, is examined. Experts calculate the total economic losses in the agriculture industry by merging these data sources and applying economic models.

Data gathering on agricultural losses during catastrophes is frequently insufficient or non-systematic. Smallholder farmers, who make up a sizable share of the agricultural workforce, may lack access to formal data gathering methods, resulting in fewer reported losses. Inconsistencies in data collection procedures across locations and disasters may exist, making direct comparisons impossible.

2.5.3 Impact on productive assets, housing, and infrastructure statistics

The process of standardizing the assessment of loss and damage on productive assets, housing, and infrastructure in Nepal is an evolving initiative grounded in a "learning by doing" approach. In the aftermath of the 2015 earthquake, the country has garnered valuable experience and established commendable practices

in evaluating the impacts on various facets of its infrastructure and assets. Despite these advancements, a crucial gap remains in the absence of standardized assessment tools for different impact sectors. Recognizing this need, the National Disaster Risk Reduction and Management Authority (NDRRMA) is poised to play a pivotal role. It is expected that the NDRRMA will take the lead in developing and finalizing standardized assessment tools. Once completed, these tools will be instrumental for use by various levels of government and stakeholders, providing a systematic and uniform approach to assess and quantify the diverse impacts of disasters on productive assets, housing, and infrastructure.

Infrastructure, by its very nature, is heterogeneous, encompassing structures, machinery, real estate, and inventory. Creating a comprehensive overview of total damages to critical infrastructure becomes unfeasible without a standardized unit of measurement applicable across all relevant asset types. The initial physical impacts on essential infrastructure are delineated individually for each infrastructure type or damage category. Counting units, such as buildings, serves as a convenient alternative for numerous crucial infrastructure types. Whenever feasible, categories currently utilized in statistics or by governments for management purposes are employed to provide additional context for these counts (ESCAP, 2018).

	<i>Measurement units</i>		
Dwellings	No. of units (households)	No. of people	Area in sq. m.
Critical infrastructures			
Hospitals, health facilities	No. of buildings by official category (tier 1, tier 2,)	capacity (no. of beds)	sq. m.
Education facilities	No. of buildings by official category (tier 1, tier 2,)	capacity (no. of students)	sq. m.
Other critical public administration buildings	no. of units		
Public monuments	no. of units		
Religious buildings	no. of buildings by official category		
Roads	km	capacity (avg. daily traffic affected)	no. of roads by official category
Bridges	km	capacity (avg. daily traffic affected)	no. of bridges by official category
Railways	km	Capacity (avg. daily passenger and/or tonnes of shipping)	
Airports	no. of buildings by official category	capacity (avg. daily traffic affected)	
Ports	no. of units by official category	capacity (avg. daily traffic affected)	
Transport equipment	no. of units		

Figure 8: Impact on various infrastructure and their measurement units

2.5.4 Impact on environment and cultural heritage

Following the catastrophic event of the 2015 Gorkha earthquake in Nepal, the government initiated a comprehensive response by conducting detailed damage assessments and sectoral impact evaluations. The scale of the disaster was particularly evident in the massive impact on the environment and cultural heritage. Recognizing the significance of these losses, the government undertook the crucial task of producing a Post-Disaster Need Assessment (PDNA). This assessment meticulously outlined the extent of damage and outlined the recovery needs specifically pertaining to the environment and cultural heritage. The PDNA served as a vital tool for strategizing and prioritizing reconstruction efforts, guiding the allocation of resources to address the urgent requirements for restoring and preserving Nepal's valuable environmental and cultural assets in the aftermath of this mega disaster.

The environmental and cultural heritage impacts of disasters can result in severe economic losses with far-reaching implications. Natural disasters can wreak havoc on ecosystems, biodiversity, and natural resources. Furthermore, the destruction of cultural heritage sites, historical landmarks, and iconic structures can result in a loss of tourism earnings as well as cultural identity. The expenses of post-disaster recovery and reconstruction operations, which can be large for restoring the environment and safeguarding cultural property, are also included in the economic losses. Furthermore, disruptions to livelihoods and economic activity in areas strongly reliant on tourism and cultural industries can have a knock-on effect on local economies.

A systematic and interdisciplinary process is used in the methodological approach to evaluate how disasters affect the environment and cultural heritage in terms of economic damage. It starts with creating a baseline of natural and cultural assets before a disaster, then prioritizes at-risk areas through vulnerability and risk assessments. Experts carry out on-site surveys after a disaster to evaluate physical damage. They estimate the financial costs of repairing and replacing damaged assets, taking into account things like ecosystem services, tourism revenue, and local livelihoods. The evaluation also takes into account the intangible value of cultural assets and makes use of economic modeling to comprehend the long-term economic implications and repercussions on other industries. This strategy offers a thorough grasp of the economic impact by combining information and analysis from diverse experts.

3 Hazard Exposure Mapping

3.1 Background

Nepal is a disaster-prone country and exposed to many natural and human-induced hazards as it has diverse topography, complex geology, and highly varying climate. Nepal ranks 11th in terms of climate risk according to the Global Climate Risk Index and 46th in terms of INFORM risk index (UNDRR, 2019). The country is in top 20 of all the multi-hazard countries in the world. In Nepal, more than 80% of the population is exposed to the risk of natural hazards (UNDRR, 2019). Earthquakes, landslides, floods, fire, thunderbolts, inundation, droughts etc. are the major hazards that result in disaster events. Due to varying geography of the country, the southern plain called Terai are more exposed to flooding especially during monsoon³³ seasons whereas hill and mountainous regions are more at risk of landslides and debris flow. Apart from that, domestic fires and forest fires are common hazards across households in Nepal.

Considering climate change and its impacts, climate induced hazards have been increasing significantly in Nepal which can be seen in the following graph.

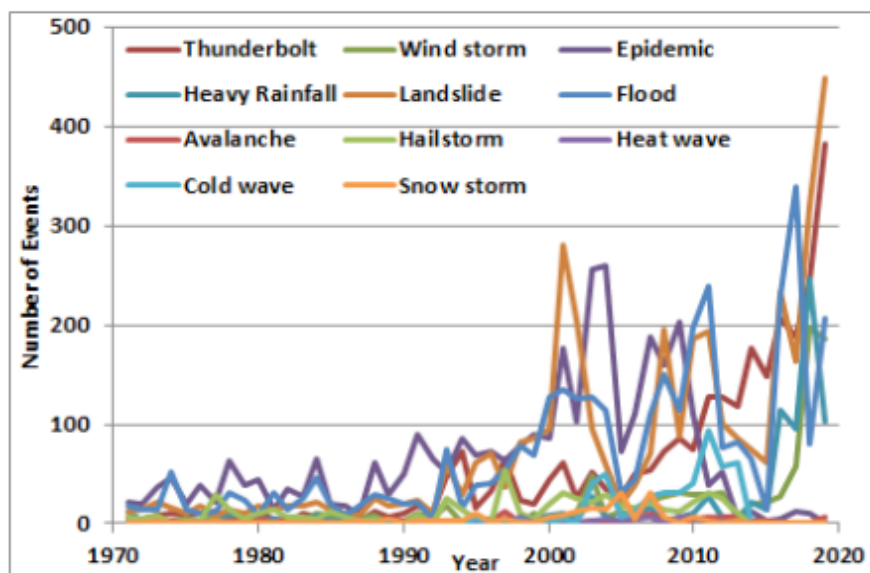


Figure 9: Trend of Climate-induced Hazards (MoFE, 2021)

Understanding disaster risk has been one of the priority areas to be worked on under the Sendai Framework for disaster risk reduction (ESCAP, 2018). Gathering and developing comprehensive risk information has always been a challenging task. Furthermore, Disaster-related Statistics Framework (DRSF) has also emphasized the use of official statistics, including socioeconomic information for disaster risk assessment. In Nepal, different sectoral agencies are responsible for official disaster data. The National Disaster Risk Reduction Management Authority (NDRRMA) has been custodian agency for the overall disaster management system. National Emergency Operation Centre (NEOC), under Ministry of Home Affairs (MoHA) manages major disaster occurrence data. The Department of Hydrology and Meteorology (DHM) has developed a 3-day flood forecasting system and provides weather forecasts and flood early warnings. Similarly, the Department

³³ Monsoon is a typical weather pattern originating in Bay of Bengal and becomes active in Nepal creating rainy season generally from 10th of June to end of September

of Water Resource and Irrigation, the Department of Hydrology and Meteorology (DHM), and the Department of Mines and Geology (DMG) have put together hazard maps for different parts of the country. Despite different hazard assessments and risk maps that are available, the products are usually relied on project-based exercises, or small-scale projects in specific localities.

National Statistics Office (NSO) is not involved directly in the collection and analysis of disaster data, however, many socio-economic related data produced by NSO needs to be integrated with disaster occurrence data. At this situation, the NSO Nepal, with technical assistance from ESCAP, is preparing two sets of maps as follows:

1. Perceived risk maps for whole Nepal at ward (lowest administrative unit of the country) level using information collected through individual and community questionnaire of the National Population and Housing Census 2021.
2. Population exposure to hazards maps using the past events recorded in the BIPAD portal and population statistics collected through the National Population and Housing Census 2021.

3.2 Concepts and definitions

According to the United Nations report of the open-ended intergovernmental expert working group (OEIWG) on indicators and terminology relating to disaster risk reduction 2016 (UNGA, 2016), the definition of the key words related to disasters are as follows:

Disaster: A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability, and capacity, leading to one or more of the following: human, material, economic and environmental losses, and impacts.

As per Nepal Disaster Risk Reduction and Management Act (2074), disaster means a natural or non-natural disaster causing a threatening situation in any place that results in loss of lives and properties and makes severe impacts on livelihood and the environment.

Hazard: A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption, or environmental degradation

Exposure: The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.

Exposure to hazard: State of being in which a person or a group of people remain in an imminent risk of danger due to hazards.

Disaster risk: The potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society, or a community in a specific period, determined probabilistically as a function of hazard, exposure, vulnerability, and capacity.

Regarding disaster risk in the community questionnaire of NPHC 2021, the respondents (i.e. the ward chair or team of ward representatives) were asked to judge the level of risk from a disaster based on their experiences and available facts/evidence. Furthermore, the respondents were requested to rank the level of risk for reported hazards into five categories such as very high, high, moderate, low, and very low.

Capacity: The combination of all the strengths, attributes, and resources available within an organization, community, or society to manage and reduce disaster risks and strengthen resilience.

Vulnerability: The conditions determined by physical, social, economic, and environmental factors or processes which increase the susceptibility of an individual, a community, assets, or systems to the impacts of hazards.

Hazard mapping: According to UNDRO (United Nations Disaster Relief Co-ordinator) hazard mapping is the process of identifying and visualising the spatial variation of hazard events or physical conditions. The main objective is to provide the residents with the information on the range of possible damage and for the disaster prevention activities. It cannot stop a disaster. However, the effective use in disaster risk management can stop/reduce the magnitude and impact of disaster. Flood maps, landslides maps, earthquake maps are specific types of hazard maps.

Hazard exposure maps: The hazard maps overlayed with population, critical infrastructure maps etc.

3.3 Scope

Based on the responses from the community questionnaire on perceived risk to natural disasters, nearly 41 per cent respondent reported that they have had high risk of flood and about 34 per cent respondents said that they felt high risk of landslide. The task force also agreed that Nepal has been suffering highly from flood and landslide. Therefore, flood and landslide were selected for hazard exposure mapping.

The perceived risk maps were visualized at ward level, the smallest administrative unit of Nepal, as the information on disaster risk from NHPC 2021 are available for every ward. After the promulgation of new constitution, Nepal was declared a Federal Democratic Republic in 2015 dividing the country into seven provinces (administrative level 1), 77 districts (administrative level 2) and 753 urban and rural municipalities (administrative level 3). Each municipality consists of 5 to 33 wards (administrative level 4) based on the geographic location and population size of the municipality.

Apart from the community's past disasters experiences, historical disaster data from BIPAD portal (<https://bipadportal.gov.np/>) was also used to visualize population exposure to historical hazards to provide an overview of numbers of population in disaster impacted areas. BIPAD portal is the national disaster management information platform that is designed to manage information on historic disaster events and its impact (damage and loss). In this project, **population exposure mapping is not based on probabilistic risk model due to the constraint in data availability and accessibility** but the project aims to develop exposure maps demonstrating the importance of baseline socio-economic data produced by NSO for disaster risk management and reduction. The exposure maps can be developed for different population groups such as children aged less than five years, persons aged more than 60 years, and the disabled.

3.4 Data sources

The information for community's perceived risk was used from the community questionnaire of the National Population and Housing Census (NPHC) 2021(See Annex 4). The Population and Housing Census provides the most authentic and comprehensive account of inventory of human resources of the country. It provides a population count with certain socio-economic characteristics by administrative divisions up to the ward level, a lowest administrative unit of Nepal.

Apart from the individual questionnaire, first time in the history of population census in Nepal, the community questionnaire was administrated for every ward. The community questionnaire aims to collect information on basic socio-economic, infrastructure and natural disasters from each ward. The supervisors of the NPHC 2021 were trained with community questionnaire and they conducted interviews with ward chairperson or ward secretary or a team of the ward committee. As per the Disaster Risk Reduction and Management Act 2017, every local level shall establish a Local Disaster Management Committee chaired by the chairperson of village municipality or Mayor of the urban municipality. The committee is responsible for making necessary arrangements for reduction of disaster risk, preparedness and response to disaster and ward officials have pivotal roles in such activities. They also report disaster related events to the related agencies.

More specifically, the disaster related information was collected through the following question of the community questionnaire.

19)	Are there any settlement areas that are at risk of natural disaster or calamities in this ward? (most vulnerable settlements)	1. Yes 2. No → QN 3																														
	If yes, please rank which of the following natural disaster/calamities the settlements are at risk to (multiple responses possible): <table border="0"> <tr> <td>1. Flood</td> <td>2. Landslide</td> </tr> <tr> <td>3. Land erosion</td> <td>4. Water inundation</td> </tr> <tr> <td>5. Cyclone/strong wind</td> <td>6. Lightening/thunderstorm</td> </tr> <tr> <td>7. Hailstorm/tornado</td> <td>8. Heavy raining</td> </tr> <tr> <td>9. Partial raining</td> <td>10. Loo (Heat wave)</td> </tr> <tr> <td>11. Cold Wave</td> <td>12. Drought</td> </tr> <tr> <td>13. Fire (in settlement)</td> <td>14. Wildfire</td> </tr> <tr> <td>15. Glacial Lake outburst flood</td> <td>16. Glaciation</td> </tr> <tr> <td></td> <td>17. Not vulnerable</td> </tr> </table>	1. Flood	2. Landslide	3. Land erosion	4. Water inundation	5. Cyclone/strong wind	6. Lightening/thunderstorm	7. Hailstorm/tornado	8. Heavy raining	9. Partial raining	10. Loo (Heat wave)	11. Cold Wave	12. Drought	13. Fire (in settlement)	14. Wildfire	15. Glacial Lake outburst flood	16. Glaciation		17. Not vulnerable	Mention the top five high risks <table border="1"> <thead> <tr> <th>Code</th> <th>Risk Ranking</th> </tr> </thead> <tbody> <tr> <td></td> <td>1st High Risk</td> </tr> <tr> <td></td> <td>2nd High Risk</td> </tr> <tr> <td></td> <td>3rd High Risk</td> </tr> <tr> <td></td> <td>4th High Risk</td> </tr> <tr> <td></td> <td>5th High Risk</td> </tr> </tbody> </table>	Code	Risk Ranking		1 st High Risk		2 nd High Risk		3 rd High Risk		4 th High Risk		5 th High Risk
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	5 th High Risk																															

Figure 10: A question on disaster risk in the NPHC community questionnaire

In addition to NPHC 2021, BIPAD portal also has enormous information regarding occurrence of disaster events. It is an integrated portal managed by NDRRMA where all stakeholders put in disaster related information. For hazard exposure mapping, the incidence of floods and landslides by local levels (administrative level 3) have been used. The maps were developed based on the population statistics and the number of occurrence of floods and landslides in the last 12 years, the whole period covered by the BIPAD portal.

The spatial data for national, provincial, district, local level and ward administrative boundaries from Department of Survey at a scale of 1:100000 were used as the base map to visualize the hazards.

The demographic and social statistics such as population, children, disabled population come from NPHC 2021. For exposure mapping, population by local level has been used and **the total population of Nepal might differ from the sum of population by local level as the institutional population is not included in the local level population.**

3.5 Methodology

For hazard mapping, a list of potential hazards with its location, intensity, and temporal characteristics is needed. Such list is usually available from the official sources such as disaster management agencies, meteorological and geological agencies of the country. There are various approaches to develop maps of potential hazards, depending on the type of hazard and the approach used to assess probabilities of a hazard occurrence. Deterministic risk models are used to assess the impact of specific events on exposure. Typical scenarios for a deterministic analysis include examining past historical events, worst-case scenarios, or

possible events that reoccur at different times. A probabilistic risk model contains a compilation of all possible “impact scenarios” for a specific hazard and geographical area (ESCAP, 2018). But such models are not being used here to develop hazard maps due to data limitations.

3.5.1 Perception of risk based on the community questionnaire in NPHC 2021

To develop perceived risk maps, the information on community’s perception of risk to disasters have been used. The ward chairperson or ward secretary or both with their associates were asked to identify major five hazards from given sixteen types of climate related hazards which are most likely to occur in their locality. In other words, the respondents were asked about the level of risk of hazards in their area. Furthermore, the respondents were requested to rank the level of risk for reported hazards into five categories such as very high, high, moderate, low, and very low based on their experiences and available facts. The maps were prepared for those hazards which are reported as very high-risk level. Using ArcGIS software, the national, provincial and district level maps were developed for different hazards. It should be noted that wards that do not have any disaster occurrence are not listed in the BIPAD portal.

3.5.2 Population exposure to hazards based on the BIPAD reported incidents and NPHC- 2021

The exposure to hazards maps are produced using hazard occurrence data from BIPAD portal and population data from NPHC 2021. Unlike to the perceived risk maps, the exposure maps are produced for whole Nepal with the visualisation of local level. Although the disaster occurrence data from BIPAD portal are available at ward level, it seems not to be feasible for mapping at ward level due to lack of unique code of wards for mapping in the BIPAD portal dataset. The steps for exposure mappings are as follows.

3.5.2.1 Hazard frequency grouping

- The 12 years (data from 1/12/2011 to 30/11/2023) flood and landslide occurrence data was downloaded from BIPAD portal on 15th December 2023.
- The 12-year flood and landslide events are aggregated at local level.
- The annual average frequency of events for every local level is calculated for each hazard by dividing the total incidents of each local level by BIPAD’s overall reporting period (12 years).
- These annual averages are plotted into a bar chart. The occurrence values of events are then sorted from the largest number of incidents to the smallest number of incidents. In the bar chart, it is observed that there are three break points that could cluster the annual average flood and landslide frequency level into four groups.
- Then four groups are assigned to each local level based on annual average frequency as very high, high, moderate, and low.
- The criteria for grouping flood and landslide frequencies are as follows.

Table 10: Criteria for grouping flood and landslide frequency level

S.N.	Hazard frequency level	Annual average occurrences of flood	Annual average occurrences of landslide
1	Low	≤ 1	≤ 1
2	Moderate	> 1 and ≤ 3	> 1 and ≤ 2
3	High	> 3 and ≤ 5	> 2 and ≤ 3
4	Very high	> 5	> 3

3.5.2.2 Population grouping

Similarly, the local levels are classified into four groups as very high, high, moderate, and low density based on their population size from NPHC 2021. In order to cluster population groups;

- Firstly, the mean of the total population is calculated to divide local levels into two groups of high and medium-low population areas.
- Then the mean value of the high population group is then calculated using the total population mean and the maximum value of the total population. This gives a cutoff level for two groups of very high and high population areas.
- Likewise, the mean value of the medium-low population group is calculated using the total population mean and the minimum value of the total population which results in a cutoff level for two groups of medium and low population areas.
- The criteria for grouping population are as follows:

Table 11: Criteria for grouping population

S.N.	Population level	Population
1	Low population area	$< 19,405$
2	Moderate population area	$\geq 19,405$ and $< 38,414$
3	High population area	$\geq 38,414$ and $< 450,407$
4	Very high population area	$\geq 450,407$

It is important to note that population grouping is required for visualization purposes, therefore mapping. If there is population groups or clusters that are already identified, commonly agreed and used by all institutions in Nepal, these clusters should be used. However, if it is not available, it is recommended that Ministries and relevant institutions collaborate to identify suitable clusters. This collaborative effort should consider factors such as the number of clusters, population size, or other criteria pertinent to Disaster Risk Reduction (DRR) activities and planning. Additionally, it's important to underscore that various statistical methods exist for data grouping, and their selection depends on factors such as data structure, data distribution, and the number and size of groups or clusters. In this project, as no clusters for population data have been obtained, it has been agreed to utilize the method outlined above. Functions for statistically grouping the data such as Quartile, Natural Breaks (Jenks), Equal Intervals etc. are also available in the GIS programmes and can be applied for clustering the data.

3.5.2.2.1 Exposure statistics

Exposure statistics could be produced and presented in two ways, one as summary statistics table, and the other as exposure mapping in ArcGIS. Steps both for the table and mapping are described as follows:

3.5.2.2.2 Mapping population exposure to hazards

- For hazard exposure mapping in ArcGIS, exposure level is calculated by multiplying the population groups by the hazard frequency groups for each local level. This multiplication shows how the areas hazards occur intersect with the areas where population live, which results in population exposure to certain hazards. Thus, the exposure score for each local level is then obtained. It should be noted that because both population groups and hazard frequency groups are clustered into four groups, a possible highest exposure score is $4 \times 4 = 16$ whereas the lowest exposure score is $1 \times 1 = 1$.
- Local levels are then clustered into 4 groups based on their exposure scores.
- Next, the exposure scores are layered in ArcGIS, where the Natural Breaks (Jenks) mode is applied in Symbology to present four levels of exposure in all administrative units. Population exposure to flood hazard is then mapped.
- The population exposure scores of floods and landslides are grouped as follows:

Table 12: Criteria for grouping population exposure to flood and landslide

S.N.	Population exposure level	Score for floods	Score for landslides
1	Low exposure	≤ 1	≤ 2
2	Moderate exposure	2-4	3-4
3	High exposure	5-6	5-9
4	Very high exposure	7-12	10-16

- It should be noted that as there is no administrative unit that is in population group 4 and in hazard frequency group 4 for floods, the maximum exposure score is 12.

3.5.2.2.3 Exposure statistics table

- To generate a summary exposure statistics table, the population numbers within each administrative unit, particularly at the local level, are aggregated for each hazard frequency group, such as floods and landslides. This process helps ascertain the population residing in areas prone to hazards.
- Apart from the total population, disaggregates by geo-regions, gender, age and specific vulnerability group such as disability are also summarized and presented utilizing DRSF tables B1a Population Background Statistics and Hazard Exposure by Geographic Regions and B1b Population Exposure by Social Groups.

3.6 Key findings and analysis

3.6.1 Perception of risk based on the community questionnaire in NPHC 2021

3.6.1.1 Statistics

Using statistical software SPSS, the data from community questionnaire were analyzed and tabulated. The major findings of the analysis are given in the following tables:

Table 13: Numbers of wards with highest risk rating (1st) to different hazard types, Nepal

Type of hazard	Number of wards	Percentage (%)
Flood	2,737	40.59
Land slide	2,268	33.63
Water Inundation (Duban)*	355	5.26
Storm	248	3.68
Drought*	196	2.91
Fire (in settlements)	180	2.67
Fire (in forest)	139	2.06
Hailstorm*	133	1.97
Land erosion*	122	1.81
Cold wave	113	1.68
Thunderstorm*	96	1.42
None (No hazard)	74	1.10
Avalanche (Snow landslide)	26	0.39
Partial rain*	18	0.27
Heavy rain	15	0.22
Heat wave*	14	0.21
Glacier lake outburst flood (GLOF)*	9	0.13

*Hazards not reported in the BIPAD portal

Table 13 shows that nearly 41 per cent of the total wards are at highest risk to flood and followed by landslide (34%). This indicates that most wards in Nepal are vulnerable to flood and landslide.

Table 14: Top five hazards with perceived risk by provinces, Nepal

Hazard rank	Provinces						
	Koshi	Madhesh	Bagmati	Gandaki	Lumbini	Karnali	Sudurpacc hhim
1	Flood	Flood	Landslide	Landslide	Flood	Landslide	Flood
2	Landslide	Storm	Flood	Flood	Landslide	Flood	Landslide
3	Water Inundation (Duban)	Water Inundation (Duban)	Water Inundation (Duban)	Hailstorm	Water Inundation (Duban)	Drought	Water Inundation (Duban)
4	Storm	Cold wave	Fire	Soil erosion	Fire	Forest fire	Soil erosion
5	Drought	Drought	Forest fire	Water Inundation (Duban)	Forest fire	Storm	Drought

Table 14 reveals that out of 7 provinces in Nepal, 4 provinces (Koshi, Madhesh, Lumbini and Sudurpacchhim) report themselves to be at the highest risk of flood, whereas 3 provinces (Bagmati, Gandaki and Karnali) list landslide as their highest risk. Overall, in 6 out of 7 provinces, floods and landslides are ranked in the first and second place as hazards with the highest risk.

Table 15: Districts with highest proportion of wards reporting highest risk to flood by province

Province	District	Wards Reporting flood as 1 st risk	Total number of wards	Percentage (%)
Lumbini	Nawalparasi (Bardaghat Susta West)	61	74	82.4
Madhesh	Saptari	130	164	79.3
Koshi	Sunsari	96	124	77.4
Sudurpacchhim	Kailali	87	126	69.1
Gandaki	Nawalparasi (Bardaghat Susta East)	62	92	67.4
Bagmati	Chitwan	58	98	59.2
Karnali	Surkhet	42	99	42.4

Table 15 indicates that among 77 districts, approximately four fifths of the wards in Nawalparasi (Bardaghat Susta West) district of Lumbini province (82.4%) and Saptari district of Madhesh province (79.3%) are assessed as at highest risk to Flood. Perceived flood risk maps at district level are included in Annex 5 of this report.

Table 16: Districts with highest proportion of wards reporting highest risk to landslide by province

Province	District	Wards reporting landslide as 1 st risk	Total number of wards	Percentage (%)
Bagmati	Rasuwa	22	27	81.48
Lumbini	Gulmi	72	93	77.42
Gandaki	Parbat	43	61	70.49
Koshi	Ilam	57	81	70.37
Sudurpacchhim	Doti	44	65	67.69
Karnali	Kalikot	55	82	67.07

Table 16 shows that among 77 districts, approximately four fifths of the wards in Rasuwa district of Bagmati province (81.48%) and Gulmi district of Lumbini province (77.42%) are assessed as at highest risk to landslide. It is important to note that for Madhesh province, landslide was not observed significantly. Storm was found as the 2nd highest hazard being reported and within the province, Bara district was observed to have highest proportion of wards (15%) reporting storm as highest risk. Perceived landslide risk maps at district level are included in Annex 5 of this report.

3.6.1.2 Perceived risk maps based on data from NPHC 2021 community questionnaire

Based on the findings from the community questionnaire given in the above Tables 13-16, the national, provincial and district perceived flood risk maps were developed. Altogether, eight perceived risk maps (one national and seven provincial perceived flood risk maps with ward level flood risk visualization) have been prepared.

3.6.1.2.1 Perceived flood risk maps

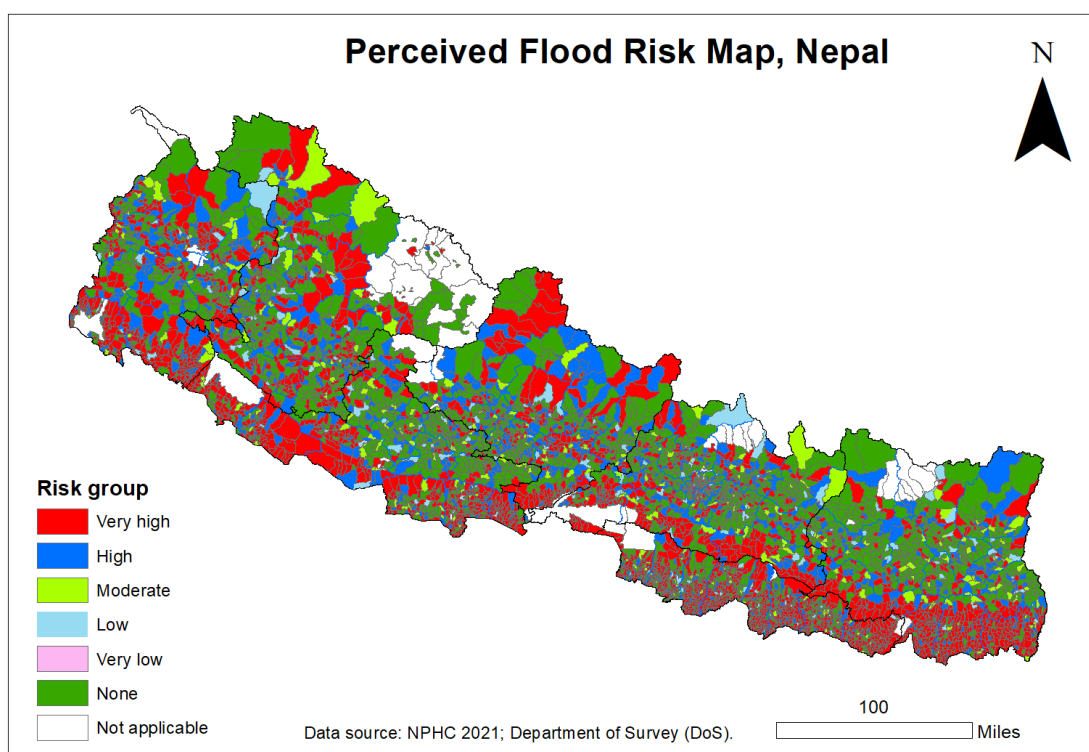


Figure 11: Perceived flood risk map, Nepal

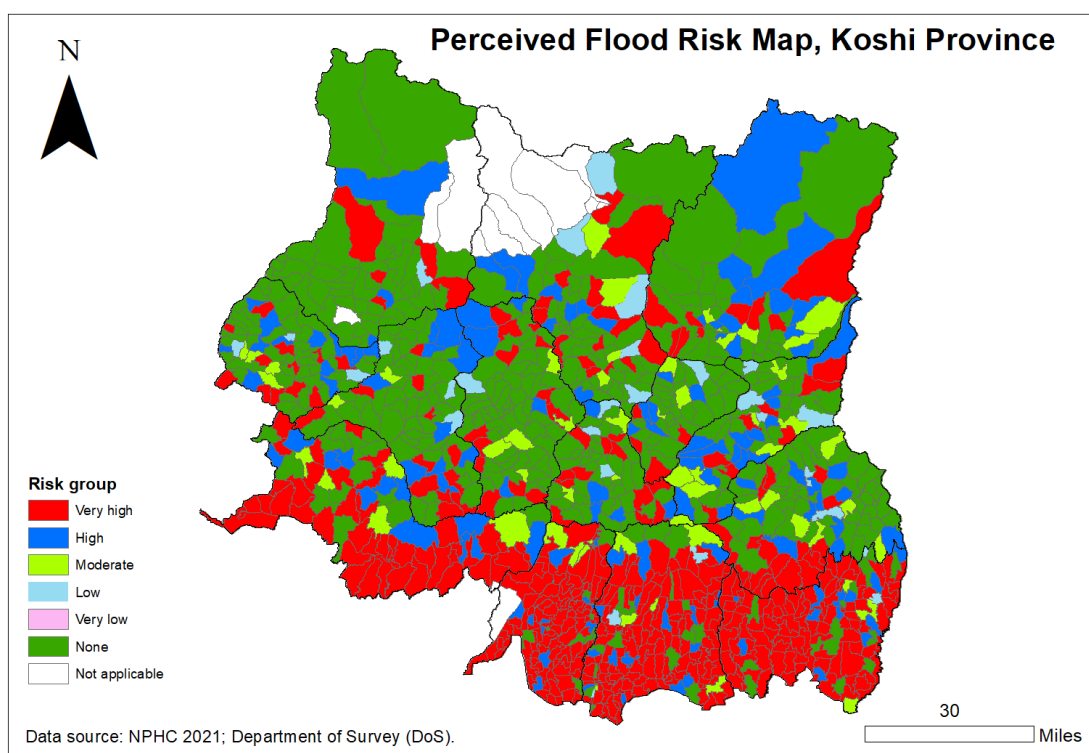


Figure 12: Perceived flood risk map, Koshi Province

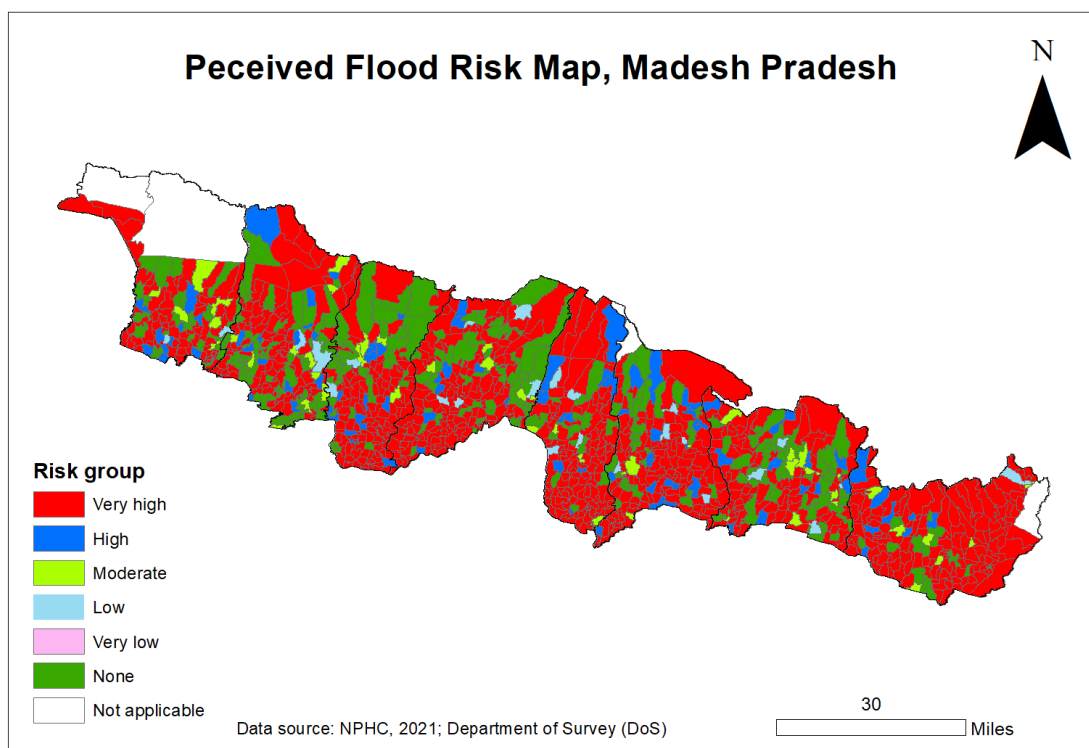


Figure 13: Perceived flood risk map, Madesh Pradesh

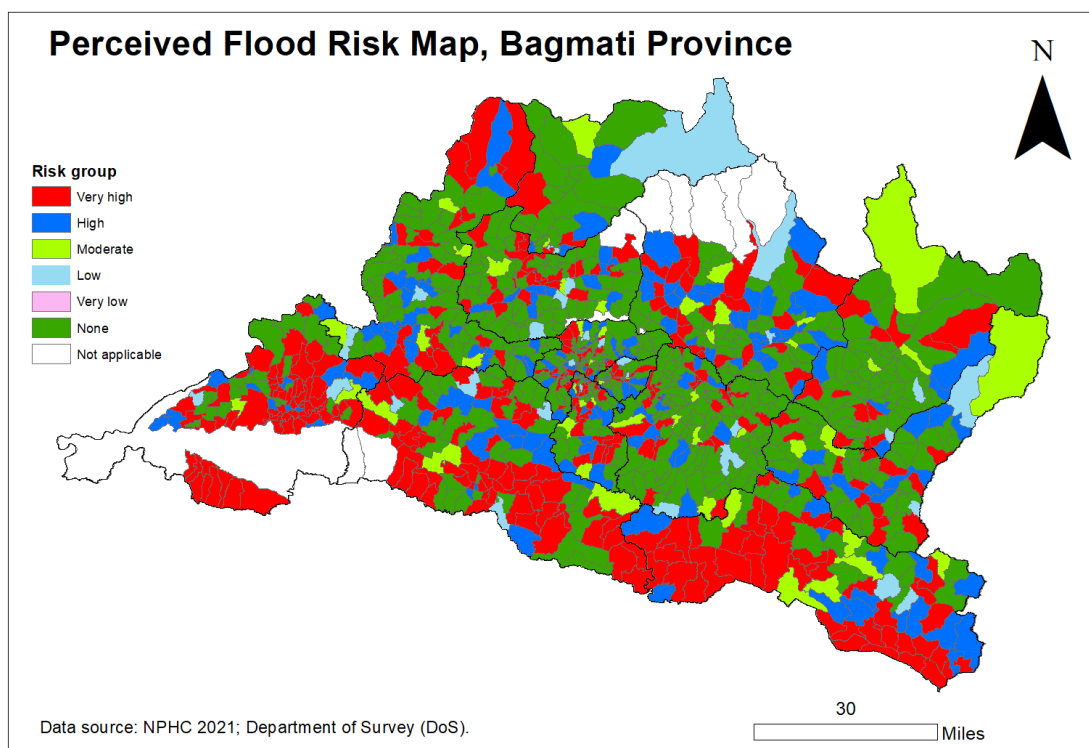


Figure 14: Perceived flood risk map, Bagmati Province

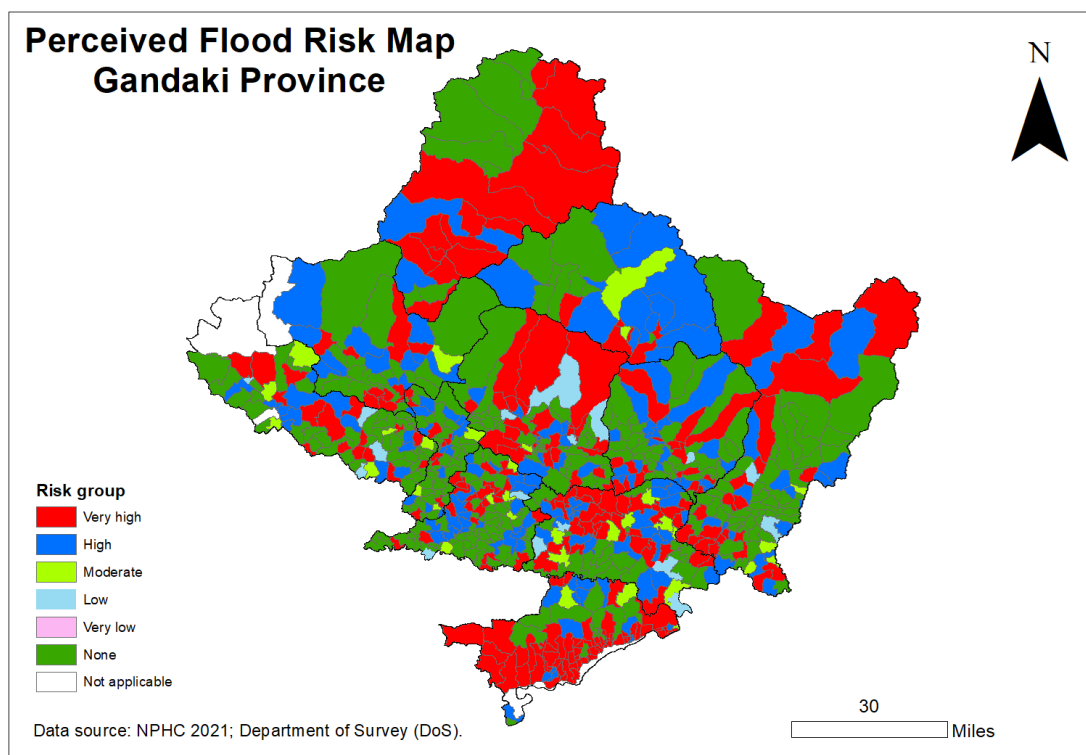


Figure 15: Perceived flood risk map, Gandaki Province

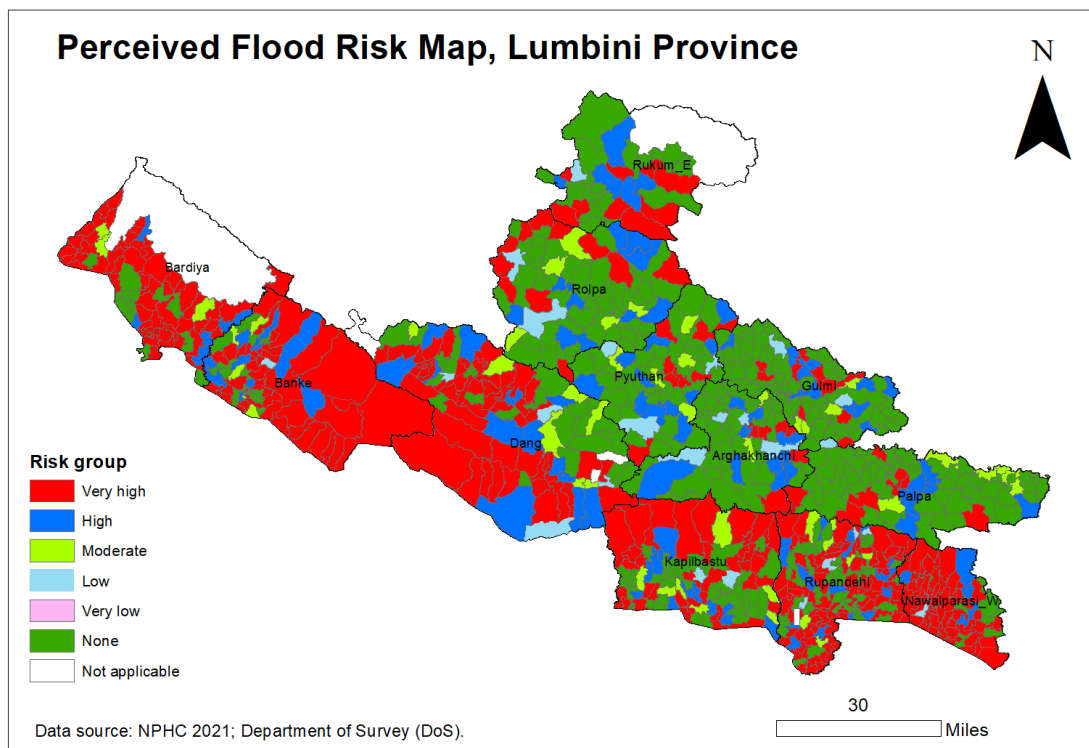


Figure 16: Perceived flood risk map, Lumbini Province

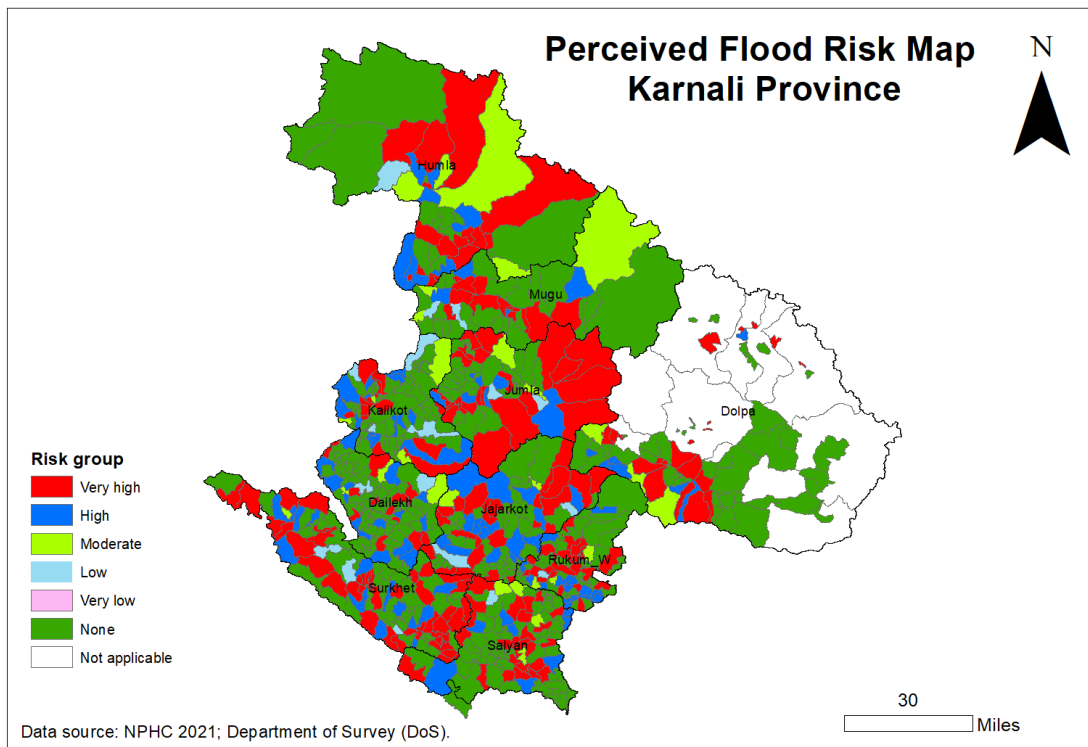


Figure 17: Perceived flood risk map, Karnali Province

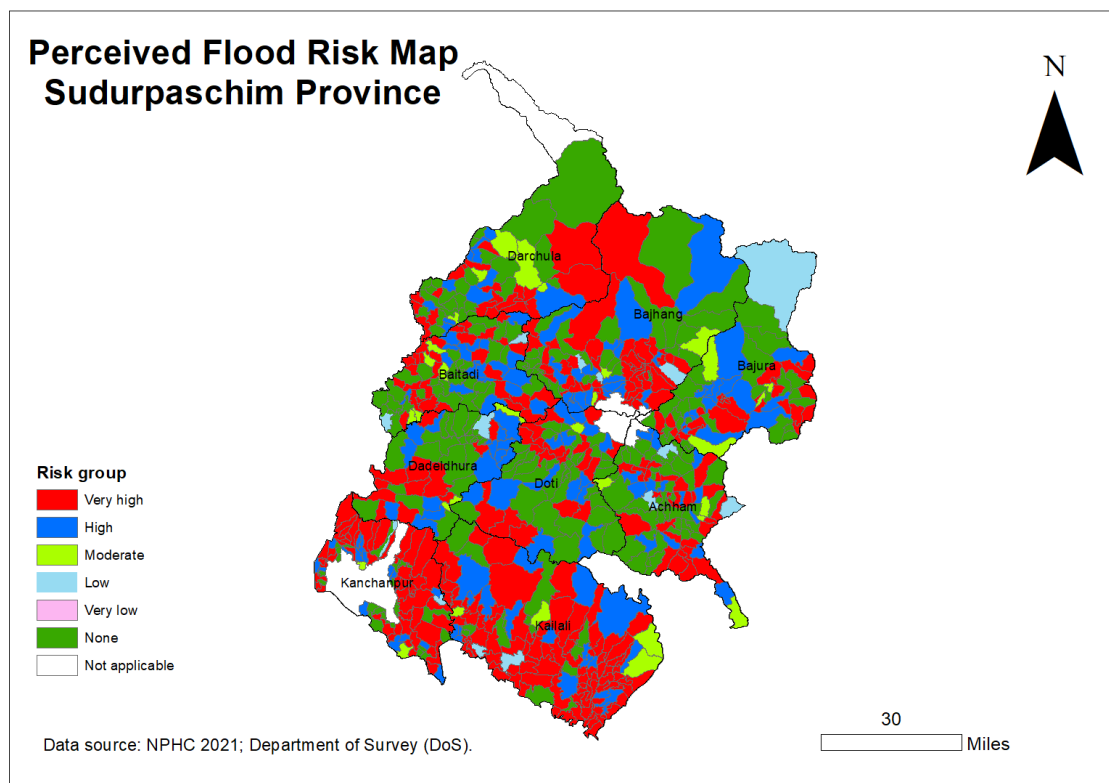


Figure 18: Perceived flood risk map, Sudurpacchhim Province

3.6.1.2.2 Perceived landslide risk maps

Like flood hazard maps, seven landslide hazard maps (one national and six provincial landslide hazard maps with ward level landslide risk visualization) have been developed. As mentioned in the Finding and Analysis Section, landslides are not observed in Madhesh Province.

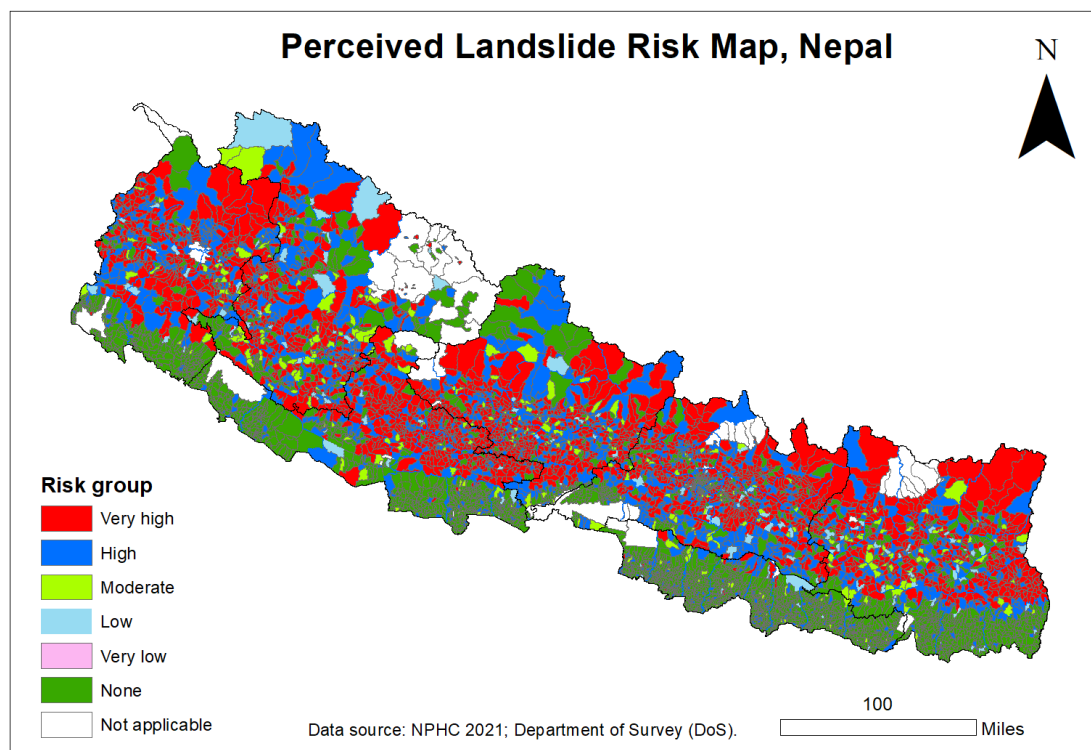


Figure 19: Perceived landslide risk map, Nepal

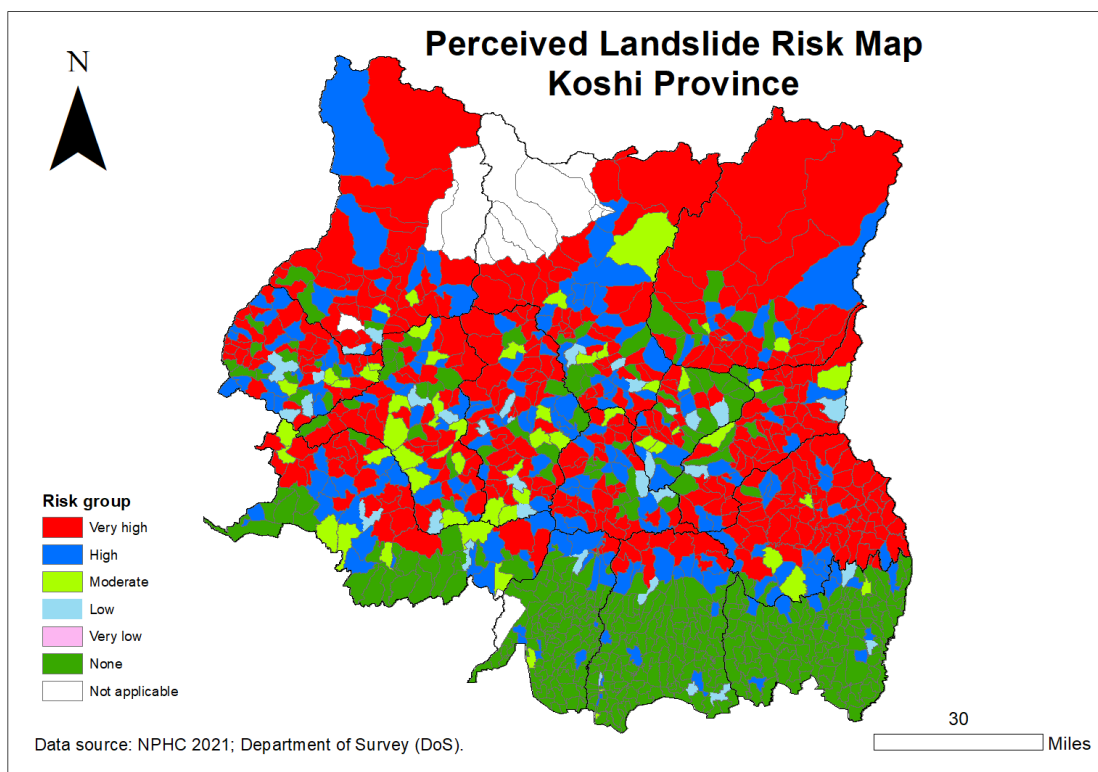


Figure 20: Perceived landslide risk map, Koshi Province

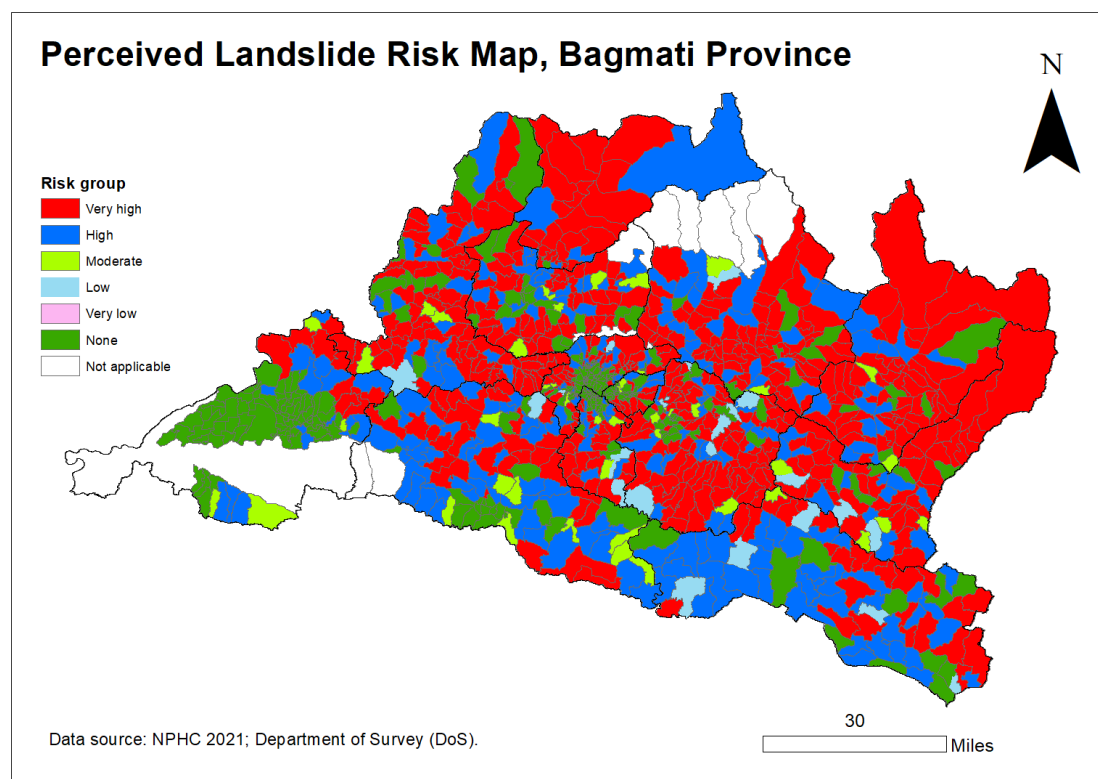


Figure 21: Perceived landslide risk map, Bagmati Province

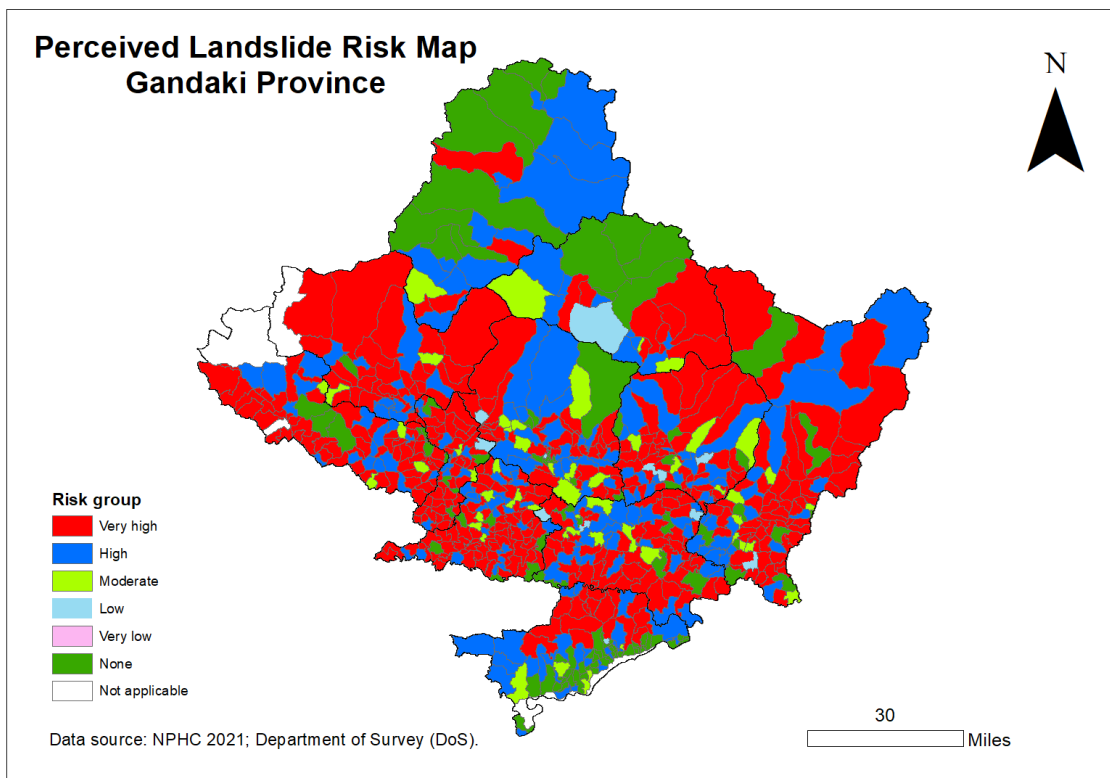


Figure 22: Perceived landslide risk map, Gandaki Province

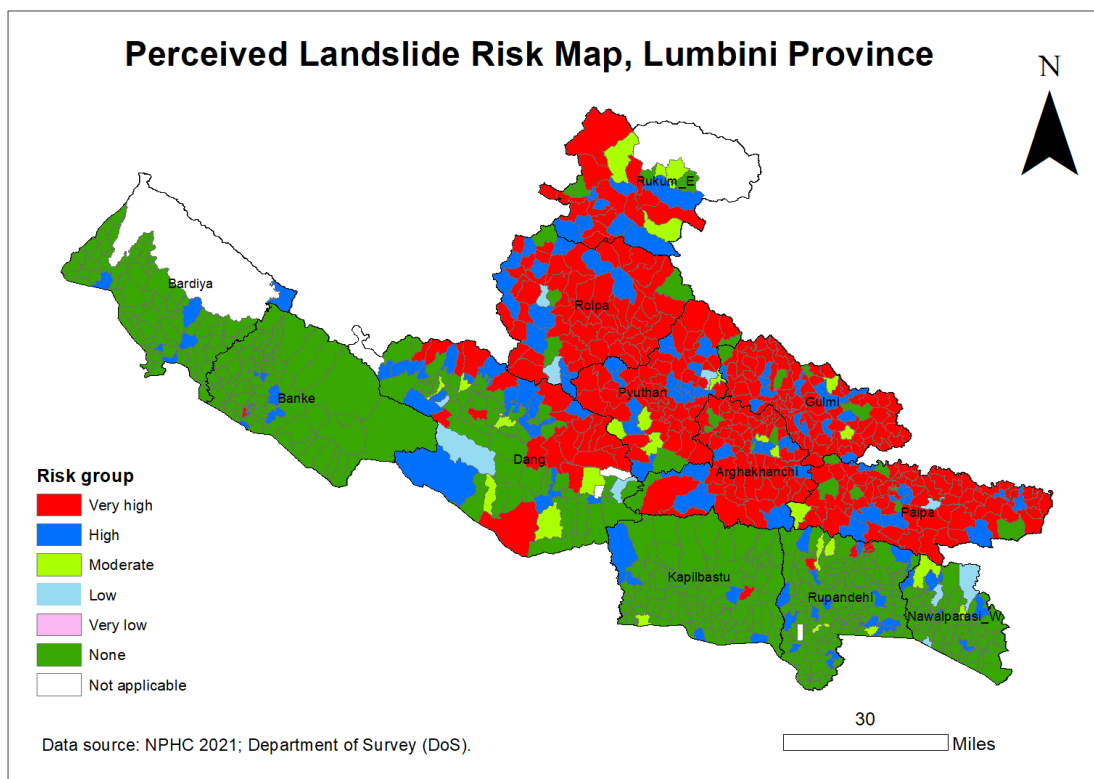


Figure 23: Perceived landslide risk map, Lumbini Province

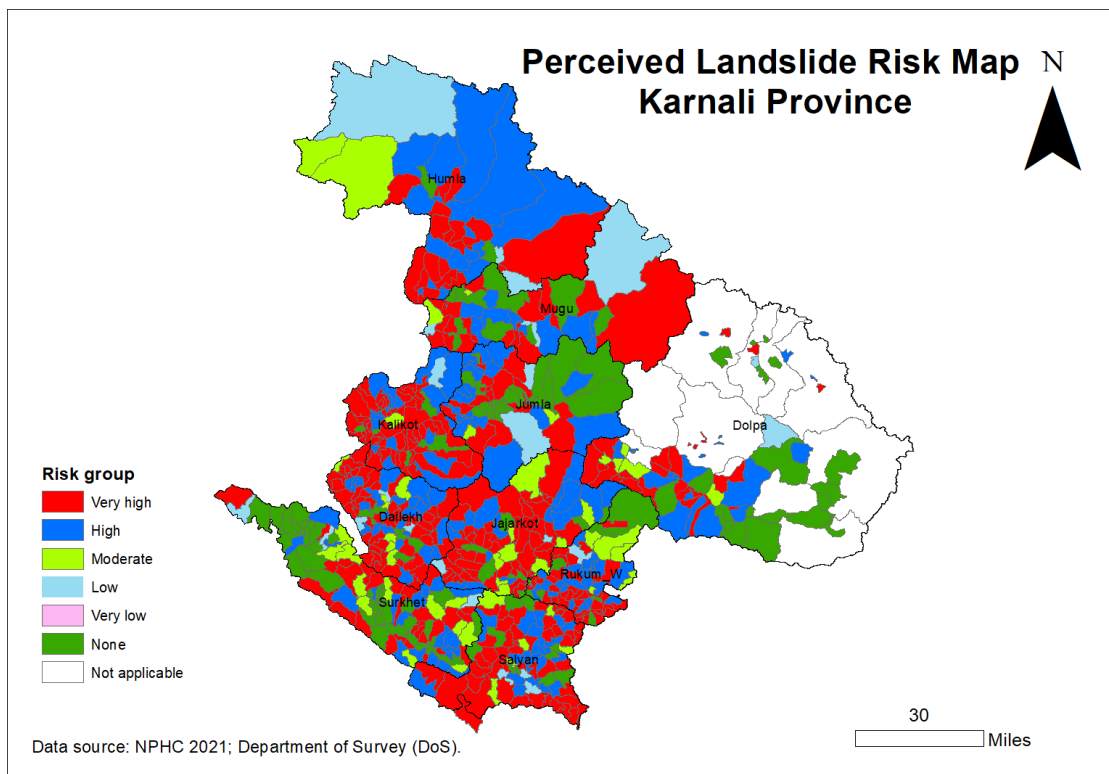


Figure 24: Perceived landslide risk map, Karnali Province

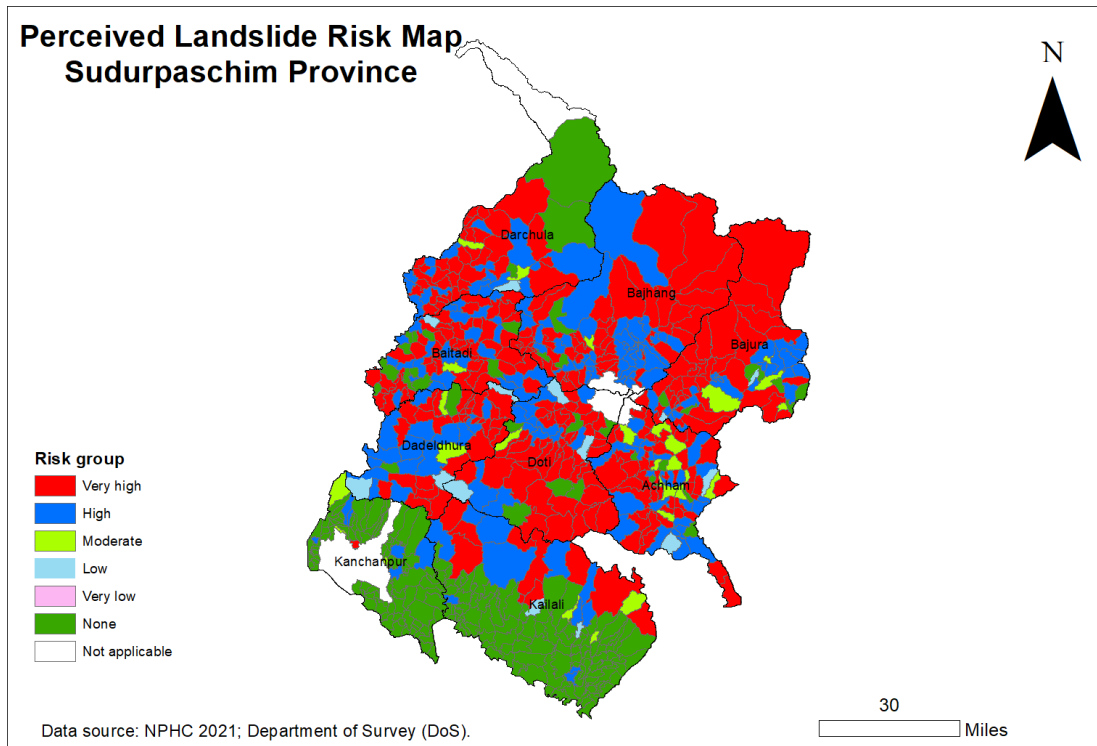


Figure 25: Perceived landslide risk map, Sudurpacchhim Province

3.6.2 Population exposure to hazards based on the BIPAD reported incidents and NPHC 2021

3.6.2.1 Statistics

3.6.2.1.1 Incidence of flood and landslide (during last 12 years)

As per data from the BIPAD portal, altogether 1,966 incidence of flood and 3,273 incidences of landslide were reported during the last 12 years across Nepal (Table 17)

Table 17: Number of hazard incidents reported in Nepal

Hazards	Number of incidents	Hazards	Number of incidents
Fire	23,372	Earthquake	200
Landslide	3,273	Snake Bite	197
Thunderbolt	2,927	High Altitude	155
Flood	1,966	Cold Wave	116
Heavy Rainfall	1,943	Epidemic	77
Animal Incidents	1,479	Storm	67
Windstorm	874	Boat Capsize	43
Drowning	515	Avalanche	33
Forest Fire	424	Snowstorm	10
Others (Non-Natural)	299	Bridge Collapse	1

Source: [BIPAD Portal](#) ((data based on 12 years i.e. from 1/12/2011 to 30/11/2023)

3.6.2.1.2 Population exposure to hazards

Tables 18 and 19 illustrate that around 26.2 million individuals (90.7%) in Nepal experience low exposure to floods, while a small portion (approximately 120 thousand, or 0.4%) is located in very high flood exposure areas. Furthermore, the data reveals a minimal disparity between the percentages of males and females with very high flood exposure. Additionally, it is noted that around 91% of vulnerable groups including children, elderly, and disabled individuals have low exposure to floods, with only 0.4% to 0.5% of these groups facing very high exposure to floods.

Table 18: Population exposure to flood (number)

Exposure to flood hazard	Total population	Sex		Age group		Specific vulnerable groups
		Male	Female	Children (Aged <5 yrs)	Population Aged >60 yrs	Disabled population
Low exposure	26,236,325	12,758,604	13,477,721	2,228,747	2,705,676	586,491
Moderate exposure	2,043,390	989,929	1,053,461	153,681	205,477	42,419
High exposure	526,048	250,927	275,121	46,666	47,915	11,245
Very high exposure	119,717	56,335	63,382	8,924	14,448	2,929

Table 19: Population exposure to flood (percentage)

Exposure to flood hazard	Percentage of population	Sex		Age group		Specific vulnerable groups
		Male	Female	Children (Aged <5 yrs)	Population Aged >60 yrs	Disabled population
Low exposure	90.7%	90.8%	90.6%	91.4%	91.0%	91.2%
Moderate exposure	7.1%	7.0%	7.1%	6.3%	6.9%	6.6%
High exposure	1.8%	1.8%	1.9%	1.9%	1.6%	1.7%
Very high exposure	0.4%	0.4%	0.4%	0.4%	0.5%	0.5%

Tables 20 and 21 shows that around 26.6 million individuals (92%) in Nepal experience low exposure to landslides, while a small portion (approximately 722 thousand, or 2.5%) has very high landslides exposure. Moreover, the data does not display a significant difference between the percentages of males and females with high and very high landslides exposure. Lastly, it can be stated that around 91% to 93% of vulnerable groups including children, elderly, and disabled individuals have low exposure to landslides, with only 2% to 2.6% of these groups facing very high exposure to landslides.

Table 20: Population exposure to landslide (number)

Exposure to landslide hazard	Total population	Sex		Age group		Specific vulnerable groups
		Male	Female	Children (Aged <5 yrs)	Population Aged >60 yrs	Disabled population
Low exposure	26,611,406	12,936,937	13,674,469	2,267,967	2,718,051	584,781
Moderate exposure	713,216	349,765	363,451	57,625	75,107	18,800
High exposure	878,587	421,924	456,663	63,468	102,004	23,137
Very high exposure	722,271	347,169	375,102	48,958	78,354	16,366

Table 21: Population exposure to landslide (percentage)

Exposure to landslide hazard	Percentage of total population	Sex		Age group		Specific vulnerable groups
		Male	Female	Children (Aged <5 yrs)	Population Aged >60 yrs	Disabled population
Low exposure	92.0%	92.0%	92.0%	93.0%	91.4%	90.9%
Moderate exposure	2.5%	2.5%	2.4%	2.4%	2.5%	2.9%
High exposure	3.0%	3.0%	3.1%	2.6%	3.4%	3.6%
Very high exposure	2.5%	2.5%	2.5%	2.0%	2.6%	2.5%

3.6.2.2 Population exposure to hazards maps based on data from BIPAD portal and NPHC 2021

3.6.2.2.1 Flood exposure maps

Using population and demographic statistics such as population, children aged less than five years, persons aged above 60 years, and disabled population, the flood exposure maps at local level were prepared based on the calculation of population exposure level.

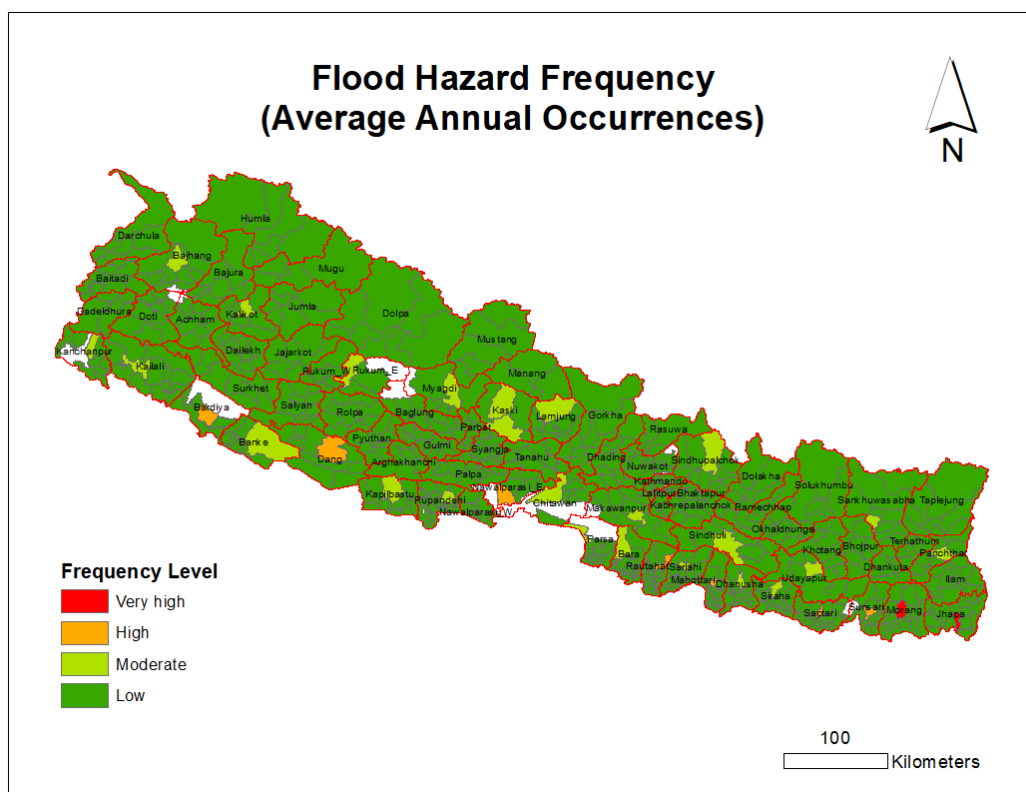


Figure 26: Flood hazard frequency (annual average occurrences)

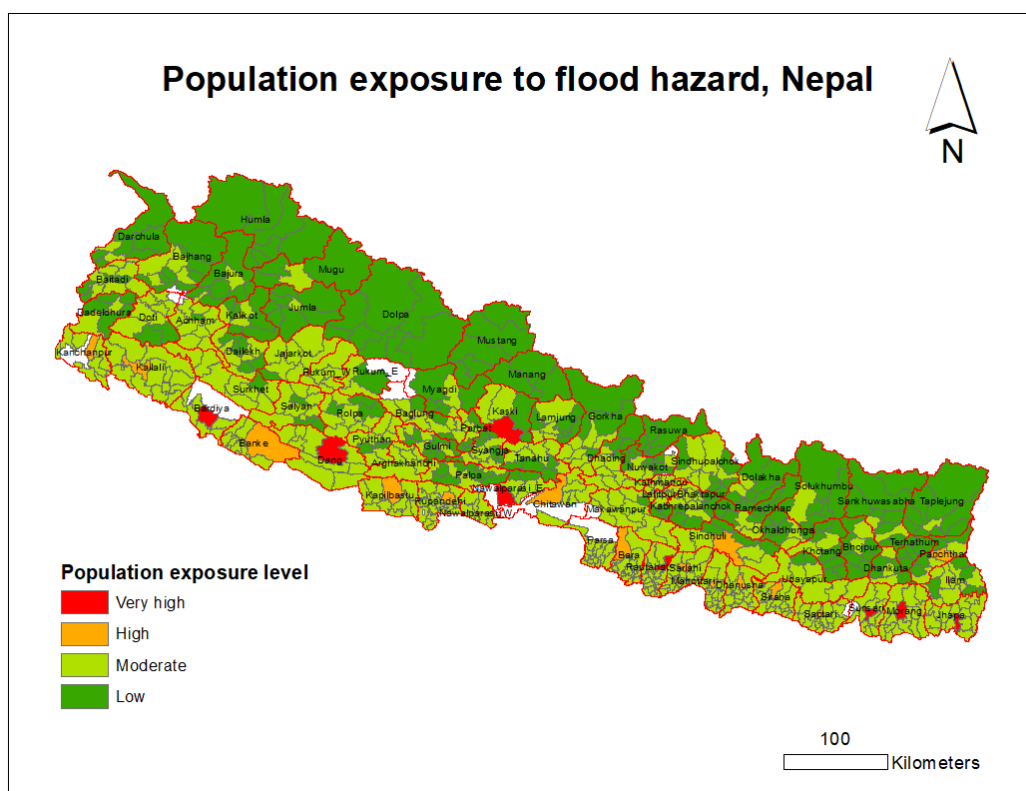


Figure 27: Population exposure to flood hazard, Nepal

3.6.2.2.2 Landslide exposure maps

Like flood exposure maps, the landslide exposure maps were developed with population and demographic statistics such as population, children aged less than five years, persons aged above 60 years, and disabled population. The landslide exposure maps at local level were prepared based on the calculation of population exposure level.

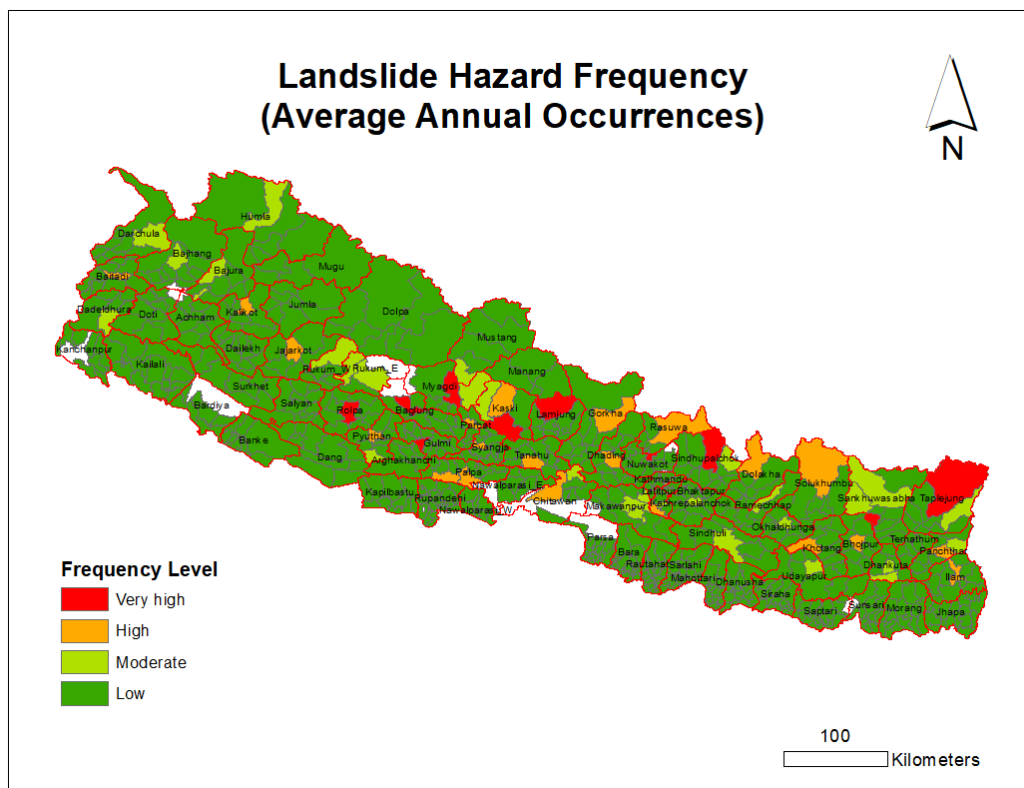


Figure 28: Landslide hazard frequency (annual average occurrence)

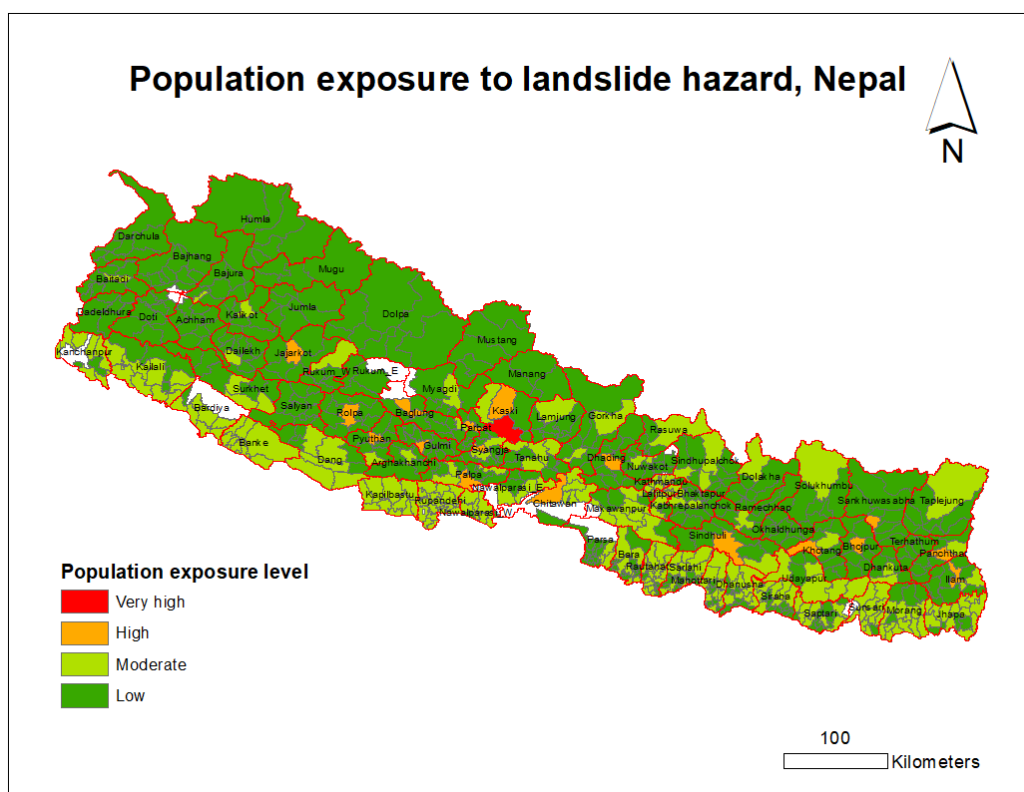


Figure 29: Population exposure to landslide hazard, Nepal

3.7 Challenges

Although NSO Nepal is a government central agency responsible for statistical activities in the country, disaster statistics has been a new area in its activities. In Nepal, Ministry of Home Affairs (MoHA) and National Disaster Risk Reduction Management Authority (NDRRMA) are major two agencies involved in the disaster management of Nepal. In these circumstances, the major challenges encountered during the implementation of the project are mainly technical and operational which can be described as follows.

- **Inadequacy of disaster related data:** Various government organizations from federal, provincial, and local governments are engaged in disaster management in Nepal. Although BIPAD portal has existed as a disaster information platform in the country, it provides only limited information. The updated and comprehensive information related to disaster was found inadequate for effective disaster management.
- **Lack of hazard probabilistic maps:** Very few institutions have prepared hazard probabilistic maps on their sectoral area for some geographic area/location but there are no comprehensive hazard probabilistic maps available for the entire country as those maps are prerequisite for preparing hazard exposure maps. Consequently, historical hazard data from the BIPAD portal was utilized in this project due to limitations in accessing hazard probabilistic maps.
- **Lack of unique administrative identifier in BIPAD portal dataset and mismatch of local name with census list of local levels:** Unique identifier is prerequisite for joining geospatial data with attribute data. In this project, the exposure mapping was prepared using dataset from BIPAD portal and there is no geocode for local level and some mistakes in local level names were found in the BIPAD portal which made it difficult in preparing exposure maps.

- **No national standard criteria for classification of hazard risk:** To prepare hazard maps, a standard classification of hazard risk level is needed. But there are not any standard criteria for risk level classification for different types of hazards.
- **Lack of expertise:** The NSO Nepal lacks sufficient technical expertise in disaster-related statistics, as this field is new to the organization. Consequently, a limited number of staff members were involved in this project due to the lack of technical personnel in mapping and GIS work.
- **Difficulty in coordination among disaster related institutions:** Disaster is a cross cutting developmental issue, and different stakeholders are working in its management. Thus, data related to disasters are scattered among different agencies and strong coordination and cooperation is needed to share the data. However, the task force formed in this project helped to coordinate different agencies to some extent, but a permanent mechanism of coordination for disaster related statistics seems to be needed.

Summary

Nepal, as a highly disaster-prone country, faces significant vulnerabilities stemming from its geographic and climatic conditions, necessitating continuous efforts in disaster preparedness and management. Institutional frameworks outlined in the Constitution of Nepal (2015) and related policies mandate disaster risk reduction and management, emphasizing data collection, analysis, and dissemination. Collaboration among government levels and international partners is maintained with clear roles defined for climate change and disaster risk reduction among institutions in Nepal.

Risk assessment in Nepal involves analysing and requiring data on hazard, exposure, vulnerability, and coping capacities, often utilizing climate data from multiple sources. Hazard, exposure, vulnerability, and coping capacity data are produced by various institutions, but challenges including the need for accurate, verified and reliable data, and outdated databases persist, highlighting the need for improved data collection methods and coordination among stakeholders. Efforts to strengthen data gathering techniques and collaboration are underway to address these challenges and improve disaster-related data issues in Nepal.

Disaster-related statistics in Nepal encompass a broad array of numerical data collected and managed by government agencies, international organizations, research institutions, and NGOs, covering various aspects such as frequency, severity, geographical distribution, and various impacts of disasters. While these statistics serve critical purposes in disaster risk reduction, emergency planning, and policy development, challenges remain in terms of data gaps, data quality, data accessibility, data integration, and data usability across different stakeholders, necessitating improvements in data collection, dissemination, sharing and coordination to enhance informed decision-making and resilience-building efforts.

The disaster data collection mechanism in Nepal is carried out by various tools such as Initial Rapid Assessment (IRA), Multi-Sector Initial Rapid Assessment (MIRA), and Cluster-Specific Detailed Assessment (CSDA), with responsibilities shifting to local levels post-disaster, aided by organizations like the Nepal Red Cross. Although the roles of institutions like the National Disaster Risk Reduction and Management Authority (NDRRMA) and the Nepal Police are clearly defined, challenges persist due to resource shortages, limited access to technology in rural areas, geographic obstacles, and delays in assessment. Improvements are needed in training, software infrastructure, and coordination to enhance the effectiveness of data collection and response efforts, as evidenced by the post-2015 earthquake reconstruction initiatives which highlighted the importance of structured data management and collaboration among government bodies.

To improve technical capacity and integrate and make use of disaster-related data existing in National Statistical System in Nepal, the National Statistics Office (NSO) participated in this project and produced statistics and maps on population exposure to hazards as prioritized by relevant stakeholders during the consultation workshop.

Population exposure maps to hazards, in general, offer crucial foundational data aiding disaster management agencies and policymakers in comprehending the distribution of populations and assets within hazard-prone zones. This understanding facilitates impact assessment, disaster mitigation efforts, and the allocation of resources as necessary. In Nepal, flood and landslide are two major hazards and they occur frequently across the country. Through consultation processes under this project, it was recommended that population exposure maps and statistics for floods and landslides in Nepal could be incorporated into various policies and plans in Nepal. These include, but are not limited to, DRR National Action Plans, Safe Settlement Policies, Flood and River Basin Control Policy and Program, Sustainable Infrastructure Development Policy, Sustainable Agriculture Policy, Local Development Plans, Provincial Periodic Plans, Forestation Plans and Soil Conservation and Water Shed Management Plans.

Flood and landslide exposure maps prepared under this study provide information on potential impacted areas and the possible adverse consequences associated with the incidence of flood and landslide respectively. The NPHC 2021 has collected the information on perceived risk level to natural hazards of all ward area and based on this information, perceived hazard risk maps have been developed for flood and landslide. This is the first time in its kind where information on the perception of risk to natural hazards across Nepal has been collected and this data is anticipated to serve as a significant milestone in the formulation of evidence-based preparedness initiatives of disaster risk reduction.

As disaster risk is a function of hazard, exposure, vulnerability and coping capacity, integrating other demographic and social statistics produced by NSO such as income, education, occupation etc. with exposure hazard maps could contribute significantly to the disaster risk assessment since such statistics could assist to assess the vulnerability and coping capacity of the different population groups. Also, critical infrastructure exposure to hazards maps can be produced to enhance risk-informed planning. In this context, maps including highways, bridges, airports, dams, water supply infrastructure, water sewage and treatment systems, electricity grids, education and health facilities etc. can be generated. It is recommended for the future to produce population exposure to floods and landslides statistics and maps at ward, settlement, and community levels. This includes considerations for minority, ethnic, and indigenous groups, as well as for migration purposes.

The intensity and frequency of hazards vary by location, necessitating ongoing risk mapping efforts by the government, particularly at the local level. It is imperative to continually develop and update risk maps for micro-areas. Here, it is also essential to underline that using grid base population data along with hazard probability risk maps in hazard exposure mapping will definitely produce more robust results³⁴. On the other hand, leveraging the information obtained at the ward and municipality level from this study, local authorities can prepare plans and strategies to mitigate the risks posed by potential hazards. Furthermore, the establishment of a coordination mechanism appears underway, necessitating clear delineation of roles and responsibilities among stakeholders involved in disaster data collection and analysis.

Lastly, it is crucial to recognize that National Statistical Office of Nepal, being the main producer of social, demographic, economic and environmental statistics, can play a crucial role in the enhancement of disaster-related statistics in Nepal. This includes but is not limited to; providing technical assistance on standardisation and conceptual harmonisation for disaster-related statistics, providing training to local governments on data collection, providing technical support on statistical and inferential analysis to produce statistical tables and information, incorporating disaster-related statistics in the upcoming surveys, providing baseline data and statistics before, during and after the disasters, providing technical assistance on the estimation of economic losses attributed to disasters, publishing data on economic loss, and establishing a sound coordination on disaster-related statistics through the Statistical Council as well as technical working groups.

³⁴ Please see the [link](#) for the step by step guide on the usage of QGIS for mapping population exposure to hazards based on grid data

References

- ADPC. (2010). *Nepal Hazard Risk Assessment*. Retrieved from https://www.adpc.net/igo/category/ID276/doc/2013-b27lym-ADPC-NHRA_Report.pdf
- Baruwal, A. (2014). Disaster Profile of Nepal. *Emergency and Disaster Reports*, 1(3), pp. 3-49.
- ESCAP. (2018). *Disaster-related Statistics Framework (DRSF)*. Retrieved from https://www.unescap.org/sites/default/files/ESCAP.CST_.2018.CRP_.2_Disaster-related_Statistics_Framework.pdf
- FAO. (2020). *Loss and Damage Assessment Methodology*.
- IPCC. (2022). Summary for Policymakers. In *Climate Change 2022: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.
- MoFE. (2021). *Vulnerability and Risk Assessment and Identifying Adaptation Options: Summary for Policy Makers*. Kathmandu, Nepal: Ministry of Forests and Environment, Government of Nepal.
- NSO. (2023). *National Population and Housing Census 2021*. Kathmandu, Nepal: National Statistics Office, Office of Prime Minister and Council of Ministers, Government of Nepal.
- UNDRR. (2019). *Disaster Risk Reduction in Nepal: Status Report 2019*. Bangkok, Thailand: United Nations Office for Disaster Risk Reduction (UNDRR), Regional Office for Asia and the Pacific.
- UNGA. (2016). Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. (A/71/644). *United Nations General Assembly. Seventy-first session (1 December 2016)*. Retrieved from https://www.preventionweb.net/files/50683_oiewgreportenglish.pdf
- WBG. (2021). *Climate Risk Country Profile: Nepal*. The World Bank Group and the Asian Development Bank.

Annexes

Annex 1: Task force on disaster-related statistics in Nepal

A task force team was formed in August 2023 to work on the disaster related statistics of Nepal and conduct the activities in the context of this project. The Terms of Reference (ToR) of the task force team are as follows:

- To find the data source of disaster related statistics and for the coordination and cooperation to integrate the disaster related data.
- To provide feedback and suggestions to improve the quality of disaster related data.
- To identify the data gaps and to provide suggestions and feedback to minimize gaps.
- To coordinate with the government and non-government organizations working on disaster related statistics.
- To work on disaster risk exposure mapping and economic loss and damage.

Below is the list of task force members.

1. Deputy Chief Statistician, National Account Statistics Division, NSO, Chairperson
2. Directors, Environment Statistics Section, NSO, Members
3. Undersecretary, Planning Division, Ministry of Forest and Environment, Member
4. Undersecretary, Climate Change Management Division, Ministry of Forest and Environment, Member
5. Undersecretary, Disaster Management Division, Ministry of Home Affairs, Member
6. Undersecretary, National Disaster Risk reduction Management Authority, Member
7. Undersecretary, Ministry of Agriculture Development, Member
8. Undersecretary, Department of Hydrology and Meteorology, Member
9. Director, National account Section, NSO, Members
10. Director, Publication and Dissemination Section, NSO, Members
11. Statistics Officer, Environment Statistics Section, NSO, Member
12. Statistics Officer, Environment Statistics Section, NSO, Member Secretary

Annex 2: Policy Framework on Climate and Disaster Risk

Policies, Plans and Regulations	Summary
Constitution of Nepal 2015	Article 30 (f): Right to the clean environment (Fundamental Right) 1. Every citizen shall have the right to live in a clean and healthy environment 2. The victim shall have the right to obtain compensation, in accordance with the law, for any injury caused by environmental pollution or degradation Article 51: Policies related to protection, promotion, and use of natural resources To make an advance warning, preparedness, rescue, relief, and rehabilitation to mitigate risks from natural disasters
National Adaptation Programs of Action (NAPA), 2010	The NAPA identified nine urgent and immediate climate change adaptation priority programs related to six thematic sectors (agriculture, forest biodiversity, water resources, health, infrastructure, and disaster). The first comprehensive government response to climate change, the NAPA also specified a coordination mechanism and implementation modality for climate change adaptation programs in Nepal
Climate Public Expenditure and Institutional Review (CPEIR) 2011	CPEIR was conducted to facilitate the integration of climate change into the budgetary process including as part of budget planning, implementation, expenditure management and financing. CPEIR highlighted the need for improvement of the institutional and financial management system at the local level to help the local governments manage climate finance. Further to this, district-level CPEIR was conducted in five representative districts which provided a recommendation on sector-specific climate change relevant assessment criteria to be used by the provincial and local governments
Climate Resilient Planning Tool, 2011	The National Planning Commission developed a climate resilience framework to guide the country in implementing development plans. It recommends methods, tools, and approaches for guiding climate-resilient planning
Climate Change Budget Code, 2013	The budget code is developed in accordance with the 11 criteria identified to assess whether the budget is directly, indirectly, or neutral to climate change. The criteria include: sustainability of natural resources and greenery promotion; land use planning and climate-resilient infrastructures; climate change-induced health hazards, climate change-induced hazards to endangered species; GHG emissions reduction; sustainable use of water resources; food safety and security; low carbon emission through renewable and alternate energy; climate-induced disaster risk reduction; awareness,

Policies, Plans and Regulations	Summary
	education and database creation, policy, legislation; and plan of action for climate change
Climate Change Financing Framework 2017	The CCFF aims to mainstream climate change in planning and budgeting at all levels of government. It focuses on reforms in three broad areas; i) integration of climate change in the planning and budgeting cycle; ii) monitoring, reporting and verification of climate change financing; and ii) improved accountability for climate change financing
Disaster Risk Reduction and Management Act, 2017	- Incorporates the whole spectrum of DRR cycle (disaster preparedness, response, rescue, relief, recovery and rehabilitation) and the diversity of disasters - Disasters are defined distinctly as natural and human-induced - Provides for a detailed action plan from the federal government to the district and local levels to draw, implement and execute a DRM plan - Provision of the establishment of the national council on DRR&M under the chair of Prime Minister - Provision of the establishment of the multi-stakeholder executive committee on DRR&M under the chair of Home Minister - Provision of the establishment of NDRRMA under MOHA - Provision of the establishment of District and Local Risk Reduction Committee - Defines the roles of security forces, fire brigades, public and commercial institutions - Provision of the establishment of Disaster Management Fund at the national level, and at the provincial and local levels, provision of commencement of disaster emergency in case of any disaster causing heavy damage by the national government
Local Government Operation Act, 2017	- Provision of formulating the local law, policy, standards and plan on environmental conservation and biodiversity and their implementation, monitoring and regulation - Provision of mitigation of environmental risk at the local level; provision of adoption of low carbon and environment-friendly development at the local level - Provision of formulating the local law, policy standards and plan on alternative energy and their implementation and regulation - Provision of formulation of policy, plan, program on safe settlements and their implementation, monitoring and regulation - Provision related to disaster management at the local level

Policies, Plans and Regulations	Summary
	- Provision of consideration of the environment, climate change adaptation, disaster management among others while formulating the plan at the local level in coherence with the national and provincial plan and policies
National Disaster Risk Reduction Policy, 2018	- Provision of inclusion of all of society in the DRR&M; provision of building coherence of DRR with Sustainable Development Goals, food security, health, climate change adaptation, environmental management - Provision of promotion of public, cooperative, and private sector financing in the DRM; provision of the establishment of 'National Disaster Risk Reduction Research and Training Centre' - Provision of developing guidelines on climate adaptive, flood and earthquake-resilient buildings, roads, bridges, powerhouse, industries, etc. - Provision of formulating regulation for the mandatory assessment of DRR and climate change while formulating and designing developmental activities - Provision of National Disaster Management Authority - Provision of formulating regulation to enable the investment of the private sector, cooperatives, insurance, companies, and bank in the DRM - Provision of allocation of at least 5 percent of the annual budget of any public institution in the DRM - Provision of the establishment of DRM fund at the federal, provincial, and local level - Provision of publishing 'National Disaster Report' on an annual basis
Disaster Risk Reduction National Strategic Plan of Action 2018-2030	- Considered climate induced hazard and GLOF hazard under the priority area 1 for the assessment of hazard - Focused on research and development regarding opportunities and challenges on DRR and climate change adaptation (long-term strategy) - Provision of establishing of coordination mechanism representing MOHA, MoFE to implement the DRR, climate change adaptation and environmental conservation activities in an integrated way (short term) - Provision of appointing of focal person, section and division on DRR in thematic ministries and departments (short term) - Provision of development of guidelines on mainstreaming of DRR in sectoral development plans (short term)

Policies, Plans and Regulations	Summary
	- Provision of inclusion of disaster risk impacts assessment in EIA and EPA (short term) - Provision of preparation of initial and detailed risk evaluation framework considering disaster and climate risk for the selection of major projects and inclusion of the framework in the guidelines (short term) - Provision of development of integrated guidelines of existing guidelines such as LAPA, Community Adaptation Plan of Action, local DRM plan, and Disaster Preparedness and Response Plan (short term) provision of development of drought management guidelines (long term) - Provision of promotion of CSA (long term) - Provision of development of climate-smart villages and cities (long term) - Provision of the establishment of ecosystem-based DRR and Management Fund from Federal to Local Level (long term)
National Adaptation Plan: Summary for Policymakers 2021-2050	NAP Summary for Policymakers developed in 2021 has identified 64 prioritized adaptation programs for all the eight thematic and one cross-cutting thematic sectors identified by the National Climate Change Policy 2019. These adaptation programs were identified for short (until 2025), medium (until 2030) and long-term (until 2050). The NAP was formulated to reduce vulnerability to the impacts of climate change by building adaptive capacity and resilience; and facilitate the integration of climate change adaptation, in a coherent manner, into relevant new and existing policies, programs and activities, in particular, development planning processes and strategies, within all relevant sectors and at different levels, as appropriate
Sustainable Development Goals Status and Roadmap: 2016-2030	The roadmap proposed key actions to strengthen resilience and adaptive capacity to climate-related hazards and natural disasters such as having a climate change adaptation plan, putting forward the idea of climate-smart villages and climate-smart farming as well as climate change education in schools

Policies, Plans and Regulations	Summary
National Climate Change Policy, 2019	The goal of this Policy is to contribute to the socioeconomic prosperity of the nation by building a climate-resilient society. This Policy has the following objectives: 1. Enhance climate change adaptation capacity of persons, families, groups and communities vulnerable to and at risk of climate change 2. Build resilience of ecosystems that are at risk of adverse climate change impacts 3. Promote a green economy by adopting the concept of Low Carbon Emission Development 4. Make judicious mobilization of international financial resources for climate change adaptation and mitigation 5. Make research, technology development and information service delivery related to climate change effects 6. Integrate the climate change issues into policies, strategies, plans, and programs of all state levels and clusters 7. Mainstream GESI into climate change adaptation and mitigation programs
15th Periodic Plan (2019/20-2023/24)	The plan considered conservation and promotion of natural and resilient development as one national strategy whereas climate change is considered as one of the cross-cutting sectors with a vision to develop a climate-resilient society through building climate change adaptive capacity and reducing the negative impacts of climate change
National Framework for Local Adaptation Plans for Action (LAPA), 2019	The LAPA framework was first developed by the Government of Nepal in 2011 as an operational instrument to implement NAPA prioritized adaptation actions. In the year 2019, it was revised considering the learnings and the federal governance structure of the country. LAPA aims to develop a climate-resilient society through facilitating the integration of climate change adaptation and disaster risk reduction and management into development planning and resource allocation
Environment Protection Act, 2019	The Environment Protection Act incorporated the provisions related to climate change in Chapter 4 which legalize the periodic study and assessment of climate change impacts in the country and prepare adaptation plan thereof by the federal, provincial and local government on the need basis. Additionally, among others, the act provides a basis for the enactment of necessary policies and technical standards for the development of technology in the sectors identified

Policies, Plans and Regulations	Summary
Second Nationally Determined Contribution, 2020	The Second NDC target is to have climate-resilient and gender-responsive adaptation plans in all the 753-local governments by 2030. Furthermore, the Second NDC has specifically outlined the timeline for the NAP update (every 10 years) and national level vulnerability and risk assessment (every 5 years). Additionally, a national strategy and action plan on loss and damage associated with climate change impacts are expected to prepare by 2025 under the Second NDC adaptation targets
Local Level Development Planning Guideline 2021	The Local Level Development Planning Guideline prepared by the National Planning Commission aims to enable local government to undertake holistic planning while also considering climate change and disaster risk in the development planning processes

Annex 3: Operationalization of disaster response to the recent disaster: Jajarkot earthquake

The devastating 6.4 magnitude earthquake that struck Jajarkot and West Rukum districts on November 3 resulted in the tragic loss of at least 154 lives and left 364 individuals injured. The destruction amounted to property losses worth billions of rupees, with reports indicating 35,455 houses partially damaged and 26,557 completely destroyed. Despite the region being within an active seismic zone, powerful earthquakes have not affected the western belt of Nepal for centuries. Seismologists had long cautioned about the potential for a significant tremor in this area, and the recent earthquake serves as a stark confirmation of these warnings.

According to the National Earthquake Monitoring and Research Centre, the Jajarkot earthquake, centered at Ramidanda in the district, registered a magnitude of 6.4 on the Richter scale. Conversely, the US Geological Survey recorded it as 5.6. The earthquake occurred at a depth of approximately 15 kilometers. Officials described the November 3 earthquake as 'moderate' in intensity, despite its substantial impact, resulting in numerous casualties and the destruction of properties valued at around NPR. 2 billion.

In the aftermath of the Jajarkot earthquake, an Initial Rapid Assessment (IRA) was collaboratively conducted involving local authorities, the Nepal Police, and the Nepal Red Cross. The government swiftly implemented a unified approach, known as the "one-door policy," for earthquake response and relief efforts. Under this policy, all development partners, including NGOs, UN agencies, civil societies, private sectors, and individuals, are mandated to coordinate their aid efforts with the government at both district and local levels. Presently, the government, under the guidance of the National Disaster Risk Reduction and Management Authority (NDRRMA), has successfully completed a comprehensive assessment detailing the earthquake's impact in Jajarkot. This assessment stands as a crucial data source pivotal for the long-term recovery and reconstruction initiatives in the region.

Following the disaster's impact, households affected by the earthquake are identified and recommended as temporary/transitional shelter beneficiary households by the local disaster risk reduction and management committee (LDRRMC). These recommendations are subsequently approved by the district disaster risk reduction and management committee (DDRRMC). The beneficiary households receive an initial installment of NPR 25,000 for the construction of temporary shelters. A final or second installment of NPR 25,000 is granted based on recommendations from the local level to those households that have complied with the specified conditions set for this final payment. The payment is transferred to the beneficiary households' bank account.

As part of the emergency relief fund, families with up to 5 members receive NPR 15,000, while families with more than 5 members are provided NPR 20,000. This financial aid aims to support families in their recovery efforts following the earthquake's impact. For families that have lost a member due to the earthquake, an initial amount of NPR 200,000 is provided, with an additional NPR 100,000 given for each additional death within a family. This financial support is intended to alleviate the hardships faced by the affected families.

Following any disaster, the retrofitting or maintenance beneficiaries will receive a total of NPR 50,000 at once following verification and approval by the LDRRMC and DDRRMC into their beneficiary bank account. On the other hand, reconstruction beneficiaries in mountain, hilly, and terai districts will receive NPR 500,000, NPR 400,000, and NPR 300,000, respectively, in three tranches. The Jajarkot district belongs to the western mountain.

Key observations in the Jajarkot earthquake response and relief efforts include:

- A woman discarding substandard lentils from aid
- Challenges posed by rain and snow for post-harvest storage in the earthquake-hit area
- Security personnel operating under limited capacity and resources for response

The number of deaths due to cold among the earthquake-displaced has reached 29 in Jajarkot.

Annex 4: Community questionnaire of the National Population and Housing Census (NPHC) 2021 (unofficial translation)

Unofficial Translated Version

Government of Nepal
National Planning Commission
Central Bureau of Statistics

Community Questionnaire	National Census 2021	Information collected through this questionnaire will be kept confidential as per the Statistics Act (2015 BS)
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Section A: Introductory Information

Province ===== Code	District ===== Code	Rural/Urban Municipality/Sub-Metropolitan/Metropolitan City) ===== Code	Ward No. ===== Code	Note: All texts should be written in Nepali while numbers should be written in English
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Section B: Basic Information of Ward

- Please provide the estimated number of the following in this ward:
 - Housing units/buildings:
 - Residential houses:
 - Households:.....
 - Population:
- How many settlements/villages are there in this ward?.....
- Which is the furthest settlement/village from the ward office?
 - Name of the settlement/village.....
 - Means of transport
 - Road transport
 - On foot
 - Both
 - Time to reach (one-way):
 - Road transport Hour:.....Minute:.....
 - On foot Hour:.....Minute:.....
- What unit of land measurement is commonly used in this ward? 1. Ropani 2. Bigha
- What are the main agriculture products produced in this ward?
A).....B).....C).....D).....E).....
- What are the main agricultural products exported usually from this ward?
A).....B).....C).....D).....E).....
- What are the main non-agricultural/mineral products produced in this ward?
A).....B).....C).....D).....E).....
- What are the main non-agricultural products/mineral products exported usually from this ward?
A).....B).....C).....D).....E).....

- 9) What are the main sources of revenue collected in this ward? (Except grants received from Rural/Urban Municipality or other agencies).

- | | |
|--------------------------------|----------------------|
| 1. Property tax | 7. Advertisement tax |
| 2. House rental tax | 8. Business tax |
| 3. House/land registration tax | 9. Service fees |
| 4. Vehicle tax | 10. Tourism tax |
| 5. Land tax | 11. Fines/penalties |
| 6. Entertainment tax | 12. Others |

SN	Write the sources with highest revenue

Section C: Information of Caste/Ethnicity and Language

- 10) What are the major caste/ethnic groups who reside in this ward? (Record according to their population size)

SN	Caste/Ethnicity	Code
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

SN	Caste/Ethnicity	Code
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

- 11) Which endangered caste/ethnic population live in the ward? (list the endangered caste/ethnic population)

Endangered caste/ethnic group : Meche (93) Raji (95) Kushbadiya (102) Hayu (106) Kishan (113)
Rautè (123) Kusunda (125) Bankariya (-) Surel (-) Lapchè (-)

SN	Name of endangered caste/ethnic group	Code
1		
2		
3		

SN	Name of endangered caste/ethnic group	Code
4		
5		
6		

- 12) Which marginalized caste/ethnic population live in the ward? (list the marginalized caste/ethnic population)

Marginalized caste/ethnic groups									
Tharu (4)	Tamang (5)	Dhanuk (22)	Kumal (30)	Bhujel (31)	Rajbanshi (33)	Danuwar (40)	Majhi (42)		
Chepang (46)	Sunuwar (49)	Satar (Santhyal) (52)	Jhangad (57)	Gangai (58)	Thami (61)	Dhimal (65)			
Tajpuriya (68)	Darai (70)	Pahari (73)	Bhotel (75)	Bote (81)	Baram (83)	Dura (91)			
	Lhopa (108)	Lhomi (Singsawa) (116)		Topkegola (118)	Walung (120)				
	Siyar (--)	Thudam (--)	Dolpo (--)						
Free (--)	Mangaal (--)	Larke (--)							

SN	Name of endangered caste/ethnic group	Code
1		
2		
3		

SN	Name of endangered caste/ethnic group	Code
4		
5		
6		

13) What are the major mother tongue spoken by population in this ward? (Record according to their population size)

SN	Language Name	Code
1		
2		
3		

SN	Language Name	Code
4		
5		
6		

Section D: Status of Facilities

14) What is the situation of availability of the following services and facilities in this ward?

SN	Particulars	Number (Write 0 if none)	SN	Particulars	Number (Write 0 if none)
1	Early Child Development Center		19	Main Market	
2	Basic Education School (Class 1-8)		20	Agriculture Collection Center	
3	Secondary School (up to class 12)		21	Cooperatives	
4	Higher Education (College)		22	Bank/Financial Institution	
5	Schools with access to electricity		23	Police Office/Post	
6	Schools with internet connection		24	Public Library	
7	Disabled friendly schools		25	Community Learning Center	
8	Basic Education Schools with WASH facilities		26	Old Age Center	
9	Basic health service center/Urban Health Center/Community health units		27	Children's home	
10	Health Post		28	Public Toilet	
11	Primary Health Care Center		29	Community Hall or Town Hall	
12	Veterinary Service Center		30	Butchery	
13	Rehabilitation Center		31	Crematorium/Burials	
14	Government Hospital		32	Playing ground/Stadium	
15	Community Hospital		33	Public Park	
16	Private Hospital		34	Lake/Pond	
17	Ambulance Service		35	Ward Administrative Office building	
18	Haat Bazar		36	Temple/Monastery/Bihar/Masjid/Church	

15) Are the following services available in the health facilities in this ward?

1	Antenatal care and counselling	1. Yes 2. No	8	Basic emergency services	1. Yes 2. No
2	Delivery service	1. Yes 2. No	9	Ayurveda and alternative medical	1. Yes 2. No
3	Family planning services	1. Yes 2. No	10	Nutrition (weighing, vitamin, iron tablets)	1. Yes 2. No
4	Vaccination	1. Yes 2. No	11	Treatment for snake bites	1. Yes 2. No
5	Health promotion services (counselling, information and education)	1. Yes 2. No	12	Treatment/injection against rabies	1. Yes 2. No
6	Treatment for diarrhea and dysentery	1. Yes 2. No	13	Free medicine distribution	1. Yes 2. No
7	Treatment for malaria	Yes 2. No	14	Postnatal care (PNC)	1. Yes 2. No

Section E: Access to Urban Services and Facilities

16) Physical Infrastructure/ Services and Facilities

1	Does this ward have road that can be used for transport throughout a year?	1. Yes 2. No
2	Is there access to public transport within a distance of half-an-hour for majority of the ward residents?	1. Yes 2. No
3	Is there local transport/urban transport service?	1. Yes 2. No
4	What is the length of the black-topped road that can operate throughout year within this ward?	km.
5	What is the length of the graveled road that can operate throughout year within this ward?	km.
6	What is the length of the dusty/muddy road that operate within this ward?	km.
7	How many households have access to safe drinking water distributed through water-pipe on basis of one tap per house?	Households
8	How many households have toilet facilities inside their houses? (Write 998 if not known)	Households
9	How many households are connected to drainage system for sewerage and sanitation?	Households
10	How many households have been reached by regular collection and waste management services?	Households
11	How many households are connected by electricity distributed through the national grid?	Households
12	How many households have high-speed/broad-band internet services in the ward?	Households
13	How many households reside in planned residential area (Land development area, community residential area, joint residential area, integrated settlement)	Percent
14	How many households can access the central market within a walking distance of 30 minutes?	Households
15	How many households reside in unplanned or poor housing (poor squatters, huts, poor housing)	Households

17) Social Infrastructure and Services/facilities

(Please provide the following information based on whether the majority of the residents in the ward have available services within a distance of half-an-hour).

1	Is there a higher education facility (secondary level & above) within a distance of half-an hour?	1. Yes 2. No
2	Is there a library facility within a distance of half-an hour?	1. Yes 2. No

3	Is there a facility for service by a medical doctor (MBBS) within a distance of half an hour?	1. Yes 2. No
4	Is there a green park, children park/playing ground within a distance of half an hour?	1. Yes 2. No
5	Is there a security point/police post within a distance of half an hour?	1. Yes 2. No
6	Is there an ambulance service within five km from the main settlement of the ward?	1. Yes 2. No

18) Economic Infrastructure/Services and livelihood

1	What is the status of migration of households in this ward?	1. No migration/negligible; 2. More in-migration than out migration; 3. More out-migration than in-migration; 4. In-migration and out-migration almost the same (Zero net migrant)
2	How many households have access to Bank/Financial Institution services within a distance of half-an-hour?	 Number
3	How many households have access to cooperatives within a walking distance of half-an-hour?	 Number
4	Is there a cinema hall/shopping mall within a distance of half-an-hour?	1. Yes 2. No
5	Is there a business center/shopping mall within a distance of half-an-hour?	1. Yes 2. No
6	How many households are engaged in non-agricultural occupation or entrepreneurship in this ward?	 Number

Section F: Vulnerability to Disaster/Calamity

19)	Are there any settlement areas that are at risk of natural disaster or calamities in this ward? (most vulnerable settlements)	1. Yes 2. No → QN 3												
	If yes, please rank which of the following natural disaster/calamities the settlements are at risk to (multiple responses possible): 1. Flood 2. Landslide 3. Land erosion 4. Water inundation 5. Cyclone/strong wind 6. Lightening/thunderstorm 7. Hailstorm/tornado 8. Heavy raining 9. Partial raining 10. Loo (Heat wave) 11. Cold Wave 12. Drought 13. Fire (in settlement) 14. Wildfire 15. Glacial Lake outburst flood 16. Glaciation 17. Not vulnerable	Mention the top five high risks <table><tr><th>Code</th><th>Risk Ranking</th></tr><tr><td></td><td>1st High Risk</td></tr><tr><td></td><td>2nd High Risk</td></tr><tr><td></td><td>3rd High Risk</td></tr><tr><td></td><td>4th High Risk</td></tr><tr><td></td><td>5th High Risk</td></tr></table>	Code	Risk Ranking		1 st High Risk		2 nd High Risk		3 rd High Risk		4 th High Risk		5 th High Risk
Code	Risk Ranking													
	1 st High Risk													
	2 nd High Risk													
	3 rd High Risk													
	4 th High Risk													
	5 th High Risk													

20) Information on damages and losses due to natural disaster/calamity in the last one year.

1. In the last one year, how many persons died due to natural disaster/calamity in this ward?	 persons
2. In the last one year, how many persons were injured due to national disaster/calamity in this ward?	 persons
3. In the last one year, how many houses were damaged due to natural disaster/calamities in this ward?	 number
4. In the last one year, how much land was damaged due to natural disaster/calamity in this ward?	Ropani/Bigha
5. In the last one year, how many livestock/poultry were lost due to natural disaster/calamity in this ward?	 number
6. In the last one year, how much crops was damaged/lost due to natural disaster/calamity in this ward?	Muri/Man

7. In the last one year, how much of the harvested food/cereals was damaged/lost due to natural disaster/calamity in this ward?	Muri/Man
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21) Information on damages and losses due to animal attack in the last one year.

1. In the last one year, how many people died due to attack by wild animals in this ward?	 persons
2. In the last one year, how many people were injured due to attack by wild animals in this ward?	 persons
3. In the last one year, how many livestock/poultry were lost due to attack by wild animals in this ward?	 number
4. In the last one year, how much crops was damaged/lost due to attack by wild animals in this ward?	 Muri/Man
5. In the last one year, how much of the harvested food/cereals was damaged/lost due to attack by wild animals in this ward?	 Muri/Man

Supervisor's Name.....

Respondent's Signature :

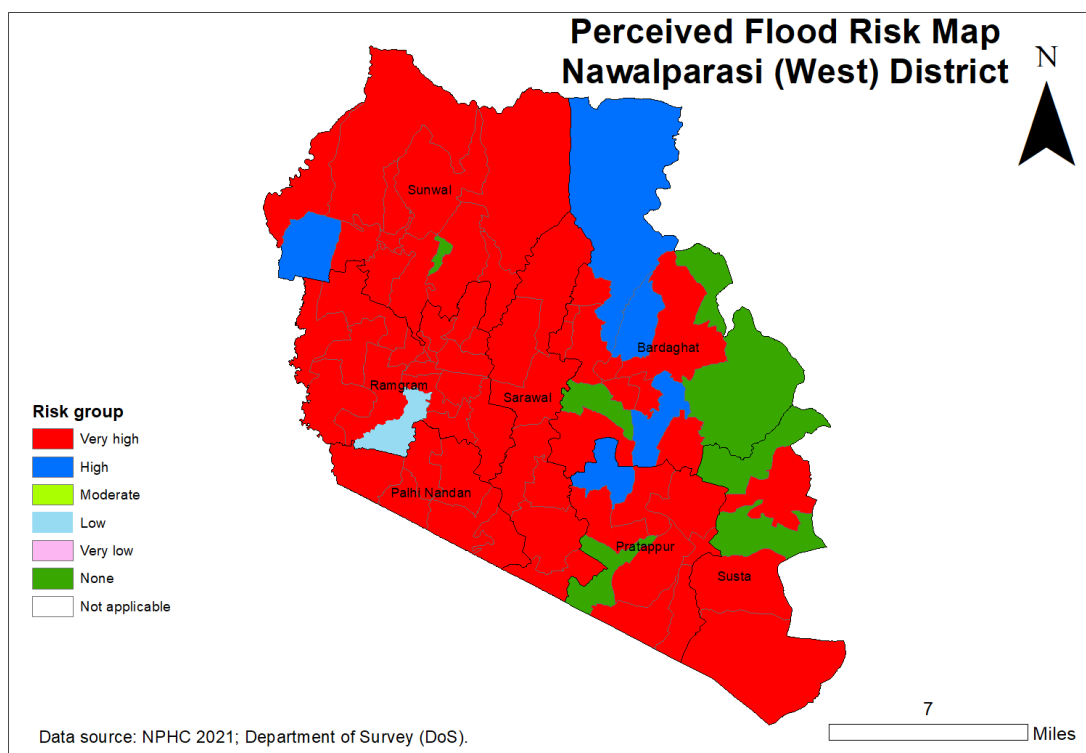
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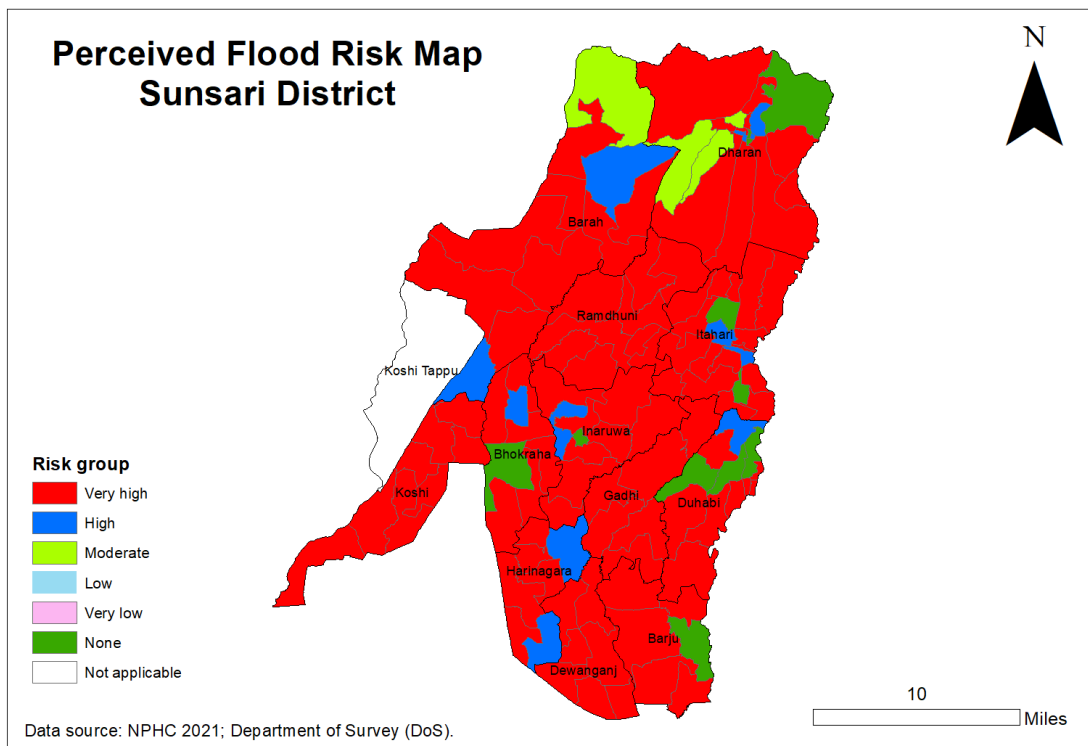
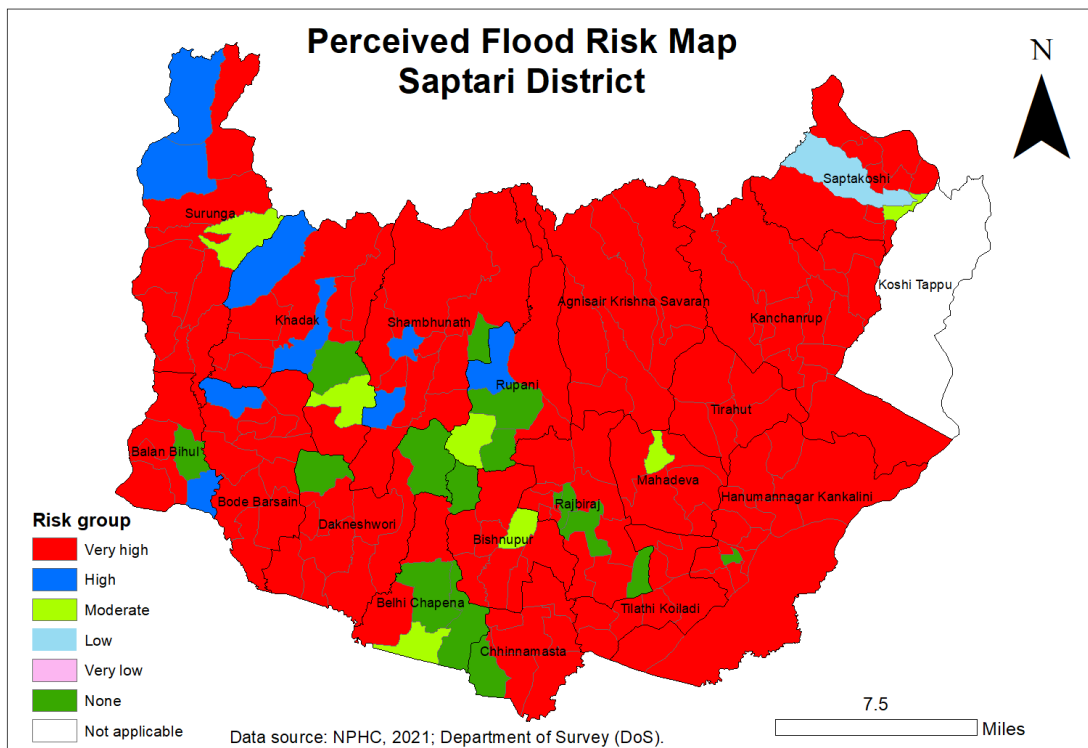
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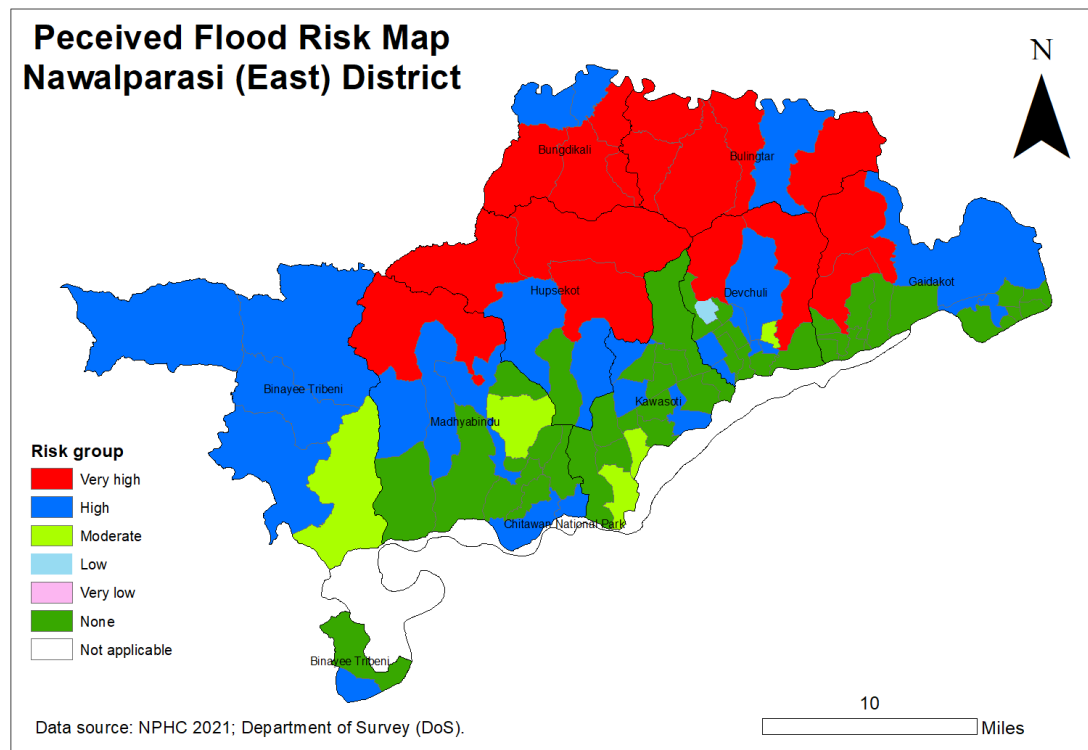
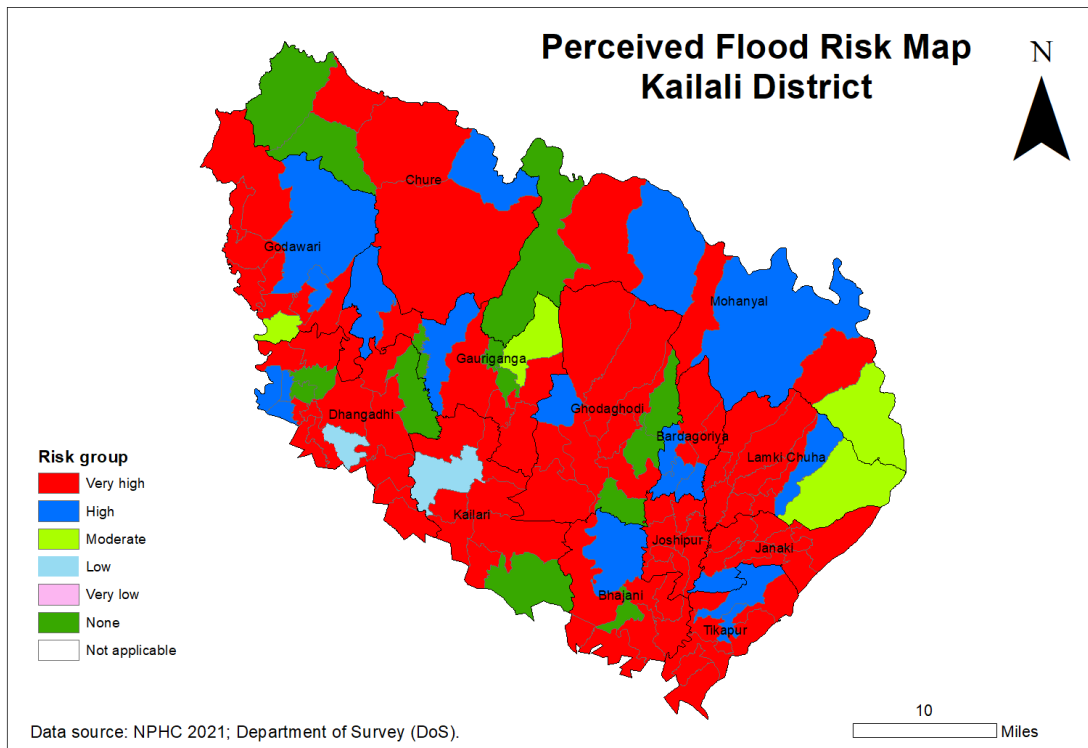


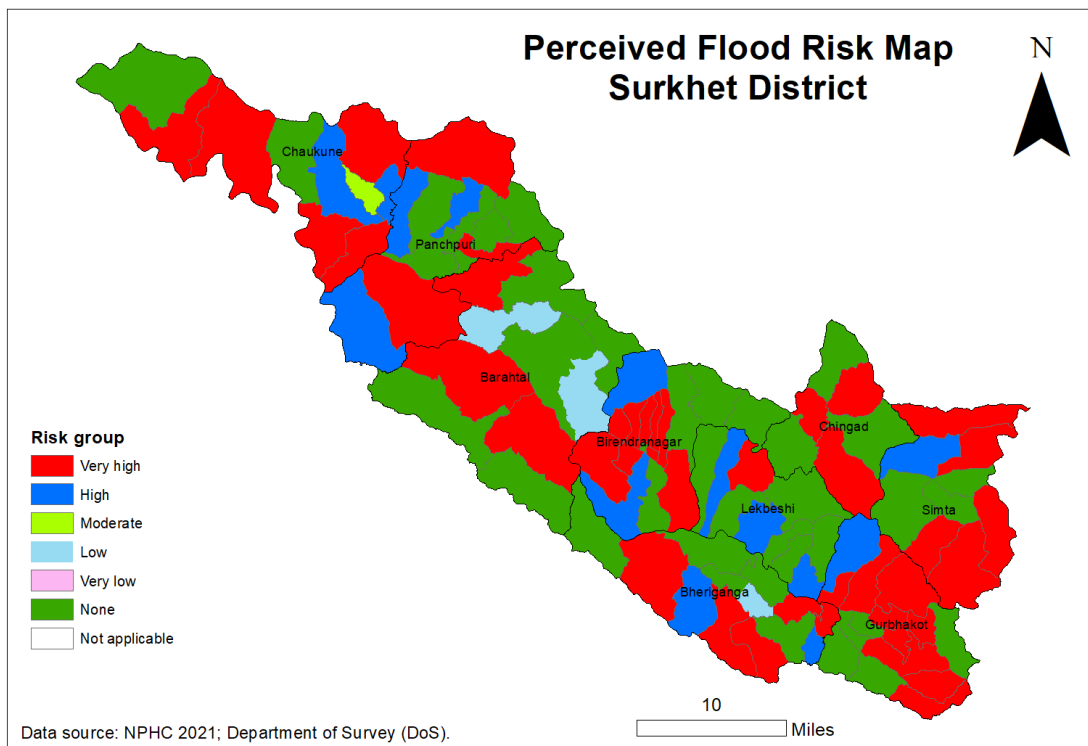
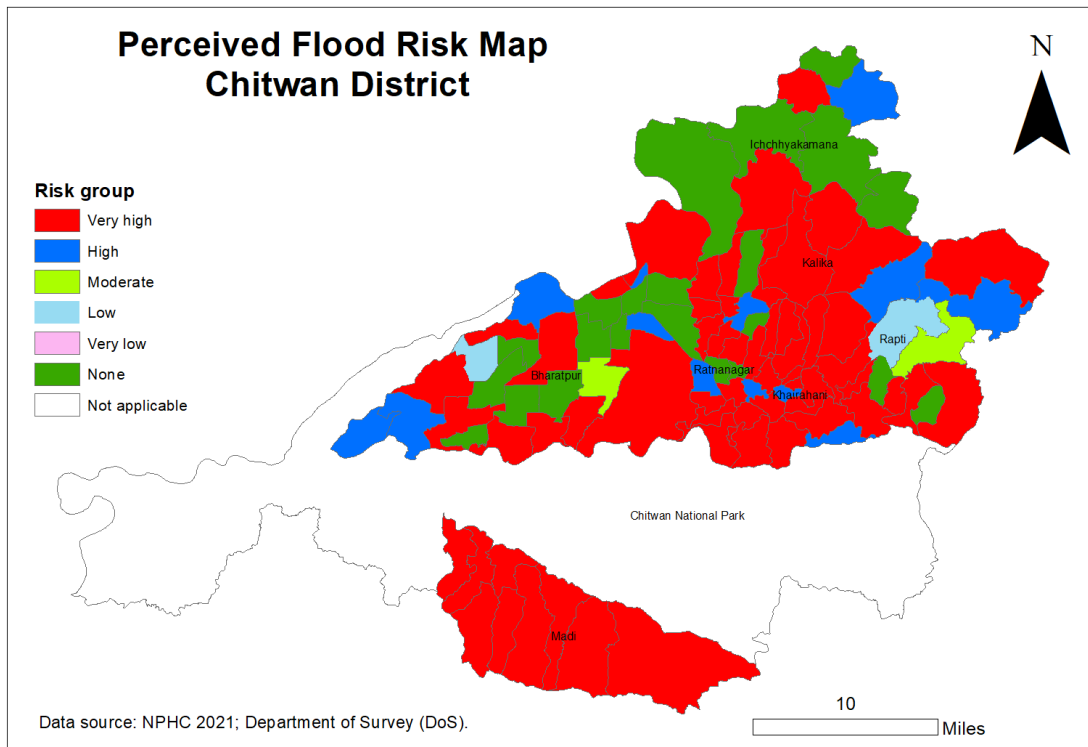
Annex 5: Perceived hazard risk maps (district level)

Perceived risk maps: districts with highest proportion of wards reporting highest risk to flood









Perceived risk maps: districts with highest proportion of wards reporting highest risk to landslide

