



Government of Nepal  
Ministry of Home Affairs

# Nepal Disaster Report 2015



Avalanche from Gangapurna Himal in Manang.





Government of Nepal  
Ministry of Home Affairs

# Nepal Disaster Report 2015



## Nepal Disaster Report 2015

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## Foreword

**Ministry of Home Affairs (MoHA)** has been publishing Nepal Disaster Report (NDR) since 2009 in every two years of interval. Corresponding to the previous three issues of the report, NDR 2015 is mainly focused on the disaster data and information collected by MoHA for the years 2013 and 2014. It is expected that the presentation and findings of this report would be of benefit to all the actors and stakeholders associated with disaster management at various levels such as: the policy makers, academia, administrators, disaster managers, researchers, donors and international and regional organizations for DRR initiatives.

It is well-known that developing countries like Nepal face increased disaster risks from a full range of known and previously unknown hazards. Thus, disaster consequences are having greater adverse effects on populations, built structures, the livelihood and environments. However, preparedness and mitigation measures reduce vulnerability to disasters and minimize the loss of lives and properties. Even with the best mitigation, preparedness and response planning, there may be some level of damage in environment, properties and infrastructures. Moreover, disruption of socio-economic condition and negative physical, psychological and health consequences may also occur. To address the disaster management cycle, the Government of Nepal has formulated and established various legislations and institutions. Despite of such efforts, sometimes the fury of unkind nature or human negligence results into disastrous events that overwhelm not only the local community's response capacities but also the response capacities of the whole country or countries. Gorkha Earthquake 2015 is the prominent example of such condition. In view of the above situation, Nepal Government needs to review and formulate proactive policies, legislations and institutions to take effective action to prepare for and mitigate the effects of natural and human induced hazards.

This report is the joint effort of the officials of MoHA and disaster management professionals. We recognize the secretarial support extended by Disaster Preparedness Network-Nepal (DPNet-Nepal) in preparing this report. Our sincere thanks go to the Editorial Board members and MoHA officials at Disaster Management Division for their time and efforts in the preparation of this report. This report also encompasses articles from the leading DRR professionals. Information available from other reliable government, inter-government and non-government sources has also been incorporated to make it more informative.

Finally, we would like to thank all DRR stakeholders for their continuous support and cooperation to bring out this Nepal Disaster Report 2015. Thank you.

(Narayan Gopal Malego)

**Secretary**

Kathmandu

December 2015







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## Acknowledgements

Under the leadership of **Ministry of Home Affairs** and the coordination from **DPNet-Nepal**, the Nepal Disaster Report (NDR) is being produced since 2009. In the series of publication of 2011 and 2013, the report of 2015 is the update of the national disaster data and information of the years 2013 and 2014.

I am highly grateful to Mr. Surya P Silwal, the then Home Secretary and Mr. Narayan Gopal Malego, Secretary, Ministry of Home Affairs for their advice and guidance in preparing this report. I would also like to admire Joint Secretary Mr. Rameswor Dungal, Under Secretaries Mr. Pradip Kumar Koirala and Mr. Baburam Bhandari and other officials of MoHA for their continuous cooperation and great care in course of the preparation of this report. Similarly, I would like to thank the UN agencies, national and international non-government organizations for the help provided to produce this report. Likewise, I would like to express my sincere appreciation to all DRR partners, experts, professionals and particularly the author of the articles who have extended great help in the preparation of this report. I duly acknowledge the contribution of all other organizations and individuals who have directly and indirectly contributed to shape this report.

I am deeply obliged to the Advisory Board and Editorial Board for their valuable guidance and constructive feedback at various stages of the preparation of this report. The support of DPNet-Nepal Executive Committee members and DPNet-Nepal Secretariat is also highly appreciated for their assistance provided in course of the preparation of this report.

Last but not the least, I acknowledge and highly appreciate the hard work of the Consultant Dr. Meen B. Poudyal Chhetri on this report. He has shown high professionalism and technical standards to come-up with this report.

This is our firm belief that NDR 2015 will be a very important and basic reference material for the readers.

(Bishal Nath Upreti)  
**Chairperson**  
DPNet-Nepal



Since the time immemorial, Nepal is witnessing increasing numbers of casualties and damages due to various types of natural and human induced disasters such as floods, landslides, fires, epidemics, GLOFs, thunderbolts, earthquake and so on. This makes Nepal as one of the most disaster prone countries in the world. Among them epidemics, floods, landslides, fires are the recurrent phenomena and earthquake is the most intensive disaster. All these disasters kill hundreds of people and cause heavy damage to physical properties worth millions of rupees every year. Gorkha Earthquake 2015 alone killed nearly nine thousand people and caused economic loss equivalent to seven billion dollars.

Disasters affect not only the people; they also set back the overall economic development of the country. Thus, the socio-economic costs of such disasters have long-term repercussions on local communities and on the entire country. Traditionally, we look at disasters mainly from a humanitarian perspective and give priority to immediate rescue and relief works. Now, it is high time to take preparedness actions and build a culture of resilience -- so that we may save more lives and properties. In the same way, we should continue improving and strengthening our capacity in mitigation, preparedness, response, recovery, rehabilitation and reconstruction in collaboration with local, national, regional and international organizations to reduce our vulnerability to disasters.

This Report is an overview of disasters and their impacts in Nepal during the years 2013 and 2014. This report also provides insight into policy and institutional responses. The need and importance of community resilience is also briefly discussed. In addition to this, professional articles on various aspects of disaster management have also been incorporated in this report. In some cases data and information were limited. The scope of the report is focused to the works led or carried out directly by the Government entities. So we realize that there are still avenues for improvement in data presentation and interpretation. We welcome constructive comments and feedbacks from the readers which would be useful for the forthcoming disaster reports.

We hope, this report may serve as a guide and reference for the government and non-government sectors, students, researchers, practitioners and anyone interested in disaster management.



Rameshwor Dangal  
**Editor in Chief**  
Joint Secretary, MoHA

## Abbreviations and Acronyms

---

AEM	Australian Emergency Management
APF	Armed Police Force
BBB	Build Back Better
CBS	Central Bureau of Statistics
CCA	Climate Change Adaptation
CBDP	Community Based Disaster Preparedness
CBEWS	Community Based Early Warning System
CCDRR	Climate Change Disaster Risk Reduction
CDMC	Community Disaster Management Committee
CDRC	Central Disaster Relief Committee
CDO	Chief District Officer
DAO	District Administration Office
DDC	District Development Committee
DDRC	District Disaster Relief Committee
DEOC	District Emergency Operation Centre
DIA	Disaster Impact Assessment
DMB	Disaster Management Bill
DPNet-Nepal	Disaster Preparedness Network-Nepal
DPRP	Disaster Preparedness and Response Plan
DRR	Disaster Risk Reduction
DRM	Disaster Risk Management
DHM	Department of Hydrology and Meteorology
DMG	Department of Mines and Geology
DWIDP	Department of Water Induced Disaster Prevention
DSCWM	Department of Soil Conservation and Watershed Management
ECHO	European Commission Humanitarian Aid department
EW	Early Warning
FA	First Aid
FY	Fiscal Year
GDP	Gross Domestic Product

GIS	Geographical Information System
GLOF	Glacier Lake Outburst Flood
GO	Government Organization
GoN	Government of Nepal
HFA	Hyogo Framework for Action 2005-2015
HFF	Himalayan Frontal Fault System
HKH	Hindu Kush Himalayan
IFRC	International Federation of Red Cross and Red Crescent Societies
IPCC	Inter-governmental Panel on Climate Change
ISZ	Indus Suture Zone
INGO	International Non-Government Organization
LAPA	Local Adaptation Plan of Action
LDO	Local Development Officer
LDMC	Local Disaster Management Committee
LDRC	Local Disaster Relief Committee
LDRMP	Local Disaster Risk Management Plan
LSGA	Local Self-Governance Act
LSAR	Light Search and Rescue
MBT	Main Boundary Thrust Fault
MCT	Main Central Thrust Fault System
MDG	Millennium Development Goal
MIS	Management Information System
MoAC	Ministry of Agriculture and Cooperatives
MoE	Ministry of the Environment
MoES	Ministry of Education and Sports
MOFA	Ministry of Foreign Affairs
MoFALD	Ministry of Federal Affairs and Local Development
MoHA	Ministry of Home Affairs
MOHP	Ministry of Health & Population
MoTD	Ministry of Town Development
MoWR	Ministry of Water Resources
MoSTE	Ministry of Science and Technology
MoE	Ministry of Environment

NA	Not Available
NAP	National Action Plan
NA	Nepal Army
NAPA	National Adaptation Plan of Action
NSC	National Seismological Centre
NAST	Nepal Academy of Science and Technology
NBC	National Building Code
NCDM	Nepal Centre for Disaster Management
NCRA	Natural Calamity Relief Act
NDR	Nepal Disaster Report
NDRF	National Disaster Response Framework
NDMA	National Disaster Management Authority
NDMP	National Disaster Management Policy
NEOC	National Emergency Operating Centre
NGO	Non-Governmental Organization
NP	Nepal Police
NPC	National Planning Commission
NPDRR	National Platform for Disaster Risk Reduction
NRRC	Nepal Risk Reduction Consortium
NRs.	Nepalese Rupees
NRCS	Nepal Red Cross Society
NS	Nepal Scout
NSDRM	National Strategy for Disaster Risk Management
PDNA	Post Disaster Needs Assessment
PPRR	Pervention, Preparedness, Response and Recovery
PRSP	Poverty Reduction Strategy Papers
PPCR	Pilot Program on Climate Resilience
RA	Regional Administrator
RDRC	Regional Disaster Relief Committee
SAR	Search and Rescue
SOP	Standard Operating Procedure
UNDP	United Nations Development Program

UNISDR	United Nations International Strategy for Disaster Risk Reduction
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
USAID	United States Agency for International Development
VDC	Village Development Committee
WCDR	World Conference on Disaster Reduction
WECS	Water and Energy Commission Secretariat
WFP	World Food Program
WHO	World Health Organization
WMO	World Meteorological Organization





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# Executive Summary

1. Nepal a Himalayan country, lies in between 80°4' to 88°12' East longitude and 26°22' to 30°27' North latitude. It has an area of 147,181 sq. km. extending roughly to 885 km. from East to West and varies from 145-241 km. North-South. The country is land locked bordering with India on the East, West and South, and China on the North. Nepal is situated in the middle portion of the Hindu Kush Himalayan (HKH) Region. The altitude ranges from a minimum of 70 meters to a maximum of 8,848 meters whereas the climate varies with its topography and altitude. A combination of rugged topography, high reef, active tectonic process and intense monsoon rain has made this fragile environment vulnerable to varieties of hazards and disasters. "The country stands at the top 20<sup>th</sup> list of the most multi-hazard prone countries in the world. The country is ranked 4<sup>th</sup>, 11<sup>th</sup> and 30<sup>th</sup> in terms of climate change, earthquake and flood risk respectively."(UNDP/BCPR, 2004).
2. With a predominantly agrarian economy where about 83 per cent of the over 26 million people of Nepal reside in rural areas, traditional, self-sustaining hills and mountain farming systems have been disrupted by increased population and fertile top soil erosion. In addition - deforestation, migration from the hills and mountains to the fertile Tarai<sup>1</sup> region and haphazardly developed urban and sub-urban centres are increasing at an unprecedented scale. Consequently, the poor, uneducated and unemployed people are compelled to make a living by settling in flood and land slide prone areas in the hills, Chure,<sup>2</sup> Tarai plains and the urban and sub-urban areas. Lack of effective land use and settlement regulations has contributed to increased vulnerability to floods and other hazards caused by both natural and anthropogenic factors (Chhetri 2011).
3. Nepal is exposed to multiple hazards such as earthquakes, floods, landslides, fires, heat waves, cold waves, lightning, windstorms, hailstorms, droughts, epidemics and so on due to its variable geo-climatic conditions, young geology, unplanned settlements, deforestation, environmental degradation and increasing population. Disasters triggered by natural hazards are causing heavy loss of lives and properties. Disasters are also the unparalleled threat to sustainable development. The effects of climate change and extremes have further aggravated the disaster vulnerability

<sup>1</sup> Tarai is a flat and fertile land mass of Southern part of Nepal that extends from East to West. It covers 23 percent of the total land of Nepal.

<sup>2</sup> The Churia hill range is highly fragile land mass which is made up of sediments, sandstone, limestone and phyllites. Thus, in the event of continuous and intense rainfall, the sediment becomes destabilized and results into floods, landslides, gully erosion, debris flow, flash floods and so on.

in Nepal. In this way, Nepal is one of the most disaster-prone countries in the world. As the country lies in the high seismic prone zone, large-scale earthquakes were frequent in the country in the past including the recent earthquake of 25 April 2015.

4. People in Nepal live with hazards, accepting them as the way of life. Despite of some good practices and Disaster Risk Reduction (DRR) initiatives, the frequency and intensity of disasters are in increasing trend. Also, because of the fatalistic nature of some people and the inadequate preparedness on part of the government and other stakeholders, vulnerability to disasters is on the rise. Likewise, absence of proactive legislations and reactive approach are other contributing factors of disaster vulnerability in Nepal.
5. Mainstreaming DRR into development planning has been initiated recently. However, it has yet to be adequately incorporated into development plans and programs. Linkages between DRR, poverty, migration, livelihood and internal displacement has not been established which have negatively affected to achieve the goals of Millennium Development Goal (MDG), Poverty Reduction Strategy Papers (PRSP) and Hyogo Framework for Action (HFA).
6. Various studies and reports over the last 33 years have shown that each year, floods, landslides, fires, avalanches and epidemics kill hundreds of people and destroy property worth billions of Rupees. They also have a negative impact on the nation's development activities. In addition, due to the geo-physical situation of the country and response

centric approach of the government and other disaster management stakeholders, the losses and damages from disasters are increasing. So far, more emphasis has been given towards the disaster response and relief rather than complete approaches including planning, preparedness and recovery. There is the need of proactive disaster management policies, laws and programs.

7. Nepal is facing the wrath of natural and human induced disasters with greater frequency and intensity. Disasters are so penetrative in every Nepalese geographic and societal framework that the people are constantly under the threat of a multitude of natural disasters. The earthquake of 1934 A.D., 1980 A.D. 1988 A.D., 2015 A.D. and the flood of July, 1993 A.D., 2008 A.D. and 2014 A.D. are the most devastating disasters which not only caused heavy losses of human lives and physical properties but also adversely affected the development process of the country as a whole. The lessons of the 1988 earthquake and the recent 2015 Gorkha Earthquake, 1993 flood and landslide, 2008 Koshi flood and 2014 flood and landslide disasters in Mid and Far Western Region of Nepal have brought about a shift of attitude on part of the planners, government officials, donor agencies, NGOs and INGOs towards the need for a coordinated disaster preparedness and response mechanism. Recent time climate change due to global warming has become 'extreme' and in the climate change vulnerability index Nepal is ranked as the 4<sup>th</sup> most climate vulnerable country in the world (World Bank 2011). Fire is another disaster which occurs on a regular basis and wild fires are damaging to already severely depleted forests and



biodiversity of Nepal which results on economic loss, land degradation and environmental pollution.

8. In the year 2013 and 2014 Nepal saw an overall increase of the disasters – particularly floods and landslides in various parts of the country. The floods and landslides that occurred in 2013 in Far Western Region particularly in Darchula district and the floods and landslides in 2014 in Mid-Western Region particularly in Banke, Bardia, Dang and Surkhet were the most frightening and devastating disasters that caused enormous losses to human lives and physical properties. In the year 2013 a total number of 460 people were killed by various disasters and in the year 2014 a total number of 487 people were killed by different disasters in the whole country. The number of human casualty is more in 2014 (487 persons) than in 2013 (460 persons). The number of missing people is far more in 2014 (357 persons) than in 2013 (165 persons). On the contrary, the number of injured persons is more in 2013 (517 persons) than in 2014 (473 persons). The number of affected families in the year 2014 is 39,812 while in 2013 only 2,697 families were affected. Likewise, large number of animals were killed in the year 2014 (5,282 animals) than in 2013 (1,535 animals). In the same way, the economic loss also was more in the year 2014 (16,753.7 million rupees) than in the year 2013 (2,057.0 million rupees). It is mainly due to the massive impact of floods and landslides in large area of Mid-Western Region of Nepal by floods and landslides. However, the total number of disaster events were more in the year 2013 (58 disasters) than in the year 2014 (42 disasters).
9. On 25 April 2015 a massive 7.6 ml earthquake struck Nepal, having the epicentre near Barpak village of Gorkha district which is northwest of Kathmandu. It was the worst quake to strike the country in more than 80 years. After 17 days on 12 May 2015, another 6.8 ml strong aftershock caused further damage and sufferings. These earthquakes took the lives of 8,896 and injured seriously 22,303 people. The earthquake destroyed 6,04,930 houses completely and 2,88,856 houses partially. It is estimated that the total value of disaster effects (damages and losses) caused by the earthquakes is NPR 706 billion or its equivalent of US\$ 7 billion. (PDNA, NPC 2015). In this way, this devastating earthquake has affected vast parts of Nepal and left deep scars in the economy and infrastructure of the country.
10. The disaster data analysis of the disaster events of the years 2013, 2014 and 2015 Gorkha Earthquake clearly show the need of huge efforts and investments in preparedness. It is extremely necessary to realize the need of preparedness plan, program and projects to reduce the loss to lives and properties in the days to come.
11. Finally, in view of the current disaster trends in Nepal, the incorporation of disaster risk reduction and resilience strategy into public and private sector development works is highly desirable. Furthermore, reducing disaster risk with preparedness plan, program and projects and building resilience with the goal of sustainable development must be the major thrust to face the challenges of hazards.



# नेपाल विपद् प्रतिवेदनको सारसंक्षेप

- हिमाली मुलुक नेपाल २६<sup>०</sup>२२' उत्तरदेखि ३०<sup>०</sup>२७' उत्तर अक्षांशसम्म र ८०<sup>०</sup>४' पूर्वदेखि ८८<sup>०</sup>१२' पूर्व देशान्तरसम्म फैलिएको छ । पूर्व-पश्चिम भण्डै ८८५ किलोमिटर लम्बाइ र उत्तर दक्षिण १४५ देखि २४१ किलोमिटर चौडाइ भएको नेपालको क्षेत्रफल १,४७,१८१ वर्गकिलोमिटर छ । पूर्व, पश्चिम र दक्षिणतर्फ भारत र उत्तरतर्फ चीनसँग सिमाना जोडिएको यो एक भूपरिवेष्टित मुलुक हो । नेपाल हिन्दुकृश हिमालय क्षेत्रको मध्य भागमा पर्दछ । यसको उचाई समुद्रको सतहबाट कम्तिमा ७० मिटर देखि अधिकतम ८,८४८ मिटरसम्म छ । यसको हावापानी उचाइ अनुसार फरकफरक छ । उबडखाबड भूबनोट, उच्च पर्वत श्रृङखला, चलायमान भौगर्भिक अवस्था र भारी मनसुनी वर्षाका कारण नेपाल विभिन्न विपद्हरूको जोखिममा छ । “यो देश बहुजोखिमयुक्त मुलुकमध्ये २० सौं स्थानमा पर्दछ । त्यस्तै जलवायु परिवर्तन, भूकम्प र बाढीको जोखिमको दृष्टिले क्रमशः चौथो, एघारौं र तिसौं स्थानमा पर्दछ ।” (यूएनडिपी/बिसिपीआर, २००४) ।
- करिब २ करोड ६० लाखभन्दा बढी जनसँख्या भएको, ८३ प्रतिशत मानिसको बसोबास ग्रामीण ईलाकामा भएको र मुख्यतः कृषिमा आधारित अर्थतन्त्र भएको मुलुक नेपालमा परम्परागत ढँगको खेती गराई, बढ्दो जनसँख्या र उर्बर भूमिको क्षयीकरणले गर्दा उच्च पहाडी भेगमा गरिने जीविकोपार्जनमुखी खेतीपाती सड्कटमा पर्नगएको छ । यसको अतिरिक्त वन जङ्गलको विनाश, पहाडबाट तराईको उर्बर भूभागतर्फ अनियन्त्रित बसाइसराइ र योजना विहीन शहरी इलाकाहरूको द्रुततर गतिबाट भइरहेको बृद्धिका कारण विपन्न, अशिक्षित र बेरोजगार व्यक्तिहरू पहाड, चुरे, तराई र शहरी इलाकाहरूको बाढीपहिरोको जोखिमयुक्त ठाउँमा बसोबास गर्न बाध्य छन् । प्रभावकारी भूउपयोग र व्यवस्थित बसोबास नहुँदा प्राकृतिक एवं मानवजन्य बाढी पहिरो तथा अन्य जोखिमको बृद्धि भइरहेको छ । (क्षेत्री २०११) ।
- परिवर्तनशील भू-जलीय अवस्थिति, नवीनतम भूभाग, अव्यवस्थित बसोबास, वनजङ्गल विनाश, वातावरण विनाश, गरिबी र बढ्दो जनसँख्याका कारण नेपाल भूकम्प, बाढी, पहिरो, आगलागी, तातो हावा (लू), शीतलहर, चट्याङ, हुरीबतास, असिना, खडेरी, महामारी जस्ता प्रकोपहरूबाट ग्रस्त छ । प्राकृतिक जोखिमहरूका कारण हुने विपदले गर्दा जनघनको व्यापक क्षति भइराखेको छ । वर्षेनी हुने विपद्का घटनाहरूले गर्दा दिगो विकासका लागि पनि बाधा उत्पन्न भएको छ । जलवायु परिवर्तनको असरले गर्दा नेपालमा विपद्को जोखिम बढ्दो छ । यसप्रकार, विश्वका उच्च विपद्ग्रस्त मुलुकहरूमध्येमा नेपाल पनि पर्न गएको छ । भूकम्पीय दृष्टिले त नेपाल अत्यन्तै जोखिमयुक्त स्थानमा पर्दछ । नेपालमा २५ अप्रिल २०१५ को विनाशकारी भूकम्प लगायत विगतमा बारम्बार धेरै ठूलठूला भूकम्पहरू गएका छन् ।
- नेपालमा मानिसहरू विपद्का जोखिमलाई जीवनको अङ्गकै रूपमा लिएर बसेका छन् । केही असल अभ्यासहरू र विपद् जोखिम न्यूनीकरण सम्बन्धी कार्यहरू भएपनि विपद्का घटनाहरूमा निरन्तर बृद्धि भइरहेको छ । साथै केही मानिसहरूको भाग्यवादी सोच र सरकारी तथा अन्य सरोकारवाला निकायहरूबाट पर्याप्त पूर्वतयारीका कार्यहरू नहुनाले पनि सड्कटासन्नताको स्थिति

बढ्दो मात्रामा छ । त्यसैगरी, नेपालमा अग्रगामी कानूनको अभाव र उद्धार तथा राहत केन्द्रित पद्धति सङ्कटासन्नताका थप कारणहरू हुन ।

५. विकास आयोजनाहरूमा विपद् जोखिम न्यूनीकरण कार्यहरूको मूलप्रवाहीकरण भर्खरैमात्र सुरु भएकोछ जबकि विकास आयोजनाहरूमा विपद् जोखिम न्यूनीकरण कार्यहरूको मूलप्रवाहीकरण बढीभन्दा बढी मात्रामा समावेश गर्नुपर्ने देखिन्छ । विपद् जोखिम न्यूनीकरण, गरिबी, जीविकोपार्जन र आन्तरिक विस्थापन/आप्रवासन बीच अन्तरसम्बन्ध अभै कायम हुनसकेको छैन जसले गर्दा सहश्राब्दी विकासका लक्ष्य, गरिबी निवारण रणनीतिपत्र र ह्योगो कार्यसंरचनाका लक्ष्यहरू हासिल गर्न कठिनाइ उत्पन्न भएकोछ ।
६. विगत ३३ वर्षका विभिन्न अध्ययन तथा प्रतिवेदनहरूले औल्याएका छन् कि बाढी, पहिरो, आगलागी, हिउँपहिरो, महामारी जस्ता विपद्ले वर्षेनी सयौं मानिसहरूको ज्यान लिएकोछ र अरबौं रूपैयांको क्षति गरेको छ । त्यस्ता विपद्का घटनाहरूका कारण देशको विकासमा पनि प्रतिकूल असर परेकोछ । सो बाहेक मुलुकको भौगर्भिक अवस्था र सरकारी तथा अन्य सरोकारवालाहरूले उद्धार तथा राहतोन्मुख विधि अपनाउनाले विपद्बाट हुने क्षति घट्नुको सट्टा बढ्दो मात्रामा छ । अहिलेसम्म योजनाबद्ध पूर्वतयारी तथा पुनर्लाभको विधितर्फ भन्दा राहतोन्मुख पद्धति तर्फ नै बढी जोडिएको पाइएकोछ । यसर्थ, अग्रगामी एवं व्यवहारिक विपद् व्यवस्थापन नीति, नियम, ऐन, तथा कानूनको खाँचो देखिएकोछ ।
७. नेपालले निरन्तर बृद्धि भइरहेका प्राकृतिक तथा मानवजन्य विपद्हरूको सामना गर्नुपरेको छ । नेपालको भौगोलिक एवं सामाजिक अवस्थामा विपद्ले यतिसम्म गहिरो असर पारेको छ कि मानिसहरू विभिन्न खाले विपद्का जोखिममा रहन बाध्य छन् । सन् १९३४, १९८०, १९८८ र २०१५ को भूकम्प र १९९३, २००८ र २०१४

को बाढी र पहिरोले मानवीय र भौतिक क्षतिमात्र गरेको नभई देशको विकास प्रक्रियालाई नै अवरूढ पारिदिएका छन् । १९८८ र २०१५ को भूकम्प, २००८ को कोशी नदीमा आएको बाढी र २०१४ को मध्यपश्चिमको बाढीपहिरोले योजनाकार, सरकारी कर्मचारी, दातृ निकायहरू, स्थानीय गैरसरकारी संस्थाहरू र अन्तरराष्ट्रिय संघ-संस्थाहरूको सोचमा परिवर्तन ल्याइदिनुका साथै विपद्को पूर्वतयारी र प्रतिकार्य व्यवस्थापनमा समन्वयात्मक सहकार्यको आवश्यकता महसूस गराइदिएकोछ । हालका वर्षहरूमा जलवायु परिवर्तन असाध्य जटिल हुनपुगेको छ । जलवायु परिवर्तनको जोखिम स्तरीकरणमा नेपाल चौथो स्थानमा परेको छ (विश्व बैंक २०११) । अर्का तर्फ वर्षेनी हुने आगलागीका कारण वन जङ्गलमा हुने डढेलोले गर्दा वन पैदावार र जैविक विविधताको नाश भइरहेको छ । आगलागीकै कारण आर्थिक क्षति, जमिनको क्षयीकरण र वातावरण विनाश बढीहेको छ ।

८. सन् २०१३ र २०१४ का वर्षहरूमा नेपालले मुलुकको विभिन्न भागमा धेरै विपद्हरू खासगरी बाढी र पहिरोको सामना गर्नुपर्थ्यो । सन् २०१३ मा नेपालको सुदूरपश्चिम क्षेत्र खासगरी दार्चुलामा गएको बाढी-पहिरो र सन् २०१४ मा मध्यपश्चिमाञ्चल क्षेत्रको बाँके, बर्दिया, सुर्खेत र दाङमा गएको बाढी-पहिरोले गर्दा जन धनको व्यापक क्षति हुनपुग्यो । सन् २०१३ मा विपद्का विभिन्न घटनाहरूमा परी मुलुकभरमा ४६० जनाले ज्यान गुमाउन पुगे भने सन् २०१४ मा ४८७ जनाको मृत्यु हुन गयो । यसरी सन् २०१३ मा भन्दा सन् २०१४ मा बढी मानिसहरूको मृत्यु हुनगयो । विपद्का विभिन्न घटनाहरूमा परी घाइते हुनेहरूको सङ्ख्या सन् २०१३ मा ५१७ थियो भने सन् २०१४ मा ४७३ थियो । विपद्का विभिन्न घटनाहरूमा परी हराउनेहरूको सङ्ख्या सन् २०१३ मा १६५ र २०१४ मा ३५७ थियो । प्रभावित परिवारको सङ्ख्या सन् २०१४ मा ३९,८१२ थियो भने सन् २०१३ मा जम्मा २,६९७ मात्र थियो । त्यसैगरी, सन् २०१४ मा ५,२८२ पशुधनको क्षति

भयो भने सन् २०१३ मा १,५३५ पशुधनको विनाश भयो । विपद्का कारण सन् २०१४ मा १६,७५३.७ मिलियन रूपैयाँ बराबरको क्षति भयो भने सन् २०१३ मा २,०५७ मिलियन रूपैयाँ बराबरको क्षति भयो । मध्यपश्चिमको विनाशकारी बाढी पहिरोले गर्दा सन् २०१३ मा भन्दा सन् २०१४ मा बढी आर्थिक क्षति हुनगएको हो । समग्रमा सन् २०१३ मा विपद्का ५८ वटा घटनाहरू भए भने सन् २०१४ मा ४२ वटा घटनाहरू भए ।

९. २५ अप्रिल २०१५ (२०७२ वैशाख १२ गते) मा गोरखा जिल्ला (काठमाडौँदेखि उत्तर-पश्चिम) को बारपाक गाउँ नजिकै केन्द्रबिन्दु बनाएर नेपालमा ७.६ एमएलको विनाशकारी भूकम्प गयो । ८० वर्षभन्दा बढी समय देखिको यो सबैभन्दा ठूलो र खतरनाक भूकम्प थियो । १७ दिनपछि १२ मे २०१५ (२०७२ वैशाख २९ गते) का दिन फेरि अर्को ६.८ एमएलको परकम्प जाँदा पनि ठूलो क्षति भयो । यी भूकम्पहरूले ८,८९६ जनाको ज्यान लिनुका साथै २२,३०३ जनालाई घाइते तुल्याए । यिनै भूकम्पका कारण ६,०४,९३० घर पूर्ण रूपले र २,८८,८५६ घर आंशिक रूपले क्षतिग्रस्त भए । यी भूकम्पहरूबाट करिब ७०६

बिलियन रूपैयाँ (करिब ७ बिलियन अमेरिकी डलर) बराबरको क्षति हुनगएको छ । (पीडीएनए, एनपीसी २०१५)। उपर्युक्त विनाशकारी भूकम्पले देशको विभिन्न भागमा असर पार्नुका साथै देशको अर्थतन्त्र र भौतिक संरचनामा गहिरो घाउ पारेर गएको छ ।

१०. सन् २०१३ र २०१४ का बाढी-पहिरोका घटनाहरू र सन् २०१५ को गोर्खा भूकम्पले पूर्वतयारीको महत्व र आवश्यकतालाई उजागर गरेका छन् । आगामी दिनहरूमा जनधनको क्षति कम गर्न विपद् पूर्वतयारीका योजना, कार्यक्रम तथा आयोजनाहरूको ठूलो खाँचो महसूस भएको छ ।
११. अन्त्यमा, नेपालको विपद्को घटनाक्रमलाई दृष्टिगत गर्दा, विपद् जोखिमको सामना गर्न सरकारी तथा निजी दुबै क्षेत्रका विकास कार्यहरूमा विपद् न्यूनीकरण तथा उत्थानशील रणनीति एवं कार्यनीति अवलम्बन गर्न अति आवश्यक छ । अझ त्यस भन्दा बढी, पूर्वतयारीका योजना, कार्यक्रम तथा आयोजना र दिगो विकासको लक्ष्यका साथ उत्थानशीलतालाई मूल आधार बनाउनुपर्ने देखिन्छ ।



# Chapter

# 1

## Introduction



Cash Distribution to Gorkha Earthquake Victims by Kathmandu CDO

Photo: MoHA

# 1 Introduction

## 1.1 Country Background

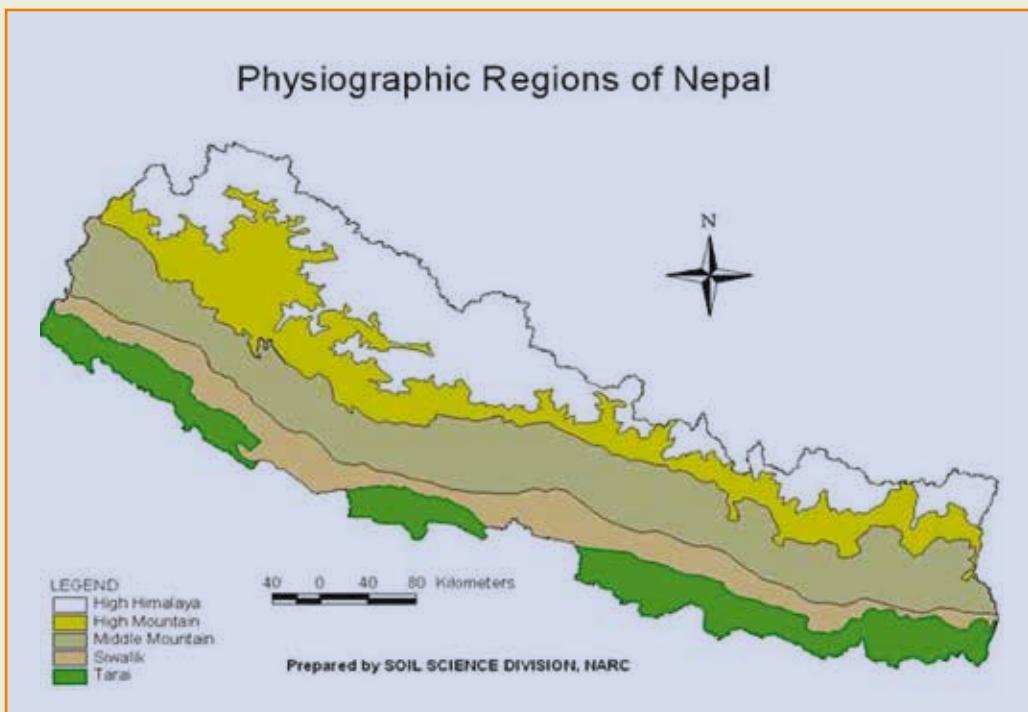
Located between India and China and with 26.5 million of population and 1,47,181 square kilometers of area, Nepal occupies 0.3 and 0.03 percentage of land area of Asia and the world respectively. In the northern hemisphere, Nepal is situated within latitude 26° 22' N to 30° 27' N and of longitude 80° 4' E to 88° 12' E. The altitude ranges from a minimum of 70 meters to a maximum of 8,848 meters whereas the climate varies with its topography. Mt. Everest – the top of the world – is both the identity and glory of this Himalayan country. The average width (North to South) is 193 kilometers whereas the average length is 885 (East to West) kilometers. The country has great variety of topography which is reflected in the diversity of weather and climate simultaneously. Specially, the country experiences tropical, mesothermal, micro-thermal, taiga and tundra types of climate. Nepal is a multi-ethnic, multi-lingual, multi-religious and multi-cultural country. The last census of 2011 revealed that there are 123 languages being spoken in Nepal whereas 125 Caste and ethnic group residing in a uniquely harmonized Nepalese society. Nepali stands as the official language of the country. There were recorded ten different religions, viz., Hindu, Bouddha, Islam, Kirat, Christian, Prakriti, Bon, Jain, Bahai and Sikha respectively by their dominance in the last census of 2011. Also known as the light of Asia, Lord Gautam Buddha was born in Lumbini of Nepal some 2500 years ago. As a distinct symbol of the country, Nepal has a flag with unique triangular shape in contrast to rectangular shape of almost all countries in the world. (Source: CBS 2014)

Physiographically, the country is divided into five regions namely: the Tarai, the Churiya

hills, the Middle hills, the High hills and the Himalayas. Ecologically, the country is divided into three regions running from east to west, namely; the Tarai, the Hills and the Mountains. The Tarai region is a low, flat and fertile land of alluvial soil. It consists of some dense forest areas, national parks with wildlife reserves and conservation areas. It covers 23 percent of the total area of Nepal out of which 40 percent is under cultivation. It is also known as the “grain basket” of Nepal. Abundant water resources, fertility and flatness permit the cultivation of a variety of crops in this area. Rice, maize, wheat, potato, sugarcane, vegetables, tobacco, jute and several other crops are being grown in this region. The Hilly region lies at the altitude between 610 meters to 4,877 meters above the sea level. This region covers 43 percent of the land area of the country out of which only 10 percent is under cultivation. In the higher altitudes of this region the main occupations include animal grazing, cottage industries and cultivation of high altitude cereals whereas in the lower altitudes, cultivation of cereal and cash crops is adopted as the main occupation. This region comprises several attractive pockets, valleys, lakes and basins. Kathmandu, Pokhara, Hetaunda, Dang, Surkhet and several other valleys of this region accommodate large populations. The Mountainous region varies from 4,878 meters to 8,848 meters above the sea level. There are more than 250 peaks in this region over 6,000 meters in height and most of them are in the eastern and the central part of the country. In this region the snow line lies above 5,000 meters and there is no human settlement above this line. Most part of the Himalaya consists of metamorphic and very soft sedimentary rocks. This region covers 34 percent area of the country out of which only 2 percent of the land is suitable for cultivation. Since this region is mostly steep, rugged, remote and cold, it is the most sparsely populated region of the country. The people living in this region have sheep, goat



Map 1



and yak<sup>1</sup> raising as their main occupation. (Source: Chhetri & Bhattarai 2001).

Nepal is divided into three major river systems from east to west: the Koshi River, the Gandaki River and the Karnali River. These river systems originate from across the Himalayan range. All those rivers are the major tributaries of the Ganges River in northern India. After plunging through deep gorges, these rivers deposit heavy sediments and debris on the plains of Nepal and India, nurturing them and renewing their alluvial soil fertility. Once they reach the Terai Region, they often overflow their banks onto wide floodplains during the monsoon, shifting course. The main river systems originate in the Higher Himalaya, with some having their origin in Tibet.

<sup>1</sup> A mountain cow covered with long and thick hairs.

## 1.2 Core Problems Associated with Disasters

According to UNISDR -- between 2005-2015 over 700 thousand people lost their lives, over 1.4 million were injured and approximately 23 million were made homeless as a result of disasters. Overall, more than 1.5 billion people were affected by disasters in various ways. Women, children and people in vulnerable situations were disproportionately affected. The total economic loss was more than \$1.3 trillion. In addition, between 2008 and 2012, 144 million people were displaced by disasters. Disasters, many of which are exacerbated by climate change and increasing in frequency and intensity, significantly impede progress towards sustainable development. Evidence indicates that exposure of persons and assets in all countries has increased faster than vulnerability has decreased, thus

generating new risk and a steady rise in disasters losses with a significant economic, social, health, cultural and environmental impact in the short, medium and long term, especially at the local and community level. Recurring small-scale disasters and slow-onset disasters particularly affect communities, households and small and medium-sized enterprises and constitute a high percentage of all losses. All countries—especially developing countries where the mortality and economic losses from disasters are disproportionately higher—are faced with increasing levels of possible hidden costs and challenges to meet financial and other obligations.

Disasters today are affecting people and causing economic losses at rates that are unprecedented and increasing rapidly. By 2050, more than half of world's 9 billion people will live in large urban centres, most of them in developing countries. The enormity and frequency of disasters will bring further challenges that warrant visionary approaches. The disaster impacts are unevenly distributed; Asia and Africa combined together take the brunt of nearly 68% of all people killed and 95% of those affected. From 2004 through 2013, disasters have killed 1 million people and affected 2 billion and economic losses from natural disasters now reach an average of US\$250 billion to US\$300 billion each year. Climate change will exacerbate the problem. (B.N. Upreti, 2015).

In the context of Nepal -- about 83 per cent of the over 26.5 million people reside in rural areas practicing traditional, self-sustaining hills and mountain farming systems which have been disrupted by increased population and fertile top soil erosion. In addition - deforestation, migration from the hills and mountains to the fertile Tarai region and haphazardly developed urban and sub-urban centres are increasing at an unprecedented scale. Consequently, the

poor, uneducated and unemployed people are compelled to make a living by settling in flood and landslide prone areas in the hills, Chure, Tarai plains and the urban areas. Lack of effective land use and settlement regulations has contributed to increased vulnerability to floods and other hazards caused by both natural and anthropogenic factors. Each year floods of varying magnitude occur during the monsoon (June - September) in the numerous streams and rivers of Nepal. In the higher reaches, the problem is mainly confined to landslides, debris flows and river bank undercutting whereas in the valley plains the floods generally overflow the bank and cause bank erosion and inundation.

It is an unpleasant fact that the vulnerability of human settlements to natural disasters is continuously rising because of misappropriation of natural resources by deforestation, encroachment of the flood plains, environmental degradation, haphazardly planned development projects and heavy influx of population to the urban areas in search of employment and livelihood. However, we have learnt from the past disasters (like the 2015 Gorkha Earthquake) that we can significantly reduce the impact of natural disasters through disaster mitigation efforts (e.g. by building earthquake resistant infrastructures). Such efforts must be integrated into development projects in order to build a culture of preparedness and prevention.

As Benjamin Franklin said, 'An ounce of prevention is worth a pound of cure,' why not commit to putting more effort into building capacity before a disaster strikes and on an ongoing basis, versus putting such an enormous amount of effort and expense at response/recovery efforts (Drager and Robertson, 2014).

The shock of the 2015 Gorkha Earthquake and the catastrophic floods and landslide in

Sindhupalchowk district and Far Western Region of Nepal in 2014 calls for the growing realisation of the nature and seriousness of multiple hazards in Nepal which demands heavy investment and multi-actor commitment in disaster resilience. Now, In addition to efforts to rebuild infrastructure damaged in the earthquake, there is a major drive to improve performance against Millennium Development Goal (MDG) targets including increasing school enrolment, safety measures and education in schools against potential disasters. Although there is significant investment in building new schools and health posts, infrastructure safety from the view point of earthquake resistance is a big issue. Due to the poor knowledge of, or adherence to, national Building Codes and limited provision of quality materials and technical oversight, this brings obvious dangers of multiple new infrastructures being constructed that are not disaster resilient due to these pressures.

**The scenario below depicts that Nepal is indeed a hotspot of disasters on the world map.**

### 1.3 Disaster Scenario of Nepal

Nepal is facing the wrath of natural and human induced disasters with greater frequency and intensity. It is one of the highest risk countries in the world due to various types of disasters. Disasters are so penetrative in every Nepalese geographic and societal framework that they are constantly under threat of a multitude of natural disasters. Nepal doesn't face some calamities like volcanic eruptions; otherwise all most all kinds of disasters are prevalent in Nepal. Therefore, it is a great challenge to protect infrastructure and property from frequent disasters such as: landslides, floods and fires. Each year flood, landslide, fire, epidemics, avalanche and various other

natural and human induced disasters lead to the casualty of thousands of human lives and destruction of physical property worth billions of rupees. The earthquakes of 1934 A.D., 1980 A.D. 1988 A.D., 2015 A.D. and the flood of July, 1993 A.D., 2008 A.D., 2014 A.D. are the most devastating disasters which not only caused heavy losses of human lives and physical properties but also adversely affected the development process of the country as a whole. Recent time climate change due to global warming has become a major concern and in the climate change vulnerability index Nepal is ranked as the 4<sup>th</sup> most climate vulnerable country in the world (World Bank 2011). Fire is another disaster which occurs on a regular basis and wild fires are damaging to already severely depleted forests and biodiversity of Nepal which results in economic loss, land degradation and environmental pollution. Thus, Nepal has been found to be a disaster prone country.

Being a developing country, Nepal lacks strong mechanism to widely share the knowledge and the information to the poor communities. More importantly, the vulnerable communities and poor people have not been able to mitigate, prepare for, effectively respond and overcome the impact of multiple hazards in various parts of the country. Often women, children, elderly and disadvantaged persons become unable to cope with the disasters as their capability and resilience is meagre. Therefore, it is highly necessary to build the capacity of the vulnerable communities in order to reduce the losses of human lives and physical properties in the time of disasters.

According to the Ministry of Home Affairs, since 2000, each year, an average of 329 people lost their lives due to various disasters and property loss of more than 1 billion rupees.

## Map 2



*Source: DIPECHO 6th Action Plan, 2012*

The map 2 above shows the floods in Tarai, landslides in the hills and mountains and earthquake in the mid hills and Tarai.

**Table 1: Types of Natural & Human-Induced Hazards in Nepal**

Types of Hazard	Prevalence
<i>Natural Hazards</i>	
Earthquake	All of Nepal is a high-hazard earthquake zone
Flood	Tarai (sheet flood), Middle Hills
Landslide and landslide dam breaks	Hills, Mountains
Debris Flow	Hills and Mountain, severe in areas of elevations greater than 1700 m that are covered by glacial deposits of previous ice-age
Glacier Lakes Outburst Floods (GLOF)	Origin at the tongue of glaciers in Higher Himalayas, Higher Mountains, flow reach down to middle Hill regions
Avalanche	Higher Himalayas
Fire (forest )	Hills and Tarai (forest belt at foot of southern-most Hills)
Drought	All over the country
Windstorms	All over the country
Hailstorm	Hills
Lightening	All over the country
<i>Human-Induced Hazards</i>	
Epidemics	Tarai and Hills, also in lower parts of Mountain region
Fire (settlements)	Mostly in Tarai, also in mid-Hill region
Accidents	Urban areas, along road network
Industrial/Technological Hazards	Urban / industrial areas
Soil erosion	Hills
Social Disruptions	Follows disaster-affected areas and politically disturbed areas

*Source: Nepal Country Report: ISDR Global Assessment Report on Poverty and Disaster Risk 2009.*

The types of natural and human induced disasters that occur in Nepal and the locations are given in the above Table 1.

The lessons of the 1988 and the very recent 2015 Gorkha Earthquake, 1993 flood and landslide, 2008 Koshi flood, 2013 and 2014 flood and landslide disasters in Mid and Far Western Regions have brought about a shift of attitude on the part of planners, government officials, donor agencies, NGOs and INGOs towards the need for a coordinated disaster preparedness and response mechanism. Nevertheless, still at the local level, community awareness and preparedness are inadequate.

Brief descriptions of some major natural disasters that occur in Nepal are given below:

### 1.3.1 Floods, Landslides and Debris Flow

There are more than 6000 streams and rivers in Nepal which flow mostly from the north towards the south generally with high velocity due to high river gradient. Most of the big rivers are snow fed which originate from the Himalayan ranges that are covered by perpetual snow. As the topography of the country is steep, rugged and high-angle slope with complex geology, very high intensity of rainfall during monsoon season causes flood, landslide and debris flow. The landslides and floods are the most destructive types of disasters in Nepal. Three quarter of the total land area of Nepal is hilly and many villages are situated on or adjacent to the unstable hill slopes. The landslide and flood with debris flow result in severe damages. Unplanned settlements and physical constructions without due consideration to the natural hazards are considerably aggravating the mountain environment. On the other hand the landslides add enormous load to the streams and rivers causing flood and debris flow downstream. Each year such types of disasters cause the losses of a number of human life and immense

damages to agricultural land, crops, human settlements and other physical properties.

In this way, floods and landslides are prevailing in most part of the country. The mountains to the north, hills in the middle, and the plains in the south, every parts of the country are vulnerable to such disasters. Floods and landslides are common during the monsoon season and invariably kill a large number of people and damage properties. The great havoc and destruction brought about by the devastating floods and landslides in central and southern part of Nepal in 1993 awakened the country to some extent from our traditional attitude toward natural disasters and their management.

The country stands at the 30<sup>th</sup> position in the world in terms of flood hazard. (UNDP/BCPR, 2004). The flood and landslide disasters of 1993, 2008 and 2014 are the most devastating which have caused enormous loss to human lives and physical properties. According to the data of MoHA, the floods and landslide disasters of the year 2013 claimed the lives of 219 people and 241 people lost their lives in the year 2014.

### 1.3.2 Fires

Fire disaster occurs mainly in the dry season between April to June. During this season the temperature rises above 35° Celsius and it rains seldom. Fire takes place mostly in the rural areas of the Tarai and Middle Hills region. Eighty-three percent of the total population live in the rural areas (CBS 2014). Most people in rural areas live in a very poor housing condition. The houses of those rural areas are usually very close to each other and are made up of straw or reeds and timber which are easily caught by fire. Thus fire

hazards are common. Forest fires also occur in Nepal. Forest fires in Nepal are perhaps less severe than in other countries, but are still capable of doing considerable damage, especially to young plantations (Jackson 1994). In the central region, fires are common in the *Pinus roxburghii* and *Shorea robusta* forests of the Terai and Mid-hills during the dry months (March to May). Fires are only occasional in *Quercus* (oak) forests. Very few fires are naturally caused in Nepal. Karkee (1991) found that 40% of forest fires in the Mid-hills are started by accident and 60% are started deliberately. Accidental causes include carelessness with cigarettes and matches, fires which are set to clear for cultivation and which then burn out of control, smouldering charcoal left by charcoal burners, fires set to smoke out wild bees when collecting honey and which go out of control, etc. Fires are also set intentionally in forests to kill trees so that the dead wood can then be collected and used for firewood, to induce new grass growth for cattle grazing, to clear land for farming, to grow grass and for hunting. Fires are also sometimes started maliciously by people with a grudge or complaint against the forest owner or manager. The Department of Forests has recognised fire as a serious threat to ecosystems and biodiversity, and has allocated some budget for fire control. However, there is no systematic and complete record of forest fires or their impacts in Nepal. A total of 59 people in the year 2013 and 62 people in the year 2014 lost their lives in fire disaster.

### 1.3.3 Epidemics

An epidemic is a severe outbreak of an infectious disease rapidly spreading among the population. Epidemics may spread from person to person and through exposure of many people to a single source, e.g. water supply. Although

epidemic occur throughout the year, in most cases the epidemic of cholera, gastroenteritis, diarrhoea, encephalitis, meningitis, typhoid, jaundice, malaria are the common types and they occur during the summer and rainy season. Thus the seasonality of epidemics is strongly correlated with floods and other hazards that take place in the monsoon months. The worst floods are usually accompanied by epidemics. Basically, lack of proper health care and sanitation are the major cause of epidemics. So far, epidemics has been found the leading cause of human casualties from disasters. In 1998 A.D. 840 people died of epidemics and 1,896 people were affected in various parts of the country. In Humla district more than 350 people lost their lives due to epidemics in the middle of 1998 A.D. In the year 2010 alone 462 people died of epidemics in Far Western Region especially in Jajarkot. The influx of Pandemic H1 N1 outbreak in Nepal caused havoc and economic loss in the same year. Only 4 people died of epidemics in 2013 in Dolpa district and 12 people died of epidemics in the year 2014 in Morang district.

### 1.3.4 Windstorm, Thunderbolt and Hailstorm

Windstorm occurs mainly during dry season between March to May. Thunderbolt occurs during monsoon and hailstorm takes place during the beginning and end of monsoon. Hailstorm causes heavy losses of agricultural crops though human life loss is seldom. Windstorm and thunderbolt causes the loss of human life as well as physical property. In recent years, casualties from the thunderbolt are in increasing trend. It may be due to the climate change or increasing population. Thunderbolt and windstorm killed 149 people in 2013. In 2014, thunderbolt and windstorm killed 99 people.

### 1.3.5 Climate Change – An Exacerbating Factor

Although Nepal is not contributing that much towards global warming, climate change due to global warming has tremendously impacted the glacier ecosystem in the Nepalese Himalayas. Climate change is not just an environmental phenomenon but also an economic, social and political issue in Nepal. From the point of view of climate change, Nepal is among the most vulnerable countries in the world.

The 4<sup>th</sup> Assessment Report of the IPCC estimates that Nepal will experience the impacts of climate change through an increase in temperature, more frequent heat waves and shorter frost durations in the future. Winters are expected to be drier and monsoon summers wetter which could result in more frequent and intense

summer floods and winter droughts. Even if total rainfall is not expected to decline, the rapid decline in glacial cover due to global warming will increase floods, GLOFs and landslide events.

Due to the global warming, the average maximum temperature in Nepal between 1977 and 1999 has increased by 0.9°C, at a rate of 0.03°C to 0.12°C per year, whereas the global average surface temperature rise of the last century was 0.6±0.2 °C. It is estimated to have gone even higher since then. (Source: Shrestha et. al. 1999). This is one of the highest registered rates of temperature rise in the world. The observed trend of rising temperature in Nepal is challenging the Inter-governmental Panel on Climate Change (IPCC) projections, as it seems that land areas will warm more rapidly than the global average.



Fifty years ago, Schneider's above photo of the Khumbu Valley in Nepal, taken on an expedition that lasted from 1956 to 1961, shows Taboche peak (over 6,500 m) in the centre, with the path to Everest base camp running up the valley to the right. Some years before, mountain geographer Alton Byers, of the conservation group the Mountain Institute in Washington DC, photographed the same view. His images have captured the effect of climate change on the region, showing how glaciers that were nestled below the summit and below the ridge lines have shrunk.

Almost 20% of the glaciated areas in Nepal above 5000 m are likely to be snow and glacier free area at an increase of air temperature by 1°C. Two degree Celsius rise in temperature can cause the loss of almost 40% of the areas. Similarly, 3°C and 4°C rise in temperature can result in the loss of about 58% and 70% of snow and glacier areas, respectively. Temperatures in Nepal have increased more than the global average temperature rise of 0.74°C over the last 100 years (between 1906 and 2005) and 0.13°C per decade in the last 50 years (between 1956 and 2005). In addition, significant variability in the rainfall is recorded in Nepal between 1959 and 1994 along both an annual and a decadal time scale. (Source: Upreti 2008).

According to recent studies, there is enough ice in Earth's polar caps to cause about 250-300 ft (80–100 m) rise of the sea level. Result of such an event would be catastrophic to human civilisation and earth's biosphere. More than 75% of the world's population lives below 300 ft. above the sea level, including the vast majority

of all large metropolitan areas. (Source: Martin Vargic, a full-time student in Slovakia). If current trends continue, 80% of the Himalayan glaciers, the water source for a sixth of the world's population, could disappear, if the current rate of emissions is not reduced. (Source: IPCC). Himalaya will have no ice by the year 2300 or even sooner. The lives of 2 billion people are at stake (Source: WWF Nepal).

We can draw the conclusion from the above statements that climate change is a growing challenge that has made changes in the amount, intensity, frequency, and form of precipitation. Thus it is causing frequent disasters.

### 1.3.6 Glacial Lake Outburst Floods (GLOFs)

Glacial Lake Outburst Floods (GLOFs) is another serious natural hazard and Nepal hosts many such dangerous lakes with extremely large volumes of water which can create catastrophic floods in the down streams. Glacial Lake Outburst Floods



Tsho Rolpa Glacier Lake

Photo: Deepak Paudel

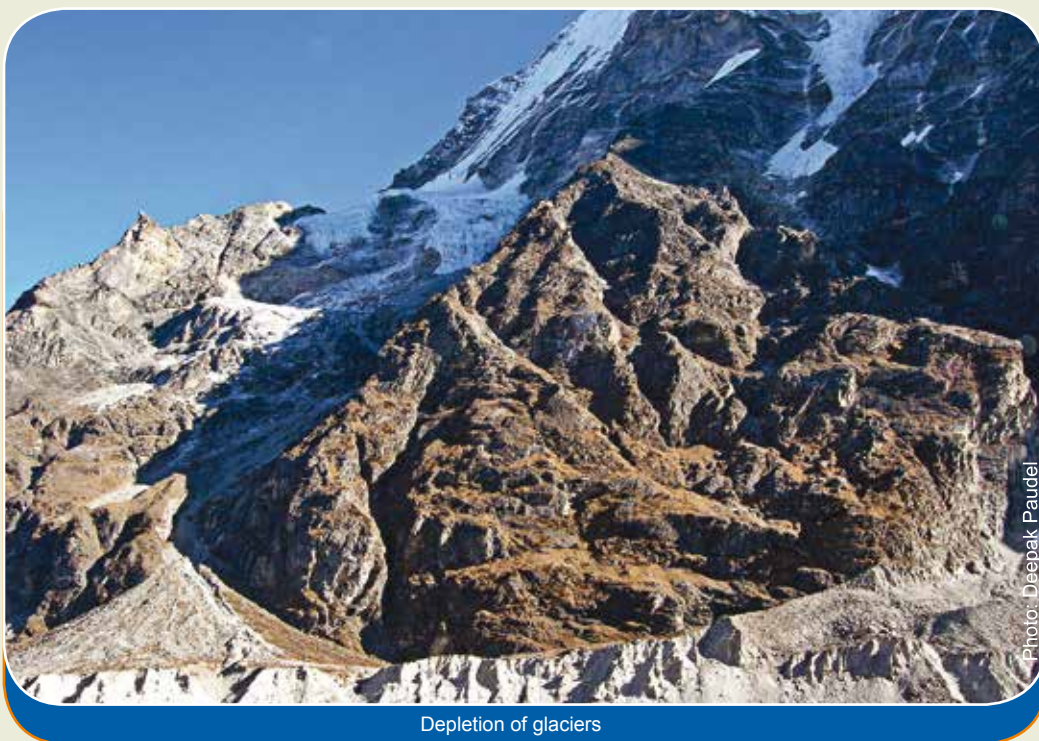


(GLOFs) are sudden discharge of ice-cold water due to failure of terminal moraine triggered by a build-up of water pressure, an avalanche of rock or heavy snow, an earthquake or cryoseism, volcanic eruptions under the ice, or if a large enough portion of a glacier breaks-off and massively displaces the water in a glacial lake at its base.

The glaciers of the Himalaya are nature's renewable storehouse of fresh water, from which hundreds of millions of people downstream have benefited annually for centuries. However, due to global changes on climate and resulting accelerated rise on global temperature, a number of glacial lakes have been emerging in the last century creating a threat of flash flood in the form of GLOFs. In south Asia, respective government as well as technical/research institutions like International Centre for Integrated

Mountain Development (ICIMOD), Water and Energy Commission Secretariat (WECS) Nepal, Wadia Institute of Himalayan Geology, United Nation Environment Program (UNEP), G. B. Pant Institute of Himalayan Environment and Development, National Environment Commission, Bhutan etc. have been studying and compiling an inventory on glacial lakes in the region. Regular monitoring and tracking of the size of these lakes has revealed that quite a few of them are expanding at an alarming rate due to accelerated glacial retreat and melting due to climate change impacts.

Glacier lakes are the most visible and probably the most dramatic consequence of climate change in the mountainous region of south Asia. Himalayan glacial lakes are dangerously close to bursting because of the ice melt caused by global warming. Floods in three major river



Depletion of glaciers

systems: the Koshi, the Gandaki and the Karnali are expected to further intensify due to changes in climate, intensity of rainfall and also because of the possibility of GLOFs.

Out of the 2,323 glacial lakes in Nepal, 26 are potentially dangerous. The areas of Upper Barun, Lower Barun, Chamlangtsho, Tsho Rolpa, Sabou, Dudh Kunda, Majang, Imja, and Thulagi have been identified as dangerous glacier lakes. These lakes contain huge volumes of water and remain in unstable condition. As a result, they can burst any time and a natural catastrophe would cause loss of life and property. About 14 such glacier lake outburst floods have been experienced between 1935 and 1991. A GLOF of 1985 caused a 10 to 15 meter high surge of water and debris to flood down the Bhote Koshi and Dudh Koshi Rivers for 90 kilometers which swept away a hydropower plant. At its peak, 2,000 m<sup>3</sup>/sec was discharged (Poudyal Chhetri and Bhattarai 2001).

### 1.3.7 Avalanche & Snowstorm

An avalanche is a rapid down slope movement of snow, ice and associated earth materials due to either natural forces or human activities. Snow storm is a storm with a large amount of falling snow. Occurring in mountainous terrain, an avalanche can mix air and water with the descending snow and can generate huge force of destruction. Powerful avalanches have the capability to entrain ice, rocks, trees and other material on the slope. The strength of avalanche is some time so high that it can sweep entire village and wash away highways. Similarly, snow-storm also can cause disruption in normal life. Even a small avalanche can block the highway causing severe impact to the society. Avalanche hazard is particularly common

in higher snow-clad areas of the Hindu Kush–Himalayan belt of the south Asia.

The northern part of Nepal is covered with high mountains i.e. Himalayas where avalanche is very common and sometimes it claims the life of human being as well. The avalanche of November 1995 killed 43 people including some foreign trekkers at Khumbu and Kanchanjungha areas. In 2 January 1999 A.D. 5 people were swept away by the avalanche which occurred in Chunchet Village Development Committee Ward No. 8 of Gorkha district. In the year 2005 A.D. 21 people, in 2009 A.D. 2 people, in 2012 A.D. 7 people, in 2013 A.D. 104 people and in 2014 A.D. 91 people were killed by avalanche and Hudhud snow-storm.

### 1.3.8 Heat Wave

Each year, parts of Nepal (particularly the Tarai area) experience high temperature conditions during the months of May and June. Strong heat wave conditions prevail and temperature soar above 44°C. People get dehydration, restlessness, and the situation worsens by frequent power shortage. There are also the instances of casualties due to heat wave from time to time. The year 2010 was unusually warm and together with the year 2005 has been recorded as the warmest year, since, record keeping started in 1880. The 2010 combined land and ocean surface temperature in the northern hemisphere was the warmest on record, while the combined land and ocean surface temperature in the southern hemisphere was the sixth warmest such period on record. The decadal global land and ocean average temperature anomaly for 2001–10 was the warmest decade on record for the globe, with a surface global temperature of 0.56°C (1.01°F) above the 20<sup>th</sup> Century average. This surpassed the previous decadal record (1991–2000) value of 0.36°C (0.65°F). (Source: MoPE).

### 1.3.9 Cold Wave

A cold wave is a weather phenomenon that is distinguished by a cooling of the air. Nepal, especially the Tarai areas are under thick freezing fog and chilly wind affected conditions in the mid-winter season. Cold waves that bring unexpected freezes and frosts can kill plants during the early and most vulnerable stages of growth, resulting in crop failure. Such cold waves may also cause famines. In the early hours of the day and during nights it is chilly and some of the unfortunate victims froze to death whereas several others die of cold related ailments (i.e. cold, flu, pneumonia, etc.). The capital city of Kathmandu also suffers sometimes. Normal life paralyses, flight schedules disrupt and the tourism industry also came under the impact when there is the thick layer of fog in the Kathmandu valley. Due to cold wave 2 people died in the year 2013.

### 1.3.10 Drought

Drought is a period of drier-than-normal conditions that lead to water-related problems. Droughts are the resultant of acute water shortage due to lack of rains over extended periods of time affecting various human activities and lead to problems like widespread crop failure, un-replenished ground water resources, depletion in lakes/reservoirs water, shortage of drinking water and, reduced fodder availability etc. Drought affects many sectors and therefore different definitions have been developed by variety of disciplines. Meteorologically drought is referred to as the absence of rain, while to the agriculturist it corresponds to the deficiency of soil moisture in the crop root zone to support crop growth and productivity. Hydrologically, drought is referred to as the lowering of water levels in lakes, reservoirs, while city planners consider the shortage of drinking water as a diagnostic for severe drought in the region.

The escalating impacts of droughts have increasingly drawn the attention of scientists, planners and society. In spite of the technological developments in providing improved crop varieties and better management practices, the vulnerability to drought in relation to the increasing needs of the growing population has become a point of great concern.

The mountainous region of Nepal is generally dry. Uneven and irregular monsoonic rainfall is the main factor of drought. The lack of irrigation facilities makes the problem even more serious as prolonged drought condition has adverse effect in crop production. The drought of 1994 affected 35 districts of the country. Agricultural crops cultivated in 1,57,628 hectares of land were destroyed. (MoPE).

### 1.3.11 Earthquake

Nepal's proximity to earthquake hazards is mainly due to her young and fragile geology. Haphazard and unplanned settlements and poor construction practice are the other reasons that have made her highly vulnerable to earthquake impacts. Earthquake threats the entire country all the time and it is poised for a mega disaster for which scientist are forecasting with a high probability of its occurrence anytime anywhere in the region. Nepal may have encountered many earthquakes throughout the history; but it has the record for the greatest loss of life since the 12<sup>th</sup> century. Even the King Abhaya Malla died in the 1310 earthquake. Since then Nepal has encountered 16 major earthquakes, including the recent devastating Gorkha Earthquake of 25 April 2015. This is the very recent striking example of earthquake vulnerability of the country. The earthquake, that left a trail of miseries that the affected population will continue to battle for years. This is, in fact, a wake-up call for policy-makers, development experts, civil society and the general public that

had not considered the existing unplanned development and uneven resource distribution. The disaster vulnerability of the country is so serious that Kathmandu, the capital city of Nepal, is number one among the 21 mega cities in the world from the point of view of earthquake risk. (Source: Upreti 2009).

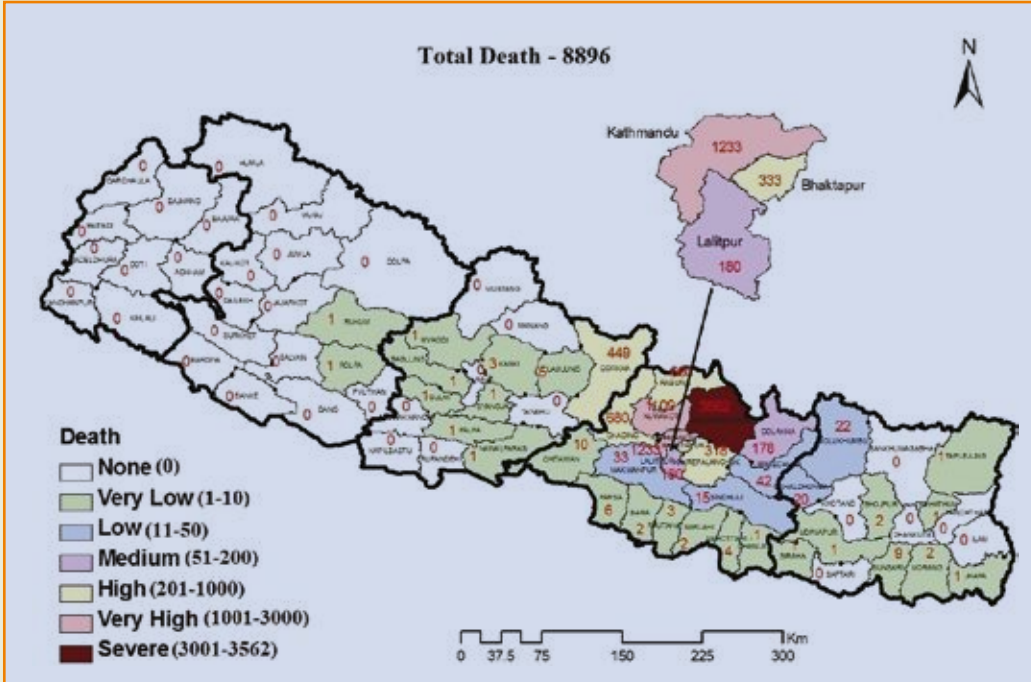
**1.3.11.1 The Gorkha Earthquake**

A 7.6 ml earthquake struck Nepal on 25 April 2015 (11:56 am local time). It occurred in a geological collision zone, where the Indian tectonic plate pushes north into the Eurasian plate, moving the ground an average of 2 cm a year. The epicentre was near the Barpak Village of Gorkha district which is 81 km northwest from Kathmandu. The devastating earthquake killed 8,891 people, with missing 198 people and seriously injured

22,303 people and rendered millions homeless. More than six hundred thousand households were fully damaged leaving around three hundred thousand damaged partially. The earthquake severely affected 14 districts (Gorkha, Dhading, Rasuwa, Nuwakot, Kathmandu, Lalitpur, Bhaktapur, Kavrepalanchowk, Sindhupalchowk, Dolakha, Sindhuli, Makawanpur, Ramechhap and Okhaldhunga) and another 31 districts affected to varying extents. This earthquake was the largest to hit Nepal after the Nepal–Bihar earthquake 1934. All these major earthquakes established that the casualties were caused mainly due to the collapse of infrastructures. This earthquake affected the entire Nepal and also affected some parts of India, Bangladesh and the Tibet Autonomous Region of China. Tremors were also felt in Bhutan and Pakistan.

**Map 3**

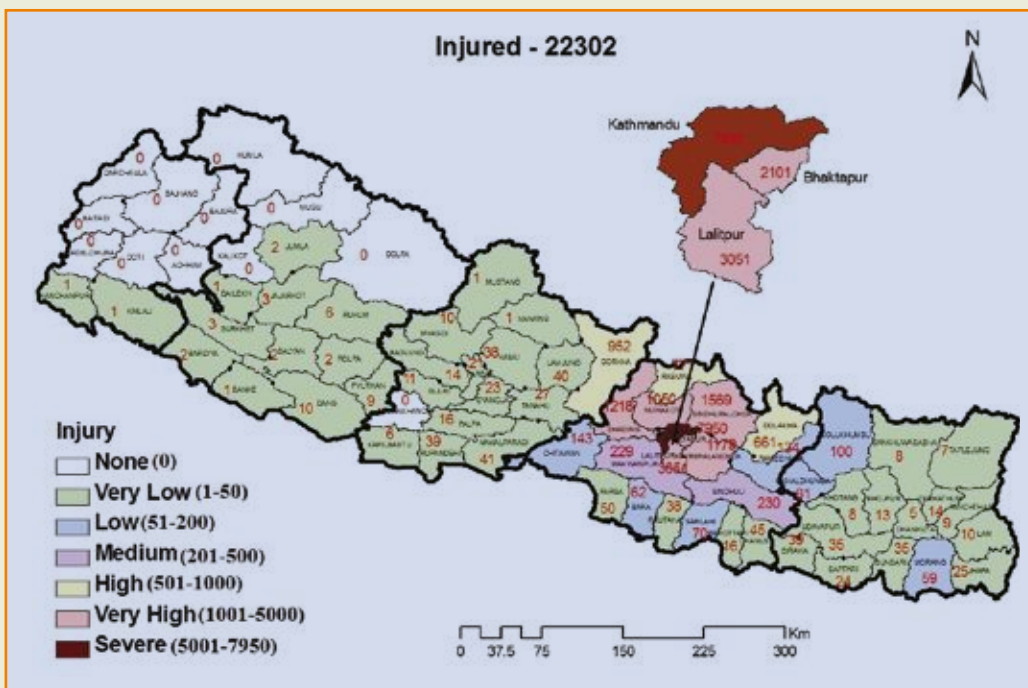
**Human Deaths Due to Gorkha Earthquake**



Source: Ministry of Home Affairs, the Government of Nepal

Map 4

Injuries Due to Gorkha Earthquake



Source: Ministry of Home Affairs, the Government of Nepal

Please see the following Map 3 which shows the number of people dead by earthquake in various districts. A total number of 8,896 people were killed from the earthquake.

This earthquake occurred in a geological collision zone, where the Indian tectonic plate pushes north into the Eurasian plate, moving the ground an average of 2 cm a year. Over decades, stress built up along a stretch of the faultline, which is called the Main Himalayan Thrust (MHT) fault, close to Nepal’s capital Kathmandu. In this area, the boundary between the two plates had become locked-stuck together by friction and so immobile-building up energy that only a major earthquake could release.

It is estimated that the total value of disaster effects (damages and losses) caused by the earthquake is NPR 706 billion or its

equivalent of US\$ 7 billion. Of that amount, NPR 517 billion (or 76 percent of the total effects) represents the value of destroyed physical assets, and NPR 189 billion (24 percent of the total effects) reflects the losses and higher costs of production of goods and services arising from the disaster. These estimates are based on the aggregation of information and data collected across sectors of social and economic activity and checked to avoid duplication of numbers. (Source: PDNA Report 2015, NPC). The map 4 below shows the number of injured people in various districts due to the earthquake on 12 and 25 April 2015. A total number of 22,302 people were injured in the earthquake.

On 26 April 2015, the Government of Nepal declared the 14 districts as catastrophic area and appealed for international



Photo: Kathmandu Durbar Square, a Cultural Heritage Damaged by Gorkha Earthquake

humanitarian assistance including search and rescue.

On 12 May 2015 at 12:50 local time another strong aftershock measuring 6.8 magnitudes

struck with the epicentre in Sunkhani of Dolkha district. The epicentre was 76 km northeast of Kathmandu. This area was already affected by the 25 April quake. The initial quake was followed by several aftershocks including



A Rural House Damaged by Gorkha Earthquake

Photo: B. N. Upreti



Photo: Dharahara (Icon of Kathmandu)—before & after the earthquake

a 5.6 magnitude. This quake of 12 May 2015 toppled already weakened buildings, triggered a series of landslides, which further hampered relief efforts. This quake alone killed more than 100 people.

According to the Department of Survey, the Government of Nepal, the movement of tectonic plates that triggered massive earthquake in the country on April 25 caused the altitude of Kathmandu Valley



Photo: Security Forces Clearing the Debris form Damaged Patan Durbar Square



Photo: Meen Chhetri

Cash Assistance Given to the Victims of Gorkha Earthquake by Social Workers

to increase by 80 centimetres. More than 400 aftershocks with Local magnitude  $\geq 4$  have been recorded till early October 2015.

Please see Table 2 below for detail data of the losses from the Gorkha Earthquake:

**Table 2: Losses Due to the Gorkha Earthquake**

Particulars	Nos./Amount
Persons dead	8,896
Missing	198
Injured	22,302
Affected Families	8,86,456
Displaced Families	6,49,815*
Houses Damaged (Fully)	6,04,930
Houses Damaged (Partially)	2,88,856
Total Material Loss	NPRs. 706 billion US\$ 7 billion#

Source: Ministry of Home Affairs; \*Situation Report of NRCS & #PNDA Report, NPC, the Government of Nepal

Mostly, old, non-engineered, adobe and masonry buildings collapsed and/or were severely damaged by the earthquake. In addition, some engineered buildings also damaged or collapsed due to poor workmanship and quality of construction materials.

The Gorkha Earthquake 2015 will have a long-term effect on Nepal's economy and development efforts for several years. The agriculture, industry, tourism and service sectors have been badly affected. This is a major set-back to Nepal's socio-economic condition. It will take many years to revive.

The map 5 denotes the total number houses that were completely damaged by the 12 and 25 April 2015 Gorkha Earthquake in various parts of the country.

#### 1.3.11.1 Response

Immediately after the earthquake, although there was chaos, confusion and distress -- National Emergency Operation Centre (NEOC) at the Ministry of Home Affairs

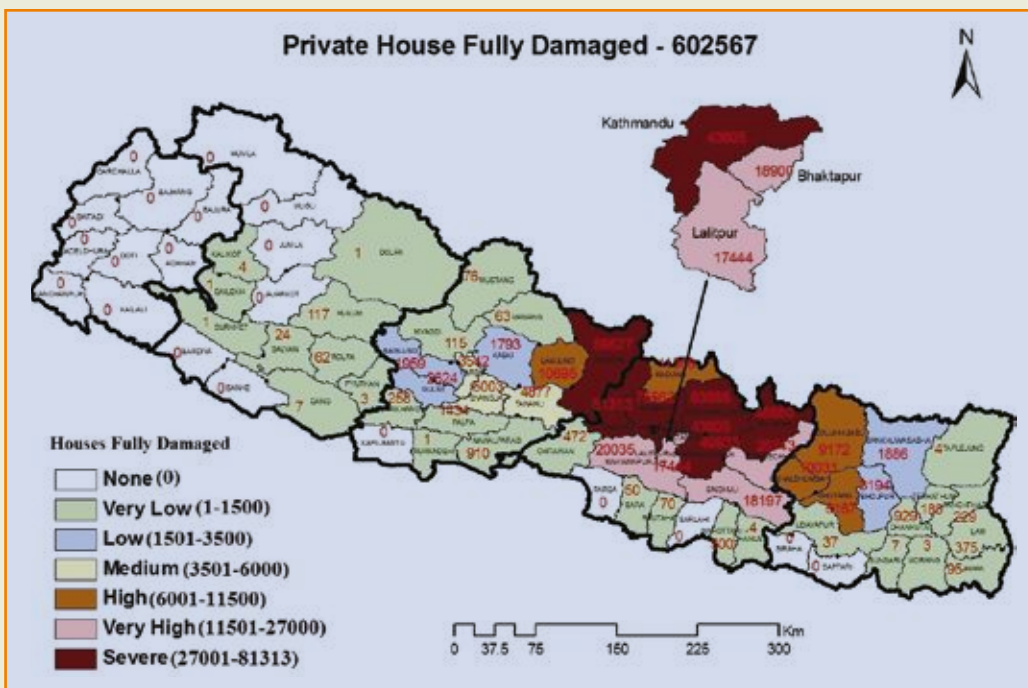


Photo: eKantipur



Photo: Displacd Persons in Temporary Shelter in Sindupalchok

Map 5



Source: Ministry of Home Affairs, the Government of Nepal

was activated at level-IV by following the National Disaster Response Framework, 2014 and Standard Operating Procedure (SoP). Soon after the quake the Prime Minister, Home Minister, other Ministers, Chief Secretary, Secretaries, high level officials and the Chief of security forces were present at the NEOC. Within two hours, the CNDRC meeting was held and made necessary decisions for immediate relief and response. Soon after, the cabinet meeting endorsed the decisions of CNDRC including declaration of catastrophic area and appealed for international assistance. Central Command Post was established under the leadership of Home Secretary. Security forces were mobilized immediately for Search and Rescue (SAR) operation with heavy equipment and helicopters. Helicopters were used in remote areas for SAR operation from Nepal Army, SAR teams from India, China, U.S.A. and private sector. Altogether 66,069 Nepal Army personnel, 41,776 Nepal Police, 24,775 Armed Police Force and 22,500 Civil Servants were mobilized for response. In total 7,606 people were rescued by 4,299 flights of Nepal Army, foreign and private sector helicopters. A total of 12,295 people were rescued by air lift and land routes. (1 month report of MoHA on 26 May 2015)

A number of volunteer groups, local people, youths, civil societies, media and political parties provided significant assistance to the affected people during the response.

Several International and local NGOs, Red Cross and Red Crescent Societies and United Nations Organizations supported from the beginning of the response. There has also been a considerable amount of aid distributed by various social organizations, private and corporates. This includes skilled technical personnel such as doctors, nurses, engineers as well as unskilled personnel and in-kind contributions.

Despite the lack of sufficient search and rescue equipment and resources, security forces played a significant role in search and rescue and relief works.

#### 1.3.11.1.2 Challenges and Gaps

It still takes some more time to assess the sectorial impacts and psychosocial consequences of the 2015 Gorkha Earthquake. The nightmare and traumatic situation inflicted by the disaster upon many people particularly among the children and adolescents are still there and may remain for a prolonged time. On the other hand, there will be several issues in the short, medium and long term recovery process at the aftermath of the disaster. There will be several other related issues, which needs to be addressed at different stages of the recovery process. This includes coordination; information; collaboration; volunteer management; temporary shelter; relocation versus in-situ reconstruction and people's resilience etc.

The following challenges and gaps were identified after the earthquake:

- (a) Search and Rescue (SAR) works carried out by the security personnel of Nepal and foreign SAR teams was commendable. But it was slow and inadequate while they failed to reach in due time in the remote, rural and hilly areas. Also it was not well-organized.
- (b) Delay and serious lapse in damage and need assessment was felt all the time. Although there was high number of international SAR team they could not contribute considerably as expected. There were 4,521 team members from 34 countries and they were able to save 16 lives with the help of Nepalese security personnel.

The cost incurred for the foreign team was quite huge. So it can be assessed that the return was quite low in comparison to the investment upon the foreign team.

- (c) Even after the response phase, some International Search and Rescue Teams remained unnecessarily for a prolonged time causing burden to the national response system.
- (d) Emergency warehouses, prepositioning of relief materials with proper inventory were also lacking.
- (e) Debris management was found as one of the big problem basically because of the lack of debris management equipment, tools and techniques.
- (f) Open spaces for temporary settlement of the displaced population were lacking.
- (g) Initially, there was a gap between the need of the affected people and delivery of services.
- (h) Weak database, absence of modern technology and lack of SAR equipment were other bottlenecks for response.

#### 1.3.11.1.3 Lessons Learnt

The biggest lesson Nepal learnt from this earthquake is that the threat of earthquakes will never end as Nepal is in seismically very active zone. The best way to be safe from earthquake hazards is to build earthquake resistant infrastructures. There should be no COMPROMISE in building earthquake resistant infrastructures. Hence, this is high time to Build Back Better (BBB) and ensure that existing structures and infrastructures are retrofitted to better standards.

It has also been realized that less attention was given to Disaster Risk Reduction (DRR) works in the past. It has been found that preparedness at all levels ranging from household to national levels was inadequate. Insufficient and poor implementation of legal instrument e.g. Building Code have also been identified as a factor for losses and damages. In a nutshell risk governance has been found weak. Not only the government, but also the NGO and INGOs were entangled with mounds of paper work (preparation of reports etc.) and discussions (seminars, workshops, interactions, meetings, visits etc.). Overall, less emphasis was given to actual hardware considerations. Resource constraints and managerial weaknesses were and are still there.

#### 1.3.11.1.4 Way Forward and Conclusions

Nepal faces an enormous challenge from major disasters like the devastating earthquake of 25 April 2015. Therefore, long-term and sustainable efforts are required to address the problems of earthquake hazards in Nepal. Although disaster management and risk reduction may be considered as additional burden in the light of competing demands for resources in a developing country like Nepal, this is high time for the government and other stakeholders to invest on considerable activity and resources into preparing for and responding to familiar and unexpected emergencies and disasters before the human and economic consequences of inaction are extensive, unmanageable and more expensive.

As the impacts will forever affect landscape, people, society, and livelihoods in Nepal – there is no choice but to adapt to hazards. Living not only with earthquakes, but also with many other hazards in daily life is the destiny of Nepalese people. Yet, the Nepalese and their neighbours and friends all over the globe, have to

reconcile themselves to the fact that tens of kilometres beneath where they live, the Indian and Eurasian plates will continue their tussle again and again. In that journey, they must build on the fundamental strengths they possess—social capital and community resilience. Despite a fragile government and post-conflict political instability, the presence of community-based institutions at sub-national levels they have maintained a social cohesion and played a constructive role in managing services like drinking water, electricity, forest and even developing

infrastructure such as trail bridges. As the Nepalese move forward, they must allow competing visions, strategies, institutional cultures, resources, and perspectives to be expressed and articulated as democratic deliberation. To rebuild Nepal, the government should call on experts inside and outside the country to engage in interdisciplinary collaboration. Non-governmental organizations, the private sector, experts, intellectuals and the media can contribute in the rebuilding and disaster-preparation efforts and working collaboratively and effectively.

# Chapter

# 2

## DRR Initiatives



Mitigative Measures in Karnali River

Photo: Deepak Paudel

## 2 DRR Initiatives

### 2.1 Introduction

Keeping in view the disaster vulnerability of the country, Nepal is in need of a well-structured DRR mechanism. To establish such mechanism, Nepal has to form and develop various structural and non-structural measures. Nepal has actively participated and contributed in various international DRR initiatives. Nepal is one of the active members of international DRR community and has followed the major decisions. In this chapter, the national and international DRR instruments as well as major legislative and institutional initiatives taken by Nepal to reduce the disaster vulnerability in the country will be briefly discussed.

#### 2.1.1 Hyogo Framework of Action (2005-2015)

Hyogo Framework for Action was adopted by 168 Governments in January 2005, at the World Conference on Disaster Reduction, held in Kobe, Hyogo, Japan. The HFA is a global blueprint for disaster risk reduction efforts during the period of 2005 to 2015 to make the world safer from natural hazards. Its goal is to substantially reduce disaster losses by 2015 - in lives, and in the social, economic, and environmental assets of communities and countries. The HFA is the first plan to explain, describe and detail the work that is required from all different sectors and actors to reduce disaster losses. It was developed and agreed on with the many partners needed to reduce disaster risk - governments, international agencies, disaster experts and many others - bringing them into a common system of coordination. The HFA outlines five priorities for action, and offers guiding principles and practical means for

achieving disaster resilience. Its goal is to substantially reduce disaster losses by 2015 by building the resilience of nations and communities to disasters. This means reducing loss of lives and social, economic, and environmental assets when hazards strike.

##### 2.1.1.1 Priorities for action

Drawing on the conclusions of the review of the Yokohama Strategy, and on the basis of deliberations at the World Conference on Disaster Reduction and especially the agreed expected outcome and strategic goals, the Conference has adopted the following five priorities for action:

1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation.
2. Identify, assess and monitor disaster risks and enhance early warning.
3. Use knowledge, innovation and education to build a culture of safety and resilience at all levels.
4. Reduce the underlying risk factors.
5. Strengthen disaster preparedness for effective response at all levels.

In their approach to disaster risk reduction, States, regional and international organizations and other actors concerned should take into consideration the key activities listed under each of these five priorities and should implement them, as appropriate, to their own circumstances and capacities. (<http://www.unisdr.org>).

The Government of Nepal has adopted National Strategy for Disaster Risk Management (NSDRM), 2009 based on Hyogo Framework for Action. The NSDRM encompasses prevention, mitigation, preparedness, response and recovery.

### 2.1.2 Sendai Framework for Disaster Risk Reduction (2015-2030)

The Sendai Framework for Disaster Risk Reduction 2015-2030 was adopted by UN Member States on 18 March 2015 at the Third UN World Conference on Disaster Risk Reduction in Sendai City, Miyagi Prefecture, Japan. The Sendai Framework is the first major agreement of the post-2015 development agenda, with seven targets and four priorities for action. The Framework aims to achieve the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries over the next 15 years. As recommended by the Third UN World Conference on Disaster Risk Reduction, the UN General Assembly has established an open-ended intergovernmental expert working for the development of a set of possible indicators to measure global progress in the implementation of the Sendai Framework for Disaster Risk Reduction 2015–2030. The General Assembly has also tasked the working group with considering, as appropriate, the recommendations of the Scientific and Technical Advisory Group of the United Nations Office for Disaster Risk Reduction on the update of the publication entitled “2009 UNISDR Terminology on Disaster Risk Reduction.” (<http://www.preventionweb.net>)

The Sendai Framework has 7 Global Targets:

- (a) Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality rate in the decade 2020-2030 compared to the period 2005-2015.
- (b) Substantially reduce the number of affected people globally by 2030,

aiming to lower average global figure per 100,000 in the decade 2020 -2030 compared to the period 2005-2015.

- (c) Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.
- (d) Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030.
- (e) Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.
- (f) Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this Framework by 2030.
- (g) Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030.

#### 2.1.2.1 Priorities of Sendai Framework

##### Priority 1. Understanding disaster risk

Disaster risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment. Such knowledge can be used for risk assessment, prevention, mitigation, preparedness and response.

##### Priority 2. Strengthening disaster risk governance to manage disaster risk

Disaster risk governance at the national, regional and global levels is very important for prevention, mitigation, preparedness,

response, recovery, and rehabilitation. It fosters collaboration and partnership.

### **Priority 3. Investing in disaster risk reduction for resilience**

Public and private investment in disaster risk prevention and reduction through structural and non-structural measures are essential to enhance the economic, social, health and cultural resilience of persons, communities, countries and their assets, as well as the environment.

### **Priority 4. Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction**

The growth of disaster risk means there is a need to strengthen disaster preparedness for response, take action in anticipation of events, and ensure capacities are in place for effective response and recovery at all levels. The recovery, rehabilitation and reconstruction phase is a critical opportunity to build back better, including through integrating disaster risk reduction into development measures. (<http://www.unisdr.org>).

#### **2.1.3 Draft Disaster Management Bill and Policy of Nepal**

It was felt since the early 90s that Nepal needed a proactive disaster management Act and policy that covers the whole cycle of disaster management. The Bill and Policy were revised by the relevant government agencies since then. The Bill was forwarded to the legislative Parliament in April 2012. In the meantime, unfortunately the Constituent Assembly was dissolved on 27 May 2012. As a result, the Bill could not become an Act. Again the Bill was submitted to the Parliament in 2014. In the meantime, following the Gorkha Earthquake the Government felt necessity to take into account the lessons learnt from the devastating earthquake and the provision

of Federal Structure of new Constitution in the Disaster Management Bill.

#### **2.1.4 National Strategy for Disaster Risk Management in Nepal**

The National Strategy for Disaster Risk Management in Nepal (NSDRMN) has been approved by the government in 2009. NSDRMN aims to achieve the goal of disaster resilient Nepal by providing guidance for improving the policy and legal environment and by prioritizing the strategic interventions. It also envisages to put forth suggestions for the institutional reorganization and development, and strategic improvement in the existing policy and legal environment for creating an enabling environment for encouraging disaster risk reduction (DRR) and preparedness planning at all levels as well as for mainstreaming DRR strategies into the national development and poverty reduction agenda. It can be taken as a commitment of the Government of Nepal to reflect the paradigm shift towards protection and safeguarding the human lives, properties, development investments, cultural heritage as well as to mitigate the disasters by improving the quality of life of the people.

As stated in earlier section, National Strategy for Disaster Risk Management (NSDRM) has been developed based on the HFA in consultation with the relevant stakeholders across all levels. The Hyogo Framework for Action 2005-2015 (HFA) was made not only because it recommends what every country should do for disaster reduction, but also because Government of Nepal had taken part in developing this framework and has made commitments to implement it. Hence, streamlining the National Strategy in line with the HFA was regarded as the most important approach to be adopted. The strategy is based on the ground realities



and identified needs of Nepal. It has tried to capture the opportunities of Disaster Risk Management (DRM) in Nepal in line with the current international understanding, scientific progress and regional initiatives. The strategy is expected to provide the road map for all sectors to prepare sector specific programs for DRM and formulate the necessary policy decisions for facilitating mainstreaming DRM into the development process. The strategy has identified 29 cross-sectoral priority strategic actions and several sectoral activities for DRM. The cross-sectoral strategies are based on gaps and issues identified and are focused on addressing the identified gaps in particular sectors. They are divided into the five HFA priority areas for Action.

### **2.1.5 National Building Code (NBC)**

The Department of Urban Development and Building Construction (DUDBC) formulated and implemented Nepal National Building Code (NBC) in 1993. The Building Act, Building Regulations and the Building Code outline the building construction legal obligations to be followed by the builders or owners through the local government. The salient features of National Building Code are building permit system, establishment of peer review, monitoring, certification of construction practices and implementation of land use planning measures.

### **2.1.6 National Disaster Response Framework (NDRF)**

The National Disaster Response Framework (NDRF) has been prepared for the effective coordination and implementation of disaster preparedness and response activities by developing a National Disaster Response Plan that clarifies the role and responsibilities of

the government and non-government agencies involved in disaster risk management in Nepal. The main purpose of this framework is to develop a clear, concise and comprehensive national disaster response framework for Nepal that can guide a more effective and coordinated national response in case of a large scale disaster. The national disaster response plan includes actions to be taken before, during and after the disasters.

### **2.1.7 National Adaptation Plan of Action (NAPA)**

The National Adaptation Programme of Action (NAPA) represents the country's notable effort to assess and prioritize immediate and urgent needs to address climate change risks through a broad consultative process. The cabinet approved the NAPA on 28 September 2010. According to NAPA, the effects of climate change have been observed, while some parts of Nepal show increasing erratic and intense rains, and such climatic trends combined with fragile topography, deforestation and eroded soils are leading to landslides and flash flood hazards. It has also been projected that rainfall intensity will increase across many areas of Nepal due to climate change and, therefore, vulnerable communities will have to increase their adaptive capacity to cope with climatic hazards. These hazards would also affect the availability of water resources particularly for household use and therefore water supplies need to be managed so they are climate proof. The major impacts of climate change in Nepal are: increased glacier-lake outburst flood (GLOF) hazards, increased variability of river runoff, increased sediments, increased evaporation from reservoirs and impacts on watershed. As a result glacier melt and precipitation patterns would occur. Nepal has wide variety of species. Obviously climate change will affect

agriculture. Majority of the people of Nepal depend on agricultural crops like rice, maize and wheat. Higher temperatures, increased evapo-transpiration and decreased winter precipitation may result into droughts. It should be considered as an early warning for food security.

### 2.1.8 Local Adaptation Plan of Action (LAPA)

Apart from the National Adaptation Programme of Action (NAPA) the government has also prepared Local Adaptation Plan for Action (LAPA). LAPA provides guidelines for the disbursement of at least 80 per cent of adaptation funds on the implementation at the local level. To support implementation, the Government of Nepal has developed a national framework for LAPA, which aims to make adaptation planning a bottom-up, inclusive, responsive and flexible processes that will identify the most climate vulnerable people and allow them to make informed decisions on priority adaptation actions. It provides an opportunity for undertaking developmental activities that are climate resilient with strong co-benefits for poverty reduction. The integration of local level Climate and Energy Plans with the LAPA could facilitate some triple-wins and produce low carbon climate resilient development (LCCRD). However, the biggest challenge to achieving these aims will be the quality of governance at all stages.

### 2.1.9 Local Disaster Risk Management Planning (LDRMP) Guideline, 2011

Keeping in view the need to develop disaster risk management from the central

to local level and mainstream it with development plan, policy and programmes at all levels, and also in order to ensure the notion of sustainable development, the “Local Disaster Risk Management Planning Guideline, 2068” has been approved and put into effect. This was also done bearing in mind the main spirit and thrust of the National Strategy for Disaster Risk Management (NSDRM), 2009 and to make disaster management participatory, transparent, accountable, inclusive and responsible by optimally mobilizing local resources and capabilities, and by ascertaining the access and ownership of all affected communities and people.

### 2.1.10 Disaster Preparedness and Response Plan (DPRP)

The national workshop on DRR in 2010 recommended 21 points which was approved by the Central Natural Disaster Relief Committee (CNDRC) for an effective disaster preparedness initiative at district, regional and national levels. One of the recommendations was to create District Lead Support Agencies (DLSA) in 75 districts among the national and international agencies to support DDRC for preparing District Disaster Preparedness and Response Plan. It resulted into very positive feedbacks from all the DRR actors. As a result, so far, almost all districts have the DPRP. However, the implementation of the DPRP has many limitations. Particular problems are dearth of resources.

### 2.1.11 Nepal Risk Reduction Consortium (NRRC)

In 2009, the NRRC<sup>1</sup> was created to bring together lead actors from the government, major donors, UN agencies, the Red Cross, INGOs and NGOs to reduce Nepal's

<sup>1</sup> <http://un.org.np/coordinationmechanism/nrrc>. NRRC started in 2009. Nine characteristics have been defined to describe the essential components for resilient communities along with indicators for monitoring progress

vulnerability to disasters through the work of 5 flagship priorities for sustainable disaster risk management. The total budget for five flagship programs is 146.8 million USD.

Under the leadership of MoHA and other ministries, a consortium was initially formed consisting of the Asian Development Bank (ADB), the International Federation of the Red Cross and Red Crescent Societies (IFRC), United Nations Development Programme (UNDP), UN Office for the Coordination of Humanitarian Affairs (OCHA), UN International Strategy for Disaster Reduction (ISDR) and the World Bank. The NRRC consists of 21-member organizations including 13 Ministries of the Government of Nepal (GoN). The Home Secretary is the Chair of NRRC Steering Committee. The Embassy of Japan and the Embassy of India joined the NRRC in 2012 as the observer. NRRC has identified 5 Flagship areas for sustainable disaster risk management.

The five Flagship areas are as following:

- (a) School and hospital safety
- (b) Emergency preparedness and response capacity
- (c) Flood management in the Koshi River basin
- (d) Integrated community-based risk reduction
- (e) Policy/institutional support for disaster risk management

For each area, the lead role has been assigned to a government ministry while an international agency is designated as coordinator to support the concerned government lead. The Flagships are organised around specific functional areas of risk reduction, preparedness, and capacity building in DRR. They cover a range of DRR-related governance reforms, structural and non-structural mitigation

measures, significant enhancement in preparedness and response capacities across government and international humanitarian actors for a major disasters, and enhancement of response and early warning capacities at community level.

#### 2.1.11.1 Key Achievements of the Flagship Program:

While the original targets of the NRRC flagship programs may not be achieved due to their ambition nature, there have been several key milestones that have been reached to strengthen disaster risk management in Nepal. These include:

- ✓ Ministry of Education led retrofitting of over 360 school buildings (against 900 targeted) in Kathmandu Valley, and the development of a Master Strategy that provides a roadmap in ensuring all schools in Nepal are earthquake safe.
- ✓ Ministry of Health led assessments of over sixty – 50 bed - hospitals in Nepal, twenty of which were then surveyed in more detail for structural, non-structural, and crisis functionality, with a final ten now being agreed for design and presentation to donors.
- ✓ Ministry of Home Affairs and Ministry of Urban Development led allotment and preparation of 83 open spaces for emergency response in the Kathmandu Valley. These medium to large spaces proved to be key points in the Kathmandu Valley for effective response to emergency.
- ✓ Ministry of Home Affairs led establishment of a Search and Rescue Secretariat incorporating all security forces and other relevant line Ministries. The Secretariat supported the development of a 15-year plan of action to ensure adequate medium and light search and rescue capacity in the security forces and connectivity

to community search and rescue. The plan for scale up is based upon capacity that already exists within Nepal.

- ✓ Ministry of Federal Affairs and Local Development has led a mass programme on community based disaster risk management which has reached over 650 (against 1000 targeted) communities and cities across Nepal in a harmonised approach under nine commonly agreed disaster resilience characteristics.
- ✓ Ministry of Urban Development has led the agreement of a national plan of action for safer buildings which will offer a broad framework in ensuring all new buildings in Nepal are built to earthquake safe standards.
- ✓ The Ministry of Home Affairs has led nationwide agreement amongst actors on common messages for public awareness to ensure coordinated and effective communications with communities.
- ✓ Focusing on Community Based DRR across the country, has set an ambitious target of building the awareness, leadership and capacity of the 1,000 most vulnerable VDCs by 2015 which at this point of time does not seem feasible. However, according to the government data nearly 50% VDCs have been made disaster resilient so far.
- ✓ Among the five flagship programs, flagship 2 (emergency preparedness and response capacity) has progressed well, flagship 3 has least progress and flagship 4 ,1 and 5 has been found satisfactory.

#### 2.1.11.2 Major Challenges of the 5 Flagship Programs

Despite the above accomplishments, info-sharing and coordination through

flagships is still an issue. More importantly, the committed fund from the donor community has not been available in due time as per their commitment. A total amount of 146 million dollars was committed from the bi-lateral and multi-lateral agencies for the five flagship programs. Now, at this point of time, it is almost impossible to get the committed amount from the donor communities and achieve the goal of five flagship programs, while the specified period of the Flagship programs is going to end by the year 2015. It seems that there is a need for greater advocacy amongst NRRC partners to communicate the issues to push critical areas forward.

#### 2.1.12 National Emergency Operation Centre (NEOC)

The National Emergency Operations Centre (NEOC) started on the 17 December 2010, by the Minister of Home Affairs and is operated under the Disaster Management Division. The objectives of the NEOC are to work as a coordination and communication point for disaster information across the country, including government agencies and other response and recovery stakeholders such as Nepal Red Cross Society, UN agencies, INGOS and NGOs.

The NEOC is a pre-fabricated building situated in the premises of the Ministry of Home Affairs in Singha Durbar. The building is earthquake resistant. It is completely self-contained, including multiple back up power supplies. The NEOC's working time is round the o'clock to collect information. As part of MoHA's strategy to further develop Nepal's emergency preparedness and response capacity, it is planning to establish district emergency operation centres (DEOCs) in all 75 districts in three phases. Till now, in 46 DEOC have already been established.

### 2.1.13 Additional Initiatives

In addition to the above, few more noteworthy achievements in disaster management activities in the country include formulation and implementation of Building Codes in Lalitpur, Kathmandu and Dharan municipal area; functioning of the Sectoral Working Groups in Food and Agriculture, Health and Logistics; implementation of separate Emergency Preparedness and Disaster Response Plans in Health, Agriculture and hospital sectors. Also, almost all districts have now developed District Disaster Preparedness and Response Plans in all districts. Department of Water Induced Disaster Prevention (DWIDP), Department of Hydrology and Meteorology (DHM), Department of Mines and Geology (DMG), Department of Soil Conservation and Watershed Management (DSCWM) has prepared different types of hazard maps in various districts.

The Department of Mines and Geology (DMG) established 21 micro-seismic stations to record the magnitude of the earthquake in Nepal. Optimum Seismic Monitoring System is also established in the National Seismological Centre (NSC) which is linked with the National Emergency Operation Centre (NEOC). Department of Hydrology and Meteorology (DHM) have developed flood and weather in real time forecasting system which is also linked with NEOC.

### 2.1.14 National Platform for DRR

National Platform for Disaster Risk Reduction is a national mechanism for coordination and policy guidance on disaster risk reduction that is multi-sectoral and inter-disciplinary in nature, which includes representatives from all stakeholders involved, such as government, international organizations, NGOs, academic institutions, the private sector and the media. National Platform for DRR in Nepal was established in 2009.

The Home Secretary is the Chairperson of Nepal's National Platform for DRR. DPNet-Nepal is providing secretarial services to the Platform. All NGOs, INGOs, UN agencies, media and private sector of Nepal that are working in the field of DRR are the member in this Platform. The National Platform for DRR in Nepal has carried out several activities such as: sharing of best practices and lessons learnt from past disasters, consultation and sharing of HFA progress and discussion and feedback to the government on Disaster Management Bill. The Platform is developing the national framework based on the Guiding Principles of Sendai Framework.

## 2.2 Gaps in Policy, Program and Practice

There are two aspects of disaster mainstreaming, one is integrating DRR in all sectoral development plans and another is mainstreaming in district and local development plan. Sectoral development covers the specific thematic areas while local development addresses the community development including basic needs of thematic/sectoral area. The local development unit i.e. Village Development Committee (VDC) has different policies and guidelines regulated through its own governing line ministries and simultaneously it would also look after guidelines of other sectoral ministries. Each guideline and policies are prepared prioritizing its own priority development issues along with showing scope of integrating disaster risk reduction. Due to the provisions made in policies and guideline of different line ministries, different development plans like local development plan, local Disaster Risk Reduction Plan (LDRMP), Pilot Program on Climate Resilience (PPCR), Climate Change Adaptation Plan for Action (CAPA), Local Adaptation Plan for Action (LAPA), School Improvement Plan (SIP) and others

there being operationalized in VDC. This has created difficulties in implementation with actual sense of DRR mainstreaming which simultaneously requires additional resources. On the other hand, research and development is hampered owing to the lack of adequate funding, qualified staff, equipment, and the gap in coordination.

Adequate coordination among the various organizations related to disaster management combined with technological gaps and limited resources compound the problem of inadequate preparedness against the impending disasters. Thus there is clear need of harmonizing the existing policies with developing a common operational approach with integrating sectoral plans so that it would give synergic result in risk reduction and sustainable development. What is now required is the political commitment to this end and decisive action on the part of the government, so that disaster reduction becomes a part and parcel of government policies.

### 2.3 Way Forward

In view of the above scenario, Nepal faces the challenges of wide variety of disasters. Some are recurrent like flood and landslide and others are intensive like earthquakes. Nepal also needs to build institutions and local capacity to minimize the impact of disasters. For any given disaster risk reduction activity to succeed, specific risks need to be targeted. Success in responses to disaster depends on factors including access to safe drinking water, reliable communication, transport and mobility, access to finances, social support, and risk minimizing strategies. Government agencies at national and local levels must coordinate the support they provide to help the affected rebuild their lives. Equally important is that agencies

evaluate and learn from the success of specific interventions, especially given the complications raised by climate change. The government cannot act alone: disaster risk reduction strategies need to be developed and maintained through private and community based approaches.

The national institutional mechanism need to be able to trigger and support the process of DRR, decentralize the responsibility, involve and engage all stakeholders and coordinate the actions nationally at all levels – from the community to the level of the national government. At the same time, the new structure should have the authority as well as the capacity to integrate DRR into the national governance and development efforts and force/facilitate program-level synergy and coordination. Considering these facts, and also based upon the lesson-based institutional restructuring implemented recently by neighbouring countries and to be able to develop compatible structure for being able to play active role in the SAARC level initiatives in DRM – Nepal needs a resourceful and authoritative institution for disaster risk management. The long awaited Disaster Management system should commensurate with the following components:

- A standardized approach to incident/crisis management that is scalable and flexible;
- Well-organized cooperation and interoperability among responders;
- Inclusive multi-hazards preparedness at all levels;
- Efficient resource coordination among the stakeholders and authorities;
- Integration of best practices and lessons learned for continuous improvement.

It is to be noted that without a proactive disaster management policy and other legal framework the above goals cannot be achieved. At the same time, all agencies (central, regional, district and local) and other government and Non-government Organizations (NGOs) should perform in a collaborative way in the field of DRR. Disaster management should be factored into policies, planning and programming related to sustainable development with clearly delineated responsibilities of government organization, NGOs, community and private sector. Risk assessment should also be made compulsory while formulating development programs. Although, at present most of the districts have prepared district level DRR plans and programs, every district should develop a comprehensive disaster management policy, supported by appropriate legislations and institutions.

At this time, the government of Nepal has the great challenge to rehabilitate the affected population of the Gorkha Earthquake and reconstruct the damaged infrastructures by the quake. The earthquake has given the message of the need of the enhancement in search and rescue capabilities. The earthquake has also indicated the need of prepositioning of relief materials. More importantly, the earthquake has pointed the need of the effective implementation of building code. Further, the government and other stakeholders of DRR have to incorporate in their future programs the four priority areas set-forth by Sendai Framework of action. At the same time, now onwards DRR plans needs to be compatible with the new Constitution of Nepal.

## 2.4 Conclusions

Keeping in view the current disaster trends in Nepal, recognition of the importance of reducing disaster risk and building resilience with a goal against which efforts could be measured must be a major contribution to meeting the challenges to be faced with sustainable development. More importantly, in order to mainstream DRR into development planning, the government and research institutions should encourage the DRR specialists. Moreover, closer integration of DRR and poverty reduction should be the part and parcel of the wider goal of mainstreaming DRR into development.

## 2.5 Key Messages

1. Focus towards cost effective DRR
2. Build aware, prepared and empowered community
3. Build trained, equipped and connected state disaster response force
4. Enhance cooperation among DRR stakeholders
5. Adopt sustainable development by recognizing the interrelationship between disaster and development
6. Learn lessons from huge disasters such as: 2015 Gorkha Earthquake and Build Back Better (BBB)
7. Maintain DRR momentum after the immediate disaster response





# Chapter 3

## Data, Facts and Figures: 2013 and 2014



Agony and Distress

Photo: Meen Chhetri

## 3 Data, Facts and Figures: 2013 and 2014

### 3.1 Introduction

In this chapter the data of human lives and property losses that occurred in the year 2013 and 2014 will be presented and analyzed. As in the past, in the year 2013 and 2014, Nepal witnessed an overall increase of the disasters – particularly floods and landslides were the most lethal disasters in various parts of the country. The floods and landslides that occurred in 2013 in Far Western Region mainly in Darchula district and the floods and landslides in 2014 in Mid-Western Region particularly in Banke, Bardia, Dang and Surkhet were the most frightening and devastating that caused enormous losses to human lives and physical properties.

Comparing the trends of average natural disasters vis-à-vis the type of disasters for

the years 2013– 2014 with those of the year 2011-2012 demonstrates that there has been a slight increase in the number of disasters and casualties for the year 2013-2014.

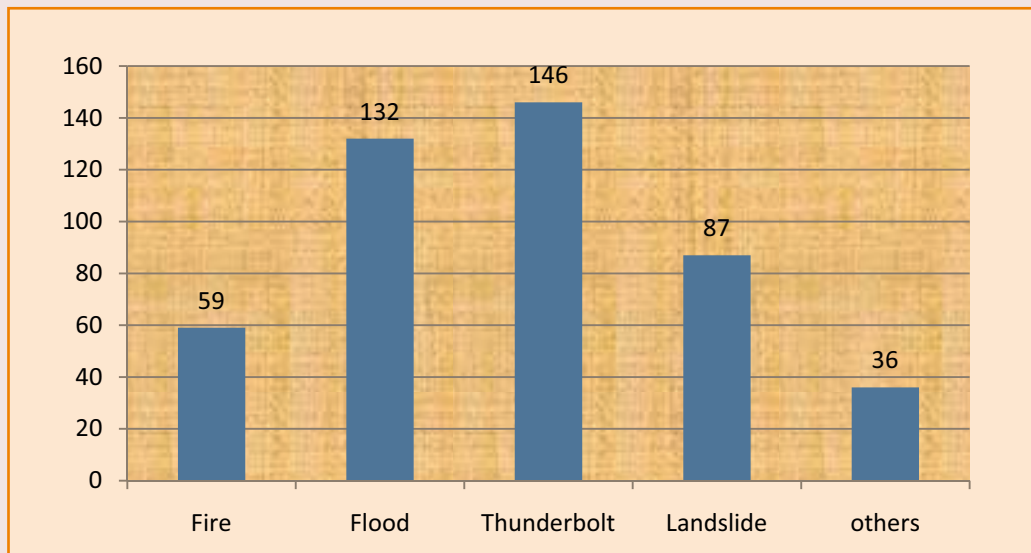
#### 3.1.1 Major Disasters in the Year 2013

In the year 2013, a landslide that occurred in Jumla, Badaki killed 8 persons. The floods and landslides of 17 June killed 1 person in Khalanga, Darchula affecting 317 families. The landslide of 18 June that occurred in Dailelekh, Malika took the lives of 8 people and affected 114 families. The fire of 13 April affected 172 families of Parsa, Dhore. Another fire disaster that took place on 17 April in Bardia, Balewa affected 250 families.

#### 3.1.2 Major Disasters in the Year 2014

In the year 2014, a massive landslide took place in Jure, Mankha -1 of Sindhupalchowk

Figure 1: Human Deaths by Disasters in 2013



Source: Ministry of Home Affairs

district. That landslide killed 33 people and 123 people have been missing. A total number of 478 families were affected from that unfortunate event. The floods and landslides of 13 and 14 August swept various parts of Banke and Bardia, Surkhet and Dang. This disaster killed 211 people and affected 35,989 families causing enormous loss to other physical properties. In such a way, floods and landslides accounted for a majority of the disasters in Nepal in 2014.

In the following section, disaster data of 2013 and 2014 have been presented using maps, tables and figures showing the total number of deaths, injuries, affected families, property damage, economic losses and other losses by various types of natural disasters. In addition to the separate presentation of the data of the year 2013 and 2014, an effort has also been made to compare and contrast the losses of the two years so as to enable the user of this report to clearly understand the trend of disasters in Nepal in these two years.

The summary sheet of disaster data from 1982 to 2014 has also been presented in the annexes for an overview of disaster losses since then. In annex 1, the loss of human lives due to natural disasters from 1972 to 1999 has been given in tabular form. In annex 2, human casualties due to natural disasters from 1972 to 1999 has been given in graphical form. In the same way, human deaths from natural disasters since 2000 to 2014 has been presented in tabular form in annex 3. In annex 4, major disasters that occurred in 2013 is shown in chronological order. Similarly, In annex 5, major disasters that occurred in 2014 is shown in chronological order.

Analysis of the loss and damage data by disasters since 1982 clearly shows that

the trend of human life loss and property damage is in increasing trend. This is basically due to inadequate preparedness. Various sources of information show that disaster management related government and non-government agencies have laid more emphasis on software (e.g. training, awareness raising, production of IEC materials, etc.) and less emphasis on hardware (e.g. construction of check dams, spurs, weirs, shelter, development of well-equipped early warning systems, etc.). So, the losses by disasters in Nepal have been found more than the world average. Large population in Nepal are badly affected by floods and landslides in different regions causing death of hundreds of people, inundating huge agriculture land, killing large number of cattle and damaging houses and other infrastructures. They also pose serious threat to economy and development. Human life loss and physical property damage was more severe by Gorkha Earthquake that shook the whole country on 25 April 2015.

### 3.2 Disaster Data Analysis of the year 2013

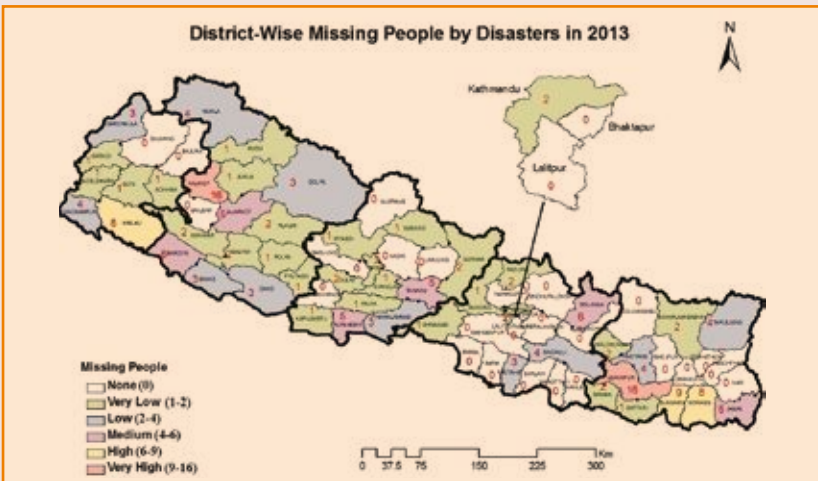
As depicted in map 6 and figure 1, the major disasters that occurred in the year 2013 were floods, landslides, fires, thunderbolts, etc. In this year thunderbolt claimed highest number of human deaths. A total of 146 people lost their lives due to thunderbolt in 2013 followed by the floods that claimed 132 lives. Landslide killed 87 people, fire killed 59 and various other disasters killed 36 people. Other disasters e.g. cold wave, epidemics, heat wave, air crash, boat capsize, windstorm, heavy rainfall, drowning, avalanches etc. killed 36 people. **In this way, a total of 460 people were killed by various types of natural disasters in the year 2013.**

Map 6



Source: Ministry of Home Affairs

Map 7



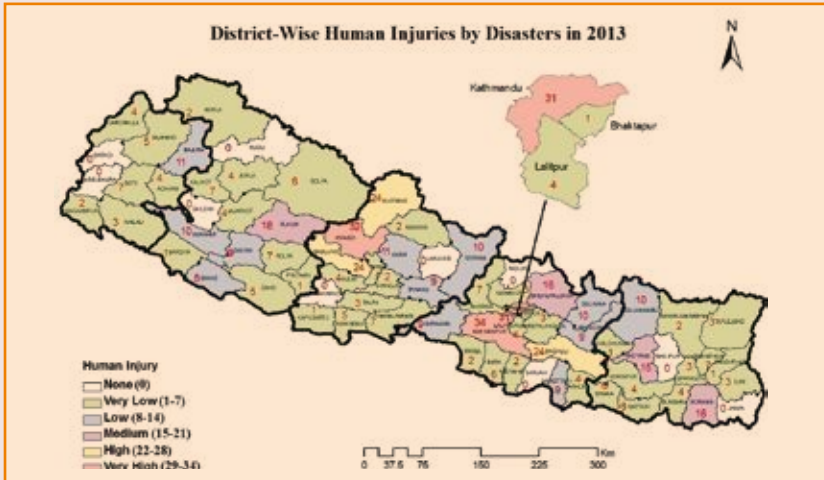
Source: Ministry of Home Affairs

The above map 6 clearly shows the number of human deaths in multi-color due to disasters in specific districts of Nepal in the year 2013. Out of 75 districts, 72 districts suffered the losses of human lives. Only three districts namely; Panchthar, Rasuwa and Dadeldhura were immune to human life losses by disasters. Jhapa, Saptari, Bara, Sindhuli, Kavrepalanchok, Ramechhap, Sindhupalchok, Makwanpur, Kathmandu, Nawalparasi, Rupandehi, Palpa, Dang, Dolpa, Jumla, Dailekh and Kailali districts

were the uppermost suffering districts bearing the loss of more than 10 people in each district.

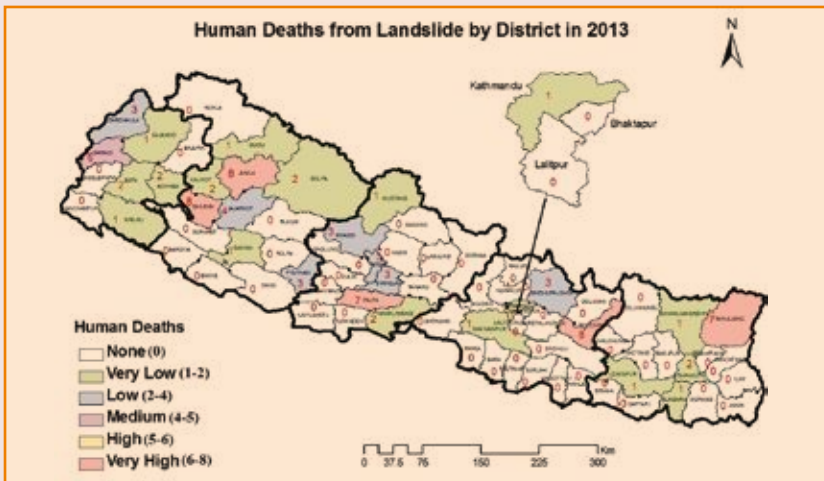
As shown in the above map 7, in the year 2013 a **total number of 165 people were recorded as missing due to disasters in various districts**. The highest number of missing people was in Udayapur and Kalikot districts having 16 missing people in each district. **These missing people can be considered as dead.**

Map 8



Source: Ministry of Home Affairs

Map 9

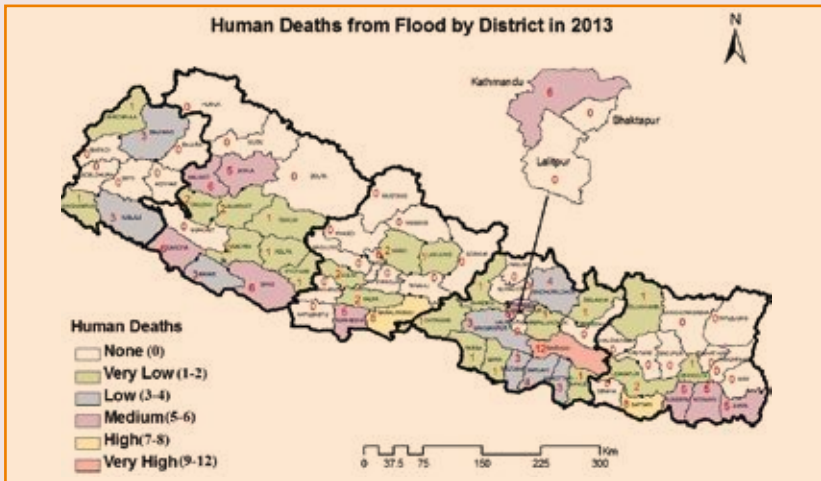


Source: Ministry of Home Affairs

The range of human injuries due to disasters in various districts has been shown in map 8 above. The highest number of injury occurred in Morang, Khotang, Solokhumbu, Dolakha, Sindhupalchok, Kathmandu, Makwanpur, Gorkha, Kaski, Baglung, Myagdi, Mustang, Rukum, Surkhet and Bajura where more than 10 and up to 34 people sustained injuries. The exact number of injured persons can be seen in each district in the above map. **In total 517 people sustained injury due to natural disasters in 2013 in the whole country.**

Human death toll due to landslides in the year 2013 is shown in map 9 above. In Taplejung 7, Dhankuta 2, Sankhuwasabha 1, Sunsari 1, Udayapur 1, Ramechhap 8, Sindhupalchok 3, Kathmandu 1, Makwanpur 1, Nawalparasi 2, Syangja 3, Parbat 3, Myagdi 3, Mustang 1, Palpa 7, Pyuthan 3, Salyan 1, Jajarkot 4, Dolpa 2, Dailekh 8, Kalikot 2, Jumla 8, Kailali 1, Achham 2, Mugu 1, Doti 2, Bajhang 1, Baitadi 5 and in Darchula 3 people lost their lives in various types of natural disasters. **The total number of deaths by landslide has been 87 in the year 2013.**

Map 10



Source: Ministry of Home Affairs

Map 11



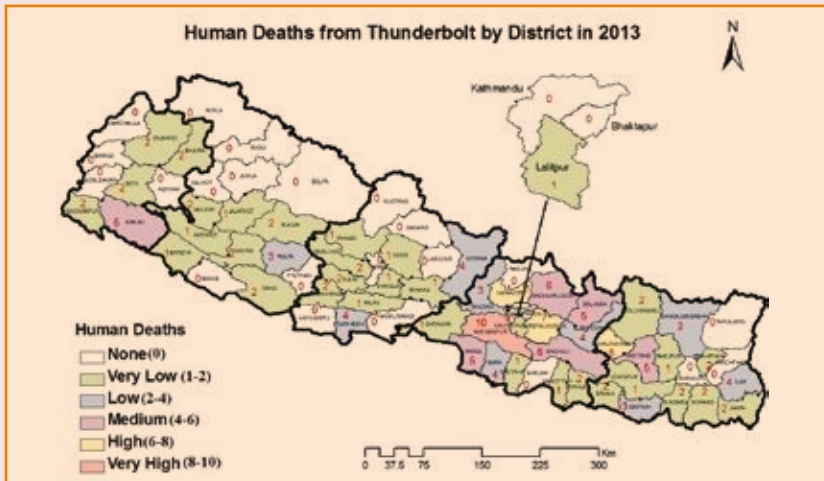
Source: Ministry of Home Affairs

As shown in the above map 10, in the year 2013 in Jahpa 5, Morang 5, Sunsari 5, Dhankuta 1, Saptari 8, Udayapur 2, Dhanusa 1, Sindhuli 12, Dolakha 1, Mahottari 3, Rautahat 3, Bara 1, Parsa 1, Makwanpur 3, Sindhupalchok 4, Kavrepalanchok 1, Kathmandu 6, Chitwan 1, Dhading 1, Nawalparasi 8, Lanjung 1, Rupandehi 5, Palpa 2, Kaski 2, Gulmi 2, Pyuthan 1, Dang 6, Rolpa 1, Rukum 1, Banke 3, Salyan 2, Bardiyaa 6, Jajarkot 2, Dailekh 2, Kalikot 6, Jumla 5, Kailali 3,

Kanchanpur 1, Bajhang 3 and in Darchula 1 people died due to floods. **The total death by floods in the year 2013 has been 132 persons.**

Human life losses due to fires in the year 2013 are depicted in map 11 above. The highest number of people were killed in Kathmandu being 6 followed by Rupandehi where 4 people lost their lives due to fires. In total 59 people died by the fire disaster in the year 2013.

Map 12



Source: Ministry of Home Affairs

Map 13



Source: Ministry of Home Affairs

In the year 2013, thunderbolts killed the highest number of people. Maximum number of people were killed in Makwanpur district 10, followed by Okhaldhunga 8 and Kavrepalanchok 7. Please see map 12 for details. **Altogether 146 people were killed by thunderbolts in the year 2013.**

According to the available data for the epidemics, in the year 2013 only **4 people died of epidemics** in Dolpa (please refer to the map 13 above). Data are not available for other remaining 74 districts. It denotes either there is the lapse in data or better health services have reduced the deaths by epidemics.

Figure 2

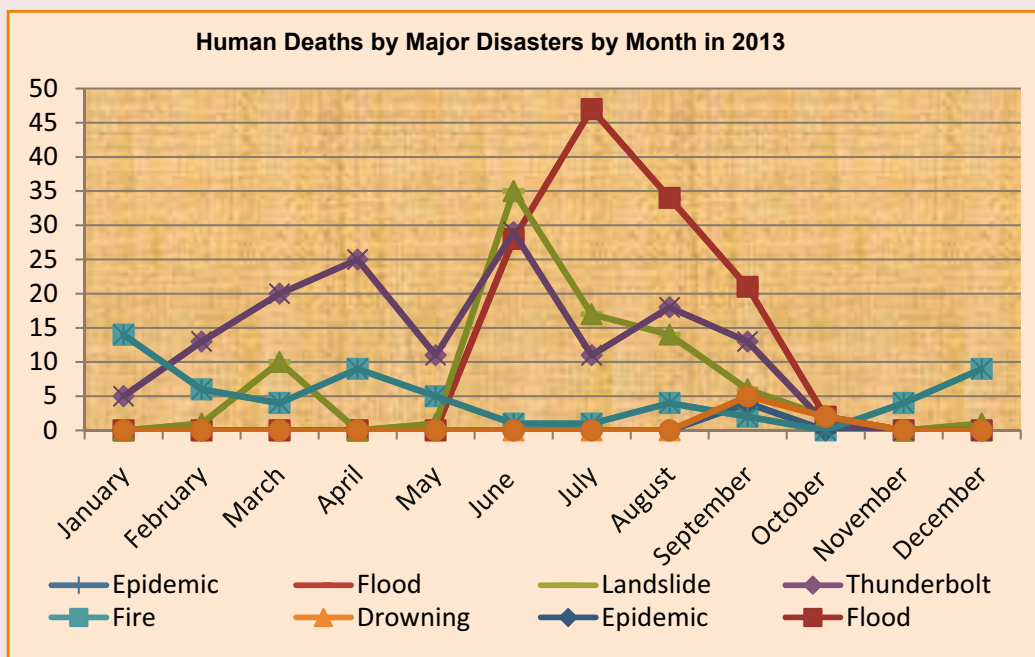


Table 3: Human Deaths by Major Disasters by Month in 2013

Months	Epidemic	Flood	Landslide	Thunderbolt	Fire	Drowning
January	0	0	0	5	14	0
February	0	0	1	13	6	0
March	0	0	10	20	4	0
April	0	0	0	25	9	0
May	0	0	1	11	5	0
June	0	28	35	29	1	0
July	0	47	17	11	1	0
August	0	34	14	18	4	0
September	4	21	6	13	2	5
October	0	2	2	1	0	2
November	0	0	0	0	4	0
December	0	0	1	0	9	0
<b>Total</b>	<b>4</b>	<b>132</b>	<b>87</b>	<b>146</b>	<b>59</b>	<b>7</b>

Source: Ministry of Home Affairs

Figure 2 and table 3 show the trend of human deaths by months in the year 2013 where we can find that most people were killed by flood and landslide between the months of June to September. Thunderbolt killed people from the month of January to October. Maximum people were killed by thunderbolt in the months of February, March, April, June, July, August and September. Fire caused human casualties mostly in the months of January, April, May, August, November and December. Due to drowning 5 people were killed in September and 2 were killed in October. A total of 4 people died of epidemic in September 2013.



Figure 3

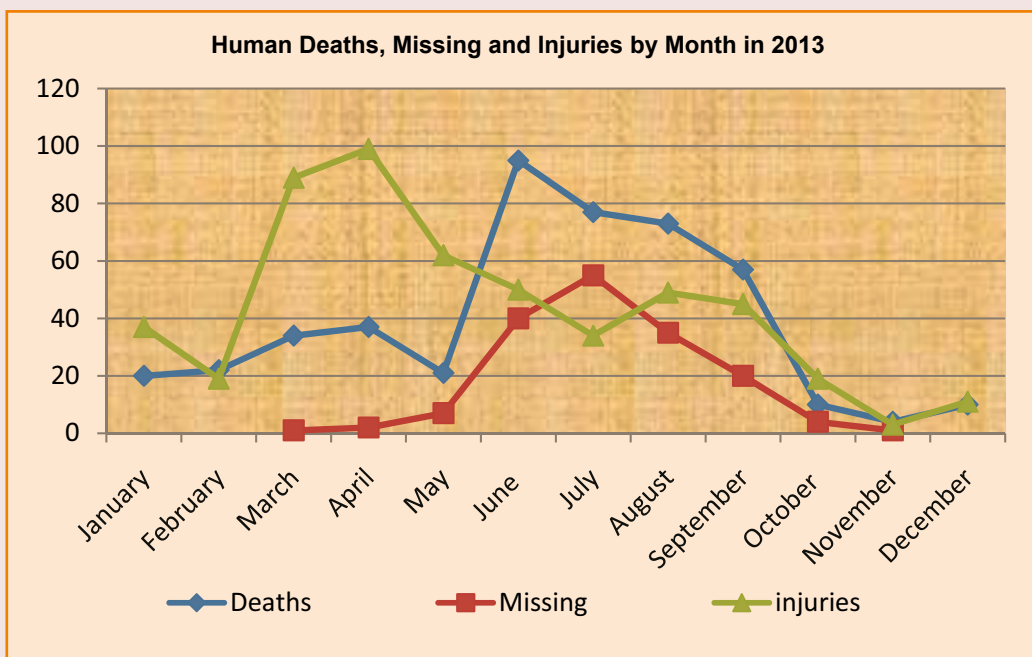


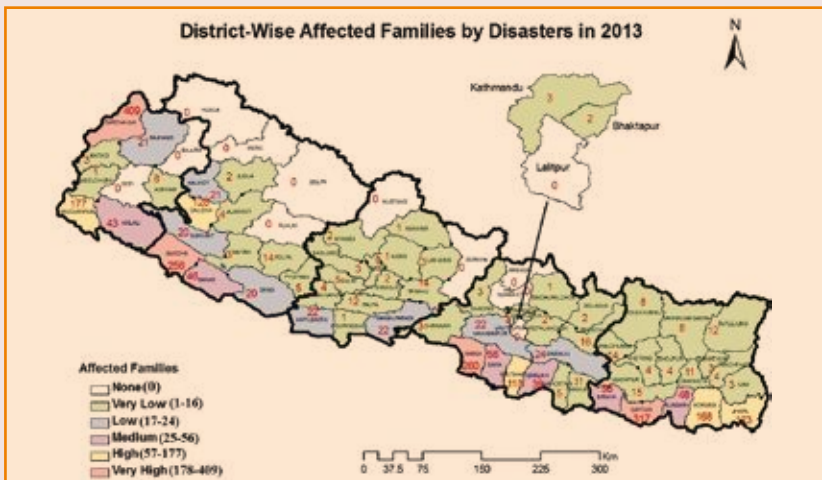
Table 4: Human Deaths, Missing and Injuries by Month in 2013

Months	Deaths	Missing	Injuries
January	20		37
February	22		19
March	34	1	89
April	37	2	99
May	21	7	62
June	95	40	50
July	77	55	34
August	73	35	49
September	57	20	45
October	10	4	19
November	4	1	3
December	10		11
<b>Total</b>	<b>460</b>	<b>165</b>	<b>517</b>

Source: Ministry of Home Affairs

Figure 3 and table 4 show the total deaths, missing and injuries in the year 2013 by various disasters. As we can see in the graph and the table above, most people were missing and killed between June and September. We can find more injuries between March and May.

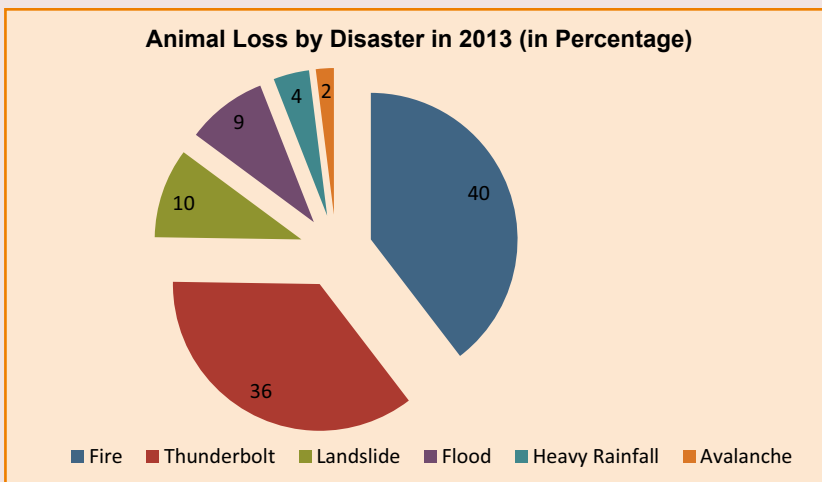
Map 14



Source: Ministry of Home Affairs

In map 14, we can see the number of affected families in each district in 2013 by disasters. The highest number of affected families in 2013 due to disasters was found in Jhapa, Morang, Saptari, Rautahat, Parsa, Bardia, Dailekh, Kanchanpur and Darchula where more than 100 families were affected by disasters. The highest number of affected families was found in Darchula followed by Saptari district. **A total of 2,697 families were affected by different disasters in the year 2013.**

Figure 4



Source: Ministry of Home Affairs

Figure 4 shows the percentage of animal killed due to various disasters in 2013. As shown in the figure, 40% animals were killed by fire followed by thunderbolt (36%), landslide (10%), flood (9%), heavy rainfall (4%) and avalanche (2%).

Figure 5

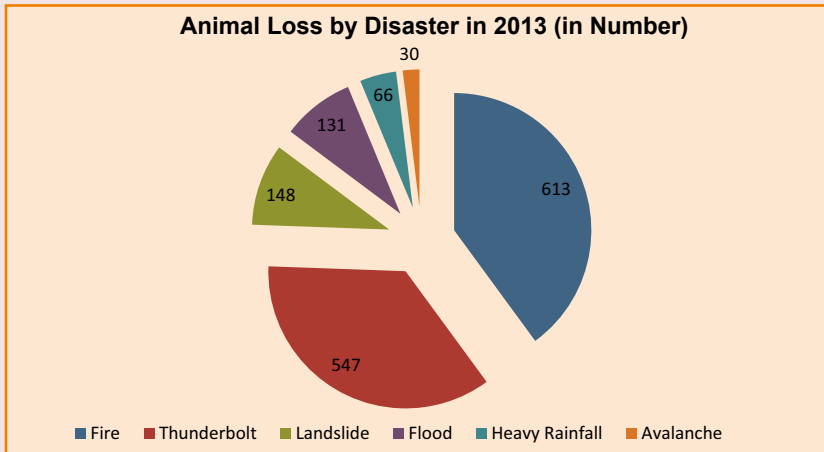


Figure 5 and table 5 show the total number of animals killed by various disasters. Fire killed 613, thunderbolt killed 547, landslide killed 148, flood killed 131, heavy rainfall killed 66 and avalanche killed 30 animals in the year 2013.

Table 5: Animal Loss by Disasters in 2013 (in Number and Percentage)

Disasters	Deaths (No.)	Deaths (%)
Fire	613	40
Thunderbolt	547	36
Landslide	148	10
Flood	131	9
Heavy Rainfall	66	4
Avalanche	30	2
<b>Total</b>	<b>100</b>	<b>1535</b>

Source: Ministry of Home Affairs

As shown in figure 6 and table 6, in 2013, fire destroyed 2689 houses and cattle sheds, flood destroyed 378, landslide destroyed 209, thunderbolt destroyed 68, earthquake destroyed 43 and windstorm destroyed 4 houses and cattle sheds.

Table 6: Houses and Cattle Sheds Damaged and Destroyed in 2013

Disaster	Number
Fire	2689
Heavy Rainfall	66
Landslide	209
Thunderbolt	68
Earthquake	43
Windstorm	4
Flood	378

Source: Ministry of Home Affairs

Figure 6

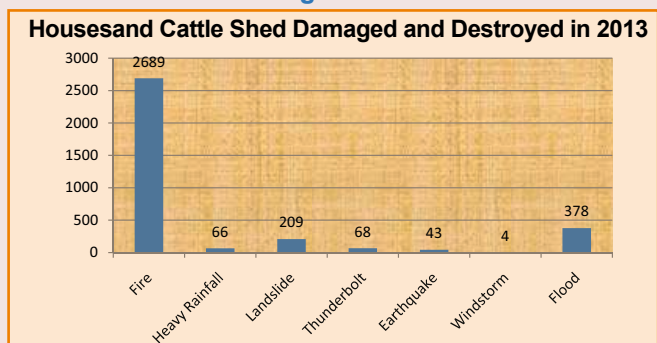
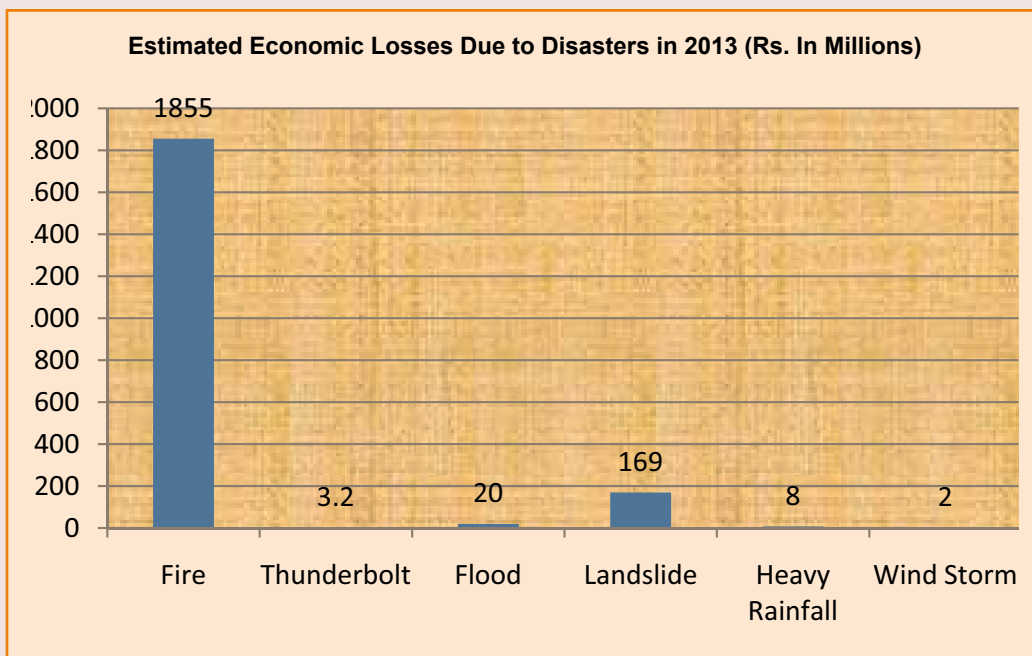


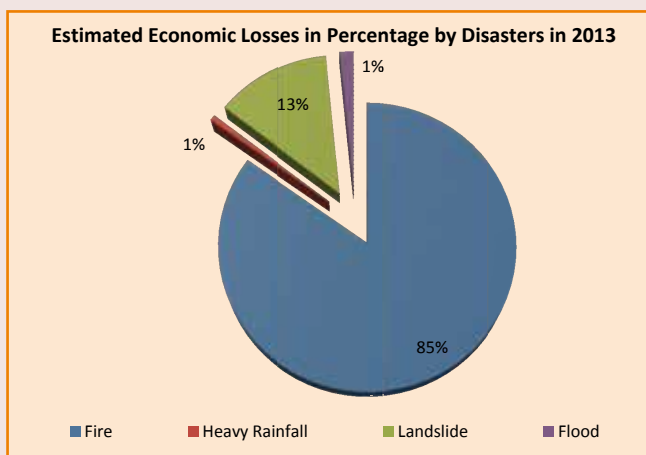
Figure 7



Source: Ministry of Home Affairs

Figure 7 shows the total economic losses caused due to floods, landslides, fires, thunderbolt, wind storm and heavy rainfall. **All these disasters caused the total estimated loss of 2,057 million rupees in the year 2013.** The fire disaster caused the highest economic loss in this year.

Figure 8



Source: Ministry of Home Affairs

In figure 8 we can see the percentage distribution of the economic losses by various types of disasters in the year 2013. Again the highest percentage is taken by the fire (85%), followed by landslide, flood, heavy rainfall, thunderbolt and wind storm.

Map 15



Source: Ministry of Home Affairs

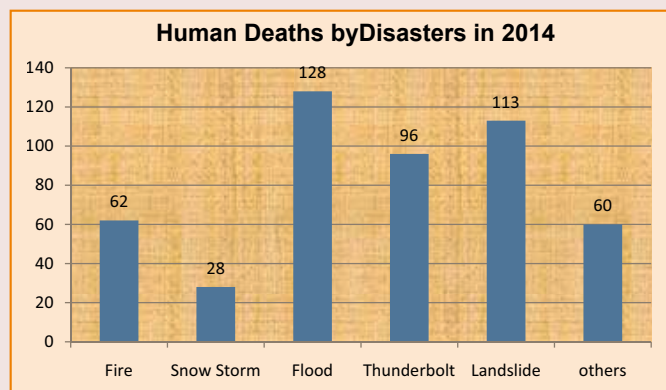
Map 15 shows the most affected districts in terms of economic losses in the year 2013. Makawanpur, Kathmandu and Rupandehi suffered the most. Each of those districts suffered economic losses above 100 million rupees.

### 3.3 Disaster Data Analysis of the Year 2014

In the year 2014 floods, landslides, thunderbolt, fires and snowstorm killed many people. As portrayed in figure 9, floods

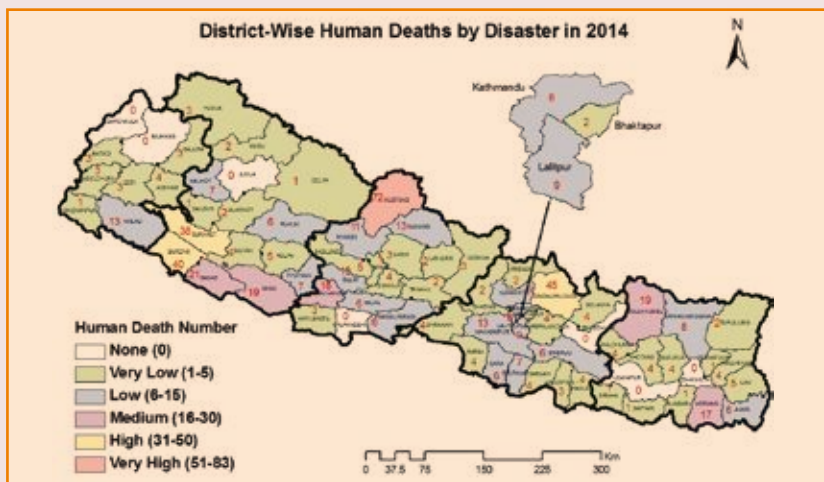
alone killed 128 people in 2014 and most of them were killed in Mid-Western Region of Nepal. This year thunderbolt stood at third position which killed 96 people while it was number one killer in the year 2013. Landslide killed 113 people, fire claimed the death of 62 people, snow storm (Hudhud) killed 28 people and all other remaining disasters such as: heat wave, cold wave, animal attack etc. killed 60 people. **A total of 487 people lost their lives due to the above mentioned disasters in the year 2014.** This year, more people were killed than in the previous year.

Figure 9



Source: Ministry of Home Affairs

Map 16



Source: Ministry of Home Affairs

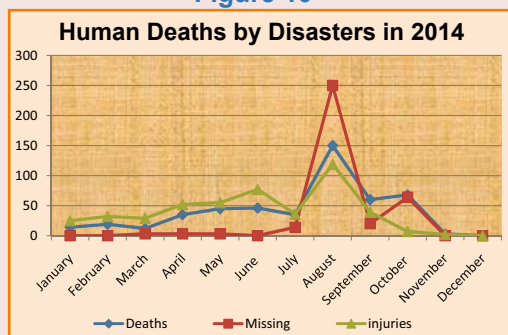
In the year 2014, Sindhupalchok district suffered most due to the landslide in Jure where 45 people lost their lives. In Bardia 40 and in Surkhet 38 people died due to floods and landslide disasters. In total 487 people lost their lives in various types of disasters in the year 2014. However, 7 districts (Dhankuta, Udayapur, Ramechhap, Rupandehi, Jumla, Bajhang and Darchula) had no human life losses. For details please see map 16.

**Table 7: District-wise Human Deaths by Disasters in 2014**

Months	Deaths	Missing	injuries
January	14	0	25
February	19	0	32
March	12	3	29
April	35	3	52
May	45	3	55
June	46	0	77
July	35	14	36
August	150	250	119
September	60	20	39
October	68	64	7
November	3	0	2
December	0	0	0
<b>Total</b>	<b>487</b>	<b>357</b>	<b>473</b>

Source: Ministry of Home Affairs

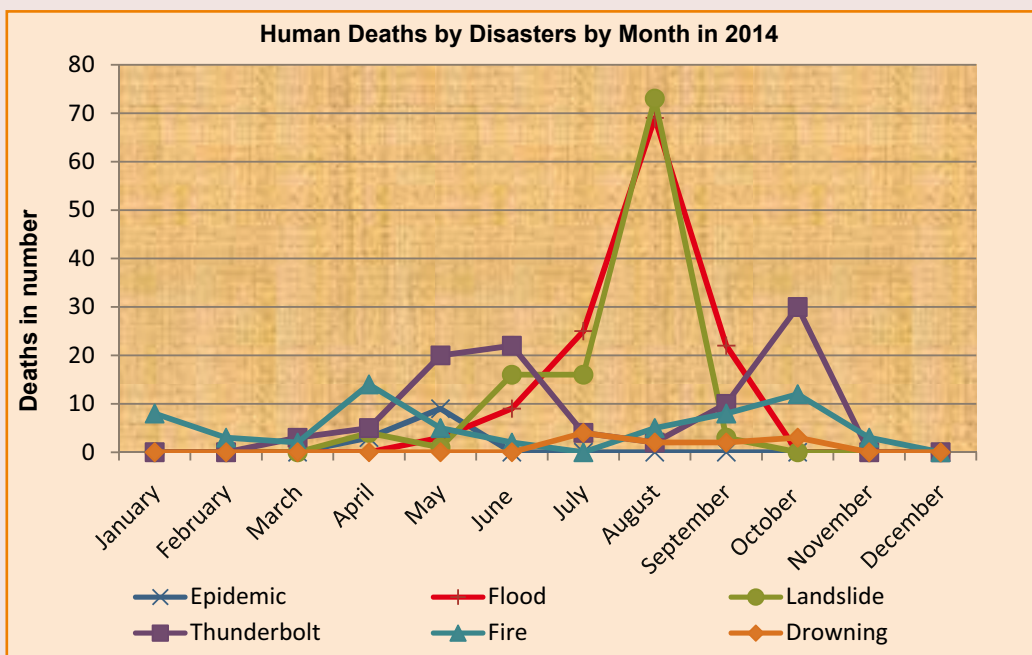
**Figure 10**



Source: Ministry of Home Affairs

Figure 10 and table 7 show the distribution of total deaths, missing and injuries in the whole year of 2014 due to different kinds of disasters. As we can see in the graph and the table, most people were killed and injured during July–September, which is also the rainy season, when landslides and floods occur. So, the number of human casualties increases during these months.

Figure 11



Source: Ministry of Home Affairs

Table 8: Human Deaths by Disasters by Month in 2014

Months	Epidemic	Flood	Landslide	Thunderbolt	Fire	Drowning
January	0	0	0	0	8	0
February	0	0	0	0	3	0
March	0	0	0	3	2	0
April	3	0	4	5	14	0
May	9	3	1	20	5	0
June	0	9	16	22	2	0
July	0	25	16	4	0	4
August	0	69	73	2	5	2
September	0	22	3	10	8	2
October	0	0	0	30	12	3
November	0	0	0	0	3	0
December	0	0	0	0	0	0
<b>Total</b>	<b>12</b>	<b>128</b>	<b>113</b>	<b>96</b>	<b>62</b>	<b>11</b>

Source: Ministry of Home Affairs

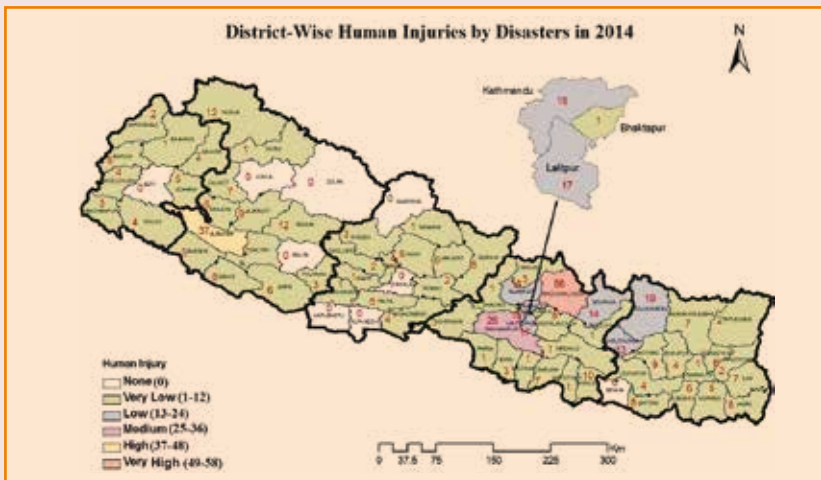
Figure 11 and table 8 show the number of deaths from various types of disasters and months in the year 2014. From the data analysis of 2014 the highest number of human casualties was by thunderbolts from April through November. While by flood and landslides most casualties and injuries have been caused in July, August and September. Fire has killed people almost every month except in the months of July and December. Three people died in October due to drowning. Epidemics killed 3 and 9 people in April and May.

Map 17



Source: Ministry of Home Affairs

Map 18



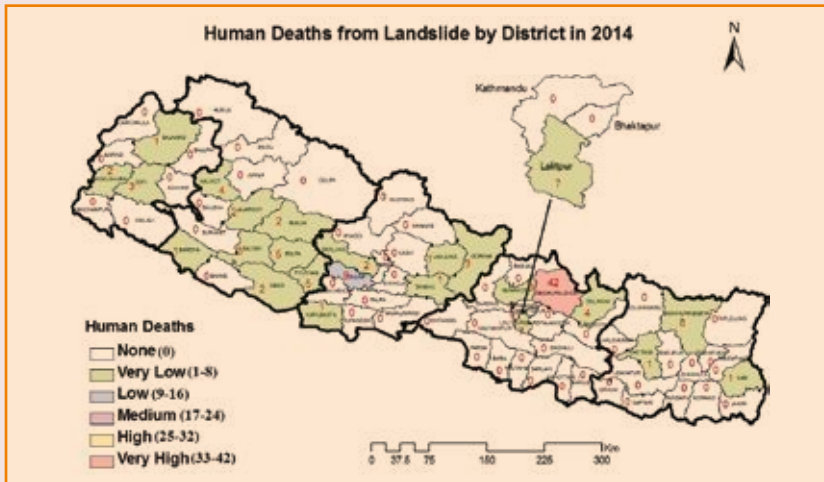
Source: Ministry of Home Affairs

We can see in map 17 and table 7 that in 2014 the highest number of missing people was in Sindhupalchok (123) and Surkhet (96), basically due to floods and landslides. No people were missing in most of the districts. The total number of missing people has been 357 in the year 2014.

Map 18 and table 7 show that in 2014 range of human injuries due to disasters in various districts according to which highest number of injuries were caused in Sindhupalchok (58 injuries) and Makwanpur (26 injuries) districts. Siraha, wish Rupandehi, Kapilbastu, Syangja, Rolpa, Mustang, Dolpa, Jumla and Doti recorded no injuries. **Total number of injuries in the year 2014 has been 473.**



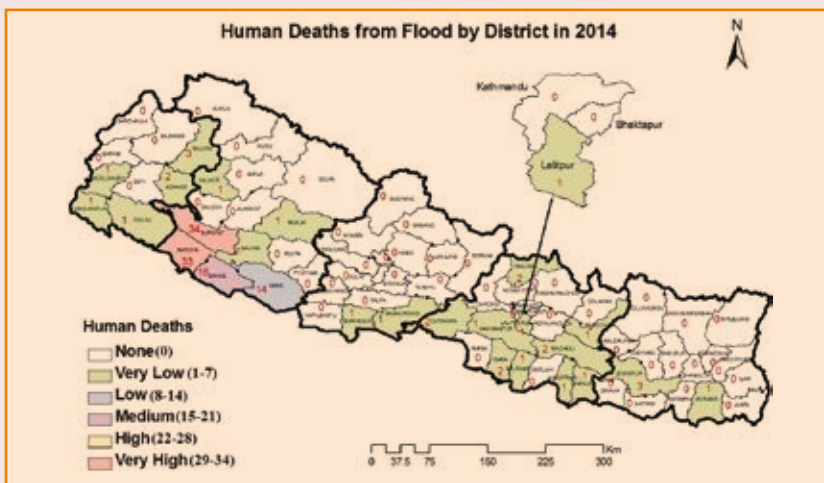
Map 19



Source: Ministry of Home Affairs

In the year 2013, maximum numbers of people (42) were killed in Sindhupalchok due to landslides in Jure. Some other districts had single digit loss of human lives. Majority of the districts had no human life loss due to disasters. Please see the map 19 and table for details. **113 people died due to landslides in the whole country in the year 2014.**

Map 20



Source: Ministry of Home Affairs

As shown in map 20 and table 8, in 2014, 34 in Surkhet, 33 in Bardia, 16 in Banke and 14 people in Dang were killed in natural disasters. The other districts had loss of only single digit human lives while most of the other districts suffered no human life losses. **Total number of death by flood has been 128 in the year 2014.**

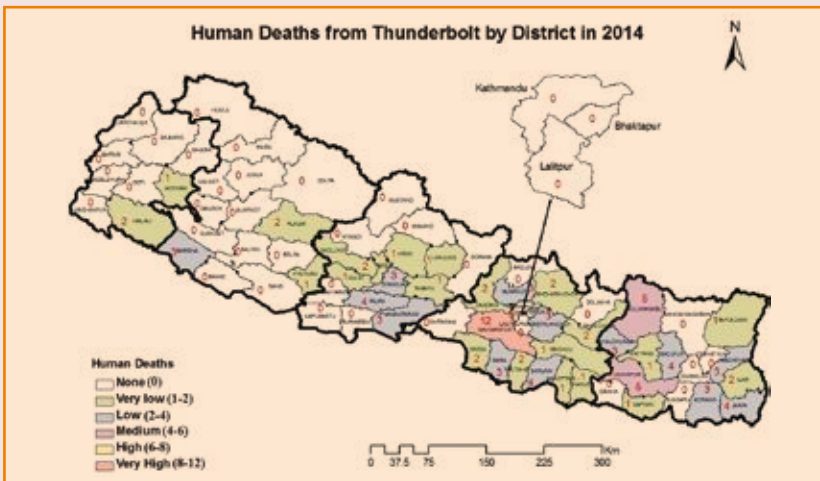
Map 21



Source: Ministry of Home Affairs

As shown in map 21 and table 8 , in 2014 fire claimed human lives of 1 in Ilam, Panchthar, Taplejung, Morang, Sunsari, Saptari, Solukhumbu, Makwanpur, Sindhupalchok Lalitpur, Syangja, Kaski, Manang, Myagdi, Dang, Pyuthan, Banke, Jajarkot, Kalikot, Achham and Kanchanpur; 2 in Jhapa, Khotang, Okhaldhunga, Dhanusa, Rautahat, Parsa, Kapilbastu, Nawalparasi, Bardia, Mugu, and Kailali; 3 in Sindhuli, Palpa and Humla; 4 in Surkhthar and 7 in Kathmandu. The other remaining districts had no casualties from fires. **The total number death by fire has been 62 in the year 2014.**

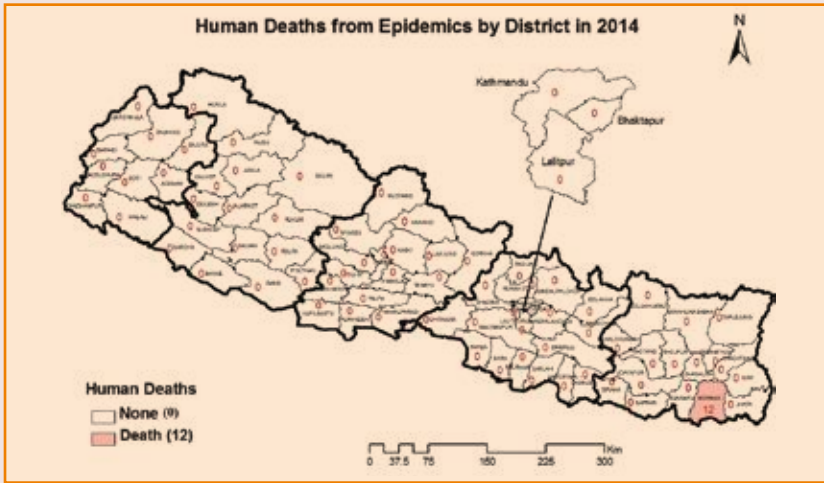
Map 22



Source: Ministry of Home Affairs

As shown in map 22, a total of 12 people were killed in Makwanpur by thunderbolts in 2014. Other districts had the single digit loss of human lives. Most districts had no human life losses due to thunderbolts. Please see map 22 and table 8 for details. **Thunderbolts killed 96 people in the year 2014.**

Map 23



Source: Ministry of Home Affairs

As depicted in the map 23, in **Morang district 12 people were reported dead** due to epidemics in 2014. All other remaining 74 districts had no loss of human lives due to epidemics.

Figure 12

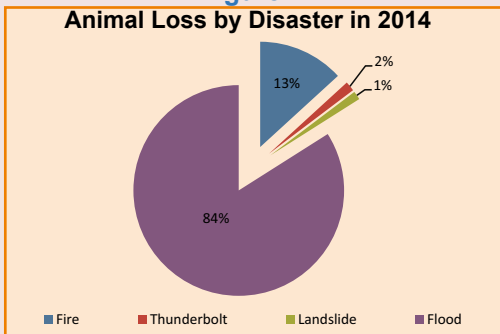


Table 9: Animal Loss by Disaster in 2014

Fire	697
Thunderbolt	79
Landslide	69
Flood	4437
<b>Total Animal loss</b>	<b>5282</b>

Source: Ministry of Home Affairs

Figure 12 and table 9 show the total percentage and number of animals killed by various disasters. The maximum numbers of animals were killed by flood disaster.

Flood alone killed 4,437 animals which becomes to be 84% of the total animals killed in the year 2014. Fire stands at second row in killing the animals reaching 697 numbers that becomes to be 13% of the total numbers of animal killed. Thunderbolt is in third row that killed 79 animals (2%). **Landslide killed 69 animals which is only 1% of the total animals killed in the year 2014 by the above mentioned disasters.**

Figure 13

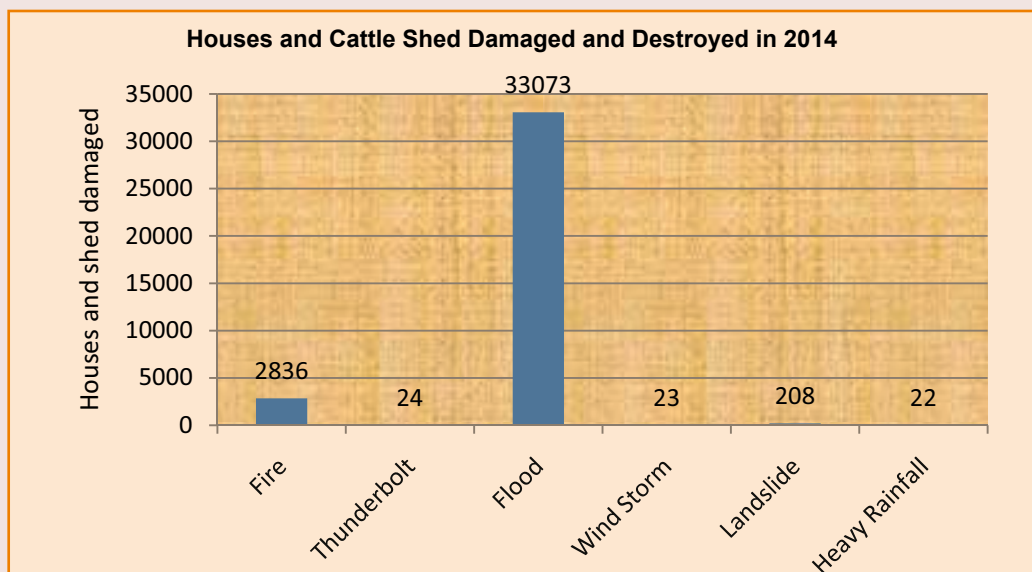


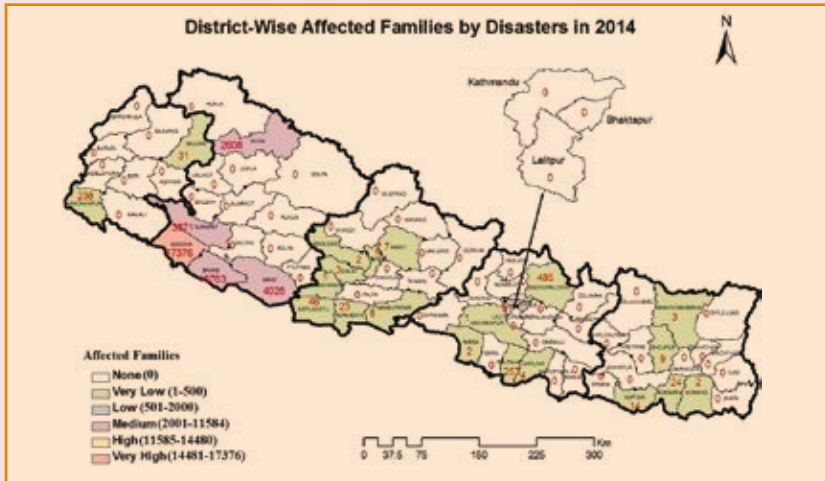
Table 10: Houses and Cattle Sheds Damaged and Destroyed in 2014

Fire	2836
Thunderbolt	24
Flood	33073
Wind Storm	23
Landslide	208
Heavy Rainfall	22

Source: Ministry of Home Affairs

Figure 8 and table 10 show the total number of damaged houses and cattle sheds by floods, landslides, fires, thunderbolt, wind storm and heavy rainfall in 2014. Flood has damaged the most. Flood alone destroyed 33,073, fire destroyed 2,836, landslide destroyed 208, thunderbolt destroyed 24, wind storm destroyed 23 and the heavy rainfall destroyed 22 houses and cattle sheds in the year 2014. **The total number destroyed houses and cattle sheds has been 36,186 in the year 2014.**

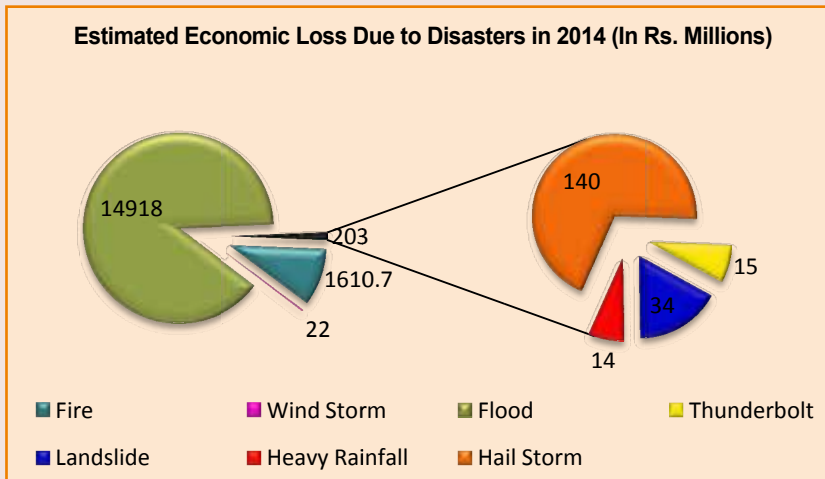
Map 24



Source: Ministry of Home Affairs

As we can see in map 24, 17,376 families were affected by various types of disasters in Bardia in 2014 which was followed by Banke (10,763 families), Dang(4,028 families), Surkhet (3,871 families) and Mugu (2,608 families). In most of the districts no families were affected. **The total number of affected families from different kinds of disasters in the year 2014 has been found to be 39,812.**

Figure 14



Source: Ministry of Home Affairs

According to the data shown in figure 14, the **estimated economic loss is about 16,753.7 millions in Nepalese Rupees in the year 2014.** Out of this total amount significant loss is due to flood (14,918.0 millions) followed by fire (1,610.7 millions).

Map 25

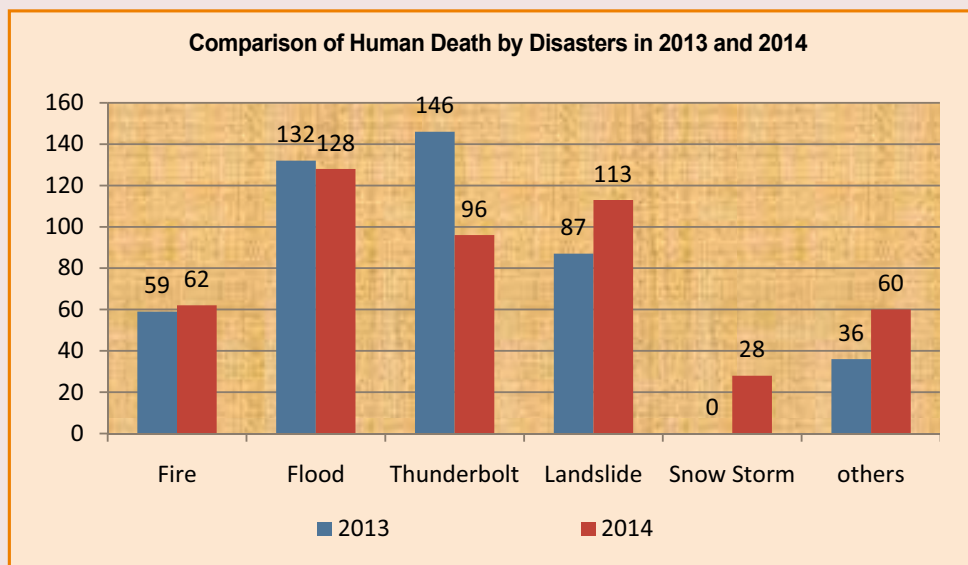


Source: Ministry of Home Affairs

The district-wise economic losses are shown in map 25 and figure 14. Sindhupalchowk, Surkhet and Bardia districts suffered most due to floods and landslide disasters resulting into enormous economic losses in 2014. Lamjung, Manang, Mustang, Rukum, Dolpa, Jajarkot, Dadeldhura, Baitadi and Darchula faced no economic losses in the year 2014.

### 3.4 Comparative Data of the Year 2013 and 2014

Figure 15



Source: Ministry of Home Affairs

**Table 11: Comparison of Human Death by Major Disasters in 2013 and 2014**

Disasters	2013	2014
Fire	59	62
Flood	132	128
Thunderbolt	146	96
Landslide	87	113
Snow Storm	0	28
Others	36	60
<b>Total</b>	<b>460</b>	<b>487</b>

Source: Ministry of Home Affairs

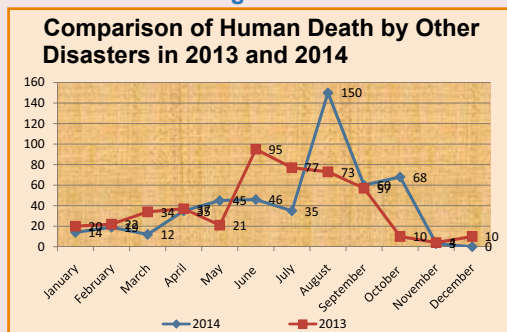
**Table 12: Comparison of Human Death by Other Disasters in 2013 and 2014**

Disasters	2013	2014
Drowning	7	8
Wind Storm	3	3
Heavy Rainfall	5	5
High Altitude	0	1
Air Crash	1	14
Boat Capsize	7	8
Avalanche	7	10
Epidemic	4	11
Cold wave	2	0
<b>Total</b>	<b>36</b>	<b>60</b>

Source: Ministry of Home Affairs

Figure 15 and the two tables 11 and 12 show the comparison of human life losses due to various types of disasters in the year 2013 and 2014. In the year 2013, thunderbolt caused the highest number of casualties. A total number of 146 people died due to thunderbolt in 2013 while in the year 2014 only 96 people were killed. Flood also killed more people in 2013 (132 killed) than in 2014 (128 killed). But landslide killed more people in the year 2014 (113) than in the year 2013 (87). Fire killed 59 people in 2013 and 62 in 2014. Snow storm didn't kill anybody in 2013, but 28 people were killed in 2014. Other disasters killed more people in 2014 (60 people) than in 2013 (36 people). **In total 460 people were killed by various types of disasters in the year 2013 and 487 people were killed in 2014.**

**Figure 16**



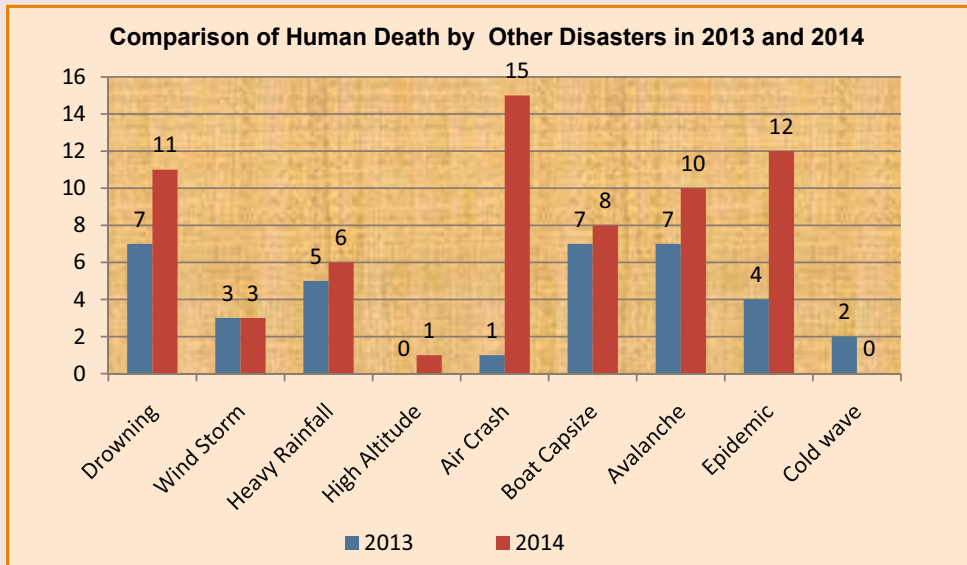
To see the monthly death toll, please see figure 16 and table 13 where we can find that most people are killed by disasters between June to September which is basically due to the rainy season that causes thunderbolt, floods and landslides. In the above figure, we can see sharp rise of the death toll in the month of 2014 August that was because of the incessant rainfall in Mid-Western Region of Nepal particularly in Banke, Bardia, Surkhet and Dang districts.

**Table 13: Comparison of Human Death by Other Disasters in 2013 and 2014**

Months	2013	2014
January	20	14
February	22	19
March	34	12
April	18	37
May	21	35
June	95	46
July	77	35
August	73	150
September	59	60
October	10	68
November	4	3
December	10	0
<b>Total</b>	<b>460</b>	<b>487</b>

Source: Ministry of Home Affairs

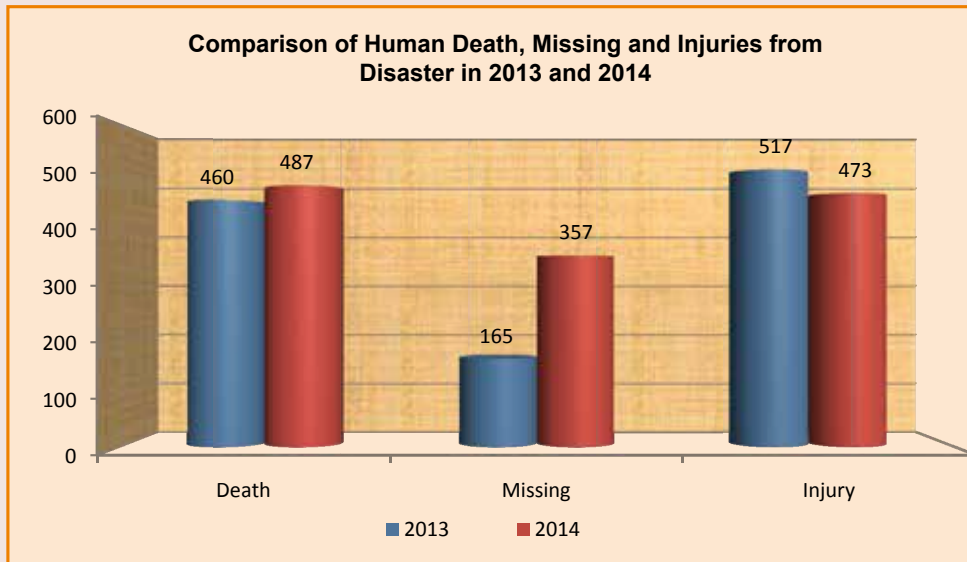
Figure 17



Source: Ministry of Home Affairs

Figure 17 shows the comparative death toll by other disasters in the year 2013 and 2014. The highest number of human casualty (15 people) was caused by air crash in 2014.

Figure 18



Source: Ministry of Home Affairs

Comparison of human deaths from all disasters in 2013 and 2014 shows that human deaths have increased in 2014, but the number of injury has slightly increased in the year 2013 than in 2014. Please see figure 18 for details.



**Figure 19**

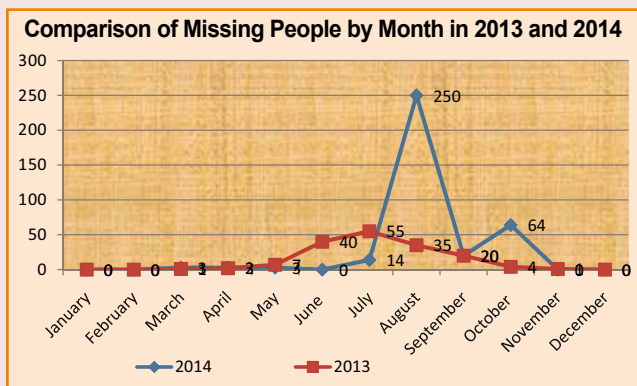


Figure 19 and table 14 show the comparative number of the missing people caused by different disasters in different months in 2013 and 2014. In the above figure we can see that in the year of 2013, more people were missing during the period of May to September than in other months while in 2014 July to September has the higher number of missing people. **A total number of 165 people were missing in 2013 and 357 were missing in 2014.**

**Table 14: Comparison of Missing People by Month in 2013 and 2014**

Months	2013	2014
January	0	0
February	0	0
March	1	3
April	2	3
May	7	3
June	40	0
July	55	14
August	35	250
September	20	20
October	4	64
November	1	0
December	0	0
<b>Total</b>	<b>165</b>	<b>357</b>

*Source: Ministry of Home Affairs*

**Figure 20**

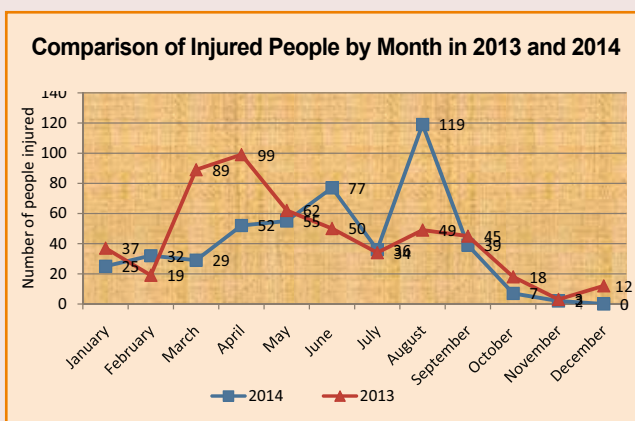


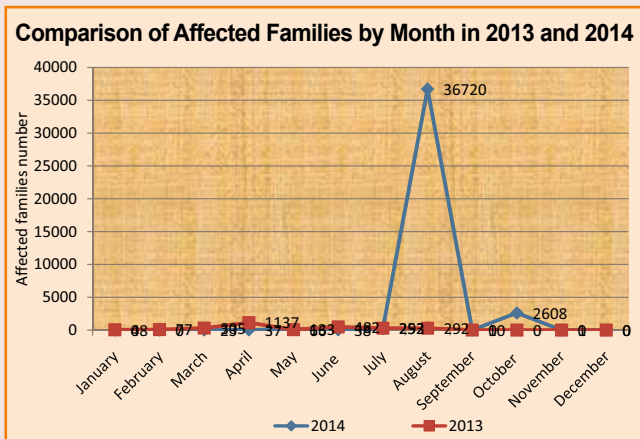
Figure 20 and table 15 show the comparative number of injured people caused by different disasters in different months in the years of 2013 and 2014. In 2013, the period of February to October has the higher number of injured people while in 2014 the month of March to September has the highest number of injuries. **A total of 517 people were injured in the year 2013 which is more than in the year 2014. In 2014 a total of 473 people were injured in various disasters.**

**Table 15: Comparison of Injured People by Month in 2013 and 2014**

Months	2013	2014
January	37	25
February	19	32
March	89	29
April	99	52
May	62	55
June	50	77
July	34	36
August	49	119
September	45	39
October	18	7
November	3	2
December	12	0
<b>Total</b>	<b>517</b>	<b>473</b>

*Source: Ministry of Home Affairs*

**Figure 21**



**Table 16: Comparison of Affected Families by Month in 2013 and 2014**

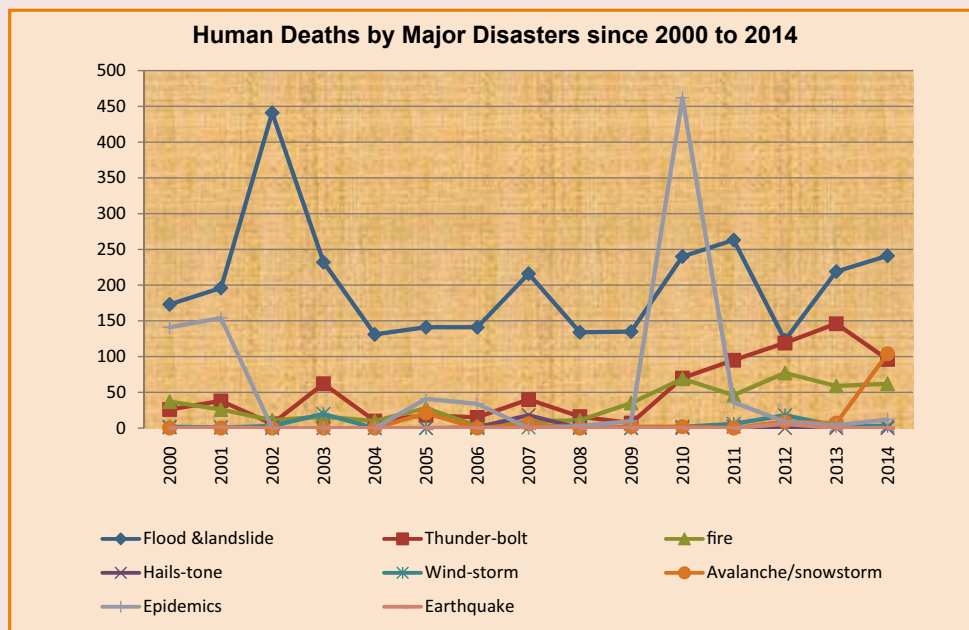
Months	2013	2014
January	48	0
February	77	0
March	305	23
April	1130	37
May	63	133
June	482	38
July	290	252
August	292	36720
September	10	0
October	0	2608
November	0	1
December	0	0
<b>Total</b>	<b>2,697</b>	<b>39,812</b>

Source: Ministry of Home Affairs

Figure 21 and table 16 is the comparative number of affected families in the year 2013 and 2014. There were a small number of affected families (2,697) in the year of 2013 while in the year 2014 the number of affected families reached to 39,812 which was basically because of the devastating floods and landslides in the month of August in Mid-Western Region.

### 3.5 Past Disaster Data Analysis from 2000 to 2014

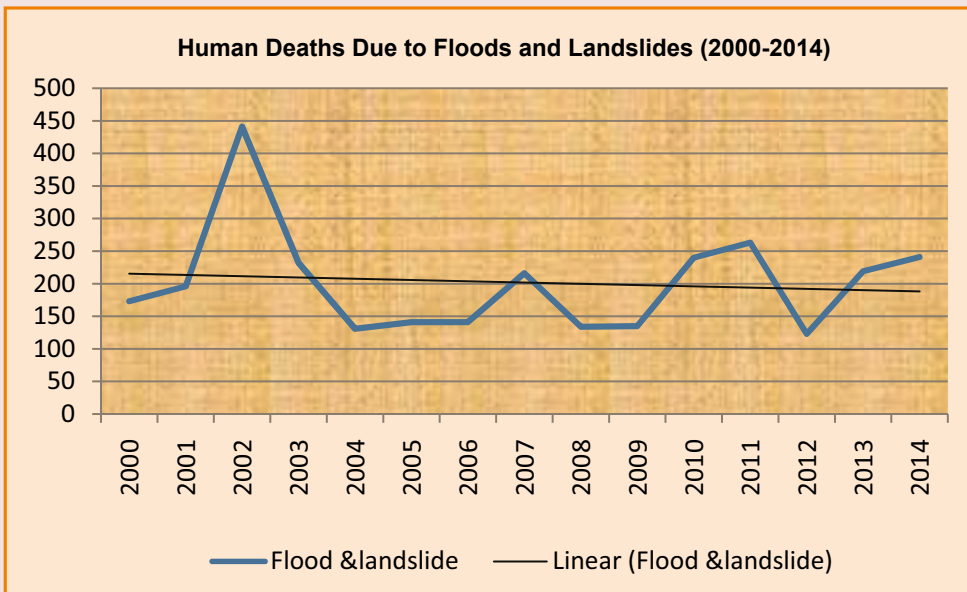
**Figure 22**



Source: Ministry of Home Affairs

Figure 22 shows the total human life losses due to various disasters from 2000 to 2014. It is obvious that floods and landslides has killed more people than any other disaster. However, between the years 2009 and 2011 epidemics has killed more people than any other disasters. The graph noticeably shows that thunderbolt stands at third position to cause the human deaths which has superseded other disasters between 2010 to 2013 except epidemics, floods and landslides.

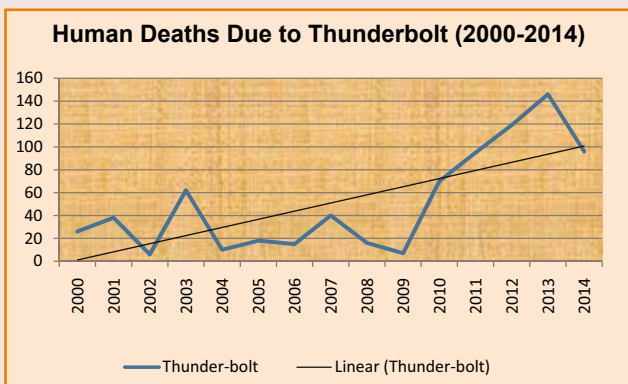
**Figure 23**



Source: Ministry of Home Affairs

Figure 23 denotes the trend of human casualties due floods and landslides from the year 2000 to 2014. Floods and landslides have caused more casualties than any other disasters in this period.

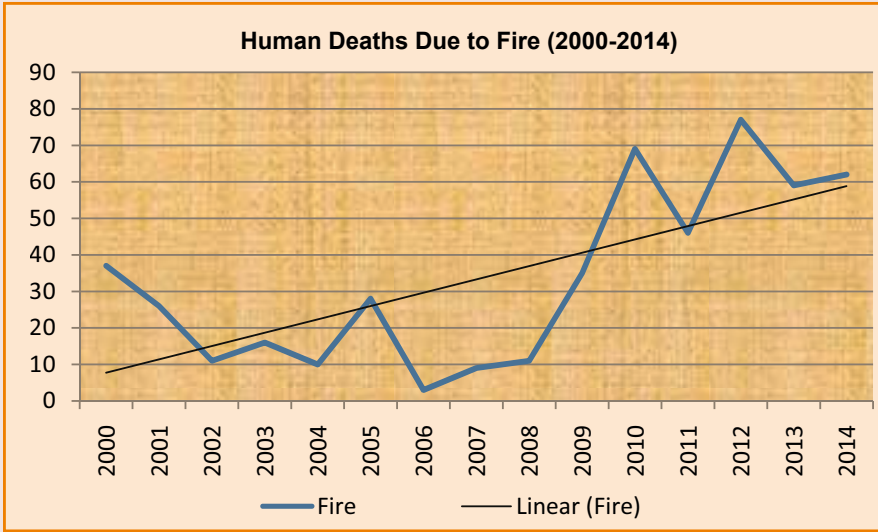
**Figure 24**



Source: Ministry of Home Affairs

Figure 24 shows the trend of human casualties due to thunderbolt from the year 2000 to 2014 which shows heavy casualties in the 2003, 2007, 2010, 2011, 2012 and 2013.

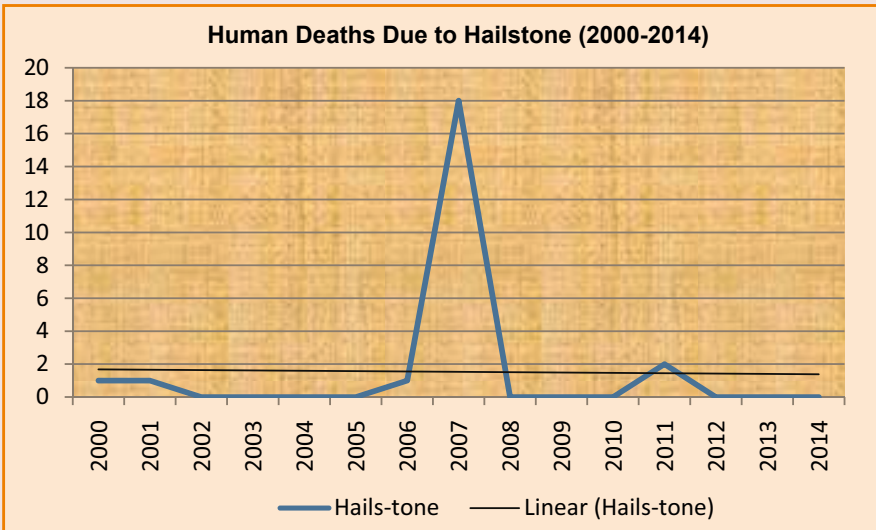
Figure 25



Source: Ministry of Home Affairs

Figure 25 shows the trend of human casualties due to fires from the year 2000 to 2014. The years 2000, 2005, 2009, 2010, 2011, 2012 and 2013 encountered more human life losses due to fires than in other years. It is to be noted here that no year is immune to casualties from fires.

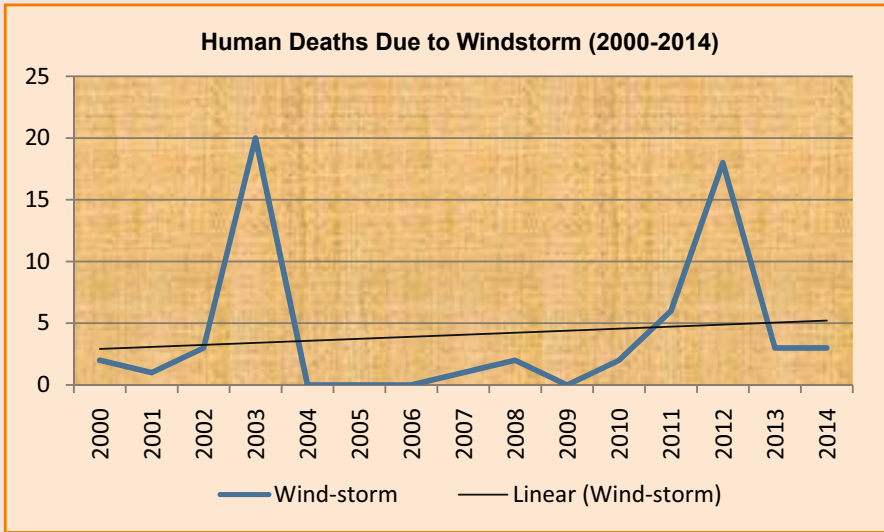
Figure 26



Source: Ministry of Home Affairs

Figure 26 shows the trend of human casualties due to hailstones from the year 2000 to 2014. In the years 2006, 2007, 2008 and 2011 hailstone caused more human life losses than in other years.

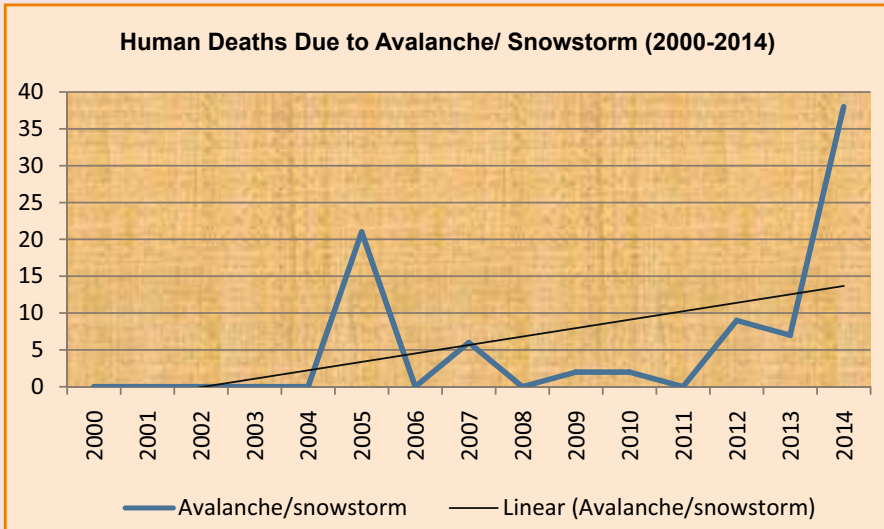
Figure 27



Source: Ministry of Home Affairs

Figure 27 shows the trend of human casualties due to windstorm from the year 2000 to 2014. The above graph indicates that in the years 2002, 2003, 2008, 2010, 2011 and 2012 caused more human life losses than in other years.

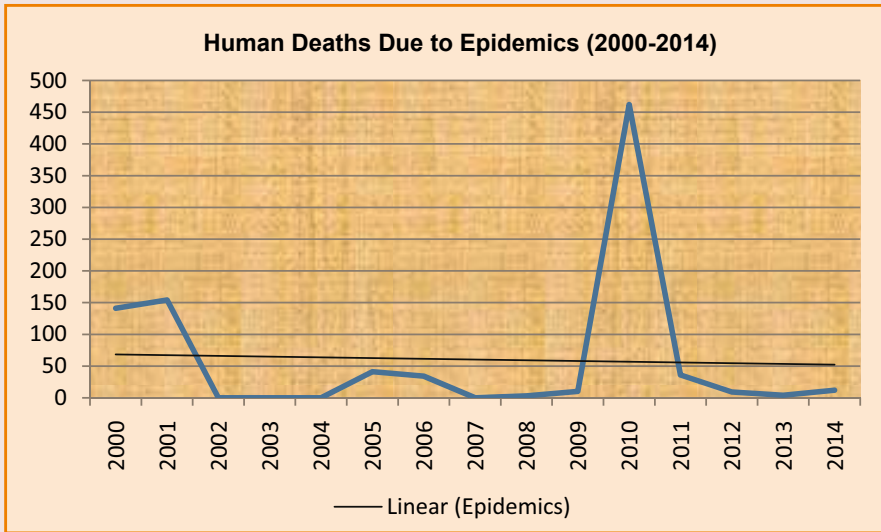
Figure 28



Source: Ministry of Home Affairs

Figure 28 shows the trend of human casualties due to avalanche and snowstorm since the year 2000 to 2014. The years 2005, 2007, 2012, 2013 and 2014 had more deaths due to avalanche and snowstorms. The reason of more deaths in 2014 was because of the Hudhud cyclone in Annapurna area where 28 people died due to Hudhud cyclone.

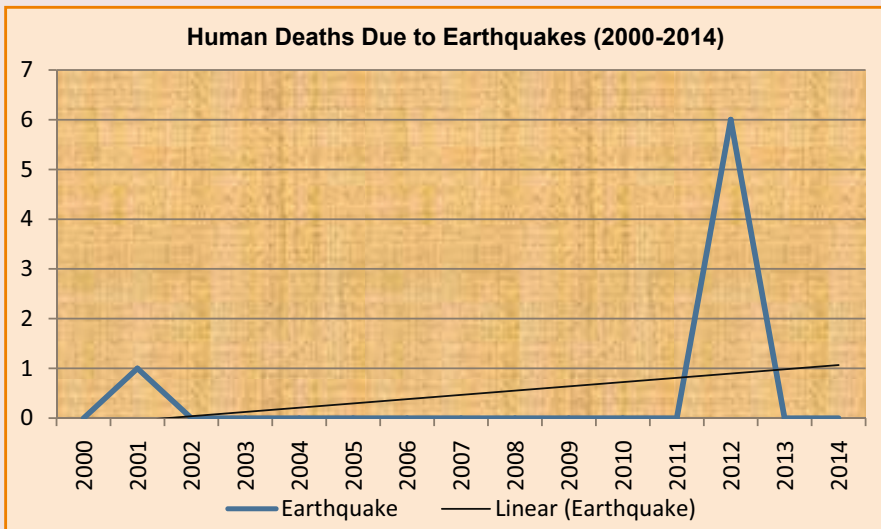
Figure 29



Source: Ministry of Home Affairs

Figure 29 shows the trend of human casualties due to epidemics since the year 2000 to 2014. Epidemics took more human lives in the years 2000, 2001, 2005, 2006, 2007, 2010 and 2011. Before the year 2000, epidemics used to kill more people than from any other disasters. But after the year 2000 less people have lost their lives from epidemics which may be due to unreported cases or improved health services.

Figure 30



Source: Ministry of Home Affairs

Figure 30 shows the death of 1 person in the year 2001 and the death of 6 persons in the Nepal–Sikkim earthquake of 2012.

# Chapter

# 4

## Articles on Disaster Management

- 📄 **Mass Casualty Management: Disasters Dealing with Mass Gathering such as Maha Shivaratri, Kumbh Mela and Al-Hajj Pilgrimage**  
*Meen B. Poudyal Chhetri, Ph.D., Post Doc*
- 📄 **Emerging Trends in Disaster Management Policy in Nepal**  
*Mr Pradip Kumar Koirala and Ms Rita Dhakal Jayasawal*
- 📄 **Impact of Hudhud Cyclone in Himalayan Region of Nepal**  
*Lt. Col. Arjun Basnet and Baburam Bhandari*
- 📄 **Seti Flash Flood: Technical Analysis and DRR Interventions**  
*Deo Raj Gurung, Sudan Bikash Maharjan, Narendra Raj Khanal, Govinda Joshi and M.S.R.Murthy*
- 📄 **Disaster Early Warning Systems in Nepal: Status, Problems and Potentials**  
*Shesh Kanta Kafle*
- 📄 **Real Time Monitoring and Flood Outlook for Reduced Flood Risks**  
*Mandira Singh Shrestha, Pradeep Man Dangol, Arun Bhakta Shrestha and Gautam Rajkarnikar*





# 4.1 Mass Casualty Management: Disasters Dealing with Mass Gathering such as Maha Shivaratri, Kumbh Mela and Al-Hajj Pilgrimage

Meen B. Poudyal Chhetri, Ph.D., Post Doc

*President, Nepal Centre for Disaster Management (NCDM), Nepal<sup>1</sup>*



Panicked People Gathered at New Road, Kathmandu After the Gorkha Earthquake

Photo: Meen Chhetri

<sup>1</sup> Kuleswor, Kathmandu, Nepal

## Keywords

**Casualty, Disruption, Impact, Mass Gatherings, Medical Services, Safety**

### Abstract

Mass gatherings is an organized or unplanned event that causes serious disruption of the functioning of a community involving widespread human, material, economic or environmental losses and impacts, which exceeds the response capability of the affected community, state or nation hosting the event and requires medical services for large number of people who have gathered to attain certain goal for a fixed period. Mass gathered in for sports, air shows, rock concerts, outdoor celebrations, political rallies, religious assemblies, social gatherings, trade-fair, visits by VIPs, celebrities and so on vary in their complexity and demand for medical services. Mass gathering events have an enormous impact and severe pressure on the local health care system and a mixture of high crowd density, limited or difficult points of access, lack of fire safety, difficulty in controlling the crowd and lack of on-site medical care that can lead to problems that results into disaster. In the above context, mass gatherings should be considered as a potential catastrophic event that may suddenly cause enormous loss to human lives and physical properties.

The objectives of this paper are to identify the risks of mass gatherings and the management strategies required to ensure community safety focusing on predominantly on case reports and literature reviews citing particular lessons identified from previous disasters. Also this paper highlights the lessons learnt from the past overcrowding disasters that indicate the need to plan ahead for the potential number of attendees, establish crowd control mechanism, form

exit points, plan for fire and health safety and decrease the risk of the happening and allocate necessary resources. Special focus to the “Hajj”<sup>2</sup> pilgrimage mass gatherings has been given in this paper.

### 1. Introduction

Mass gatherings have unique features and behavior that pose risks to the population around and the concerned government. It is usually an organized and sometimes unplanned or spontaneous event where a serious disruption of the functioning of a community involving widespread human, material, economic or environmental losses and impacts occur. Such events often exceed the response capability of the affected community, state or nation hosting the event and require medical services for large populations who have gathered to attain certain goal for a definite period. Hence, if a large number of people gather at one site, some of them may have heart attacks, asthma attacks, headache, unconsciousness, nausea, epilepsy and so on which they will normally exhibit in that period of time. Children, women, disabled and older people will have higher rates of fatality or illness than younger populations. Even small fire in a confined space may have disastrous impact on a large number of people; such as a nightclub, marriage ceremony fire etc. Similarly, when a huge mass accumulates in a location which is not designed to accommodate large number of people, the structure may collapse causing loss of lives and injuries. Food, water and waste disposal in an environment where the physical infrastructure is inadequate

<sup>2</sup> The annual “Hajj” Islamic pilgrimage in Mecca, Saudi Arabia is one of the world’s largest gatherings.

or inappropriate often cause health and sanitation problems. Therefore, there is amplified public health risk during and after mass gatherings.

## 2. Definitions

The definition of a mass gathering itself is not without debate. The National Association of EMS Physicians (NAEMSP) defined it as: “Organized emergency health services provided for spectators and participants at events in which at least 1000 persons are gathered at a specific location for a defined period of time.” As usual there have been many definitions posed not only in the literature but also in policy, legislation and procedural documents. Some try to define mass gatherings in terms of raw numbers of people; even to categorize the gatherings according to the size of the crowd. Mass gatherings pose a particular risk to community health; risks which derive not only from the normal health risks of large numbers of people but also from the particular dynamics that occur when many people gather together and move about (Gerry FitzGerald et al 2014).

The definition from EMA is as follows:

“An event associated with the congregation of large numbers of people gathered together in a single place for a particular purpose<sup>3</sup>.”

The Arkansas State definition of a mass gathering is 1000 people in a place for 12 hours. This definition includes time at least. Yet, these figures cannot be taken as the strong basis, while they are dependent on many variables. Because, even a relatively small crowd in a small confined space may exhibit many of the same risks as a large population in a larger open space. A more

functional classification would, therefore, reflect the nature of the enhanced risks of mass gatherings and the disparity between the size and nature. If considered carefully in planning for mass gatherings, these might reduce morbidity and mortality in the event of a potential disaster due to mass gathering.

Mass gatherings, including scheduled events in sports facilities, air shows, rock concerts, outdoor celebrations and visits by celebrities, vary in their complexity and demand for medical services. Mass gathering events have an enormous impact and severe pressure on the local health care system and a mixture of high crowd density, limited or difficult points of access, lack of fire safety, difficulty in controlling the crowd and lack of on-site medical care that can lead to problems that results into disaster. In the context of the above situation, the mass gatherings needs to be considered as a hazardous event that may suddenly turn into disaster causing enormous loss of human lives and physical properties.

## 3. Methodology

To prepare this paper all peer-review literature articles containing information related to mass gathering, crowd disasters, case reports and the lessons learnt from there have been analyzed and reviewed to reach to a meaningful conclusion. The mass gathering incidents from 1971 – 2011, were identified and analyzed through literature and web search. Qualitative and quantitative data have been collected for this paper. Citations within articles were advance searched to ascertain additional references that would reinforce and verify the information obtained. Web search has been one of the important sources of information and review.

<sup>3</sup> Definition for Mass Gatherings, Emergency Management (EMA), Australia

#### 4. Mass Gatherings during the “Hajj” Pilgrimage

“Hajj” is one of the world’s biggest mass gatherings of Muslims from about 160 countries that takes place each year in Mecca and other parts of western Saudi Arabia. It is a ritual that is intended to promote the Islamic brotherhood and sisterhood by showing that everyone is equal in the eyes of Allah. All physically and financially capable adult Muslim are required to complete the expensive and difficult journey at least once in their lifetime. The week of Hajj occurs during the last month of the Islamic calendar and the pilgrims have to perform a number of services or rituals before arriving in Mecca.

The “Hajj” is associated with the life of Islamic prophet Muhammad since the 7th century. Since then millions of Muslims gather at Grand Mosque in Mecca to mark end of hajj pilgrimage and celebrate start of Islam’s biggest holiday. For Muslims, the “Hajj” is the final pillar out of the five pillars of Islam which are the foundation of Muslim life. Islam’s five pillars of faith are; the faith or belief in the oneness of God and the finality of the prophet-hood of Muhammad; establishment of the daily prayers; concern for and almsgiving to the needy; self-purification through fasting; and the pilgrimage to Mecca.

Despite of religious values and significance of the “Hajj” pilgrimage, there are some issues and challenges of health hazard, security and exposure to potential disaster such as stampede. It is indeed a big logistic challenge for the Royal Government of Saudi Arabia. Although the Saudi authorities have paid due attention to mitigate those problems, severe incidents have been occurring time and again. Since the 1950s, the Saudi government has

spent more than \$100 billion to improve the facilities of housing, transportation, sanitation and health care to the pilgrims. Now the pilgrims enjoy modern facilities and perform rites at ease. Keeping in view the growing numbers of pilgrims and possibility of accidents, various crowd-control techniques have been adapted to ensure safety.

#### 5. The Salient Features and Phenomena of Mass Gatherings

The local health care system will have severe stress due to heavy influx of people, limited and/or restricted points of access, inability or inadequate crowd control system and lack of immediate medical care and emergency response are the major features and phenomena of possible and potential risk of disaster during the mass gatherings. Mass gatherings are more challenging during spontaneous events as they can occur without any warning and specific planning while they can overwhelm the street or available space and situation.

##### Following are some of the examples of spontaneous and pre-planned events:

- Spontaneous political unrest or rallies,
- Demonstration or protest or even a celebration
- Sporting events;
- Pop/Rock concerts;
- Religious events;
- Visit by Dignitaries
- Air shows;
- Fireworks;
- Transport hubs (particularly on holidays);

- Shopping centers;
- Trade Fair; and,
- Jamborees, other out-door and residential gatherings/celebrations (marriage, get-together, parties etc.)

**Factors of potential disaster during mass gatherings and considerations to be taken care of:**

- ▶ Indoor/outdoor;
- ▶ Shade/shelter;
- ▶ Landscape and site hazards;
- ▶ Remoteness;
- ▶ Unexpected adverse weather condition (e.g. wind/hail storm, lightning, heavy rainfall, snowfall etc.);
- ▶ Time (day or night?);
- ▶ Incidence of alcohol, drugs and weapon;
- ▶ Size and nature of the crowd;
- ▶ Crowd (Seated or mobile?)
- ▶ Age, gender and health status of the crowd;
- ▶ Mood and behavior of the crowd;
- ▶ Length of the e-vent;
- ▶ Risk taking behaviors (e.g. circus, racing, swimming, stunt etc.)
- ▶ Physical infrastructure (e.g. stadium – has it designed to accommodate the expected number of people and their behavior? Can it be evacuated quickly and where will the people go? If the site is confined, what is the nature of the restriction? Can the barrier be removed quickly to decongest the site in the event of a rush?

- ▶ Venues - Will there be a single or multiple venues?
- ▶ Lighting and Power Supply - How will lighting and power be supplied and what safety issues may arise?
- ▶ Are there adequate WASH facilities?
- ▶ Are the organizers well experienced to tackle the crowd? How efficient and effective are the security personnel and volunteers?
- ▶ Clinical management (e.g. can the general and specific clinical requirements be fulfilled? How will any casualties be triaged and transferred? Are the medical personnel well trained and well equipped? Are the sites of health services clearly identified and accessible to the crowd? etc.)
- ▶ Financial considerations (e.g. what are the compensation and insurance arrangements? etc.)
- ▶ Are there multi agency coordination and coordination with event organizers and community services or not?

**The size and number of gatherings can be categorized as following<sup>4</sup>:**

- Mass gathering  
200-100,000
- Major mass gathering  
100,000-250,000
- Super mass gathering  
250,000-500,000
- Extreme mass gathering  
500,000-1 million
- Mega mass gathering  
>1 million

<sup>4</sup> Molloy M, Sherif A, Natin S, et al, Management of Mass Gatherings. In Koenig KL, Schultz C, eds. 2009, Koenig and Schultz's Disaster Medicine: Comprehensive Principles and Practices. First edition, Cambridge University Press.

## 6. Key Lessons and Messages

Historical records show that there have been many serious incidents during the “Hajj” in the past. In the massive gatherings like “Hajj,” it is a difficult task to make necessary arrangements each year for the growing number of pilgrims. However, the government has invested handsome amount of money and other resources to mitigate the possible threats and disasters. Nowadays, keeping in view the large numbers of people, many of the rituals have become more symbolic (e.g. it is not necessary to kiss the Black Stone; instead, pilgrims may point at it on each circuit around the Kaaba). Also, the large pillars used in the pebble throwing were changed to long walls with basins below to catch the stones to ensure safety. Likewise, someone can be assigned for the animal slaughter. Due to the Ebola outbreak in West Africa in 2014, the Muslims from Sierra Leone, Liberia and Guinea could not obtain visas by Saudi Arabia as a precaution against the fatal virus.

Keeping in view the past events, the following 5 areas should be managed properly and adequately in order to avoid and control the possible unwanted events<sup>5</sup>:

- (i) **Overcrowding** – It may happen due to overselling of tickets, while often crowd rush at a time and at once. Therefore, crowd flow can be controlled through well-trained security personnel and volunteers. They should be debriefed before an event in an effort to improve crowd safety and avoid panic.
- (ii) **Event Access Points** – Well-managed and adequate entry and exit points (including the emergency exits) are highly desirable to avoid congestion and overflow of the people. Emergency

exits should be free from obstruction, and functioning properly, with appropriate signs and signals. There should also be proper management for the accessibility of disable people. It should be taken into account that if the site is bounded, what is the nature of the restriction, can the fence be removed quickly to decongest the site in the event of a mass movement of people or not while people arrive gradually, but they rush to leave.

- (iii) **Fire Safety Measures** – Adequate number of fire extinguisher in strategic and vulnerable sites are required. Fire fighters and engines equipped with appropriate and necessary equipment should be assigned in alert position.
- (iv) **Medical Preparedness** – Well-trained, well-equipped and experienced on-site medical care personnel having necessary medicines and apparatuses should be on-site to mitigate and address possible disaster victims. A hospital command center should be established in due time. Additionally, local hospitals should be involved for planning of mass casualty actions.
- (v) **Emergency Response** – In most cases, emergency response have been found poor. Poor initial communication with emergency medical services was found in many instances.

**Sanders et al have suggested as following:**

- (i) Basic first aid within 4 minutes
- (ii) Advanced Life Support within 8 minutes
- (iii) Evacuation to a medical facility within 30 minutes.

<sup>5</sup> These 6 key areas are applicable everywhere not only for the “Hajj.”

However these suggestions are based on only low patient numbers requiring triage and are low-level evidence and expert judgment. In addition to the above command, control and coordination mechanism or incident command system should be in place to respond efficiently, effectively and timely manner so as to avoid or lessen the morbidity and mortality.

## 7. Some Unfortunate Episodes of Mass Gatherings

- I. 1971 - The Ibrox stadium disaster occurred as the football fans leaving the stadium got caught up with fans entering the stadium at the same time, leading to crush and stampede when all fans heard a goal being scored.
- II. 1981- The Stardust fire in Dublin was believed to have been intentionally started from the ignition of newspapers under flammable seats resulting in 48 deaths and 128 injuries on the spot.
- III. 1985 – The Bradford football stadium caught fire due to a discarded cigarette. Within five minutes, a small fire in rubbish under the seating spread-out and engulfed the whole stadium. 56 spectators died on the spot and more than 200 injured. The spectators rushed to leave the stadium, but the exit gates were locked.
- IV. 1988 – At least 71 people died and hundreds others were injured due to a stampede into Dasarath Stadium in Kathmandu, Nepal during a football match. This unfortunate event occurred due to a sudden high speed windstorm. There were not sufficient exit gates and the whole crowd rushed at once to leave the stadium and people crushed each other.
- V. 1989 – At least 95 spectators died and more than 400 were injured in Hillsborough football stadium due to crowd rush.
- VI. 1990 – During the Hajj in Mecca, Saudi Arabia a stampede caused the death of 1,426 people where the pilgrims spontaneously rushed to leave the site through single exit. Most of the pilgrims were Malaysian, Indonesian and Pakistani.
- VII. 1994 – On 23 May, at least 270 pilgrims were killed due to a stampede at the stoning of the Devil ritual.
- VIII. 1998 - On 9 April, at least 118 pilgrims were trampled to death and 180 injured in an incident on Jamarat Bridge.
- IX. 1998- In Gothenberg, Sweden, a discotheque caught fire resulting the death of 63 people and leaving 213 injured. There were 375 attendees while the capacity of the discotheque was to hold only 150 persons.
- X. 2003 – In Toronto, Canada during the Rolling Stones Concert, many people had physical and mental problems like: headache, nausea, vomiting, musculoskeletal, breathing problem etc. 1870 people sought medical attention. 66% of them were treated in first aid tent and others were transferred off site. There were 4,50,000 fans accumulated together.
- XI. 2004 -At an Indian wedding ceremony, 441 people died and hundreds others sustained injury. This ill-fated event happened due to the synthetic cloth tent which was engulfed by fire and there was no easy access to leave the site.
- XII. 2001- On 5 March, at least 35 pilgrims were killed due to a stampede during the stoning of the Devil ritual.

- XIII. 2003 - On 11 February, the stoning of the Devil ritual claimed 14 pilgrims' lives.
- XIV. 2004 – On 1 February at least 251 pilgrims were killed and 244 injured in a stampede during the stoning ritual in Mina.
- XV. 2006 – At least 346 pilgrims died injuring hundreds others in a crush during the stone-throwing ritual at the “Hajj” pilgrimage in Mecca. This unfortunate event happened after travellers arrived on the bus together at the eastern access ramps to the Jamarat Bridge which caused pilgrims to trip, rapidly resulting into deadly crush. 23,78,636 pilgrims from 187 countries registered for the Hajj. 16,54,407 pilgrims were from abroad. 45% of the pilgrims were females.
- XVI. The terrorist bombings in London on 7 July 2005, made the largest mass casualty event in the UK since World War 2. There were 775 casualties and 56 deaths, 53 at scene. 55 patients were triaged to priority dispatch and 20 patients were found critically injured.
- XVI. 2010 - During the Love Parade in Germany overcrowding fans of a music festival headed to devastating consequences in a tunnel providing the only means of entrance and exit.
- XVIII. 2013 - The “Maha Kumbh Mela<sup>6</sup>” was held at Allahabad, Prayag, India where an estimated 100 million people visited the place during the festival that spread over 55 days. Unfortunately, on 10 February 2013, a stampede at the railway station killed 36 and injured at least 39.
- XIX. 2013 – In Mecca, Saudi Arabia 3.5 million pilgrims were registered for “Hajj” pilgrimage. Among them 1.7 million were from 187 different countries. There were also unregistered cohorts. Despite tireless efforts and management by the Saudi government many people had health and injury problems.
- XX. On 24 September 2015, a crowd collapse caused the deaths of at least 2,177 pilgrims who were suffocated or crushed during the annual Hajj pilgrimage in Mina, Mecca, Saudi Arabia. The Agence France-Presse (AFP) reports a figure of 2,223 killed. The 2015 Mina crash now stands as the deadliest Hajj disaster in the history.

## 8. Nepal's Context

The history of mass casualty in Nepal dates back to 1988. As mentioned earlier, during a football match, 71 people died and hundreds others were injured due to a stampede into Dasarath Stadium in Kathmandu, Nepal. Fortunately, after that large scale mass casualty in 1988 any other that type of mass casualty due to mass gatherings has not occurred in Nepal so far. However, small number of casualties, injuries and illness do occur from time to time during mass gatherings such as: Maha Shiva Ratri<sup>7</sup>, Gai Jatra, Ghode Jatra, Indra Jatra Bisket Jatra, 12 Years Godavari Mela<sup>8</sup>, Maghe Sakranti Mela in Devghat

<sup>6</sup> “Kumbh Mela” is considered to be the largest peaceful gathering of Hindu pilgrims that takes place every third year at one of the four places by rotation namely; Haridwar, Allahabad, Nashik and Ujjain of India where people gather to bathe in a sacred Ganga river since 2,500 years.

<sup>7</sup> Maha Shiva Ratri is a gathering of huge mass in the month of February each year in the temple of Pashupatinath located in Kathmandu, Nepal to pay homage to Lord Pashupatinath (also called Mahadev or Shiva) on the occasion of Lord Shiva's birthday.

<sup>8</sup> Mass gatherings in special occasions.



and in various other occasions during which time a number of people gather to celebrate or mark those events.

The salient features of the mass gatherings in Nepal are minimum or no casualties and injuries during mass gatherings. There are many reasons behind the minimum or no loss during various events where thousands of people assemble together. Main reasons are as following:

- 8.1 *Mutual respect*: Nepal is a multi-cultural and multi-lingual country. In respect of cultural heritage, Nepal is one of the richest members of the world cultural community. It is a homeland of several caste/ethnic groups of people. The differences in life style of these people, in aggregate, reflect varieties in culture. Despite of such diverse culture, religion, caste and language – Nepalese people live together with good accord. They respect each other's religion and culture.
- 8.2 *Social harmony*: Being diverse in religion, culture and way of life, Nepalese people live together in good harmony without any prejudice or conflict. There is no significant record of religious or cultural clash between the different religious and cultural groups.
- 8.3 *Low crime rate*: Comparatively there is less crime in Nepalese society. Although there are the incidents of crimes in urban areas, the rate of crime in rural areas is minimum. Most of the people still live in rural Nepal. According to the the last Population Census 2011 carried out by the Central Bureau of Statistics, among 26.4 million people of the country 83 percent people live in the rural areas.
- 8.4 *Less violence and crime despite of undeveloped security measures*: The

violence and crime in Nepal is less, if we take into account the population size, geophysical condition and difficult terrain of the country. Furthermore, although the security system of Nepal is not well-advanced the incidents of violence and crimes are low.

Whatsoever, Nepal Government has to think and plan better to respond immediately, effectively and efficiently to address and mitigate the possible unfortunate incidents that may occur in future mass gatherings. Additionally, Nepal needs to develop and modernize its security system to promptly respond to security threats and incidents.

## 9. Recommendations

In light of the Nepalese and global scenario of mass gatherings and possibility of casualties and injuries following recommendations have been set forth to be taken into consideration from the respective governments:

- (1) Lessons learnt from the past events clearly indicate that most disasters had similar features and therefore disaster managers should consider during the time of planning for a mass gathering.
- (2) In the event of mass casualty incidents (MCIs), medical directors, physicians and nurses have to play a variety of roles before, during, and after such event. The role of physician throughout the MCI response and the role of medical director during disaster mitigation and preparedness with strategies to develop a local infrastructure of partnerships, communications and protocols are of high importance. Throughout the response and recovery, medical directors should focus on facilitating patient flow and distribution

instead of acute care and command, serving as a contact person under unified command. The social media, print media and electronic media also play important role in establishing and maintaining multiagency collaboration and information sharing.

- (3) Health crews need briefing before the event and debriefing particularly after spontaneous events. Data collection, reporting and patient follow up also needs to be carried out.
- (4) For the mass gatherings such as “Maha Shiva Ratri”, “Hajj” and “Kumbh Mela”, on-site medical care needs to be improved in order to tackle the disastrous situation.
- (5) The emergency medical service personnel and vehicles must not have the problem of access to the event sites. Therefore, adequate numbers of access points solely for entrance and exit point at the event site are highly necessary. There should also be the provision of unidirectional flow of crowd members avoiding the merge of the crowd again.
- (6) For mass gatherings on larger scale such as Olympic Games, an assessment of terrorism risk assessment might be necessary, with further medical provisions available during the planned events.
- (7) It is highly necessary to include health in emergency planning committee; establish a health sub- committee; undertake a risk analysis; develop a health plan; determine the level and nature of resources required; establish health command and control both during the planning phase and the event.

## 10. Conclusions

The key health challenge of mass gatherings is to ensure that sufficient planning, preparation and organization is in place in order to minimize the risks, ensure the health and safety of participants and audience, manage the health of people and respond effectively in the event of a significant event. Therefore, event organizers have the responsibility of ensuring the availability of emergency medical services for spectators and participants. If considered carefully in planning for mass gatherings, these might reduce morbidity and mortality should a disaster occur. Organizers should be made responsible to comply with the health standards. Although, there are no specific legislative requirements for mass gatherings, a range of legislative instruments exist in many countries that have relevance including the Public Health legislation, Police legislation, Traffic Act, Local Government ordinances and Occupational Health and Safety legislation etc. Every mass gathering event should have a major incident and mass casualty plan (including the evacuation plan) which should be activated in the event of a disaster.

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## 4.2 Emerging Trends in Disaster Management Policy in Nepal

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Participants and Resource Persons of Pandemic Disaster Preparedness Training

Photo: Meen Chhetri

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## 1. Background

The world has witnessed an alarming increase in the frequency and severity of disasters in recent years: between 1994 and 2013, EM-DAT recorded 6,873 natural disasters worldwide, which claimed 1.35 million lives or almost 68,000 lives on average each year. In addition, 218 million people were affected by natural disasters on average per annum during this 20-years period.

The frequency of geophysical disasters (earthquakes, tsunamis, volcanic eruptions and mass movements) remained broadly constant throughout this period, but a sustained rise in climate-related events (mainly floods and storms) pushed total occurrences significantly higher. Since 2000, EM-DAT recorded an average of 341 climate-related disasters per annum, up 44% from the 1994-2000 average and well over twice the level in 1980-1989.

Disaster risk is continuing to increase, mostly because greater numbers of vulnerable people and assets are located in exposed areas (Tom Mitchell, 2014). The vulnerability of disaster is increasing globally, regionally and nationally.

Nepal stands at fourth in terms of climate change, 30th in terms of flood hazard; and 11th in terms of earthquake vulnerability. Additionally, Kathmandu is number one earthquake vulnerable city in the world. A 7.8 magnitude earthquake struck Nepal on 25 April 2015. The earthquake was followed by a number of aftershocks throughout Nepal, with one shock reaching a magnitude of 6.7 on 26 April and another one measuring 7.3 magnitudes on 12 May. These quakes caused the death of nearly 9000 people and enormous damage to physical properties worth billions of dollars.

## 2. Major disasters and vulnerabilities

### 2.1 Flood and landslide as a recurrent disaster

Flood is caused by heavy precipitation, which may occur at any place except high Himalayan region during the monsoon season. Inundation along the riverbanks and erosion of land along the riverbanks causes loss by damaging irrigation and communications facilities and fertile lands across or adjacent to the riverbanks. Such phenomenon's have caused loss of lives and property in mountainous areas of Nepal and have posed severe hazards to physical infrastructure like roads and bridges. Inundations have disrupted social and economic development of many parts of terrain region in the country.

The floods of August 2008 in Koshi River, September 2008 in Western Nepal and July and August 1993 in the Bagmati and other rivers were the most devastating floods in Nepal. Nepal has observed Monsoon flood as well as Flash flood. Rainfall variability (unequal rainfall in time and space), topography (steep Mountain and flat Tarai), Deforestation (decreasing vegetative cover) are the major factors contributing to the floods in Nepal. The 1978 flood in the Tinao River Basin, the 1980 flood along the Koshi River, the 1985 cloudburst and outburst of the debris dam in the Tadi River Basin, the 1987 flood in the Sunkoshi Basin resulting in the submergence of the central and eastern Terai and the 1989 cloudburst affecting the Central Region – some areas of Chitwan and the Western region – the inner Terai and Butwal and Parasi areas are among the major floods recorded in Nepal. The devastating flood that occurred from July 18-20, 1993, in the Central Region

surpassed all the floods mentioned above in terms of its ferocity and the damage it caused to the national economy. It caused heavy destruction of life and property, made thousands of people homeless, and destroyed standing crops spread over thousands of hectares of lands. The 44 districts were affected and some 1,336 people lost their lives in that disaster. About half a million people from 73,000 households were affected (ICIMOD, 2007).

The movement of earth, rock or debris down slope under the influence of gravity by certain processes, considered, as a landslide is also major threat in Nepal. Landslide usually occurs as secondary effects of heavy rainfall and earthquakes. In so many cases, the landslide has occurred in Nepal even if there is small amount of rainfall, but it was continuous for weeks. A debris flow is slurry of soils, rocks and organic matter combined with air and water. In general, the middle hills are prone to landslides. The natural phenomena like heavy rainfall, active geo-tectonic movements, deforestation and disturbance of hill slopes are also the major causes for occurring landslides.

On August 5, 2014, the mass landslides occurred in the Sindupalchok district that claimed the life of 156 people, making it the deadliest to hit the nation in past three decades. The landslide has also created a dangerous blockage of the Sunkoshi River, stoking fears of floods downstream in neighbouring India's Bihar state, where the river is known as Koshi. The landslide also damaged part of the Arniko Highway linking Kathmandu with the Tibetan capital Lhasa, stranding more than 500 foreign hikers and their guides.

## 2.2 Earthquake, a great threat for Nepalese

Nepal is the 11<sup>th</sup> most earthquake-prone country in the world. Nepal lies in the seismic vault of the ridge of two giant plates namely Indian and Tibetan Plates (Yu Jin, 1996) have placed Nepal as more vulnerable to earthquake. Historical events have shown the extent of damage. The great earthquake of June 7, 1255, damaged palaces, temples, and houses in the Kathmandu Valley and killed one-third of its population. The earthquake of August 26, 1833, destroyed 4,040 buildings, killed 414 persons, and injured many in the vicinity of Kathmandu where there were hundreds of additional fatalities: it also destroyed houses in the eastern villages (ICIMOD, 2007) followed by 1934 AD earthquake in Nepal with the magnitude of 8.4 on the Richter scale, claiming 8519 people lives in Nepal. There have been earthquakes time and again causing severe lives and properties loss in 1980, 1988 and 2011. On Saturday morning, 25 April 2015, a 7.6 magnitude earthquake as recorded by Nepal's National Seismological Centre (NSC), struck Barpak in the historic district of Gorkha, about 76 km northwest of Kathmandu almost after over 80 years since the last mega earthquake hit Nepal. The tragic earthquake was followed by more than 380 aftershocks greater than magnitude 4.0 as of 19 August 2015. Four aftershocks were greater than magnitude 6.0, including one measuring 6.8 which struck 17 days after the first big one with the epicentre near Mount Everest. To date, there are over 8,890 casualties, 198 missing and 22,303 injuries. (MoHA, Gorkha Earthquake, One-Month Report). It is estimated that these earthquakes have affected the lives of eight million people, almost one-third of the population of Nepal<sup>3</sup>.

<sup>3</sup> Nepal Earthquake 2015, Post Disaster, Needs Assessment Report

### 2.3 Other disasters

Fire is a recurring disaster in Nepal. A large numbers of incident of fire are reported, mostly in the Terai where about three quarter of houses are built with thatched roofs during the dry season from February to May. Forest fires occur throughout Nepal and result deforestation of around 1.7 per cent of the total forest area annually. These fires cause economic losses and environmental degradation throwing ecosystems out of balance. It is also threatening valuable and endangered flora and fauna, degrading the soil and inducing flood and landslide. Most of the fire incidents are caused by negligence of the people in Nepal. Hunting practices, carelessness by cigarette smoker, deliberate fire to accelerate growth of grasses to feed livestock, fire set by herb and charcoal collectors and children playing with fires are some of the reasons for forest fires. Certain type of trees especially Sal (shores Robusta) is particularly susceptible to fire. About 86 per cent of the population of the country inhabit in the rural areas mainly in thatched houses closely clustered where fire hazards are likely to be common.

Glacial lakes are like natural water reservoirs dammed by ice or moraines. Lake outburst can be triggered by several factors: ice or rock avalanches, the collapse of the moraine dam due to the melting of ice buried within, the washing out of fine material by springs flowing through the (piping) earthquakes or sudden inputs of water into the lake e.g. through heavy rains or drainage from lakes further up glacier. ICIMODs 2001 inventory of glaciers, glacial lakes and GLOFs counted 3252 glaciers and 2323 glaciers lakes in Nepal 20 of which are very vulnerable to flooding (MoHA, 2009). GLOF affects high Himalayan region as well as downstream by extremely damages of lives and properties. Major events shown in past were TamorKoshi (1980), Sun Koshi (1935, 1981), DudhKoshi (1977, 1985), Arun (1968, 1969, 1970) etc.

In Nepal, most of the country is in the grip of drought-like condition from the end of March till the monsoon arrives in June, but the districts like Manang and Mustang in the Trans-Himalayan region are extremely dry throughout the year and the Terai and western hills are more frequently affected by floods and landslides than other regions. Drought results in crop failures and famine, both during the monsoon season and rest of the year, when winter crops are sown. About 5,000 families living in pockets in the hills and Terai are badly affected by drought each year (MoHA, 2009). Planned land use with crop rotation, rain water harvesting, drought monitoring, using recycle water, developing irrigation system, water rationing are some of the strategy which help to minimize impact of drought.

Although about 300 people died in June and July 2009 in Midwestern part of the country, this year there is no severe case of diarrhoea, but it is likely to burst again anytime in the monsoon season, as the country is always in the threat of the epidemic of diarrhoea. Some other kind of disasters are drought, hailstone, thunderbolt, avalanche, boat capsized, structure collapse, cold wave, hot wave, swine flu, bird flu, encephalitis, meningitis is common during hot and rainy season. The lightning, hailstorm are other common natural disasters are increasing in Nepal. According to the Ministry of Home Affairs, the lightning alone killed about 200 people in 2012. The sudden avalanche and heavy snowfall in winter season sometimes cause heavy loss of human lives and properties. Road accident and Aircraft accidents are also major source of disaster in Nepal. In Nepal, road accidents are one of the top ten causes of death. Aircraft accidents are more common in hilly terrain and areas with extreme climatic condition. However, the road accident and aircraft accident has been dealt by other government agencies, treating them as an accident, not the disaster one.



A scenario of past disastrous events during 1980-2012 (DisInventar) reveals that epidemics, landslide and floods takes the largest toll of life every year, and urban or rural fire are the principle hazards in terms of their extent and frequency of occurrence as well as the spread and intensity of physical and socio-economic impacts. Earthquake is a major potential hazard to reckon with – the country is located on an active seismic belt and the exponential urbanization trend over the past decade with general disregard of earthquake-resistant measures in building construction is the cause of ever-increasing earthquake risk.

### 3. Disaster Management in Nepal from policy perspective

Disaster management system in Nepal is largely relief and response focus. Ministry of Home Affairs is coordinating the overall disaster management activities, although different ministries are presuming their duties of disaster preparedness. In the absence of a dedicated authority, it has become increasingly more challenging for the timely, efficient and effective management of disasters. As the ICIMOD reported in a way 'Efficient implementation of preparedness activities has often been hampered by lack of coordination between and within government and non-government organizations. The focus of disaster management has been on relief/response and recovery to support communities struck by disasters largely in an ad hoc basis and, in many cases, to an insufficient degree. Lack of effective coordination has, in many cases, led to gaps and duplication of response works of various aid organizations. The priority is still mainly reactive to cover the post-disaster needs, i.e., rescue and relief work, and this is a common mind-set of people and organizations working in this sector.

Because of this mind set, preparedness activities have not received sufficient priority in disaster management activities (ICIMOD, 2007).

The NCRA has envisaged the Natural Disaster as earthquake, fire, storm, flood, landslide, heavy rain, drought, famine, epidemic, and other similar natural disaster. The Act also includes industrial accidents or accidents caused by the explosions or any other kinds of disaster. The Act has provision to set up different institutions from centre to local level to administer relief and rescue works during the emergency. The Central Natural Disaster Relief Committee (CNDRC) is supported with Relief and Treatment sub-committee and Supply, Shelter and Rehabilitation sub-committee at the centre level as an apex body of

*The strength of policymaking is integral to the strength of government as a whole, and that of the country at large. When policies fail, the costs (whether monetary or otherwise) can be significant. (POLICY MAKING IN THE REAL WORLD), Michael Hallsworth, with Simon Parker and Jill Rutter*

disaster management in Nepal. There is provision of a Regional Natural Disaster Relief Committee (RDRC), District Natural Disaster Relief Committee (DDRRC) and Local Disaster Relief Committee (LDRRC). Among those institutions, CNDRC and DDRRC are quite functional since then however, two subcommittees, RDRRC and LDRRC could not function as expected.

The Local Self Governance Act (LSGA) 1999 empowers local bodies to govern themselves. It recognizes that local people and local bodies are the most appropriate points of entry to meet the development needs at the local level. The LSGA authorizes to undertake certain functions

with respect to DRR by local bodies. The National Strategy for Disaster Risk Management (NSDRM) was promulgated in 2009. This strategy has been developed based on Hyogo Framework for Action (HFA) 2005. A detailed process was adopted during the preparation of the NSDRM, 2009. Multiple consultations were organized to solicit the view of governmental, nongovernmental agencies, local bodies, academic institutions, private sector, UN agencies, INGOs, and civil society organizations, as the long-term vision of the strategy is to develop Nepal as a disaster-resilient community. It has also a mission to provide guidance and ensure effective disaster management through development and implementation of the concept of effective preparedness for mitigation, disaster risk reduction and incidence of calamities. In addition, 29 activities have been identified within the priority areas of NSDRM. Realizing that disaster management is a multidimensional and multi-agencies responsibility, sectoral strategies have also been adopted. The strategy has also proposed new institutional arrangement for disaster management, which entail the formation of a National Disaster Management Council (NDMC) to be chaired by Prime Minister. Besides, it also envisions National Disaster Management Authority (NDMA) as a secretariat of the council where other three committees under the council for preparedness, rescue and relief and reconstruction and rehabilitation activities. The strategy realizes that disaster management is possible only through integrated, participatory, and collaborative involvement of all partners.

The Government of Nepal formed Nepal Risk Reduction Consortium (NRRC) in May 2009 in collaboration with development partners... In addition, the consortium initiated a multi-stakeholder consultation process with the Government of Nepal and civil society organizations to identify

short to medium term disaster risk reduction activities that are both urgent and viable within the current institutional and policy arrangements in the country. Based on the government priorities and feedback received from multi-stakeholder groups, five flagship areas for disaster risk management in Nepal have been set forth that are: i) school and hospital safety ii) emergency preparedness and response capacity iii) flood management in the Koshi river basin, iv) integrated community based disaster risk reduction/management and v) policy/Institutional support for disaster risk management.

As the history, shows that the Disaster Management Programs was first included in the 10th national plan (2002-2007) of the government of Nepal. Since then the, emphasis has gone to an ascending orders till the current three year plan (2013/14-2015/16) that has emphasized the disaster management as a separate topics and also has tried to mainstream the disaster management with various line items topics. This has also focus on the important of new disaster management act and new institutions to deal with the disasters. The plan emphasizes on policy formulation, strengthening institutional mechanism, EWS, coordinated approach for DRR and linking disaster management with climate change and development. It is hoped that this attempt would be a landmark in the history of Disaster Management. The plan has set up its vision to minimize social and economic loss and damage caused by disasters. The main objective of plan is to promote the security of life and property from the impact of natural disasters through sustainable, environment-friendly and result-oriented development by making disaster management practices efficient, competent, strengthened and effective.

The current 13th three-year development plan (2013/14-2015/16) has not only

devoted separate chapter for disaster management issues, but also the plan addressed disaster management issues more comprehensively. It has set its disaster management goal to achieve the goal of Hyogo Framework for Action by 2015 and has tried to link up with the Sendai Framework of DRR 2015-025, along with the long term goal of the plan is to develop disaster resilient Nepal. Moreover, mainstreaming disaster risk reduction, institutional and legal reform and preparedness for better response are the strategies of this plan. There are various acts, rules, regulations and guidelines, which have little or more provisions about disaster management. These are: Soil and water conservation act, 1982, Nepal building act, 2007 and Building Code, 1994, Environmental protection act, 1996, National agriculture policy, 2004, National shelter policy, 1996, National urban policy, 2006, National water plan, 2005 and Water resource policy, 1993, National water resource strategy, 2002, Water induced disaster management policy, 2006, Climate Change Policy 2011 and some strategies related to health and infrastructure sectors are considered as a majors in the area of disaster management in Nepal.

Ministry of Home Affairs (MoHA) acts as National Focal Agency on Disaster Management and lead agency responsible for implementation of the Natural Calamity (Relief) Act, 1982. The MoHA is also responsible for rescue and relief work, data collection and dissemination, as well as collection and distribution of funds and resources. The assigned task is being implemented through Disaster Management Division, placing three sections namely Disaster Preparedness and Recovery Section and Disaster Study and Research Section along with the response focused National Emergency Operation Center (NEOC). The CNDRC is chaired by the Home Minister and includes related

ministries and security agencies along with voluntary organizations such as Nepal Red Cross Society and Nepal Scout. CNDRC is responsible for preparing national policies on preparedness, response and recovery and ensuring their implementation including stockpiling relief and rescue materials, collecting and disseminating relief materials and fund during emergency, give direction to the district and local committees for the execution of relief work. The Regional Disaster Relief Committee (RDRC) is present in all five regions of Nepal and is chaired by the Regional Administrator. It is responsible for supporting and monitoring the activities implemented by District Disaster Relief Committee (DDRCs), formulates regional, and district disaster management plans. All 75 districts of Nepal have a DDRC chaired by the Chief District Officer (CDO), who is the highest-level government official at district level and takes disaster related decisions. It comprises various line agencies including district based security agencies and the district chapter of NRCS and critical facilities such as irrigation, road, livestock, health etc as well. The role of DDRC is to coordinate the local committees, formulate district disaster management plan, coordinate and operate relief work during emergencies and provide information to RDRC and CNDRC.

## 4. 2008 Koshi Flood year of disaster policy breakthrough

### 4.1 Koshi Flood 2008

On August 18, 2008, the river Koshi burst through its eastern banks, 8 km north of the Indian border. At its peak, the intensity of water force went up to 166,000 cubic feet per second (cusec) compared with the regular 25,744 cusec, running straight down south through a new course 15-20 km wide and 150 long north to south. This created major flooding in Nepal and

India The floods damaged numerous villages and left rendering over a million homeless and 2.7 million affected and over 200 people reported to have died in both Nepal and India. This flood is considered as one of the costliest and most deadly natural disasters in the history of these neighbouring countries. A large-scale loss due to Koshi flood has brought significant destruction, hindering economic performance and depriving communities of their assets, livelihoods, and labour force, all too often locking them into endemic poverty cycles. In addition, each year, Nepal is plagued with the same disasters, affecting thousands of people, destroying lives and livelihoods, and necessitating the externalization of disaster response.

The devastation wrought by disasters, however, has not only presented an opportunity to initiate improvements in

quality of life and changes in attitudes about risk while undertaking reconstruction tasks but also pushed country to formulate various key policies regulations to help its people to revive the local economy, restore livelihoods, and improve access to safe housing and wellbeing. There are at least 17 different policies/regulations/guidelines have been formulated and in action since post Koshi floods.

## 4.2 Policy Changes

Being as a signatory to Hyogo Framework of Action, 2005-015, Nepal was having invisible pressure to the national government to change the Disaster Management Policy from response focus to preparedness focus, which was triggered by the Koshi Flood in the country context. The flood not only caused the losses of lives and

### Box 1: History of Koshi Embankment Breaches<sup>4</sup>

The Koshi River presents a challenge in terms of long and recurring flood hazard. A major flood in 1953-54 led to the “Koshi project” which was aimed at flood control and irrigation. The project led to the creation of a barrage and embankments on each side were designed to protect approximately 2800 km<sup>2</sup> of land in north Bihar and Nepal. Despite this intervention and a long history of flood control management in the basin for more than 5 decades, the river continues to cause extensive flooding due to breaches.

1963: The first breach on the western embankment in Nepal

1968: Five breaches in north Bihar

1971: Collapse of the 1969-built Bhatania Approach Bund

1980: Eastern embankment breach 1984: Eastern embankment breach

1991: Breach in the western embankment near Joginia in Nepal

2008: Breach in eastern embankment

<sup>4</sup> BIHAR KOSI FLOOD (2008) NEEDS ASSESSMENT REPORT, June 2010

properties, but also triggered the pressure to the government to expedite the process of policy changes. This can be visualised with so many rules and regulation given below. Since the MoHA is putting pressure the duty of overall responsibility of disaster management at national level, it has created some sort of responsibility to Prime Minister Office and other related Ministries. Most of the Government Agencies are working together with Non-Governmental

Sector to deliver better response and relief coordination. This new initiation and sense of responsibility can be seen with immense changes of then existing rules and policies in the area of disaster management. Some of the major changes are listed here:

The changes in Disaster Management Policy can be seen since the amendment of Rescue and Relief Standards of 2007 (1st revision in 2008 and 2nd in 2012 June), as

### Major Changes in DM Policy in Box

- Rescue and Relief Standards, 2007 (1st revision in 2008 and 2nd in 2012 June)
- Prime Minister Disaster Response Fund Guideline 2006, (1st revision in 2008)
- PM Natural Disaster Response Fund 2006 (1st revision in 2008) activated intensively
- Disaster Related Funds at Line Ministries, started from 2008
- Cluster System rolled out in 2008 after Koshi floods and 26-government ministries established disaster desks from 2010.
- National Strategy for DRM (NSDRM), 2009
- The Cabinet at Office of the Prime Minister and Council of Ministers (OPMCM) takes active role in disaster management from 2008
- National Risk Reduction Consortium (NRRC) 2009-2014, chaired by Home Secretary started from 2009
- Five-Flagship Program initiated from 2009 (2009-2014) and extended
- Rescue and Treatment Sub-committee chaired by Health and Population Minister play active role from 2008
- Supply, Shelter and Rehabilitation Subcommittee, chaired by Urban Minister play active role from 2008
- National Platform on Disaster Risk Reduction, 2008
- National Emergency Operation Center at National Levels and Regional/ District Emergency Centres (EOCs) from 2010
- SAHANA Program for data collection, processing and for dissemination from 2011
- Publication of Nepal Disaster Report started from 2009
- Disaster Preparedness and Response Plan (DPRP) Guideline formulated and rolled out across the country from 2011
- Local Disaster Risk Management Guideline, 2012

it was not sufficient to address the need and expectations of disaster victims, as one can see the changes in relief amount and relief package declaration. Beyond the Standard, a high-level committee headed by the Minister, Physical Infrastructure and Management was formed and the cabinet has decided to offer the relief package based on the recommendation made by the committee.

The Prime Minister Disaster Response Fund Guidelines 2006 has been revised in 2008 for an effective disaster response. Before that, there was no existence of the line Ministry Funds to response, as in 2008. The Disaster response related funds at Line Ministries have been established and such funding arrangement is found effective.

The Cluster System was rolled out after the Koshi floods in 2008. Initially, clusters were led by the UN agencies and INGOs, later it is adopted and owned by the Government. In the current context, we can see that respective government Ministries are leading the cluster activities with the support for the UN as co-lead. This is a great success in the history of cluster transitioning. This initiation was started from the lesson learned from Koshi Flood and further it was carried out at policy initiation from the Government. To expedite the process, the 26-Government Ministries has established disaster desks from 2010, in the name of Disaster Section at MoFALD and MoUD; and in the name of Disaster Unit at Different Ministries. To carry out all efforts in an effective manner, Government has formulated and implemented the National Strategy for Disaster Risk Management (NSDRM) in 2009 that has defined and identified the exact role and responsibility of different Ministries. It has specified the role of Preparedness to Morfeld and the role of recovery to Mound, fixing the role of Response and Immediate Relief to Mohan. This also envisaged the existence

of a powerful and well-functional National Disaster Management Authority directly under the Disaster Management Council headed by the Prime Minister.

The formulation and enactment of the NSDRM was a milestone achievement in the history of Disaster Management in Nepal. The Office of the Prime Minister (OPMCM) and Council of Ministers is taking active role in disaster management from 2008, as it has got high national and international attention for better response. The then Prime Minister and Chief Secretary were actively engaged with the better response and immediate relief. At that time, it has got somehow raised the issue that only the involvement of MoHA in rescue and immediate relief is not sufficient, it requires the special attention from the Prime Minister and Chief Secretary. It has been found at that time that the response focused MoHA has less attention towards the Preparedness. The National Risk Reduction Consortium (NRRC) 2009-2014 was formulated to show the concern of MoHA for the Preparedness. The Koshi Flood has pressurised the Government Agency, especially the MoHA to shift its focus from response to preparedness. Under the NRRC initiation, the Five-Flagship Program was formulated from 2009 (2009-2014), under which the School and Hospital Safety, Emergency Preparedness, Koshi Flood Management, Community Participation in Disaster Management and Policy/institutional reform areas has been taken as a priority programs. (Repeated) In this priority program, one can see that the Koshi Flood Management has taken as a Priority Three Area. One can visualise the effective influence of Koshi Flood in the policy changes dimension. Natural Relief Calamity (Relief) Act envisaged the existence of two sub-committee headed by Health Minister and Urban Development Minister. These two sub-committee, Rescue and Treatment Sub-committee

chaired by Health and Population Minister and Supply, Shelter and Rehabilitation Subcommittee, chaired by the Minister Urban Development has played active role from 2008. As a joint effort of government and non-governmental sector, the National Platform on Disaster Risk Reduction (HFA 2005-2015) started in 2008 as a close circle group however, it is later developed as a loose network to accommodate more agencies working in disaster management on 2011, The NPDRR is headed by Ministry of Home Affairs, coordinated by DPNet and technically supported by United Nation Development Program. Though the establishment of DRR Platform is a global commitment of the government, it was actually developed after the push and the context of Koshi Flood at the local level.

MoHA is taking the overall responsibility of Disaster Management focusing more on response work. Information flow and immediate rescue and relief has been coordinated through Disaster Management Section that has further realised that this is not sufficient arrangement for information sharing and dissemination. Because of this reason, Emergency Operation Centre (EOC) at National, Regional and District level has been established from 2010 to expedite the process of disaster information collection and dissemination. The information processing in EOCs has been expediting through the SAHANA Program and DRR portal from 2011.

The need of a national publication containing disaster management information has been felt highly desirable. To address this need, the publication of Nepal Disaster Report has started from 2009. Since then, it is being published after every two years. The series of disaster report publication is a new initiative taken from MoHA along with the wider DRR stakeholders. Similarly, the District Disaster Preparedness and Response Plan (DPRP) Guideline has been

formulated and rolled out across the country from 2011 with the provision of District Lead Support Agency (DLSAs) to support the lead agency i.e, District Disaster Relief Committees at district level. Local Disaster Risk Management Guidelines has been enacted from 2012 can be observed as a new policy initiation in the area of disaster management in Nepal.

### 4.3 Lessons learnt

- i. Medium and large-scale disasters have caused huge suffering and damages to lives and properties every year in Nepal. The national disaster response plan needs to be prepared for effective coordination, mobilisation of resources, and provide timely humanitarian assistance to the disaster affected people.
- ii. Nepal is prone to various types of disasters whether they are natural or human induced. To carry out efficient, timely and effective response, national capacity has to be enhanced and authority needs to be well set up to reduce to prevent and mitigate the losses of lives, physical properties and environmental damages.
- iii. The national disaster response capacity and participation of international humanitarian communities depend on the scale, type and the impact of the disasters
- iv. The NCRA 1982 is reactive in nature therefore the NSDRM should be pre-emptive in practice, as the works done in preparedness phase will greatly minimize the losses while responding actual disaster. Therefore, Nepal needs to translate national strategy for disaster risk management and national disaster response framework into actions without any further delay.

- v. Inter-country disaster management policy needs to be formulated and clearly defined with the roles of responsibilities of each country and its people. As a principle of humanity, all disaster victims despite of where they come from, needs to provide relief assistance. The evidence from various studies suggests that though relief and rescue operations will be continued, in the post disaster situation, the lack of international coordination agreement between as the governments, will create lots of challenges during the difficult time especially in the context of Nepal receiving the international humanitarian assistance.
- vi. In order to ensure the success of relief and (or) disaster preparedness efforts, the humanitarian agencies needs to consult the affected communities to ensure their participation in planning and decision-making. In addition, relief efforts must include a long-term income-generating project that considers the capacities of the local people. More importantly, it is highly to map the particular socio-economic and environmental vulnerabilities.
- vii. **For effective disaster management, local government should be empowered by providing adequate funds and resources on the one hand and the local community should be enabled by education and training on the other.**

## 5. Conclusion

The 2008 Koshi floods has been a turning point in terms of initiating various policies related to disaster management and risk reduction. Nepal has formulated and implemented host of policies and other legislations within the past 7-8 years.

It is in fact encouraging to state that policy makers have realized that disaster risk management is a key to achieve sustainable development. After becoming signatory to HFA in 2005, the GoN has prioritized DRR in its development agenda and adopted National Strategy for Disaster Risk Management (NSDRM) in 2009. The NSDRM has clearly incorporated five priority areas as stipulated in the HFA. Apart from other DRR plan, program and projects, the introduction of the five flagship areas have been instrumental to prioritise immediate action for disaster risk management in Nepal. Establishment of National Emergency Operations Centre and National Platform on DRR, introduction of DRR Focal desks in various government ministries has not only helped effective implementation of disaster risk reduction related policies and programs through the involvement of relevant ministries, departments, security agencies and local bodies but also open up windows to coordinate and collaborate with national and international agencies. Such great initiation to the development of disaster management policies in the country will only be translated into action if there are sincere commitments from all sectors in resource allocations, increased cooperation and collaboration among various national and international agencies and involvement of private sectors and media.

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## 4.3 Impact of Hudhud Cyclone in Himalayan Region of Nepal

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## Background

October second week of 2014, the severe cyclonic storm 'Hudhud'<sup>3</sup> struck the Trans-Himalayan Region and triggered mighty storms, torrential rainfall, heavy snowfalls and avalanches in Mustang, Manang, its neighboring districts and Annapurna traking route. Tourism is the main source of these people. Annapurna traking route is the popular route over the world for the traking. This was not an exceptional occurrence



Image from Nasa shows Cyclone Hudhud over India's eastern coast.

in Nepal, a land where mountains are steep and unstable. Heavy rain and snow storms in Nepal were the result of Cyclone 'Hudhud', which hit neighboring India's eastern coast during that weekend.

Two days after cyclone 'Hudhud' made landfall in Eastern India, it tore into Nepal. It caused extensive damage of physical infrastructures, settlements, climbing and trekking routes, expedition base camps filled with foreign tourists and climbers and loss of lives due to the sudden, furious and unexpected snow storms and avalanches. The incident occurred suddenly after the monsoon season when the period was considered safe and popular for trekking and climbing at high altitudes. Heavy rainfall due to the cyclone also affected central and western parts of Nepal.

Just before this devastating snowstorm, the perfect storm hit Nepal killing at least 43 foreign trekkers as well as seriously wounding Nepal's tourism industry. The tourism industry then, was still recovering from the aftershocks of an ice avalanche that struck the lower reaches of Mount Everest in April, killing 16 guides in the worst disaster in the history of the world's highest peak<sup>4</sup>.



Cyclone Hudhud path and affected area map

<sup>3</sup> The word Hudhud comes from Arabic and refers to the hoopoe bird – the national bird of Israel. But the current cyclone is named by Oman. An international panel on tropical cyclones led by the World Meteorological Organization (WMO) decides to name their cyclones as a committee in the spirit of co-operation and consensus. Eight countries - India, Pakistan, Bangladesh, Maldives, Myanmar, Oman, Sri Lanka and Thailand - took part in the meeting to name upcoming cyclones in the regions. They came up with a list of 64 names - eight names from each country. The list goes alphabetically, according to each country.

<sup>4</sup> "Cyclone Hudhud triggers rains in Nepal." REPUBLICA, Oct 14:

## Indian Scenario

Under the influence of an upper-air cyclonic circulation, a low-pressure area formed over the Andaman Sea on October 6, 2014. It slowly consolidated and was upgraded to a depression and continued to encounter a favorable environment, and a tropical cyclone formation. The deep depression made its first landfall over Long Island, Andaman, and had reached cyclonic storm intensity, naming it 'Hudhud' on 8 October 2014, after entering the Bay of Bengal, Hudhud continued to intensify the following day, and was upgraded to a severe cyclonic storm. Hudhud crossed the coast of Andhra Pradesh at the noon of October 12 over Visakhapatnam, with winds exceeding 185 km/h (115 mph causing 61 deaths within Andhra Pradesh and an estimated damage of US\$3.4 billion)<sup>5</sup>. This made Hudhud the most destructive cyclone to ever hit India. The effects of Cyclone Hudhud, that hit the southern parts of India on Sunday with heavy rains and winds of almost 200 kmph, were felt in Nepal on Monday, October 13, 2014.



An unexpectedly heavy snowstorm fell on the Thorang-La

Effects of Hudhud were first felt in the middle and eastern regions of Nepal, immediately after the cyclone unleashed its effects on the Indian states of Andhra Pradesh, Orissa, West Bengal, Madhya Pradesh and Bihar<sup>6</sup>.

## Back to Nepal High Altitude Scenario

Three months from September; are marked as the busiest trekking and hiking season in Nepal, with thousands of foreigners along with their porters and guides hiking Nepal's Annapurna Circuit, when weather conditions are normally clear. However, October of 2014 witnessed unusually heavy snowfall sparked by Hudhud, covering Trans-Himalayan region. The Thorong La (5416m), on the trail that surrounds Mount Annapurna and Mustang valley also hit severely. "I was regularly following the news and updates about the Hudhud storm warning issued by the Government of Nepal and India on television and the internet. It seemed ferocious and I thought it would surely cause a lot of damage in the areas hit by it. When the weather went from bad to worse, for the safety of the school children, we had to close the school temporarily as there were hail storms and it also began to snow. The afternoons were foggy and we also experienced exceptionally heavy rain. I heard about similar weather conditions and few snowfall and landslides from my counterpart Devendra Lamichhane serving as a CDO in Manang district. " (Babu Ram Bhandari, CDO of Mustang.)

The blasting sounds of the wind were very scary. It used to be completely dark throughout the day but was terrible after 5 pm. The torrential rain fell continuously

<sup>5</sup> Wikipedia: The free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web 12 Oct.2014

<sup>6</sup> Nepalnews.com Published on 13 Oct 2014



Heavy rains, strong winds and deteriorating weather condition in Mid Hills of Nepal

accompanied by ear-splitting thunder. The road leading to the Muktinath temple and the smaller trails leading to the nearby villages were water logged. The communication lines started going down and we were unable to contact and receive the information about hikers and trekkers stranded in Thorang-la. Then for days together we were without internet, land line phone and even mobile phone connectivity. “In such a scenario we activate District Emergency Operation Center (DEOC) and establish comand center at District Head Quarter Jomsom without any delay to counter the further consequences triggered by ravaging storm.” (CDO Babu Ram Bhandari)

## Rescue Effort

It was decided to activate District Emergency Operation Center and established comand post headed by CDO in Jomsom and sends the troops to establish the temporary operating base (TOB) at Muktinath area (Digrame 1). On the way to Muktinath, the rescue team met with few foreign trekkers (Germans) who had managed to escape from the scene and received

the information about 5 other Germans stranded at Yekle Bhatti area. Team reached that location in the middle of the night and evacuated them (One having compound leg fracture) and back to Muktinath. The snowfall was the worst in a decade with almost 1.8 meters (6 ft) of snow falling within 12 hours. Continuous snowfall was also hampering the rescue effort. With the total support of the civilian agencies, the rescue team managed to establish an Integrated Operational Base successfully at a height of 4800m Dump



Map Showing Annapurna region



Nepalese Army rescuers removing the bodies and evacuating stranded hikers and trekkers

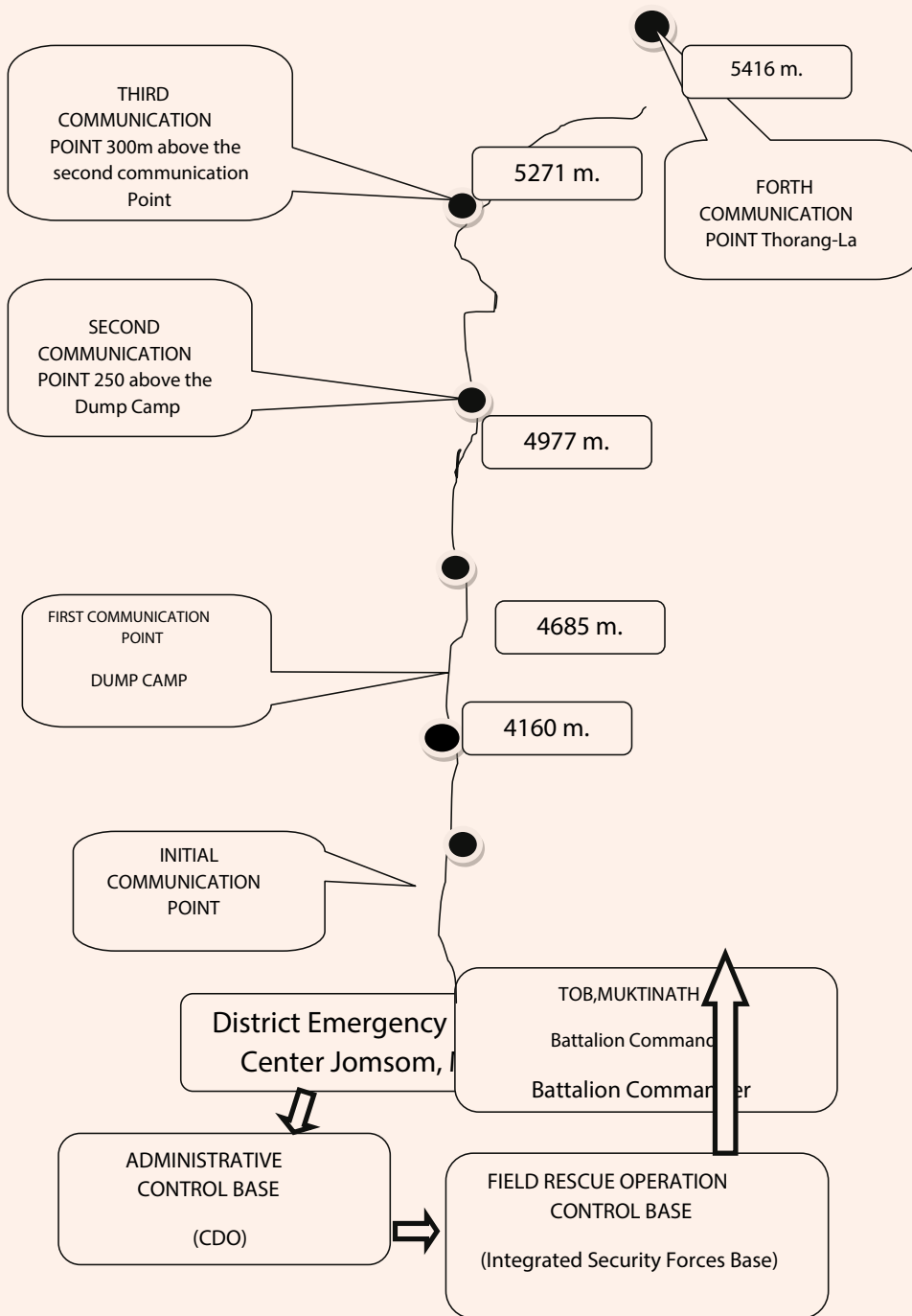
Camp area and launched the Mountain Rescue Operation for a week establishing four communication points along the route up to Thorang-la. Nineteen injured people were rescued from first communication point and enormous efforts were made to rescue over 3 hundred trekkers stranded in that region (Please refer the Appendix 'A' showing the different Communication Points established in Muktinath Thorsng-La Route). Trekkers in that area at the time of the storm consisted of citizens from several countries. Two dead bodies (Japanese) were recovered at second communication point on the way to Thorang-la. At least 13 of the dead trekkers were recovered in different communication points. They were from Canada, Israel,

Poland, Slovakia, India and Vietnam. Nine bodies of Nepalese guides to foreign trekkers were also recovered from Sanda Pass on the border between Dolpa and Mustang districts. The devastating snowstorm triggered avalanches that took place in other side of Thorong Pass (5416m), between Phu village and the Kongla Pass bordering China, Sangda Pass, and at Dhaulagiri Base Camp. The integrated rescue operation supported by Nepal Army light helicopters and medical team managed to rescue and save the lives of 346 trekkers, climbers and porters and extracted 28 dead bodies from the snow rubble. Likewise private sector helicopter also support from Traking agency association of Nepal.



The integrated rescue Team supported by Nepal Army light helicopters and Army Medics

Diagram 1





## Lessons Learnt

### 1. Co-ordination and co-operation:

Outstanding team work with other line ministries/agencies and cluster agencies were admirable. Administrative control team commanded by CDO in Jomsom was the leading unit which had constantly coordinated with center and field rescue team and supported as per its requirements.

#### Suggestions:

Regular meetings, seminars and workshops to address relevant concerns are recommended to establish cordial relationship, identify joint goals for team accomplishment, maintain collaborative culture and winning the hearts and minds of the populace in the district as well as for swift and efficient deploy and employ while confronting disaster situations.

**2. Resources:** Rescue team had confronted with lack of appropriate snow gears and communication equipments initially. Entire affected area turned to be communication dead zone immediately after being hit by the snow storm. Only one light military helicopter was available while dealing with disastrous hardships.

#### Suggestions:

(a) At least one platoon (39 men) of security forces (Local Unit) should be equipped with enough appropriate high altitude gears while operating in Trans-Himalayan region.

(b) Integrated team must be equipped with at least one satellite phone with excellent power back up.

(c) Only air asset (helicopter) turns out to be the first or earliest means for casualty evacuation. Other cluster agencies must be sensitized about the emergency situations so that they can lend joint hands voluntarily, while dealing with this kind of disaster situations in order to save people lives, especially in high altitude where resources are scarce.

**3. Detail Area Study:** The integrated rescue team with high altitude experts successfully reached the Yekkle Bhatti area on same night which made overall rescue effort effective, producing impressive results. It was because the team was familiar with terrain and route leading to Thorang-La.

#### Suggestions:

(a) Local responsible authorities should be well acquainted with terrain and ongoing activities.

(b) Atleast one trained tracking guide and satphone should be in each group.

(c) Annapurna Conservation Area Project (ACAP) should be furnished with well updated data, tracking system, facts and figures about trekkers and hikers.

(d) Proper electronic registration and monitoring system should be in place around the clock in order to track the Trekkers and Hikers, keeping close contact with Metrological Department.

(e) At least four to six sheds 40'X30' with toilet facilities should be built and guiding poles should be placed along the route from Muktinath to Thorang-la.

## Conclusion

The Hudhud cyclone would have been less damaging, if there was preparedness and early warning system in place. Despite of those shortcomings the local administration and security (Nepal Army, Nepal police, Armed Police Force) were able to reduce the casualties and economic damage. By learning the lesson from Hudhud, we have to be prepared and should develop early warning system to avoid such losses in future.

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## 4.4 Seti Flash Flood: Technical Analysis and DRR Interventions

*Deo Raj Gurung<sup>1</sup>, Sudan Bikash Maharjan<sup>2</sup>, Narendra Raj Khana<sup>3</sup>, Govinda Joshi<sup>4</sup>, M.S.R.Murthy<sup>5</sup>*



Before the Seti River Flood Disaster

After the Seti River Flood Disaster on 5 May 2012

- 1 Integrated Mountain Development (ICIMOD)
- 2 Integrated Mountain Development (ICIMOD)
- 3 Integrated Mountain Development (ICIMOD)
- 4 Integrated Mountain Development (ICIMOD)
- 5 Integrated Mountain Development (ICIMOD)

## ABSTRACT

The Seti Flash Flood of 5 May 2012 exemplifies some of the challenges the Himalayan countries faced with due to inherent geological, topographical, and climatological complexities. This flash flood which came out of a blue took many lives and damaged livelihood of many who survived. Cause of the event remained mystery for long and baffled many researchers looking for cause of the event until satellite data, air borne survey, and interaction with local people started to unveil the mystery. The cause and the subsequent processes that resulted in catastrophic flood revealed sequence of cascading events. The event however complex it may seem is a natural process, which went to become a disaster due to lack of preparedness. This article apart from putting in perspective the sequence of events that resulted in flood based on published article, reviewed DRR interventions in pre and post event. The review showed some positive development in improving preparedness but issue of sustainability question the effectiveness of the effort. Finally this article puts forth some way forward to sustain these interventions so that it can contribute in averting another disaster that no one knows when it will befall.

**KEYWORDS:** Seti river, flash flood, Pokhara, disaster, DRR.

### 1. Introduction

On 5<sup>th</sup> of May 2012 flash flood along the Seti River of Kaski District of Nepal (Figure 1) swept away infrastructures and settlements, killing about 72 people and damaging bridges and house [1]. It is one of the many such events Nepal and countries<sup>6</sup>

across the Hindu Kush Himalaya (HKH) has witnessed and will continue to do so. Between 1900 and 2012 these countries witnessed 1912 major hydro-meteorological hazard and earthquake events out of which 40% of the total is flooding events (EmDAT). Similarly 74.7% of the people killed and 54.8% of the economic loss is attributed to flooding events. Historical disaster loss database spanning from 2000 to 2014 (April) managed by Ministry of Home Affairs (MoHA), Government of Nepal (GoN) has 12141 recorded events of 18 different disaster types<sup>7</sup> of which 38.5% (4674 events) pertains to flood and landslide events, which accounts for 55.91% of people killed and 48% of economic loss.

Seti flash flood of 5th May 2012 unlike rainfall induced flooding events was shrouded with mystery in terms of genesis of the event in the immediate days after the event. Initial unfounded rumor was of Glacial Lake Outburst Flood (GLOF), understandably so due to the source being in the high mountains. National and international scientists pondered hard to put pieces together and connect the dots to reveal actual happening and understand the phenomenon, thus giving way to many hypothesis. The strongest of all the hypothesis are [2] and [3] based on remote sensing analysis and air survey. Review of these hypothesis is presented in following heading. Understanding of the process in completeness and retrospect prepares us to better manage similar events if encountered in future. This article looks back in time, 3 years after the event and attempts to gain better understanding of the event based on analysis done by different scientists, and looks to the future mainly focusing on preparedness alternatives to minimize death and destruction.

<sup>6</sup> Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, Pakistan

<sup>7</sup> Air crash, avalanche, boat capsize, bridge collapse, cold wave, drought, earthquake, epidemic, fire, flood, flood & landslide, landslide, forest fire, hailstorm, rainfall, thunder bolt, wind storm, and others.

## 2. Geo-Physical Setting

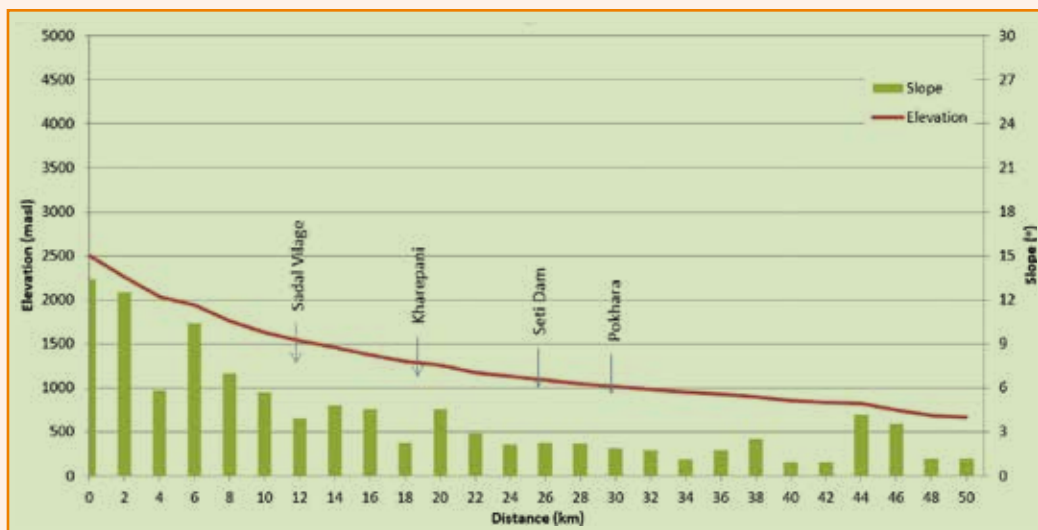
The Seti River catchment, upstream of Dobhanghat is 1473 km<sup>2</sup> (Figure 1) with elevation ranging from 750m to 7555m asl (Figure 2). North to south the Seti basin transcends from Tethys Himalayan Sequence (THS), Higher Himalayan Crystalline (HHC), and Lesser Himalayan Sequence(LHS) [4]. The THS contains a sequence of Cambro-Ordovician to Cretaceous marine sedimentary rocks that represent a large carbonate shelf sequence formed along the northern passive margin of the Indian plate [5]. South of THS is HHC, referred as Upper Greater Himalayan Sequence (Upper GHS) by [5]. Upper GHS consists of quartzite, schist, gneiss, migmatites and leucogranites. Further south is LHS mainly consisting of shale, slate, siltstone, sandstone, graphitic schist, phyllite, and amphibolite [4].

The Seti River starts at the base of Annapurna about 2500m asl and traverse south to an elevation of 1100m asl at Seti Dam, a drop of 1400m in longitudinal distance of 26 km (Figure 2). Longitudinal

Figure 1. Elevation map (top) and geology map (bottom) of Pokhara area. Geology map is sourced from [4].



Figure 2. Longitudinal profile of Seti River from the source.



river profile as mapped using 90m SRTM DEM show higher gradient in the north as compared to south. Upper reaches of the Seti River is topographically challenging due to steep and narrow gorge, due to which it is devoid of human settlements.

### 3. Cause of the Seti Flash flood

There were many speculation about cause of the flood in immediate days after the event, including GLOF and Landslide Lake Outburst Flood (LDOF). As satellite data of post event became available and airborne survey possible, the cause of the flood was ascertained to be sequence of events as organized below in the order of occurrence.

#### 3.1 Rockfall and daming of Seti river

From the very beginning the issue of contention was source of the flood water which is estimated to be 7,480,000m<sup>3</sup> [6] with estimated peak discharge varying from 10 m<sup>3</sup>/s [7] and 8,400m<sup>3</sup>/s [6], at Kharapani. This actually made locals speculate the event to be either GLOF or LDOF. Rapid assessment by a team in International Centre for Integrated Mountain Development (ICIMOD) based on satellite data (Landsat) mapped a fresh land/rock slide scar (Figure 3) and indicated likelihood of a role in the flood generation process to explain large volume of flood water, which was refuted by [2]. The Landsat ETM+ images of 2012 (3rd

and 19th March, and 20 April) used by ICIMOD team clearly showed progression of rockslide in months preceding to the event. Rockslide which was non-existence in image dated 3rd March grew from 0.01 km<sup>2</sup> to 0.06 km<sup>2</sup> between 19 March and 20 April, over a period of one month.

The role of the rockslide has now been ascertained after image analysis, air borne survey and field investigation by a team comprising of international and national experts. The rockslide “affected a knick point in the Seti River gorge and impounded glacial meltwater and spring snowmelt” which got breached by a process triggered by an avalanche in southwest flank of the Annapurna IV (Figure 4).

#### 3.2 Snow, ice and rock avalanche

Snow, ice and rock avalanche [2],[7],[8] with estimated volume of 32,725,000m<sup>3</sup> [6] occurred in southwest flank of the Annapurna IV (Figure 4) at about 09:00 AM local time on 5 May 2012, as inferred from the amateur video clip captured by Captain Alexander Maximov of the Aviaclub Nepal (<https://www.youtube.com/watch?v=Uk82ggshSKs>). The impact of the avalanche is said to have created seismic waves which was picked up by global seismic network which was analyzed by S.G.Eksrom, a Columbia University geoscientists, according to which time of avalanche is estimated as 09:09:56 AM [9]. So the avalanche is expected to have occurred between 9:00 AM and 9.09 AM.

**Figure 3. Time series Landsat image showing development of landslide.**

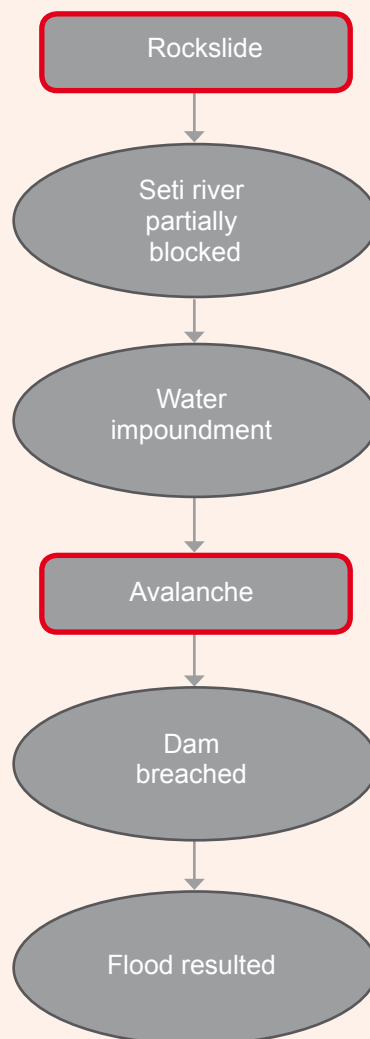


Dimension of the failure that initiated the avalanche is summarized in Table 1. The avalanche made near vertical fall of about 1,500m from 6,700 m asl to 5,200m asl [7] which generated high potential energy rock enough to pulverize unconsolidated rock debris (glacial moraines and ancient glacial lake silts and gravels) resting unstably in the deep bowl of the Sabche Cirque [8]. The volume of material that fell on the base of the Sabche Cirque is estimated as 14,500,000m<sup>3</sup>, while the volume of debris which flowed into the Seti River was calculated at around 18,230,000m<sup>3</sup> [6]. Estimate velocity of the avalanche was 200km/hr [6] and the high energy fall caused the failed rock mass to disintegrate into pieces producing a large amount of dust clouds, and frictional heat produced due to debris movement melted ice and snow which formed hyperconcentrated slurry flows leading to even accelerated movement of the debris towards the Seti gorge [6]. The high speed avalanche created air blast strong enough to fell trees along the right flank of the upper part of Seti gorge (Photo 1).

### 3.3 Breaching of rockslide dam

Energy of the avalanche was so that transported material were made into high-speed debris which fell into Seti gorge. The average slope of the base of the Sabche Cirque where dislodged materials made an impact and inlet of the gorge is 14° [6], which played a role in generating high speed avalanche. This high speed avalanche consisting of ice and rock made into impoundment reservoir, and aided by

**Figure 4. Process flow to illustrate sequence of event that led to Seti flash flood.**



**Table 1. Summary of detachment block that induced avalanche (Source: [7]).**

Aspect	Unit (m)	Basis
Width	Approx. 550	Based on the satellite image
Depth	Max approx. 100, Average approx. 70	Based on the satellite image
Length	850	Based on photo taken from helicopter



Photo 1. Narrow and deep gorge in the upper reaches of Seti River. Also visible are fallen trees due to air blast the avalanche in ensuing processes generated (Source: [2]).

“violent ground-surge event, plus possibly an air blast caused by a violent gravity flow of airborne debris then burst the rockfall dam” [8]. Sudden release of the impounded water is source of enormous volume of flood water which is estimated to be 7,480,000 m<sup>3</sup> [6] at Kharapani village, about 20 km downstream of impounded reservoir.

This subsequent breach of rockslide dammed reservoir resulted in flood with estimated volume of 7,480,000 m<sup>3</sup> [6] of water at Kharapani, and estimated peak discharge ranging from 10 m<sup>3</sup>/s [7] to 8,400m<sup>3</sup>/s [6]. The flow was mainly muddy mix of fine silt similar to glacial flour found at the source [2].

On the large question of if climate change had any role in causing Seti Flash Flood, report prepared by a team of scientists including National Aeronautics and Space Administration (NASA) of the United States refutes the role and attributes it to be “geological changes” [10]

## 4. Impact

The impact of the event was felt further downstream as the physical challenging topography was devoid of human settlement and infrastructure in the immediate vicinity of the source. Sardikhola Village Development Committee (VDC) and Sadal village in Machhapuchhre VDC are worst hit by the powerful outburst [10]. Kharapani settlement (also known as Tatopani) in Sardikhola VDC and Sadal village in Machhapuchhre VDC (Figure 1) were hit hard [11].

In total 71 people (including 40 missing) loss their life and estimated property loss of worth of Rs. 49.25 million reported according to the report made by DDRC [11]. [8] reported loss of lives to be 72. In total 4 houses, 2 local temples, 16 temporarily erected sheds, 2 suspended trail bridges, 7 tractors, 3 mini trucks, and 1 van were swept away by the flood [7]. In the same article [7] accounted for 52 goats and 17 cow and buffaloes killed based on the data provided by the rescue team. Most of the people killed were picnickers, locals, tourists and laborers working on sand/stone quarry in the river bank [10]. The wash out also destroyed two water supply system supplying 80% of the drinking water to Pokhara valley.

It is praiseworthy that alert sounded by Captain Alexander Maximov of the Aviaclub Nepal about the avalanche, radioed to aviation tower in Pokhara airport saved from taking more lives and inflicting greater loss from the event. This message was immediately disseminated by the tower to concerned agencies and local FM radio stations.



## 5. DRR Interventions

### 5.1 DRR interventions implemented

Disaster risk reduction interventions can be well spread across time and space, from early warning to post disaster reconstruction. In this case alert sounded by Captain Alexander Maximov and disseminated through other communication channels (FM, mobiles) forewarned the downstream communities, and gained time in preparing state mechanism to respond to the inevitable. Humanitarian and national agencies responded immediately, as a result of adequate preparedness put in place by state and non-state players [11]. The response was led by District Disaster Relief Committee (DDRC) in coordination with the security forces (Nepal Army, Nepal Police and Armed Police Force), the Nepal Red Cross Society (NRCS) and other humanitarian agencies. The coordination was reported to have been of highest level

and OCHA report dated 8 May [11] reports of distribution of immediate cash and NFI support to the flood affected families and the families of the deceased by DDRC and NRCS. Unlike other disaster, flood can render entire affected area useless by turning into field of debris obliterating whatever potential and promise it had once, and government had relocated affected families to safer ground.

Apart from the immediate response a 2 year (April 2012-March 2014) project titled “Building Disaster Resilience Community” (BDRC) in Pokhara was implemented by ActionAid Nepal, and Practical Action Nepal, along with Siddhartha Club (a local partner) [12]. The project put in place structural and non-structural flood risk management measures. Non-structural measures included formation of Disaster Management Committees (DMC) and Task Force at different levels: Wards (18 Wards<sup>8</sup> of Pokhara Sub-metropolitan City), VDC<sup>9</sup> (7 VDCs) and Municipality (Pokhara). Task



Photo 2. Display board at District Administrative Office, Pokhara displaying river water level.

<sup>8</sup> Ward No. 1 to 18.

<sup>9</sup> Hemja, Lamachaur, Puranchaur, Machhapuchhre, Sardikhola, Lahachowk and Ghachowk.

force was also formed in Government Schools. Capacity building of stakeholders were done through training and workshops on first aid, drinking water, and sanitation under BDRC project. The project also distributed search and rescue kits, life jackets, gloves, lights, hand mike, and rope to locals of aforementioned 18 Wards and 7 VDCs and additional 6 Wards<sup>10</sup> situated close to the river. On structural measure the project installed Flood Early Warning System (FEWS). The FEWS comprises of a bubbler sensor in Seti River and meteorological station in Jyamibari VDC upstream of which no settlements exists. The details (rainfall, water level) from the sensors are displayed in display boards installed in Kapuche and DEOC through CDMA technology (Photo 2). One designated person has been assigned to maintain the system and communication any alarming situation develops to downstream communities. Designated focal persons assigned in the downstream settlements (eg. Santi Tole) are provided with Siren system which upon getting informed about the rising water level and heavy rainfall will be sounded out to alert locals.

In addition usual flood control measures like gabion walls are put in place regularly on need basis to deflect river water from over topping banks and minimizing flow velocity.

## 5.2 Gaps and needs

There seems to be complete lack of preparedness prior to the Seti Flash Flood event, also echoed by experts in different forums [13]. Things has certainly improved after the event with community based activities implemented under BDRC enhancing community resilience by EWS and more structured response mechanism

in place [12]. These interventions will, if sustained will go long way in averting disaster like in past. However, what is understood from interaction with authorities (CDO office, LDO office) as existing gap is non-existence of flood hazard maps, a tool to implement land use codes for planning and implementing development activities. Disaster is a result of interaction between exposure elements like human settlements and infrastructures with hazard (flood in this case). Strict compliance to flood hazard maps as planning tool for development activities manages large part of the risk by minimizing the interaction between these two important facets of disaster triangle.

Upstream-downstream linkages bear more relevance in connection to flooding, as source for deluge is often in the high mountain setting. Despite that there is lack of high mountain monitoring instrumentation to monitor physical processes which is of high importance for many domains including disaster management. There is need for such high altitude monitoring stations if we are to understand high alpine processes, aspect critical for proper management of downstream environment.

Human memories are short and more than often our readiness to respond appropriately enhanced through capacity building interventions like training, workshops and drills decline over time. Emergency drills, workshops and training needs to be made a regular exercise so that the knowledge and experience gained is sustained. Ideally such drills will be effective if done during pre-monsoon with involvement of communities and disaster managers.

Rampant extraction of sand and boulders from Seti River has long raised concerns of various quarters [14]. The unplanned extraction has proved as counter measure

<sup>10</sup> Ward No. 1, 3, 9,10, 15 and 17

to some DRR interventions and thereby aggravated the risk situation. Quarrying in haphazard fashion has undermined flood protection measures (gabion walls and boxes put in place) to avert flooding thus rendering protection measures futile. The licensing for sand and boulder extraction therefore has to be more regulated with due consideration to impact particularly from flood risk.

## 6. Way Forward

Based on the discussions in preceding sections, there is a need to have greater role of Disaster Management Committees (DMC) to ensure better mainstreaming of DRR into development planning and implementation process. The DMCs should be empowered and given a regulatory role while licensing of activities such as mining of river materials. Flood hazard maps along the Seti River is imperative as a blue print for development if new development is to be made disaster resilient. Although it is difficult to model flash flood like the one that happened on fateful day of 5 May 2012, by and large flood hazard map with extreme situation can help minimize risk.

Ownership of DRR measures put in place by different projects by state and in particular by local government is imperative for sustenance of the measures for making communities disaster resilience. DMC should conduct drills at least once in every year at all levels so that desired response readiness is ensured. A complete drill also ensures technical FEWS is functioning, without which ensuing response measures is impacted.

Increasing high mountain monitoring stations has become matter of urgency as these alpine environment is sensitive to climate change and associated changes. One needs to understand the situation in the source if we are to effectively manage impact zones in the downstream.

## 7. Conclusions

The Himalayan region with complex topography and active geomorphology is hot spot of natural hazards which in most cases result in disaster. Hazard is a natural process and cannot be averted completely, while with appropriate risk reduction measures impact of natural hazard can be minimized. Therefore both hazard and risk management options need to be considered. We should accord emphasis on pro-active than reactive DRR measures, and has to include state mechanisms and communities in partnership to work closely in addressing increasing challenges faced by communities.

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# 4.5 Disaster Early Warning Systems in Nepal: Status, Problems and Potentials

*Shesh Kanta Kafle*



2014 Flood in Tarai

## Introduction

The ultimate goal of early warning systems is to protect lives and property, and they therefore constitute one of the key elements of any disaster reduction strategy (UNISDR, 2002). The early warning system enables concerned authorities and at-risk communities to know about hazards of the locality, community vulnerabilities and impending risk, warning messages, and building and mobilizing their response capabilities to reduce risks.

The Early Warning System is a process in which community risk knowledge is acquired and disseminated to the at-risk communities prior to the disasters strike. In other words, “early warning is the provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response” (UNISDR, 2004). Early warning systems include a chain of concerns, namely: understanding and mapping the hazard, monitoring and forecasting impending events; processing and disseminating understandable warnings to political authorities and the population, and undertaking appropriate and timely actions in response to the warnings (ibid.).

Early warning is about the provision of information to individuals, households, groups or a community about:

- i. the existence of danger or hazard
- ii. What can be done to prevent, avoid or minimize the danger?
- iii. Receiving the early warnings, analysing the messages, disseminating the warnings and responding them are the key steps of the early warning system.

A complete and effective early warning system comprises four inter-related

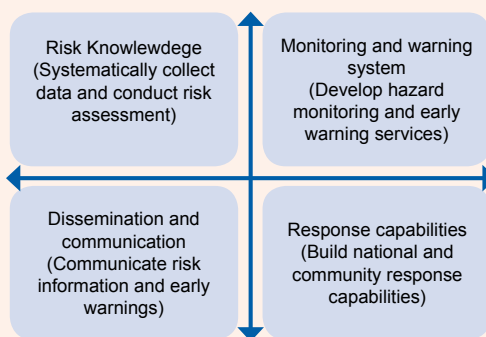
elements: risk knowledge, monitoring and warning service, dissemination and communication, and response capability (see Figure 1, UNISDR, 2005). A weakness or failure in any one part could result in failure in achieving the essence of the entire system.

### Why early warning systems?

Early warning systems are recognized in both the Hyogo Framework for Disaster Reduction (2005-2015) the Sendai Framework for Disaster Risk Reduction (2015-2030) as an important element of disaster risk reduction and hence to the achievement of sustainable development and sustainable livelihoods. Disaster occurrences and impact are increasing, mainly owing to an increase in the size and vulnerability of exposed populations, but also possible to increase in the frequency and severity of certain hydro-meteorological hazards as a result of climate change. Economic losses from disasters can greatly set back hard-won development gains.

Advances in science and technology during the last decade have improved the potential of early warning to reduce human loss. Early warning systems also must

**Figure 1. Key elements of a people-centred early warning system (UNISDR, 2005).**



be comprehensible and accessible to all users. They must deliver clear and concise messages tailored to respective social and cultural contexts. The ability to deliver vital information to the public at risk has not always been successful. In many cases, local mechanisms for communicating risk and interpreting warnings remain very weak (Shrestha et al., 2014).

An effective EWS enables the concerned authorities and at-risk communities to know about the hazards of the locality, community vulnerabilities and impending risk, warning messages, and building and mobilizing their response capabilities to reduce risks (Kafle, 2007). Early warning helps reduce economic losses by allowing people to better protect their assets and livelihoods. For example, they can safeguard homes, save livestock or find out safest locations for shelter in times flood or other disaster events, thus limiting not only the immediate impact of disaster but also the effects on assets that can reduce economic wellbeing and increase poverty.

The establishment of early warning and associated preparedness and response systems has been an important contributor to the reduction in the number of death from disasters over the last decades. EWS also promotes the development and the application of the scientific knowledge, including improved science and technology information dissemination.

The national and community based EWS help:

- Better understanding and knowledge of local hazards, vulnerability and risks
- Quick analysis of the information and delivery to the at-risk communities
- Easy to communicate with people in local languages

- Cost effective and efficient
- Easy to monitor hazards and vulnerability

The traditional framework of early warning systems is composed of three phases: monitoring of precursors, forecasting of a probable event, and the notification of a warning or an alert should an event of catastrophic proportions take place (Villagran je Leon and Bogardi, 2006). An improved four-step framework being promoted by national emergency agencies and risk management institutions includes the additional fourth phase: response capacity building. The purpose of this fourth element is to recognize the fact that there needs to be a response to the warning, where the initial responsibility relies on emergency response agencies (ibid.). A complete and effective early warning system should comprise of all these four inter-related elements: risk knowledge, monitoring and warning service, dissemination and communication, and response capability. A weakness or failure in any one part could result in failure of the whole system (UNISDR, 2005; Kafle, 2012)

## The early warning system framework

The Government of Nepal has reported significant achievements in the development and implementation of EWS for floods, landslides, and Glacial Lake Outburst Floods (GLOF) (EDMHA, 2015). However, this has not been very effective as not all the four components of the people-centred EWS have been taken into account. A brief description of the current status of the legal and institutional frameworks is given below.

## Legal and policy instruments

The Government of Nepal has included Disaster Management programs in its 10th National Development Plan for the first time. The 10th five year plan set its objectives as 'to contribute substantially to make the public lie secure by managing the natural and man-made disaster systematically and effectively and by making the development and construction related programs in the country sustainable, reliable and highly gainful'. A clause to strengthen the provisions of assessing disaster risk in development infrastructures as also highlighted.

Ministry of Home Affairs (MOHA) is the nodal body in the field of Disaster Management in Nepal. There are provisions of Central Natural Disaster Relief Committee, Regional natural disaster relief committee, and district natural disaster relief to coordinate the disaster preparedness and response activities in the country.

Nepal is the pioneer country in formulating DM Act in South Asia. The Natural Disaster Relief Act of 1982, Local Self Government Act 1999, Building Code 1994, DRR strategy 2009 are some of the existing legal provisions in Disaster Management in Nepal. These legal and institutional provisions are flexible and all the activities relating to gender sensitive EWS can be done using these instruments. The following are the key legal instruments related to the DRR and EWS in the country:

1. Natural Calamity (Relief) Act 1982
2. Local Self Governance Act (1999)
3. The Tenth-Plan (2002-2007)
4. Medium Term Expenditure Framework (MTEF)
5. Sendai Framework for Disaster Risk Reduction
6. DRR strategy 2009

7. Nepal Water Resources Act 1992
8. Nepal Water resources Strategy 2002
9. National Action Plan on Disaster Management 1996

However, many of these policies/provisions are not specific to EWS.

## Key actors in Disaster Management and Early Warning System in Nepal

Disaster Early Warning Systems are an infancy stage in Nepal (Shrestha, 2014, CEDMHA, 2015). No effective multi-hazard early warning systems at national and local levels have been established. Some hazard specific alerts generation and dissemination mechanisms have been established and response capabilities of local communities have been built, however these are project specific and cover a few hundred villages. Studies suggest that very few organisations have covered all the four aspects of the early warning system in their program interventions (Shrestha et al., 2014, revised) (Table 1).

**Risk Knowledge:** In the study conducted by Shrestha et al., 2014, it was observed that around 60% respondents did not have the institutionalized system of knowledge management and documentation in the case of EWS. None of the organizations did the comprehensive hazard and vulnerability assessment with giving enough impetus on women's traditional knowledge and perceptions in the natural hazard analysis. Ten per cent organizations reported that they involved women groups in community mobilization and implementing of community level initiatives.

**Monitoring and warning services:** It is important to engage men and women to do a regular monitoring of hazards in



Table 1. Involvement of organizations<sup>1</sup> in the key elements of the people-centred E

S.No.	Organizations	Risk Knowledge	Monitoring and warning services	Dissemination and communication	Response capability
<b>A</b>	<b>Government agencies</b>				
1	Ministry of Irrigation				
2	Department of Hydrology and Meteorology		.	.	
3	Department of Water-Induced Disaster Preparedness		.	.	.
4	Ministry of Home Affairs	.	.	.	.
5	Ministry of Education	.	.		
6	National Planning Commission	.	.		
7	Ministry of women and children	.	.		
8	Department of Soil Conservation and Watershed Management		.	.	.
9	Ministry of Health	.			
10	Ministry of Information	.			
11	Ministry of Defense	.	.		
12	Ministry of Federal Affairs and Local Development (MOFALD)	.	.	.	.
13	Ministry of Tourism and Civil Aviation	.			.
<b>B</b>	<b>INGOs</b>				
1	Practical Action		.	.	.
2	Plan International		.	.	.
3	Oxfam		.	.	.
4	Mercy Corps		.	.	.
5	Save the Children		.	.	.
<b>C</b>	<b>National NGOs</b>				
1	DPNet			.	.
2	NDRMF			.	.
3	CDMS		.	.	.
4	SOHAN			.	.
5	AFFAN			.	.
6	CORD				.
<b>D</b>	<b>UN and humanitarian organizations</b>				
1	UNDP-CDRMP	.		.	.
2	Nepal Red Cross Society	.	.	.	.
	<b>Total</b>	<b>11 (42%)</b>	<b>16 (62%)</b>	<b>18 (69%)</b>	<b>19 (73%)</b>

(Source: Shrestha et al. 2014, revised)

<sup>1</sup> This is not the complete list; only those who were interviewed during the study.

**Table 2. Involvement of organizations in EWS.**

Categories	Number	%
Risk Knowledge	11	42
Monitoring and warning services	16	62
Dissemination/information	18	69
Response capacity	19	73

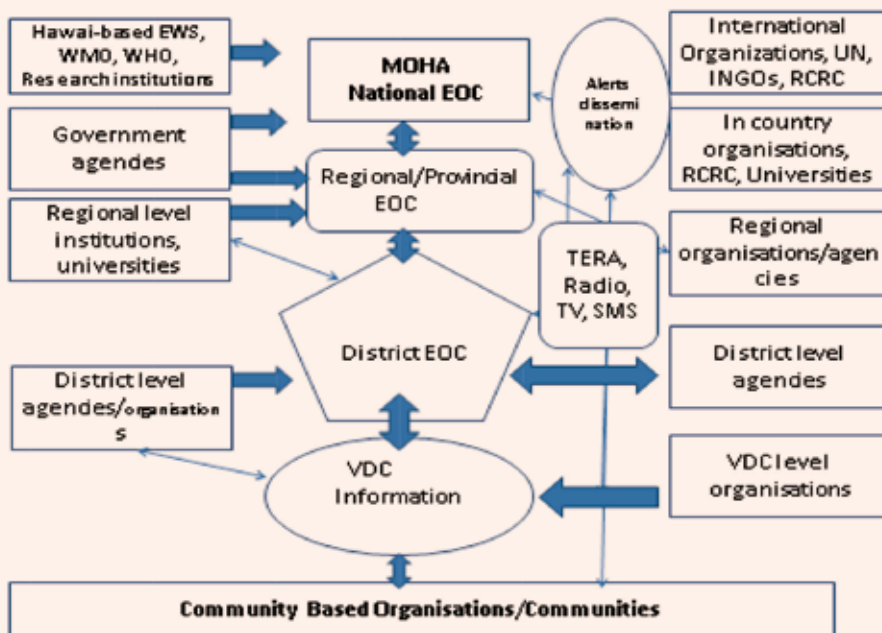
(Source: Shrestha et al. 2014, revised)

the locality and generate information for warning purposes. Involvement of women and men will help identify the information accurately, on time and earlier than done stand alone. It will help reduce the risks.

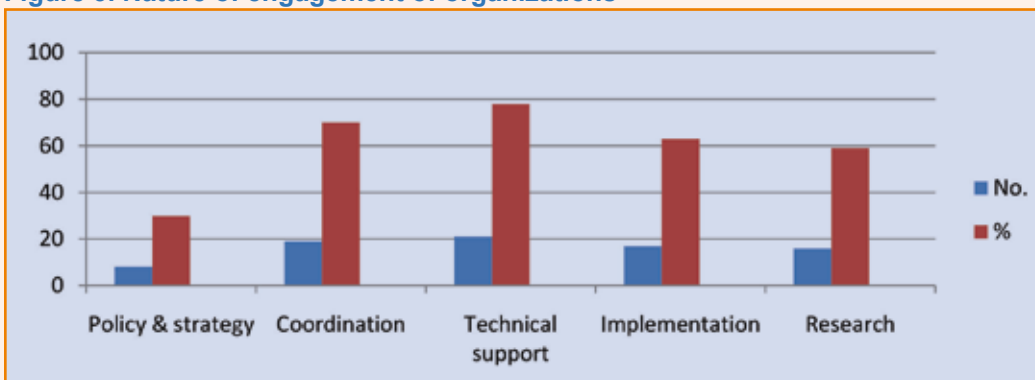
**Dissemination and information:** Dissemination and information: Women as disaster alert recipient were not considered while sending disaster messages. Sending disaster messages through radios, mobile phones do not ensure that the messages are received by women and girls. Some organizations have formed women groups

and mobilized women and girls in EWS. However, messages are not gender sensitive and dissemination mechanisms are not gender either.

**Response capacity building:** Majority of the organizations surveyed were involved in response capacity building. However, it was not systematic and linked to EWS. Although women play an important role in responding to disasters and are capable to cope with, adapt and withstand the impact of disasters, they are usually not involved in the EWS processes.

**Figure 2. Proposed Early Warning System framework**

**Figure 3. Nature of engagement of organizations**



Majority of the organizations (75%) consulted were involved in providing technical support in the areas related to early warning system.

### Key challenges and gaps

The absence of policy and legal frameworks is weakening the efforts of the establishment and strengthening of effective and functional early warning systems in Nepal. The key gaps and challenges may be listed as follows:

- Legal and policy frameworks that ensure the establishment and mobilisation of government, non-government and private sectors
- Coordination with various partners
- Sectoral linkage/integration is a challenge.
- Linking work of various ministries to the disaster risk management is lacking.
- So far coverage of EWS is very limited to certain geographic areas; improvement in technology is also needed.
- Resource constraints (financial and human resources)

### Conclusion and recommendations

In order to make the system more effective, the following recommendations may be made:

1. Promulgation of appropriate policy and EWS frameworks should be developed and made operational.
2. Regular monitoring of local hazards and communications between CBOs, District, region and the national EOCs.
3. Involvement of local government and stakeholders in EWS initiatives should be done from the very start of the Program.
4. Capacity of staff, volunteers needs to be enhanced in hazard monitoring, dissemination.
5. Turnover of trained community members (they go for foreign employment), Need to organize trainings on a regular basis.
6. Gender perspectives should be integrated into project cycle management of a DRR program including the disaster risk assessment, early warning system, information

management, community awareness and training. Gender disaggregated data on local hazards, community vulnerabilities, capacities and risk need to be maintained.

7. Establish and strengthen all the four key elements of early warning system including response capacity building
8. Research on various aspects of EWS/ gender mainstreaming in Nepalese context is suggested.
9. Need to initiate Public-Private Partnership (PPP) on EWS and promotion of corporate social responsibility to share the burden of government
10. MoHA needs more holistic method on disaster risk management, current practices more focused on preparedness and response.
11. Local politics has hampered the development activities; need to build capacities of political authorities
12. Various DRR and EWS tools and frameworks need to be revised and make them gender sensitive.
13. EWS must be built on four essential aspects (Mercy corps and practical Action 2010):-effectiveness, efficiency, equity and legitimacy.

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## 4.6 Real-Time Monitoring and Flood Outlook for Reduced Flood Risks

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Jure Floods and Landslides 2014

Photo: DPNepal

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## Introduction

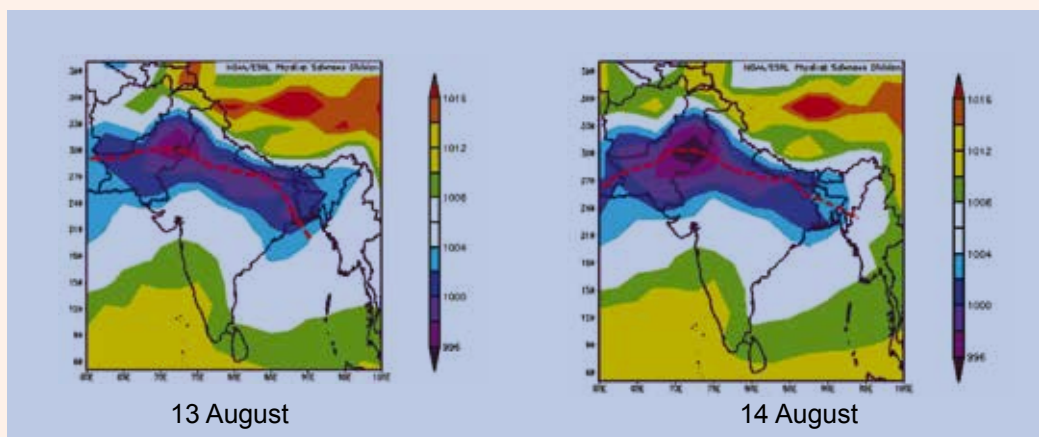
The 2014 monsoon season started with rainfall below normal. According to the Department of Hydrology and Meteorology (DHM), rainfall deficit in the Mid and Far Western region of Nepal for the month of June was around 50 percent. Experts predicted below normal rainfall for South Asia during the 2014 monsoon. Consensus on this was developed at the 5th South Asia Climate Outlook Forum based on an expert assessment of prevailing global climate conditions and forecasts from different climate models from around the world (SASCOF 2014). Weak El Niño/Southern Oscillation (ENSO) conditions prevailed over the Pacific Ocean. The ENSO is a global climate phenomena that has a significant influence on the year-to-year variability of the monsoon over South Asia. While the month of June and July saw very little rain with less than 50 % of the normal worrying farmers the month of August painted a different picture. In contrast to the June and July rainfall, in August many parts of Nepal received heavy rainfall. The month started with the Sun Koshi landslide disaster killing 160 people and displacing thousands. While this was

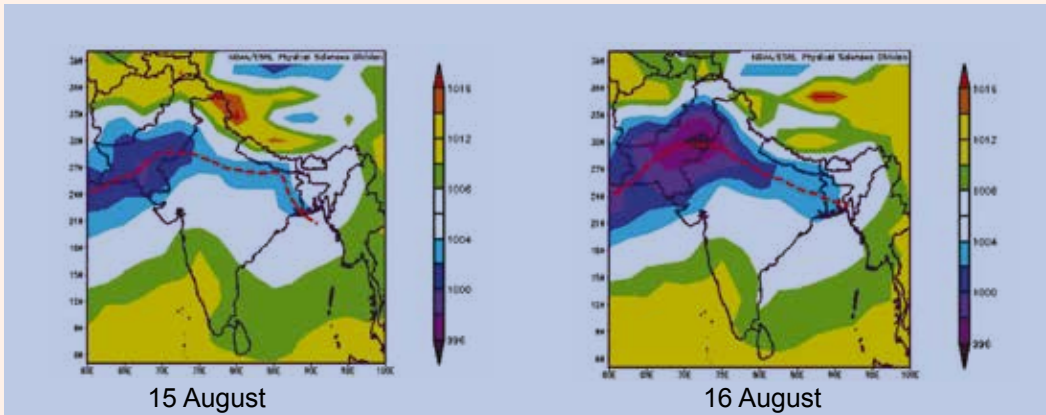
still fresh in people's minds the country was hit by yet another large scale disaster. Three days of continuous rainfall from 14-16th August brought about devastation throughout Nepal. This paper describes the floods and landslides that occurred due to the three day intense rainfall, real-time monitoring and the flood outlook that provides increased lead time to minimize the adverse impacts of flood disasters.

## What Caused the Floods?

The timing and amount of precipitation and its distribution across Nepal are controlled fundamentally by the annual monsoon system (Kansakar et al.,2004). When rainfall was at its lowest the previous two months in June and July the question is what type of climatic event has brought about this disaster? This phenomenon is not new but has happened many times in the Himalayas with differing magnitude and duration. When the axis of the monsoon trough which is the low pressure from the Bay of Bengal remains parallel to the Himalayan foothills it brings in a change in the rainfall pattern. At the time of this occurrence there is intense rainfall above

**Figure 1 Surface level atmospheric pressure from 13-16 August based on NCEP/NCAR reanalysis data**





the Himalayan foothills like what happened in 1993. This phenomenon is also known as the monsoon break in India. In Figure 1 the position of the monsoon trough is indicated with a red line over the four day period from 13-16 August 2014 which brought in intense rainfall in many parts of Nepal.

### Real-Time Flood Monitoring

Real-time observation of water level and rainfall are key input to flood monitoring. Real-time monitoring can immediately notify decision makers about dangerous water levels through telemetry. Real-time monitoring also provides continuous datasets for better understanding the variation of flows at daily, monthly and seasonal basis. The DHM has a network of real-time hydrometeorological stations across Nepal. More than 50 real-time hydrometeorological stations provide the rainfall and water level of the major rivers such as the Koshi, Karnali, Narayani. The DHM has identified different warning and danger levels for stations in major rivers depending on the volume of water discharge. Warnings are issued as soon as the water levels exceed a given threshold or the alert level. The real-time stations

transmit data on a regular prefixed interval and are available in a web-based platform ([www.hydrology.gov.np](http://www.hydrology.gov.np)).

Between 13 and 14 August within a period of 48 hours high rainfall was observed in the Koshi basin with Chatara receiving 191.2 mm, Mulghat 129.2 mm and Rabuwabazar 113.6 mm. On 15 August 2014 in many areas of western Nepal rainfall exceeded 100 mm rainfall within 24 hours with Birendranagar receiving 423.1 mm, Chisapani (Karnali) 493.8 mm and Beljhundi (Dang) 346 mm (Regmi 2014). Many of the rivers Koshi, Narayani, West Rapti and Karnali were flowing above alert level resulting in large areas to flood. The flood levels in the Koshi went above the alert level with discharge exceeding 7000 m<sup>3</sup>/sec at 6.37 m close to the 6.8 m danger level (Figure 2). Around midnight on 14 August the water level in the West Rapti river crossed above danger level and remained above this level for 30 hours (Figure 3) creating inundation and widespread flooding. To enable timely preparedness alerts were posted by DHM on its website which provided the water levels in the Koshi, Rapti, Karnali and Narayani rivers.

Figure 2 Water level and discharge at Chatara, Koshi (14 -16 August)

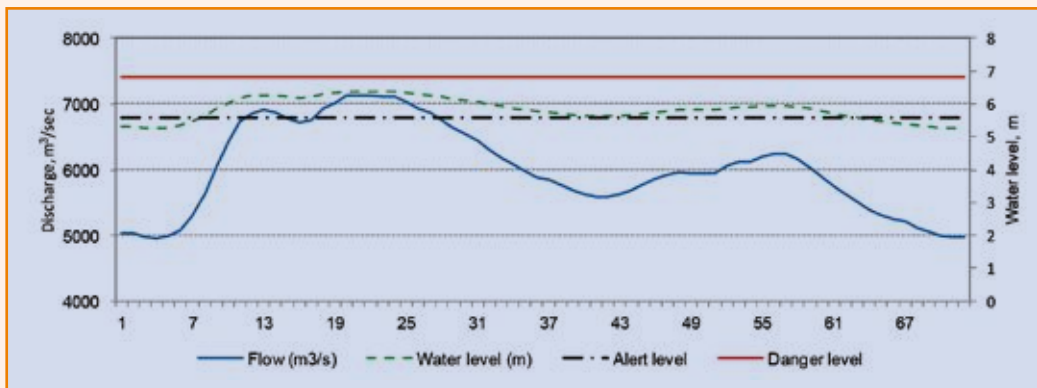
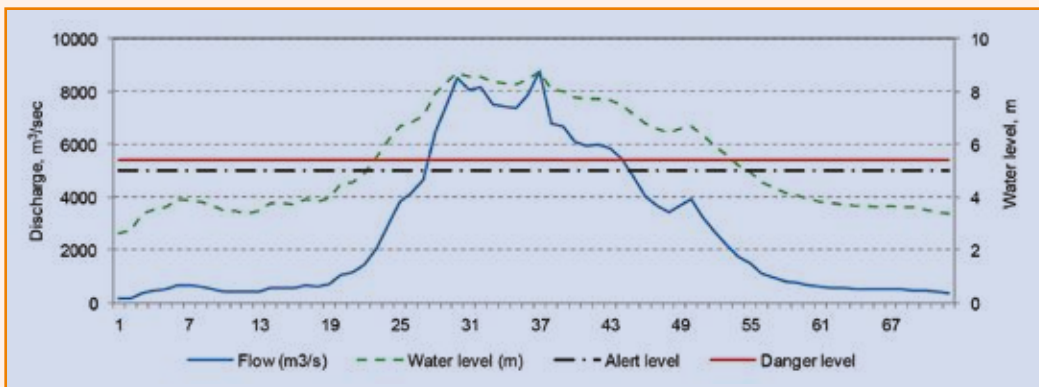


Figure 3 Water level and discharge at West Rapti, Kusum (14 -16 August) (Source: [www.hydrology.gov.np](http://www.hydrology.gov.np))



## Impact of Floods

Over 48 hours of torrential rainfall, from 14-16 August triggered numerous floods and landslides, disrupting normal life in 23 districts throughout Nepal. According to the Nepal Red Cross Society and Ministry of Home Affairs a total of 202 people were reported dead, 149 injured and 248 reported missing due to the disaster. Similarly, 36,949 families (184,745 people) were affected and 10,193 families (50,965 people) displaced. Women, children and elderly were reported to be amongst the worst affected. The highly impacted districts were Banke, Bardiya, Dang and Surkhet. Highways were damaged obstructing transportation.

In Surkhet 34 bodies were recovered. In Bardiya 33 people were killed and 15 missing. In Dang 14 people were killed with five missing and in Banke 15 were killed with five missing. The major infrastructure of Babai Irrigation Project and some parts of the Sikta Irrigation were damaged. The summary of the damage incurred during the event is provided in Table 1.

During the floods in the Karnali and the Babai river basins in August 2014 coordination amongst various organizations in responding to the disaster was found to be poor (Zurich Insurance Company 2015). Chhetri and Bhattarai (2001) also indicated the lack of coordination among



**Table 1 Summary of people killed and affected during the floods from 14-16 August, 2014**

Districts	Number of people			Number of families		Number of houses destroyed	
Banke	15	5	2	2889	11,699	2889	8810
Bardiya	33	15	2	17,376	17,376	3859	13,517
Surkhet	34	91	26	3132	3132	1978	1054
Dang	14	4	2	872	872	511	361
SubTotal	96	115	32	33,079	33,079	9237	23,842
Other 19 affected districts	106	133	117	3870	3870	956	2914
<b>Total</b>	<b>202</b>	<b>248</b>	<b>149</b>	<b>36,949</b>	<b>36,949</b>	<b>10,193</b>	<b>26,756</b>

Source: Nepal Red Cross Society

various organizations related to disaster management along with technological gap as problems of inadequate preparedness against impending flood disasters. Despite this lack of coordination the local responses were found to have been effective which contributed to minimizing the losses. Floods washed away the gauging station in Chepang on the Babai river. However,

the gauge reader was able to inform the people downstream about the high flood conditions though with some delay due to poor mobile network connectivity.

The Himalayan Times reported the August 2014 floods also swept away the canal of Triveni Micro Hydropower Project that left the district headquarters of Bajura (Martadi)

**Figure 4 Power house of the Triveni Micro Hydropower Project at risk by the Bahuli Rivulet, in Martadi of Bajura (Source: Prakash Singh) <http://www.the-himalayantimes.com/fullNews.php?headline=Bajura+headquarters+in+dark+for+five+days&NewsID=424456#sthash.77OQPrqW.dpuf>**



without electricity (Figure 5). (<http://www.thehimalayantimes.com/fullNews.php?headline=Bajura+headquarters+in+dark+for+five+days&NewsID=424456>). Due to the damage to the transmission lines the Bardia district was also in darkness. Between 2000 and 2013, according to the Ministry of Home Affairs (MOHA) a total of 3608 landslide and flood events have been recorded killing 1295 people with US\$ 85 million economic loss.

## Flood Outlook and Warning System

The International Centre for Integrated Mountain Development (ICIMOD) in partnership with the World Meteorological Organization (WMO) and the regional member countries from Bangladesh, Bhutan, China, India, Nepal and Pakistan developed the Hindu Kush Himalayan Hydrological Cycle Observing System (HKH-HYCOS). The aim of HKH-HYCOS is to enhance regional cooperation in hydro-meteorological data collection and sharing for flood forecasting to support disaster

prevention and flood management at the regional level (Shrestha et al., 2015). Using advanced technologies for data collection and transmission the project has upgraded 38 hydrometeorological stations in four countries to transmit real-time data on river level and rainfall, 12 of which are in the Koshi Basin of Nepal. The real-time data available from the region, satellite based products and weather forecasts are assimilated into rainfall runoff model using Mike 11.

The HKH-HYCOS regional flood outlook provides real-time flood information products pertaining to the threat of potential large-scale flooding in the Ganges Brahmaputra basins to provide adequate products to the national hydrometeorological agencies to support and enhance national flood forecasting and warning services. The model includes 86 sub-catchments with 21 nodes for calibration and validation as illustrated in Figure 5. Out of the 86 subcatchments 10 are in Nepal which includes the subbasins of Karnali, Narayani and Koshi. The modelling system is based on historical data for calibration and validation so that extreme events that

Figure 5 Regional flood outlook in the Ganges Brahmaputra basin

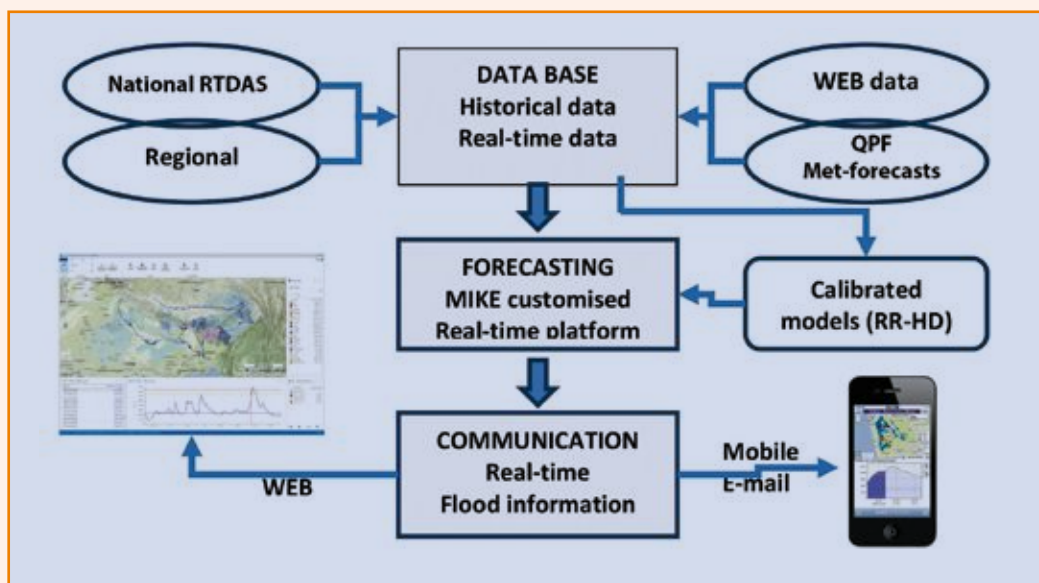


have occurred in the past are simulated correctly. The components of the regional flood outlook system are illustrated in Figure 6. The developed model forms the basis of the real-time flood forecasting system, which will require real-time data from the various sub basins within the participating countries. The computed forecasts are based on data assimilation using the actually observed real-time data, which is found to significantly improve forecasts (Madsen et al., 2003). The real-time information allows comparison of observed and forecast data for evaluation of the performance of the developed system.

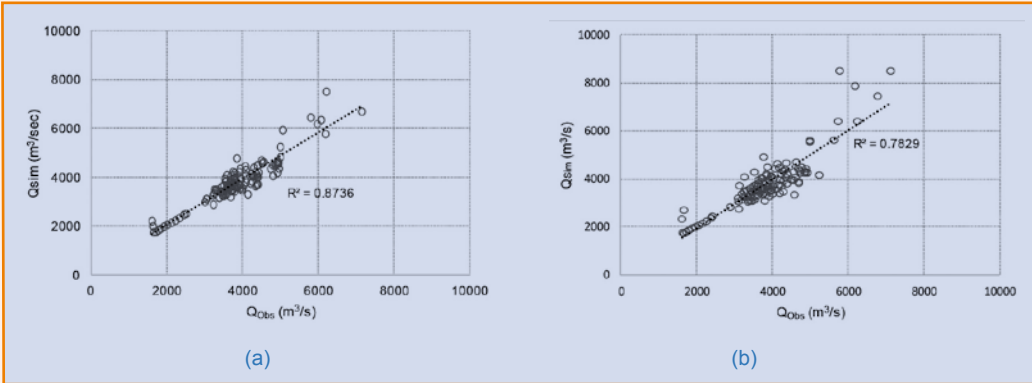
The model was piloted to simulate the flows during the 2014 monsoon. Observed discharge data were assimilated at several gauging stations up to the time of forecast. The model was used to prepare forecasts with a lead-time of 72 hours every 12 hours. From 14-16 August, when many parts of Nepal experienced continuous rainfall resulting in widespread flooding, the performance of the flood outlook model was evaluated. The performance of the model for 12 hr and 24 hour for the 2014 monsoon

period from July through September are presented in Figure 7. The coefficient of determination ( $R^2$ ) for 12 hr forecast is 87% and for 24 hr is 78%. The model results for the Koshi basin in Chatara for a one day period from 14–15 August are shown in Figure 8. The flood outlook was found to perform well in generating flow forecasts up to 24 hours in advance. The initial conditions at the time of forecast are updated; the forecasts improved significantly for the first 24 hours, after which the predictions deteriorate. These results are based on a initial development of the model and is now being updated with cross sections and additional ground information, which is expected to significantly improve the model performance. ICIMOD is working to improve the regional model and supporting DHM to customize the model over Nepal for improved flood forecasting. With further improvement, the regional flood outlook is expected to support national hydrometeorological services in providing better forecasts, preparing timely flood bulletins, and increasing the forecast lead time for timely action by decision makers.

**Figure 6 Regional flood outlook system**



**Figure 7 Performance of 12hr (a) and 24hr (b) observed and simulated discharge at Chatara on the Koshi**



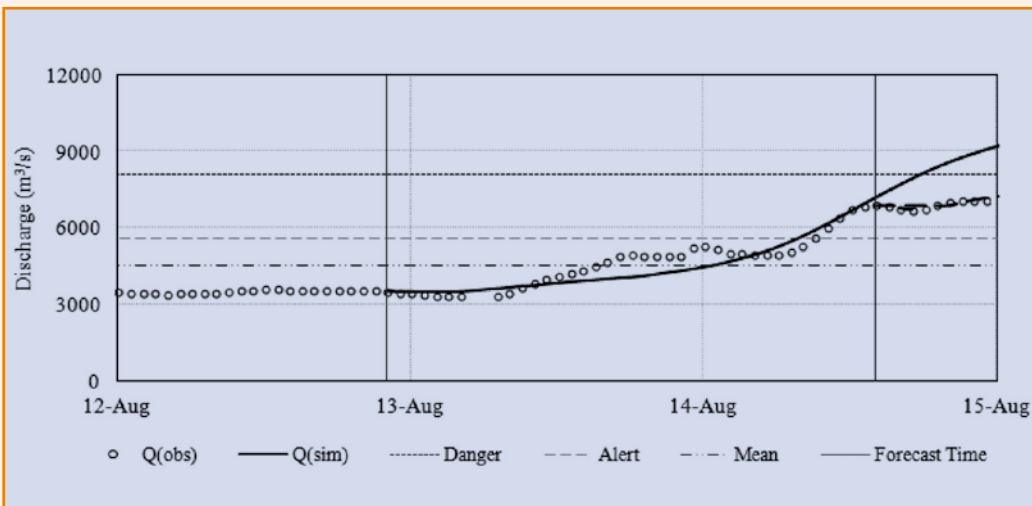
**Lessons Learnt and Conclusion**

During the 2014 floods huge loss of lives, properties and infrastructure was recorded. More than 200 people were killed, thousands of families affected, roads, bridges and hydropower damaged. This calls for the need to have sounder preparedness, response and planning and design of infrastructures considering the impact of changing climate and variability for improved flood resilience.

Often during such flood disasters, societal inequalities are amplified, and poor people – especially women, the elderly, and children, living along river banks and in the flood plains – are particularly vulnerable. To make early warning systems effective and efficient, we must recognize the active role that women play in family livelihood security, and efforts must be made to involve women and men equally in creating and receiving early warnings and alerts.

Real-time monitoring of water levels and rainfall, transmission of data and communication

**Figure 8 Flood outlook at Chatara on the Koshi from 13-15<sup>th</sup> August, 2014**



and warning are crucial in saving lives and property. Real-time monitoring systems can immediately notify various agencies about eminent disasters. During extreme events break down of the gauging station with sophisticated real-time monitoring systems and its transmission have been experienced as in the Babai river basin. Thus, even with automatic state of the art systems, observation by gauge observers are needed for providing back up in case of telemetry and instrument failure and to provide additional information of flooding conditions.

Since 2001, despite increased efforts in addressing disaster risk reduction in Nepal there are still gaps in coordination as illustrated by the 14-16 August event. There is a need to institutionalize EWS at various levels with proper governance mechanisms. The need to strengthen disaster risk governance to manage disaster risks is an important element of the Sendai 2015 framework of Disaster Risk Reduction endorsed by 187 countries around the globe, including Nepal.

The EWS that are in place in Babai and Karnali did provide timely warning during the 2014 flood event however, in some places the lead time available was very short challenging the communities to promptly evacuate and move to safer grounds. In such cases reliable and timely warning can be provided using flood forecasting models. Real-time monitoring of hydrological and meteorological variables generates valuable information that can be fed into hydrological models. These models can be used to provide information about areas at risk of inundation during a flood event. The results of the regional flood outlook piloted in 2014 indicate that it is a promising tool that may support effective flood forecasting at the national level.

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## Annex 1

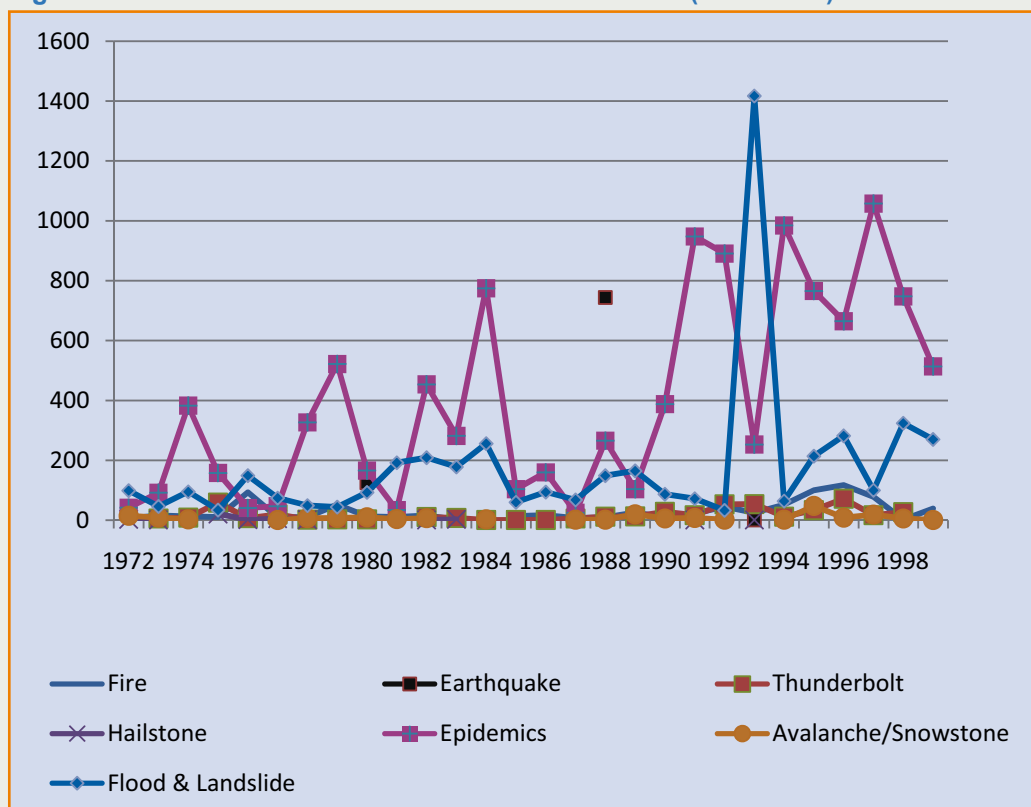
Table 3 Loss of Human Lives Due to Natural Disasters (1972-1999)

Year	Fire	Earthquake	Thunderbolt	Hailstone	Epidemics	Avalanche/ Snowstorm	Flood & Landslide	Total
1972	6			3	42	15	99	165
1973	16		6	1	92	9	46	170
1974	13		9		383	3	95	503
1975	11		59	21	158		34	283
1976	93		7	2	41		149	292
1977	10		20	5	47	1	74	157
1978	11		2	2	327	7	49	398
1979	52		3		522	8	44	629
1980	13	125	3		166	10	93	410
1981	11				34	4	192	241
1982	16		11	1	454	7	209	698
1983	2		8	3	282		178	473
1984			1		775	3	256	1035
1985	14		1		104		60	179
1986	17		1		160		94	272
1987	7		6		25	2	68	108
1988	10	744	12		266	2	149	1183
1989	26		13		104	20	165	328
1990	9		28		388	6	87	518
1991	23		17	1	948	8	72	1069
1992	45		53		891	2	33	1024
1993	25	1	54	1	253		1417	1751
1994	52		12		985	2	64	1115
1995	100		34		766	48	214	1162
1996	117		72		665	9	282	1145
1997	78		17		1058	19	100	1272
1998	2		27		748	6	324	1107
1999	39				514	1	270	824
<b>Total</b>	<b>818</b>	<b>870</b>	<b>476</b>	<b>40</b>	<b>11198</b>	<b>192</b>	<b>4917</b>	<b>18511</b>

Source: DISInventar

## Annex 2

Figure 31 Human Casualties Due to Natural Disasters (1972-1998)



Source: DesInventor

In the above figure 31 we can see the losses of human lives due to various types of disasters between 1972 to 1998. The figure shows that most people are killed by epidemics followed by floods and landslides. Epidemics killed a number of people in 1995. We can see the sharp rise of death toll in the year 1993, which is because of the floods and landslides in central Nepal. A total number of 1,537 people died in that single disaster. So the three types of disasters namely; epidemics, floods and landslides have been found more destructive than other disasters between the years 1972 to 1998.

## Annex 3

### Human Deaths From Disasters Since 2000 to 2014

Year	Flood & landslide	Thunder-bolt	Fire	Hail-stone	Wind-storm	Avalanche/snowstorm	Epidemics	Earthquake	Total
2000	173	26	37	1	2	-	141	0	380
2001	196	38	26	1	1	-	154	1	417
2002	441	6	11	0	3	-	0	0	461
2003	232	62	16	0	20	-	0	0	330
2004	131	10	10	0	0	-	0	0	151
2005	141	18	28	0	0	21	41	0	249
2006	141	15	3	1	0	-	34	0	194
2007	216	40	9	18	1	6	0	0	290
2008	134	16	11	0	2	0	3	0	166
2009	135	7	35	0	0	2	10	0	189
2010	240	70	69	0	2	2	462	0	845
2011	263	95	46	2	6	0	36	0	448
2012	123	119	77	0	18	9	9	6	361
2013	219	146	59	NA	3	7	4	0	438
2014	241	96	62	NA	3	38	12	0	452
<b>Total</b>	<b>3026</b>	<b>764</b>	<b>499</b>	<b>23</b>	<b>61</b>	<b>85</b>	<b>906</b>	<b>7</b>	<b>5371</b>

Source: Ministry of Home Affairs



## Annex 4

### Major Disasters in 2013 in Chronological Order

SN	Date	District	VDC/ municipality & wards no.	Types of disaster	Death	Missing	Injured	Affected families
1	3-Jan	Sindhuli	Kakurthakur-6	Fire	1		1	1
2	6-Jan	Bhaktapur	Bhaktapur-1	Fire	3			1
3	18-Jan	Rukum	Purtimkada-6	Thunderbolt	1		9	
4	25-Jan	Dhading	Jogimara-2	Fire	2			1
5	5-Feb	Bajura	Gothkada-7	Thunderbolt	2		5	
6	6-Feb	Surkhet	Garpan-3	Thunderbolt	1		2	1
7	1-Mar	Sindhupalchowk	Batase-3	Fire	1			1
8	7-Mar	Kavrepalanchowk	Chamangbesi-8	Thunderbolt	2			5
9	9-Mar	Saptari	Rayapur-9	Fire				45
10	10-Mar	Gorkha	Saurapani-9	Thunderbolt	1		7	
11	10-Mar	Solukhumbu	Deusa-6	Thunderbolt	1		4	
12	14-Mar	Jumla	Badaki-4	Landslide	8		4	1
13	21-Mar	Sindhuli	Netrakali-5	Thunderbolt	2		10	
14	21-Mar	Baglung	Amarbhumi-5	Thunderbolt	1		3	1
15	21-Mar	Khotang	Chisapani-9	Thunderbolt	1		2	1
16	24-Mar	Saptari	Tikuliya-9	Fire				15
17	26-Mar	Morang	Govindapur-1	Fire				97
18	29-Mar	Sunsari	Simariya-9	Fire				12
19	31-Mar	Rolpa	Ghodagaun-2	Fire			1	6
20	1-Apr	Saptari	Bagaduwa-3	Fire				40
21	3-Apr	Kaski	Lekhnath-11	Boat Capsize	3	2	3	
22	4-Apr	Siraha	Fulkahakatti-1	Fire			4	14
23	5-Apr	Bara	Inarwamala-2	Fire				25
24	8-Apr	Saptari	Mainashreeharsabahu-3	Fire				24
25	12-Apr	Sindhuli	Kalpabriskhya-4	Fire			1	14
26	13-Apr	Parsa	Mirjapur-2,3	Fire				39
27	13-Apr	Rautahat	Basbitti-9, Raghunath-3,4	Fire				82
28	13-Apr	Parsa	Dhore-2,8	Fire				172
29	14-Apr	Saptari	Nilathi-6	Fire				25
30	15-Apr	Sindhupalchowk	Thokarpa-7,8,9	Thunderbolt	1		3	
31	16-Apr	Banke	Holiya-3	Fire				37
32	17-Apr	Bardiya	Belawa-7	Fire				250
33	1-May	Surkhet	Neta-5	Fire			1	16
34	4-May	Saptari	Joganiya-7	Fire				39
35	9-May	Myagdi	Ramche-1	Thunderbolt	1		7	
36	12-May	Bara	Sukipathara-1	Wind Storm	2		2	
37	15-May	Mustang	Marpha-5	Air Crash			22	
38	5-Jun	Taplejung	Thumkima-4,6	Landslide	7	4	3	
39	17-Jun	Darchula	Khalanga-5	Flood	1			317

40	18-Jun	Kalikot	Mehalkadi-4	Flood	5	13	1	20
41	18-Jun	Baitadi	Siddheshwor-2	Landslide	5			3
42	18-Jun	Dailekh	Malika-2	Landslide	8			114
43	18-Jun	Palpa	Birkot-3	Landslide	3			2
44	9-Jul	Jhapa	Rajghad	Flood				81
45	9-Jul	Kailali	Dhanshingpur-1	Flood				30
46	10-Jul	Jhapa	Sharanamati-3	Flood	1			93
47	19-Jul	Saptari	Gobargadha-6	Flood				21
48	22-Jul	Nawalparasi	Rakachuli-9	Landslide	2	3	5	18
49	5-Aug	Udayapur	Mainamaini-9	B o a t Capsize	2	15		
50	13-Aug	Darchula	Dhuligada-9	Flood				92
51	13-Aug	Ramechhap	Khimti-4	Landslide	8		6	9
52	31-Aug	Kanchanpur	Dodhara-1	Flood		1		173
53	2-Sep	Dolpa	Saldang-3,4	Epidemic	4			
54	4-Sep	Banke	Holiya-9	B o a t Capsize	1		8	
55	19-Sep	Makawanpur	Hanimari-4	Thunderbolt	1		1	
56	30-Sep	Udayapur	Rupatar-7	Landslide			4	
57	16-Oct	Solukhumbu	Bung-9	Avalanche	3			
	12-Dec	Sindhupalchowk	Gumba	Landslide	1		1	

Source: Ministry of Home Affairs

## Annex 5

### Major Disasters in 2014 in Chronological Order

SN	Date	District	VDC/ municipality & wards no.	types of disaster	Death	Missing	Injured	Affected families
1	17-Jan	Humla	Goti	Fire	3		12	
2	18-Jan	Makwanpur	Simbhanjang-6	Thunderbolt			1	
3	13-Feb	Saptari	Haripur-7	Fire			3	
4	14-Feb	Baitadi	Sarkar-1	Thunderbolt			3	
5	16-Feb	Arghakhachi	Khidim-8	Air Crash	18			
6	1-Mar	Kailali	Lalbojhi-4	Boat Capsize	7	3		
7	20-Mar	Terathum	Isubu-4	Thunderbolt			5	
8	28-Mar	Rupandehi	Manmateriya-5	Fire				23
9	9-Apr	Doti	Daud-6	Landslide	3			
10	9-Apr	Kathmandu	Kathmandu-14	Fire	2			
11	10-Apr	Saptari	Jamuna Madhyapur-6	Fire	1		2	
12	4/18/2015	Solukhumbu	Sagarmatha Base Camp	Avalanche	13	3	7	
13	22-Apr-14	Saptari	Banainiya-9	Fire				14
14	24-Apr-14	Dang	Siuj-5	Fire				7
15	9-May-14	Dang	Rajpur-9	Fire				33
16	13-May-14	Kapilbastu	Maharajgunj-2	Fire	1			29
17	15-May-14	Sunsari	Ramgunj Belgachhiya-9	Fire				17
18	2-Jun-14	Bardiya	Sanoshree-1	Thunderbolt	1		3	
19	7-Jun-14	Bajura	Kolti-1,2	Flood	3		1	30
20	19-Jun-14	Pyuthan	Khung-8	Landslide	5		1	
21	19-Jun-14	Gulmi	Aglung-8	Landslide	9			
22	9-Jul-14	Nuwakot	Rautbesi-6	Thunderbolt			12	
23	19-Jul-14	Kanchanpur	Bhimdutta-11,12,13	Flood				163
24	19-Jul-14	Kanchanpur	Belauri-7	Flood				50
25	2-Aug-14	Sindhupalchowk	Mankha-1	Landslide	33	123	47	478
26	4-Aug-14	Sankhuwasabha	Sabun-3	Landslide	8	2		3
27	9-Aug-14	Dolakha	Jiri-7	Landslide	4		8	
28	14-Aug-14	Surkhet	Different Places	Flood	34	91	26	3866
29	13-Aug-14	Bardiya	Different Places	Flood	33	15	2	17376
30	13-Aug-14	Banke	Different Places	Flood	15	5	2	10763
31	14-Aug-14	Dang	Different Places	Flood	14	4	2	3984
32	14-Aug-14	Rautahat	Dharampur-6,7,8,9	Flood				250
33	14-Aug-14	Rukum	Chunabang-8	Landslide	2		2	
34	15-Aug-14	Gorkha	Phinam-6	Landslide	3		8	
35	8-Sep-14	Makawanpur	Betini-5	Thunderbolt	2		4	
36	14-Sep-14	Mustang	Treeking Route	Snow Storm	24			

37	14-Sep-14	Manang	Treeking Route	Snow Storm	3	7		
38	14-Oct-14	Manang	Nar-4	Snow Storm (Hud-hud impact)	6			
39	14-Oct-14	Myagdi		Snow Storm (Hud-hud impact)	5			
40	14-Oct-14	Mustang		Snow Storm(Hud- hud impact)	48			
41	25-Oct-14	Mugu	Shree Kot	Hailstones				2608
42	25-Oct-14	Solukhumbu	Kabu-7	Thunderbolt	1		4	
43	6-Nov-14	Parsa	Birjung-16	Fire	1			
44	26-Nov-14	Sinduli	Bubaneswori-7	Fire	1		1	

Source: Ministry of Home Affairs

## Annex 6

### Glossary and Terminologies

Understanding of disaster terms and terminologies is highly necessary for the disaster management professionals. Therefore, following are some key terminologies for the exact understanding which can be useful in daily business.

**Alert:** A heightened level of vigilance due to the possibility of an event in the area of responsibility. No action is required however the situation should be monitored by someone capable of assessing the potential of the threat.

**Assessment:** Survey of a real or potential disaster to estimate the actual or expected damages and to make recommendations for prevention, preparedness and response.

**Bench Mark:** An accurate height measurement of a feature marked on a map.

**Biological Disaster:** Disaster caused by the exposure of living organisms to germs and toxic substances.

**Biological Hazard:** It includes infectious and cytotoxic waste.

**Blizzard:** Violent winter storm, lasting at least three hours, which combines below freezing temperatures and very strong wind laden with blowing snow that reduces visibility to less than 1 kilometer. [AEM, Glossary]

**Bund:** An enclosure around plant or tanks to contain leakage or spillage.

**Bushfire/Wildfire:** A fire involving grass, scrub or forest.

**Call-Out:** The executive command to deploy resources.

**Call Sign:** The name assigned to a radio user for communications purposes.

**Casualty:** An injured person. A person killed or injured as the result of the incident or emergency.

**Climate:** is commonly defined as the weather averaged over a long period. The standard averaging period is 30 years, but other periods may be used depending on the purpose. Climate also includes statistics other than the average, such as the magnitudes of day-to-day or year-to-year variations.<sup>1</sup>

**Climate Change:** is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It may be a change in average weather conditions or the distribution of events around that average (e.g., more or fewer extreme weather events).<sup>2</sup>

**Climatic Hazards:** are the harmful effects of climate change on livelihoods and ecosystems. They can be caused by gradual climate variability or extreme weather events. Some hazards are continuous phenomena that start slowly, such as the increasing unpredictability of temperatures and rainfall. Others are sudden but relatively discrete events such as heat waves or floods.

**Climate Variability:** refers to variations in the climate statistics from the long term statistics over a given period of time.

<sup>1</sup> <http://en.wikipedia.org/wiki/Climate>

<sup>2</sup> [http://en.wikipedia.org/wiki/Climate\\_change](http://en.wikipedia.org/wiki/Climate_change)

**Climate Change Mitigation:** refers to strategies and policies that reduce the concentrations of greenhouse gasses in the atmosphere either by reducing their emissions or by increasing their capture.

**Climate Change Adaptation:** refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Source: Intergovernmental Panel on Climate Change (IPCC). In other words, it consists of initiatives and measures to reduce the vulnerability of natural and human systems to actual or expected climate change effects. They can be spontaneous or planned responses to actual or expected conditions.

**Cluster:** A “cluster” is essentially a “sectoral group” and there should be no differentiation between the two in terms of their objectives and activities; the aim of filling gaps and ensuring adequate preparedness and response should be the same. [IASC Guidance Note on Using the Cluster Approach Nov 2006]

**Cluster Approach:** The Cluster Approach aims to strengthen humanitarian response capacity and effectiveness in five key ways: i) ensuring sufficient global capacity is built up and maintained in key gap sectors/ areas of response; ii) identifying predictable leadership in the gap sectors/areas of response; iii) facilitating partnerships and improved inter-agency complementarity by maximizing resources; iv) strengthening accountability; and v) improving strategic field-level coordination and prioritization in specific sectors/areas of response by placing responsibility for leadership and coordination of these issues with the competent operational agency. (IASC Guidance Note on Using the Cluster Approach Nov 2006)

**Cluster Leads:** A “cluster lead” is an agency/organization that formally commits to take on a leadership role within the international humanitarian community in a particular sector/area of activity, to ensure adequate response and high standards of predictability, accountability & partnership. (IASC Guidance Note on Using the Cluster Approach Nov 2006)

**Commander:** A single-agency term. A commander has authority only within that agency. Responsibilities include the direction and coordination of the activities of that agency. A commander operates vertically within that agency and cannot command members of another agency. [AEM, Glossary]

**Command:** Command is the internal direction of the members and resources of an agency in the performance of the organization’s role and tasks. Command operates vertically within an organization. [AMI, Australia]

**Community:** A group with a commonality of association and generally defined by location, shared experience, or function. A social group which has a number of things in common, such as shared experience, locality, culture, heritage, language, ethnicity, pastimes, occupation, workplace etc. [AEM, Glossary]

**Comprehensive Approach:** The development of emergency and disaster arrangements to embrace the aspects of prevention, preparedness, response and recovery (PPRR). PPRR are aspects of emergency management, not sequential phases.

**Control:** Control refers to the overall direction of emergency management activities in an emergency situation. Authority for control is established in legislation or in an emergency plan and

carries with it the responsibility for tasking other organizations in accordance with the needs of the situation. Control relates to situations and operates horizontally across organizations. [AMI, Australia]

**Coordination:** Coordination refers to the bringing together of organizations and other resources to support an emergency management response. It involves the systematic acquisition and application of resources (organizational, human and equipment) in accordance with the needs of the situation. Control relates to situations and operates horizontally across organizations. [AMI, Australia]

**Coordination Centre:** A centre established at State, district or local level as a centre of communication and coordination during times of disaster operations.

**Community Preparedness:** Actions taken by a community to mitigate the effects of potential disasters. Community resilience: Community resilience is a relative term and refers to an ideal condition of a community in terms of its capacity to anticipate, prepare for, respond to, and recover quickly from the impacts of a disaster. The disaster resilient community is a positive concept, and while complete resilience is not attainable, every community is striving to achieve it.

**Contingency Planning:** Contingency Planning is a management process that analyses specific potential events or emerging situations that might threaten society or the environment and establishes arrangements in advance to enable timely, effective and appropriate responses to such events and situations.

**Cost Effectiveness:** A measure of effectiveness expressed in terms of the cost per unit of benefit. For example, in risk

analysis the expenditure incurred per life saved is a measure of cost effectiveness. [AEM, Glossary]

**Counselling:** The process of providing psychological support to persons involved in an incident.

**Damage Assessment:** A report on the extent of damage caused by an event.

**Debriefing:** The process of sharing the good and bad points of the response to an incident as a means to improving any future planning and responses. [AEM, Glossary]

**Disaster:** A disaster is any event, natural or human induced which threatens human lives, damages private and public property and infrastructure, and disrupts social and economic life. Thus, it is a serious disruption in a community, caused by the impact of an event that requires a significant coordinated response by the state and other entities to help the community recover from the disruption like: human life loss, illness, injury, property loss and damage to environment [AMI, Australia]. UN-ISDR defines disaster as a serious disruption of the functioning of a society, community or a project causing widespread or serious human, material, economic or environmental losses, which exceed the coping ability of the affected society, community or project using its own resources.

**Disaster Management:** Disaster Management is a collective term encompassing all aspects of planning for and responding to disasters. It refers to the management of both the risks and consequences of disasters. [UNISDR 2004]. Disaster management covers all measures that help a society to avoid, minimize loss and recover from the impacts of disasters. These measures

include activities, which take place before, during and after a disaster event. Disaster management, therefore, incorporates all stages of the disaster cycle which are seen as a continuum and not as discreet and independent components. In other words, disaster management is the body of policy and administrative decisions and operational activities which pertain to the various stages of a disaster at all levels.

**Disaster Management Planning:** Disaster Management Planning is a sequential and continuous process. Good planning requires diagnosis, resources, evaluation and feedback towards fulfilling the goal of disaster reduction. Because of the wide scope of disaster management and the numerous actors involved it is essential that a framework for co-ordination is essential. [Oxford Centre for Disaster Studies]

**Disaster Research:** May be broadly understood as a systematic inquiry, before and after a disaster, into a relevant disaster management problem (COAG, Natural Disasters in Australia: Reforming mitigation, relief and recovery arrangements: 2002).

**Disaster Response:** The taking of appropriate measures to respond to an event, including action taken and measures planned in anticipation of, during, and immediately after an event to ensure that its effects are minimised and that persons affected by the event are given immediate relief and support (Disaster Management Act of Australia 2003).

**Disaster Response Capability:** The ability to provide equipment and a suitable number of persons, using the resources available to the local government, to effectively deal with, or help another entity to deal with, an emergency situation or a disaster in the local government's area (Disaster Management Act of Australia 2003).

**Disaster Response Operations:** The phase of disaster operations that relates to responding to a disaster (Disaster Management Act of Australia 2003).

**Disaster Risk Management:** It is the systematic process of using administrative directives, organizations and operational skills and capacities to implement strategies, policies and activities to lessen the adverse impacts of hazards and the possibility of disaster. [UNISDR 2004]

**Disaster Risk Reduction:** The concept and practice of reducing disaster risk through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. The conceptual framework of DRR is to minimize vulnerabilities and disaster risks throughout a society; and avoid or limit the adverse impacts of hazards; which is done within the broad context of sustainable development. Therefore DRR is reducing exposure to hazards, lessening vulnerability of people and property, wise management of land and the environment, and improving preparedness and early warning for adverse events are the examples of disaster risk reduction. [UNISDR 2004]

In summary -- the principle of reducing risks from natural as well as man-made hazards is known as disaster risk reduction (DRR) which will ultimately lead to resilience.

**Displaced Person:** Person, who, for different reasons or circumstances, has been compelled to leave their home. They may or may not reside in their country of origin, but are not legally regarded as a refugee. [AEM, Glossary]

**District Disaster Management Plan:** A plan prepared under the Disaster



Management legislation that document planning and resource management to counter the effects of a disaster within the disaster district.

Drought refers to the naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems. Source: United Nations Convention to Combat Desertification.

**Early Warning System:** The aim of early warning is to warn people well ahead of any possible disaster so that the losses of human lives could be saved. In generic terms, early warning constitutes a process whereby information concerning a potential disaster is provided to people at risk and to institutions so that tasks may be executed prior to its manifestation to minimize its detrimental impacts, such as fatalities, injuries, damage and interruptions of normal activities. In other words, early warning is the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities, and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss. To be effective, an early warning mechanism must include public education, accurate risk perception, a communications system to relay the message and an emergency management system to adequately coordinate the response. [Coppola 2011]

**Earthquake:** refers to the sudden release of slowly accumulated energy along tectonic plates that make up the earth's crust. They represent a particularly severe threat due to the irregular intervals between events, the lack of adequate predictive models, and the associated hazards which include: ground shaking; vertical or horizontal fault

movements; landslides, and liquefaction (amplification of ground shaking in areas of unconsolidated materials and high water tables).

**Emergency Relief:** It refers to the period immediately following the occurrence of a disaster when steps are taken to meet the needs of survivors in respect to shelter, water, food and medical care. Activities undertaken during and immediately following a disaster include immediate rescue, relief, damage and needs assessment and debris clearance.

**Epicentre:** The point on the Earth's surface directly above the focus (or hypocenter) of an earthquake.

**Evacuation:** The planned relocation of persons from dangerous or potentially dangerous areas to safer areas and eventual return.

**Exposure:** The circumstance of being exposed to radiation, or: a defined dosimetric quantity now no longer used for radiation protection purposes.

**Flood:** refers to a rise, usually brief, in the water level in a stream to a peak from which the water level recedes at a slower rate. Source: International Glossary of Hydrology.

**Forecast:** Statement of expected meteorological conditions for a specific period and for a specific period and for a specific area or portion of air space.

**Gender:** The social attributes and opportunities associated with being male or female and the relationships between women and men and girls and boys, as well as the relations between women and between men. These attributes, opportunities, and relationships are socially constructed and are learned

through socialization processes. They are context/time-specific and changeable. Gender determines what is expected, allowed, and valued in a woman or a man in a given context. In most societies, there are differences and inequalities between women and men in responsibilities assigned, activities undertaken, access to and control over resources, and decision-making opportunities. Gender is part of the broader socio-cultural context.

**Gender Mainstreaming:** Mainstreaming a gender perspective is the process of assessing the implications for women and men of any planned action, including legislation, policies or programs, in all areas and at all levels. It is a strategy for making both women's and men's concerns and experiences an integral dimension of the design, implementation, monitoring, and evaluation of policies and programmes in all political, economic, and societal spheres so that women and men benefit equally and inequality is not perpetuated. The ultimate goal is to achieve gender equality (ECOSOC 1997).

**Global Positioning System (GPS):** A highly-accurate navigation system based on a constellation of 24 satellites orbiting the earth at 20,000 kilometers that transmit back a set of signals. [AEM, Glossary]

**Global Warming** refers to the increase in the average temperature of the Earth's near-surface air and the oceans since the mid-twentieth century and its projected continuation. Source: UN-ISDR.

**Hazard:** A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Hazard can include latent conditions that may represent future threats and can have different origins: natural (geological, hydro meteorological and

biological) or induced by human processes (environmental degradation and technical hazards." [UN/ISDR, Geneva 2004].

**Hurricane** refers to a rotating, intense low pressure system, which forms over tropical oceans with maximum surface wind speeds that exceed 74 mph (119 km/h).

**Landslide** is a general term covering a wide variety of landforms and processes involving the movement of earth, rock and debris down slope under the influence of gravity.

**Mainstreaming** can be defined as the process of analysing how a particular process impacts on all sectors, now and in the future, both internally and externally, to determine how each sector should respond based on its comparative advantage.

**Millennium Development Goals(MDG)** refers to a set of eight development goals promulgated by the United Nations in 2002 to meet the needs of the world's poorest people by 2015.

**Mitigation** refers to structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards. Source: UN-ISDR.

**Inventory:** A list of the type and quantity of hazardous materials in transport, stored or in process.

**Lead Agency:** An organization which because of its expertise & resources is primarily responsible for dealing with a particular hazard.

**Lifelines:** The public facilities and systems that provide basic life support services such as water, energy, sanitation, communications and transportation. Systems or network that

provide services on which the well-being of the community depends.

**Micro Zonation:** Subdivision of a region into areas where similar hazard-related effects can be expected. Seismic micro zonation is the mapping of a local seismic hazard using a large scale.

**Mitigation:** Mitigation is defined as any sustained effort undertaken to reduce a hazard risk through the reduction of the likelihood and/or the consequence component of that hazard's risk. [Coppola 2011]. Mitigation, sometimes called prevention or risk reduction, is often considered the "cornerstone of disaster management [FEMA, 2010]. Mitigation embraces all measures taken to reduce both the effect of the hazard itself and the vulnerable conditions to it in order to reduce the scale of a future disaster. Therefore mitigation activities can be focused on the hazard itself or the elements exposed to the threat. Examples of mitigation measures which are hazard specific include modifying the occurrence of the hazard, e.g. water management in drought prone areas, avoiding the hazard by sitting people away from the hazard and by strengthening structures to reduce damage when a hazard occurs. In addition to these physical measures, mitigation should also be aimed at reducing the physical, economic and social vulnerability to threats and the underlying causes for this vulnerability. Therefore mitigation may incorporate addressing issues such as land ownership, tenancy rights, wealth distribution, etc. [Oxford Centre for Disaster Studies]

**Pandemic:** Prevalent throughout an entire country or continent, or the whole world, as in disease.

**Post-disaster Assessment:** Addresses performance during and the risks revealed by a disaster event in order to improve

future development of mitigation measures. Post-disaster assessment forms part of continuous improvement of the whole system (Adapted from COAG, Natural Disasters in Australia: Reforming mitigation, relief and recovery arrangements: 2002).

**PPRR:** An abbreviation for prevention, preparedness, response and recovery.

**Prediction:** A statement of the expected time, place and magnitude of a future event .

**Preparedness:** The knowledge and capacities developed by governments, professional response and recovery organizations, communities, and individuals to effectively anticipate, respond to, and recover from the impacts of likely, imminent, or current hazard events or conditions. This protective process embraces measures, which enable governments, communities and individuals to respond rapidly to disaster situations to cope with them effectively. Preparedness includes the formulation of viable emergency plans, the development of early warning systems, the maintenance of inventories and the training of personnel. It may also embrace search and rescue measures as well as evacuation plans for areas that may be 'at risk' from a recurring disaster. Preparedness therefore encompasses those measures taken before a disaster event, which are aimed at minimizing loss of life, disruption of critical services, and damage when the disaster occurs. All preparedness planning needs to be supported by appropriate legislation with clear allocation of responsibilities and budgetary provisions.

**Prevention:** Regulatory and physical measures to ensure that emergencies are prevented, or their effects mitigated. Measures to eliminate or reduce the incidence or severity of emergencies [AEM, Glossary]. In other words, It is the avoidance of adverse impacts of

hazards and related disasters. Prevention expresses the concept to completely avoid adverse impacts through action taken in advance. It is more applicable to health related hazards. There is a famous saying that “Prevention is better than cure.”

**Public Awareness:** The process of informing the community as to the nature of the hazard and actions needed to save lives and property prior to and in the event of disaster. [AEM, Glossary]

**Public Health:** The discipline in health sciences that, at the level of the community or the public, aims at promoting prevention of disease, sanitary living, laws, practices and healthier environment.[AEM, Glossary]

**Rapidity:** the capacity to meet priorities and achieve goals in a timely manner to contain losses, minimize damages and avoid future disruptions.

**Recovery:** Recovery is the emergency management function by which countries, communities, families & individuals repair, reconstruct or regain what has been lost as result of a disaster and, ideally, reduce the risk of similar catastrophe in the future. In a comprehensive EM system; which includes pre-disaster planning, mitigation and preparedness actions, recovery actions may begin as early as during the planning process and activities, long before a disaster occurs. Once the disaster strikes, planned and unplanned recovery actions are implemented and may extend for weeks, months or even years. [Source: Early Warning Principles and Systems by Carlos, J., & Leon, V. 2012]

**Reconstruction:** It is good reconstruction attempts to return communities to improved pre-disaster functioning. It includes the replacement of buildings, infrastructure and lifeline facilities so that long-term development prospects are

enhanced rather than reproducing the same conditions which made an area or population vulnerable in the first place.

**Redundancy:** the extent to which elements or systems satisfy functional requirements in the event of disruptions, disturbances, or damages.

**Rehabilitation:** It is the activities that are undertaken to support the victims’ return to “normal” life and re-integration into regular community functions. Rehabilitation includes the provision of temporary public utilities and housing as interim measures to assist longer term recovery. Rehabilitation is the operations and decisions taken after a disaster with a view to restoring a stricken community to its former living conditions, while encouraging and facilitating the necessary adjustments to the changes caused by the disaster. [AEM, Glossary]

**Resilience:** Resilience is the capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures. Resilience is defined by the UNISDR as: “The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.”

**Resourcefulness:** the capacity to identify problems, establish priorities and mobilize financial and human resources to elements or systems that are threatened by disruption, disturbance, or damage.

**Response:** The response function of emergency management includes actions aimed at limiting injuries, loss of life and damage to property and the environment that are taken before, during and immediately after a disaster. Disaster response is the second phase of the DM cycle. It consists of warning/evacuation, search & rescue, providing immediate assistance, assessing damage, continuing assistance and the immediate restoration of infrastructure. The aim of emergency response is to provide immediate assistance to maintain life, improve health and support the morale of the affected population. Such assistance includes transport, temporary shelter, and food, to establishing semi-permanent settlement in camps and other locations. It also may involve initial repairs to damaged infrastructure. The focus in the response phase is on meeting the basic needs of the people until more permanent and sustainable solutions can be found. [Source: Wikipedia]

**Richter Scale:** An open-ended logarithmic scale used to express the magnitude or total energy of a seismic disturbance (or earthquake). In this scale an increase of 1 indicates a thirty-fold increase in energy. [AEM, Glossary]

**Risk:** Risk describes the expected losses caused by a particular phenomenon and is a combination of the probability of an event with its negative consequences.  $R = H \cdot V / C$ , where R is risk, H is hazard, V is vulnerability, C is coping capacity. Risk is the likelihood of an event occurring multiplied by the consequence of that event, were it to occur:  $RISK = LIKELIHOOD \times CONSEQUENCE$  (Ansell & Wharton, 1992). Or the above relationship can be written as an equation: Disaster Risk = Hazard + Vulnerability. Then, there are four components of risk namely; probability, consequences, hazard and exposure.

**Robustness:** strength and the ability of elements or systems to resist stress without suffering damages or loss of function.

**Sanitation:** Sanitation is the hygienic means of promoting health through prevention of human contact with the hazards of wastes as well as the treatment and proper disposal of sewage or wastewater. It pertains to the wholesomeness and cleanliness of food.

**Search and Rescue (SAR):** The process of locating and recovering disaster victims and the application of first aid and basic medical assistance as may be required.

**Seismic:** Related to sudden and usually large movement of the Earth's crust.

**Simulation Exercise:** Decision making exercise and disaster drills within threatened communities in order to represent disaster situations to promote more effective coordination of response from relevant authorities and the population. [AEM Glossary]

**Standard Operating Procedure (SOP):** A set of directions detailing what actions could be taken, as well as how, when, by whom and why, for specific events or tasks. [AEM, Glossary]

**Stockpiling:** The process of prior identification, availability and storage of supplies likely to be needed for disaster response.

**Storm Surge:** refers to an above normal rise in water level on the open coast due to atmospheric pressure reduction as well as wind stress.

**Sustainability:** refers to management of planetary resources for the benefit of present generations without compromising the reasonably foreseeable needs of future generations for such services.

**Sustainable Development:** Development in the present that does not destroy the resources needed for future development.

**Tagging:** Method used to identify casualties as requiring immediate care (Priority I), delayed care (Priority II), minor care (Priority III), or as deceased. [AEM Glossary]

**Trauma:** Injury of any nature.

**Tremor:** A shaking movement of the ground associated with an earthquake or explosion.

**Triage:** The process, by which casualties are sorted, prioritized and distributed according to their need for first aid, resuscitation, emergency transportation and definitive care. [AEM Glossary]

**Tropical Storm:** refers to an organised low pressure system forming in tropical latitudes with sustained wind speeds of between 38-73 mph (38-73 km/h).

**Tsunami:** refers to an ocean wave or series of waves caused by an abrupt disturbance of the ocean floor that displaces a large volume of water. They can be caused by earthquakes, volcanic activity, or undersea landslides.

**Vector:** Insects capable of transmitting disease. It includes flies, fleas, lice, mites, mosquitoes and ticks.

**Volcanic eruption:** refers to openings in the earth's crust through which molten rock and gases escape to the surface. Volcanic hazards stem from two classes of eruptions: explosive eruptions in which the rapid dissolution and expansion of gases from the molten rock takes place as it nears the surface; and, effusive eruptions where lava flows are the major hazard.

**Vulnerability:** "The conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards." [UN/ISDR, Geneva 2004]. "The extent to which a community, structure, service, or geographic area is likely to be damaged or disrupted by the impact of particular hazard, on account of their nature, construction and proximity to hazardous terrain or a disaster prone area." (DMTP, 1991, p 53)

**Warning:** Dissemination of message signaling imminent hazard which may include advice on protective measures. [AEM Glossary]

**WASH:** It is used in international development programs, refers to "Water, Sanitation and Hygiene". Specifically it may for example refer to water, sanitation and hygiene project or an advocacy campaign initiated by a national or international organization. Access to safe water, adequate sanitation, and proper hygiene education can reduce illness and death, and also impact poverty reduction and socioeconomic development.<sup>3</sup>

**Weather:** It is the state of the atmosphere, to the degree that it is hot or cold, wet or dry, calm or stormy, clear or cloudy. Weather refers, generally, to day-to-day temperature and precipitation activity relatively in a local area.<sup>4</sup>

**Zonation:** The subdivision of a geographical entity (country, region etc.) into homogenous sectors with respect to certain criteria (for example, intensity of the hazard, degree of risk, same overall protection against a given hazard etc.). [AEM Glossary].

<sup>3</sup> [Wikipedia.org/wiki/WASH](http://Wikipedia.org/wiki/WASH)

<sup>4</sup> <http://en.wikipedia.org/wiki/Weather>

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