Disasters and Ladakh

Action Points for Management and Mitigation

Administration of
Union Territory of Ladakh

Leh, Ladakh

G.B. Pant National Institute of
Himalayan Environment (NIHE)
(an autonomous institute of Ministry of Environment,
Forest & Climate Change, Govt. of India)

Kosi-Katarmal, Almora

Inner Front Cover Page

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[Document based on the session 'Vulnerability to Disasters and Mitigation of Risks' under 'Carbon Neutral Ladakh - a New Beginning']

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Citation:

.....2020. Disasters and Ladakh: Action Points for Management and Mitigation. G.B. Pant National Institute of Himalayan Environment, Kosi-Katarmal, Almora.

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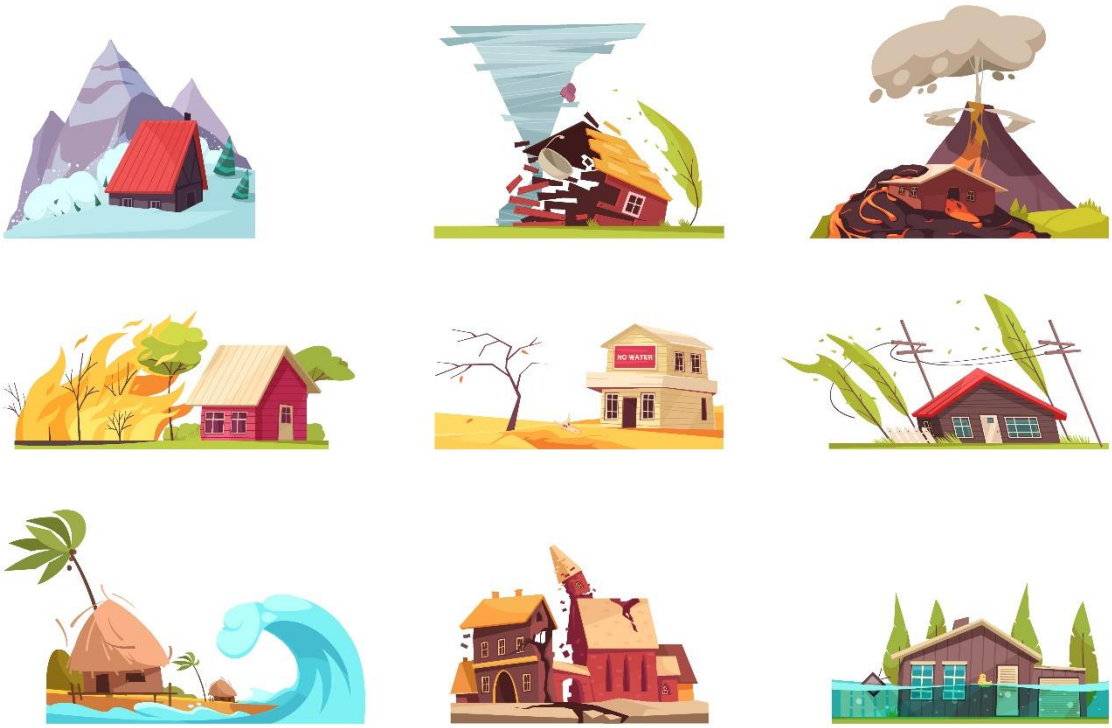
Abbreviations

APRA – Accident Prevention and Relief Authority
ATI – Administrative Training Institute
BMC – Block Management Committee
CATS –Centralized Accident and Trauma Services
CRED – Centre for Research on the Epidemiology of Disasters
CBO – Community Based Organizations
CC – Climate Change
CWC– Central Water Commission
DDMA – District Disaster Management Authority
DM – Disaster Mitigation/Management
DMA – Disaster Management Act
DMMS – Disaster Materials Management System
DMS –Disaster Management System
DRR – Disaster risk Reduction
DST – Department of Science & Technology
ECC – Emergency care centres
EMS – Emergency Medical Services
GBPNIHE –GB Pant National Institute of Himalayan Environment
GSI – Geological Survey of india
GoI – Government of India
GoUT – Government of Union Territory
HRVA– Hazard & Risk Vulnerability Assessment
IIRS – Indian Institute of Remote Sensing
IMD – Indian Meteorological Department
LBSNAA - Lal Bahadur Shastri National Academy of Administration
LGM – Last Glacial Maximum
MHA – Ministry of Home Affairs
MoEF&CC – Ministry of Environment, Forest and Climate Change
MoES – Ministry of Earth Sciences
NCDM – National Centre for Disaster Management
NCGG - National Centre For Good Governance
NDMA– National Disaster Management Authority
NDRF– National Disaster Response Force
NDMP– The National Disaster Management Plan
NEC– National Executive Committee
NIDM– National Institute of Disaster Management
NGO – Non-Governmental Organization
NH – National Highways
NIH – National Institute of Hydrology
NPDM –National Policy on Disaster Management
NPDRR – National Platform for Disaster Risk Reduction
SASE – Center for Snow and Avalanche Study Establishment
SDMA – State Disaster Management Authority

SDRF – State Disaster Response Fund
SDRF – State Disaster Response Force
SEC – State Executive Committee
SH – State Highways
SOP – Standard Operating Protocol
SPDRR – State Level Platform for Disaster Risk Reduction
TCP – Town and Country Planning
UNDMT– United Nations Disaster Management Team
UNDRR – United Nations Office for Disaster Risk Reduction
UNISDR – United Nations International Strategy for Disaster Reduction
UT – Union Territory
UToL – Union Territory of Ladakh



Natural Disasters

Acknowledgement

This booklet is an outcome of four day Summit on 'Carbon Neutral Ladakh - A New Beginning'. The participants of the Summit contributed significantly to make the event engaging and content rich. We thank them all.

The encouragement and guidance received from Hon'ble Lieutenant Governor of Union Territory of Ladakh, Shri RK Mathur, and the Secretary, Ministry of Environment, Forests and Climate Change, Shri C.K. Mishra, is thankfully acknowledged. Shri Rigzin Sampheal, Commissioner Secretary, Ladakh UT, provided constant support and guidance for successful organization of the event. We sincerely thank him. Dr. J.R. Bhatt, Advisor, MoEF&CC, helped in finalizing the Action Points.

The draft document was reviewed by Dr Indrajit Pal, Assistant Professor and Chair, Disaster Preparedness, Mitigation and Management (DPMM), Asian Institute of Technology, Thailand. His constructive inputs on earlier version of the document are gratefully acknowledged.

This event was not possible without untiring efforts of staff and officers of Wildlife Protection Department, Ladakh. The Scientists and Researchers of Ladakh Regional Centre of GB Pant National Institute of Himalayan Environment (NIHE) provided the background support. We gratefully acknowledge the support received from all of them.

Partial financial support received from Mountain Division of NIHE and through Project grant to Wildlife Protection Department, Leh under National Mission for Himalayan Studies (NMHS), MoEFCC, is gratefully acknowledged.

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Foreword

Preface

1. Disasters, Climate Change, and Vulnerability:

Disaster has been defined as "a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts" by United Nations Office for Disaster Risk Reduction[1]. Centre for Research on the Epidemiology of Disasters (Belgium) categorises disasters into two main groups– (a) Natural, and (b) Technological. The following is description of Natural Disasters, their subgroups, and Main Types within each Subgroup[2].

Disaster Subgroups & Their Main Types	Definition of Sub-Group
GEOPHYSICAL • Earthquake • Mass Movement (dry) • Volcanic activity	A hazard originating from solid earth. This term is used interchangeably with the term geological hazard.
METEOROLOGICAL • Extreme Temperature • Fog • Storm	A hazard caused by short-lived, micro- to meso-scale extreme weather and atmospheric conditions that last from minutes to days.
HYDROLOGICAL • Flood • Landslide • Wave action	A hazard caused by the occurrence, movement, and distribution of surface and subsurface freshwater and saltwater.
CLIMATOLOGICAL • Drought • Glacial Lake Outburst • Wildfire	A hazard caused by long-lived, meso- to macro-scale atmospheric processes ranging from intra-seasonal to multi-decadal climate variability.
BIOLOGICAL • Epidemic • Insect infestation • Animal Accident	A hazard caused by the exposure to living organisms and their toxic substances (e.g. venom, mold) or vector-borne diseases that they may carry. Examples are venomous wildlife and insects, poisonous plants, and mosquitoes carrying pathogens and viruses
EXTRA-TERRESTRIAL • Impact • Space weather	A hazard caused by asteroids, meteoroids, and comets as they pass near-earth, enter the Earth's atmosphere, and/or strike the Earth, and by changes in interplanetary conditions that effect the Earth's magnetosphere, ionosphere, and thermosphere.

[1]http://www.un-spider.org/node/7661 (Visited on 6 April 2020)
[2]https://www.emdat.be/classification(Visited on 5 April 2020)

Globally, disaster events are increasing since recorded history of data (since 1900) where hydrological (flood, landslide, etc.) and meteorological disasters (extreme temperature, fog, etc.) are in much rise than the other types (Fig. 1).Study on global fatal landslide, occurred between 2004 and 2016, indicates that Asia is more vulnerable (highest number of events; 75% of landslides) with substantial numbers of landslides in states in India along the Himalayan Arc, and neighbouring countries (south-eastern China, Bangladesh, Myanmar, etc.)[3].

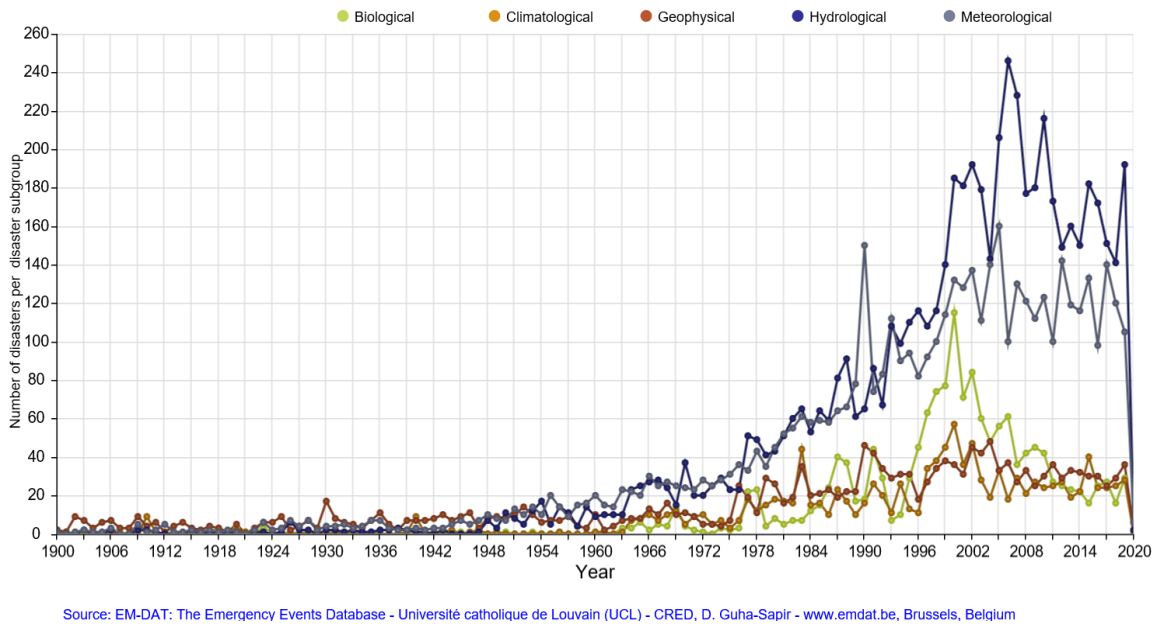

Fig 1. Since 1990, Global trend of disastrous events by Sub-Groups of disaster classification.

1.1. National Definition, Classification and Events:

In national scenario disaster has been defined[4] - "*A disaster is a catastrophe, mishap, calamity in any area, arising from natural or manmade causes, which results in substantial loss of life or human suffering, damage destruction of property, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area*", and Impacts of disasters are enumerated as: (i) loss of lives, (ii) loss of property and infrastructure, (iii) damage to livelihood, (iv) economic losses, (v) environmental damages- flora & fauna, (vi) sociological and psychological after effects, (vii) civil strife. India is affected by 33 different types of disasters, and the adopted national classification of disasters is as follows.

[3] MJFroude and DN Petley. 2018. Global fatal landslide occurrence from 2004 to 2016, Nat. Hazards Earth Syst. Sci., 18: 2161–2181, https://doi.org/10.5194/nhess-18-2161-2018.

[4] Nair, SS, Gupta, AK, Roder, K. 2013. Databases and Statistics for Disaster Risk Management. National Institute of Disaster Management and Deutsche Gasellschaft fur internationale Zusammenarbeit Gmbh (GIZ). New Delhi. 228 p.

Sl. No.	Disaster Group	Types of Disaster
1	Water and Climate related Disasters	Droughts, Floods, Cloudburst, Cyclones, Tornadoes, Hailstorm, Thunder and Lightning, Heat- and cold Waves, Snow avalanches, Sea erosion, Tsunami
2	Geologically related Disasters	Earthquakes, Landslides and Mudflow, Dam failures / Dam Bursts, Mine Fires
3	Chemical, industrial and nuclear	Chemical and Industrial disasters, Nuclear disasters,
4	Accident related Disasters	Forest fires, Urban fires, Village fire, Mine flooding, Oil spill, Major Building collapse, Serial bomb blasts, Festival related disaster, Electrical disaster and fires, Air, Road, and Rail accidents, Boat capsizing
5	Biologically related Disasters	Biological disasters and epidemics, Pest attacks, Cattle epidemics, Food poisoning

India has experienced most of these described disaster types or felt their threats in recent time history of recorded observations and has witnessed a significant growth in increasing number of natural disasters where frequency of natural disasters is increasing. For example, decadal analysis indicates that between 1991 and 2000 26 events of disastrous riverine floods occurred while between 2001 and 2010 this number increased to 79, and in present decade (2011 onward) 29 such events have been already registered. A remarkable damage to property (houses) and agriculture (cropped area) in last 20 years (2001-2019)

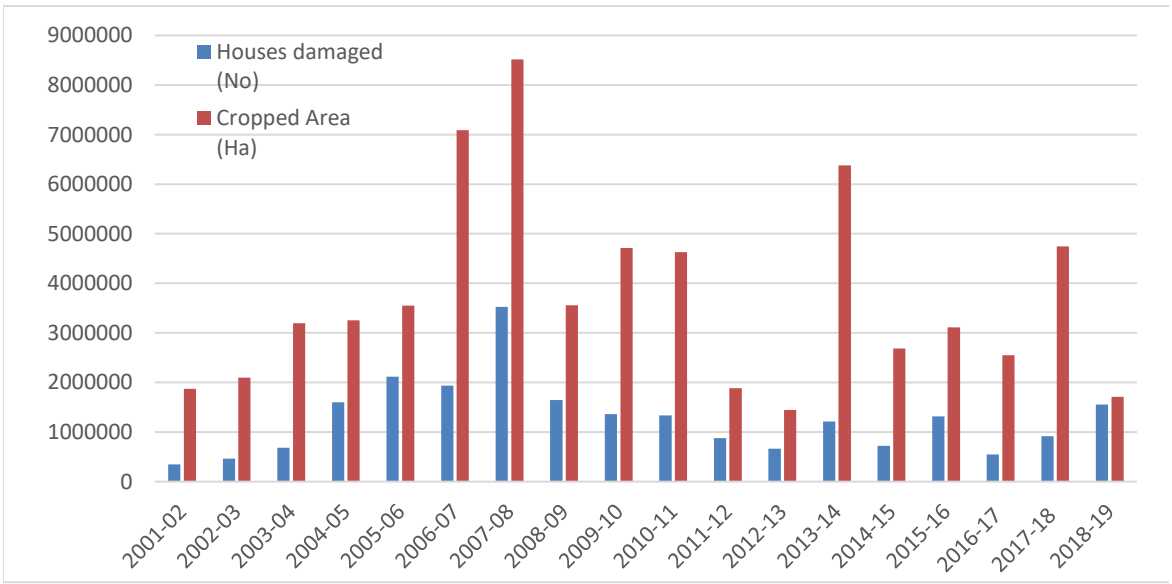

Fig 2. Damage to important assets due to natural extreme events in India.

has been experienced by the country due to extreme natural events (Fig. 2), which took a toll of nearly 39 thousand human lives and more than 14.7 lakh cattle[5].

Between 2001 and 2010, significant damaged in the country was caused due to floods, cyclonic storm, landslides, etc. (lives lost 21,975; cattle lost 9,79,677; house damaged 1,50,22,070; cropped area affected 424.69 lakh ha)[6], however, since 1926, more than three hundreds disastrous floods events occurred in India[7]those accounted for a death toll of more than 73 thousand lives of countrymen.

[5] NSO (2020), EnviStats-India 2020: Vol.I: Environment Statistics, National Statistical Office, Ministry of Statistics & Programme Implementation, Government of India, New Delhi.
[6] Ministry of Home Affairs (MHA); Disaster Management & data.gov.in
[7] EM-DAT: The Emergency Events Database – Country Profile Created on April 5, 2020

1.2. Vulnerability of Ladakh to Disasters:

In India, mountainous regions are highly susceptible to landslides. Between 1948 and 2017, 49 disastrous events of landslide in the country took a toll of 5035 persons, while 536 were injured and more than 2 lakhs people were affected by these events. Among the sub-types of Landslide (main type), 10 disastrous events of avalanches (sub-type) happened in the Indian Himalayan region from 1986 to 2017. These events took a toll of 885 human lives while more than 250 were injured.

Ladakh is prone to disastrous events of snowfall. In 2016 several events of heavy intensity (64.5-115cm in 24 hrs) happened leading to causalities of human lives. Some of the details for year 2013[8], and year 2016[9] are given.

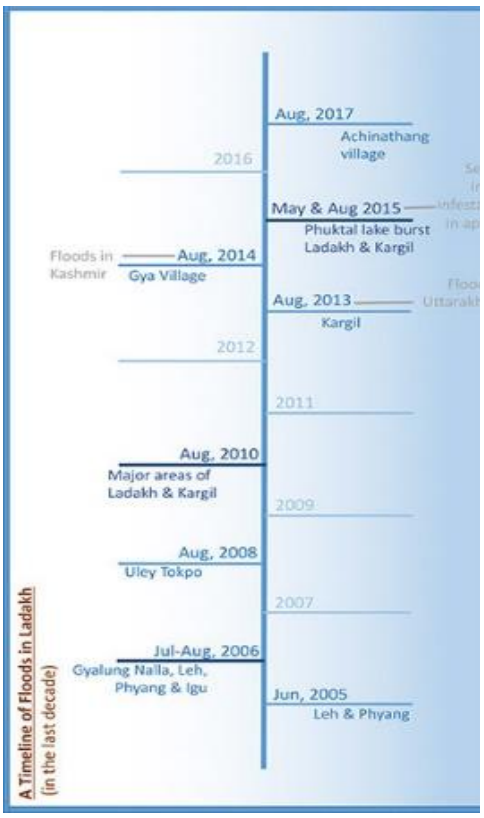

Fig 3. Ladakh: Flood timeline in recent years

Source: Preksha Sharma. 2018. Ladakh Floods: A Timeline of Disaster. https://thewire.in/environment/ladakh-floods-

Records of flash floods (sub-type) in the country (1968-2018) indicate that more than 32 hundred casualties occurred in 28 disastrous events and over 38 million people were affected. Events of disastrous riverine floods were 139 from 1926 to 2017. Timeline of flood occurrence in Ladakh shows occurrence of several events in recent times (Fig. 3).

Sl. No.	Date	Intensity	Causalities, Cause, and Area
1	5 Feb 2013	Moderate	22,000 livestockperished in Leh
2	26 Apr 2013	Heavy	One person died and 6others injured onSrinagar-Leh highwaywhen 3 vehicles werehit by the avalanche.
3	3 Jan 2016	Heavy	4 number due to Snow Avalanche (Southern Glacier)
4	3 Feb 2016	Heavy	10 number due to Snow Avalanche (Siachin)
5	19 Mar 2016	Heavy	1 number due to Snow Avalanche (Kargil)
6	25 Mar 2016	Heavy	2 number due to Snow Avalanche (Turtuk)

[8]Disastrous Weather Events of 2013. Indian Meteorological Department, Pune.
[9]Disastrous Weather Events of 2016. Indian Meteorological Department, Pune.

1.3. Threats of Climate Change in Ladakh:

Vulenrability analysis for country on several disaster and hazard zonation done by national agencies places Jammu and Kashmir State (undivided state) inhigh risks zones (Fig. 4, 5. and 6), however data defeciency in landslide incidence map appears. Entire state of Jammu and Kashmir state has been placed in the category of annual rainfall between 1001-2000mm (Fig. 5) while large part of the undivided state was trans-Himalayan landscape represented by the present Union Territory of Ladakh which receives very less rainfall.

The present Union Territory of Ladakh is divided in two districts, and both differes in some climatological features[10]. While Kargil district has wide range of climate from sub-tropical to temperate and even alpine in high elevated regions, Leh district has climatic condition of of arctic and desert type, hence ofently refered as 'Cold Desert'. Total annual rainfall also varies in these two regions of Ladakh. The average annual rainfall in the Kargil district (3 stations, 12-16 years average) is 319.4 mm while it is 96.7 mm for Leh distict (4 stations, 16-25 years).

Patterns of precipitation also varies between these regions of Ladakh. Rainfall of southwest monsoon season (June to September) contributes 24% of the annual rainfall in Kargil while it accounts large part in Leh district (45% of total). Pre-monsoon months (March to May) contributes more (33% of the annual) in Kargil region than in the Leh region (27% of total). The winter months (December to February) contribute rainfall for about 31% of the annual normal rainfall in Kargil region while it is about 21% in Leh region. Months having highest average of rainfall also differs in both the regions- March with an average of 44.2 mm in Kargil and July with an average of 15.6 mm in Leh. However, number of rainy days (i.e., days with rainfall of 2.5 mm or more) varies between stations, average rainy days in a year are more in Kargil district (27 days) than the Leh district (11 days). The average height of snowfall is about 200 to 500cm in Kargil while it ranges from 200 to 400cm in Leh district. In such dry conditions floods are ocurring in recent times in this cold desert area (Fig. 3), and flood event of 2010 in Leh is recorded in top ten disastrous flood events in the country, which claimed more than 250 lives and huge loss of property and infrastructure.This event was caused by a period of unusual intense precipitation which triggered debris flows and mudflows.

[10]Climate of Jammu and Kashmir. 2014. Climatological Summaries of State Series No 20. Indian Meteorological Department, Pune. pp 176.

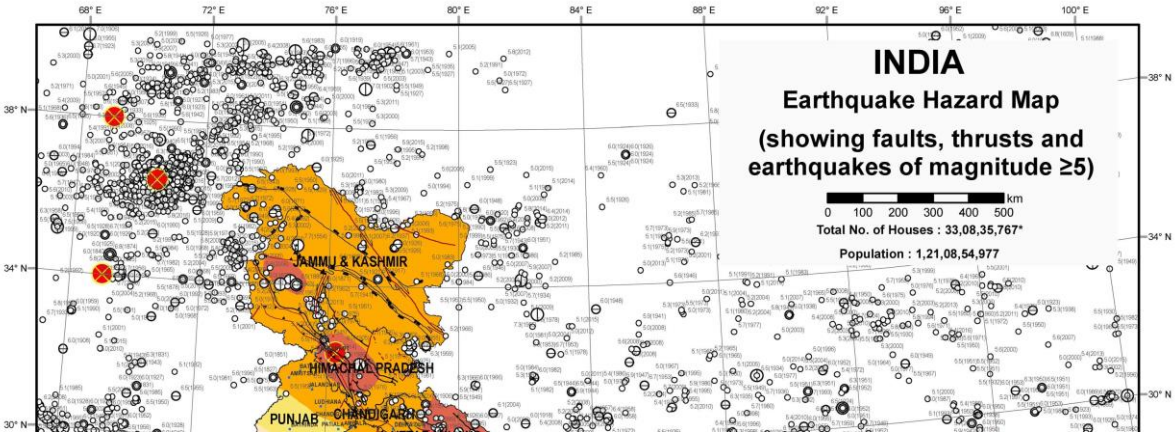

Fig 4. Earthquake hazard map showing events 5 or more magnitude in richer scale.

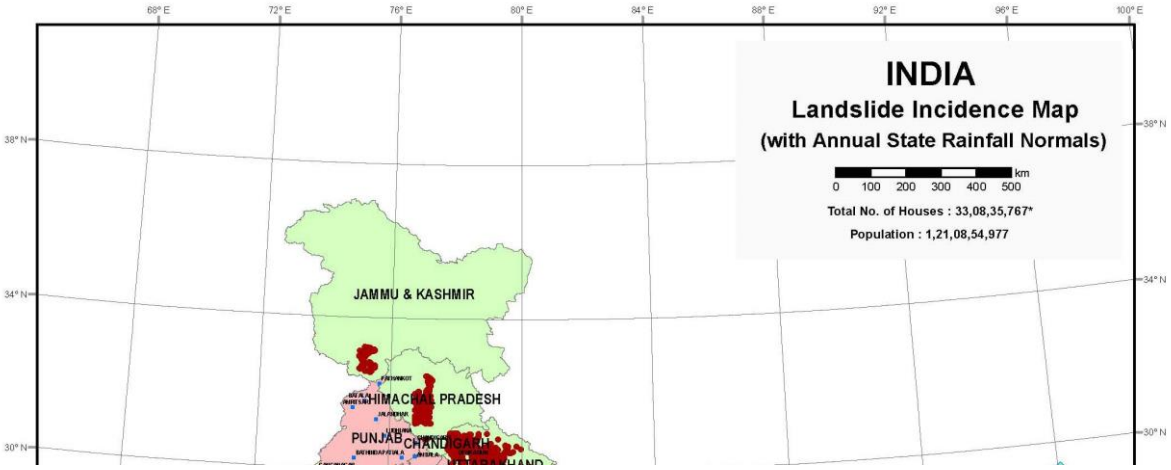

Fig 5. Landslide incidences. Green colour shows rainfall intensity 1001-2000mm Annual Rainfall.

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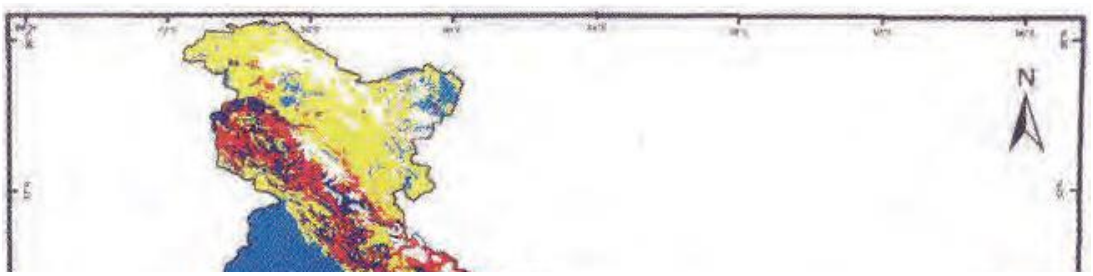


Fig. 6. Landslide Hazard Zonation. Most of the Ladakh falls in moderate to Low (yellow) and Unlikely category (blue colour).

Sources for Fig, 4, 5, and 6 are from Building Materials & Technology Promotion Council[11] (Govt of India).

[11]Vulnerability Atlas of India. 2019. Building Materials & Technology Promotion Council, New Delhi.

Statistical analysis of the climate over Leh using different datasets[12] shows a slight but significant trend of change where a warming with reduced precipitation in the current decades is noticiable, andthere is somewhat of an inverse relationship between temperature and precipitation. Comparision between different datasets indicate varied results some showing increasing and others showing decreasing trends, but significant increasing precipitation is seen in few datasets.There is also some indication of decreasing number of days having high precipitation though reported otherwise. This suggests that overall the region is receiving more rainfall than the arid region is used to. This study indicates a rapid increase in temperature and varied precipitation patterns in recent decades foreshadows a further changing climate with a higher probability of unexpected events in the coming years. Such changes in climatic pattern may have irreversible impacts leading to devastating consequences which are sometime part of the global cliamte. For example, disastrous event of 2010 is attributed to complex system and wave energy transport of the jet stream where southerly and easterly winds prevailed with higher surface air pressure which corresponded to easterly winds turning around the south of the Tibetan High located in the northern part of the Tibetan Plateau bringing moisture into Ladakh from the south part of the Tibetan Plateau. Southeasterly flow brought moisture to Ladakh and converged, resulting in the precipitation events of 4–7 August[13]. Another school suggets that south-west monsoon of India contributed to this evnt which is contrary to general belief that this monsoon does not reach Ladakh. Report suggests that 40% of all the annual extrmem rainfall events occurred during the monsoon months, and events of 5 August 2010 and 25 July 2011 were associated with westward moving cyclonic circulations in middle troposphere(~500 hPa) over the Tibet-Ladakh region, where orography (usually considered obstacle) may play a role by enhancing the rainfall associated with westward moving cyclone circulations in the middle troposhphere[14]. Thus, it can be concluded that whatever the reason it was, landscape of Ladakh is prone to global anamolies created on the face of climate change.

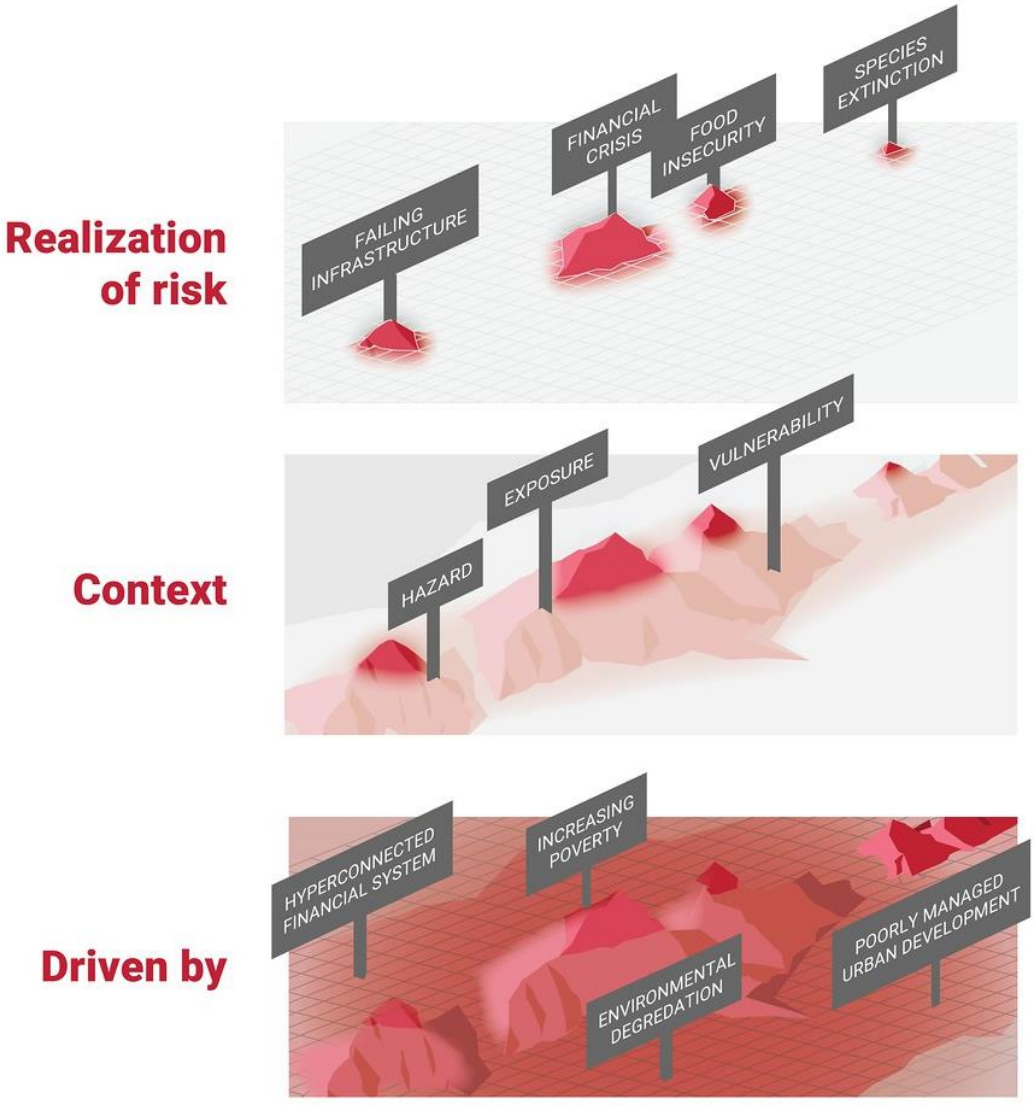
Long geological records also indicate that Indus River valley region is suspectable to mass movements, catastrophic land sliding, outburst floods and tectonic activity, such

[12]A Chevuturi, AP Dimri and RJ Thayyen. 2016. Climate change over Leh (Ladakh), India. Theor Appl Climatol. DOI 10.1007/s00704-016-1989-1

[13]A Yatagai et al. 2012. Meteorological Conditions Related to the August 2010 Flood Event inLadakh, in the West Himalayas. Geophysical Research Abstracts. Vol. 14, EGU2012-12856-1

[14]SC Bhan et.al. 2015. An analysis of monthly rainfall and the meteorological conditions associated with cloudburst over the dry region of Leh (Ladakh), India. Mausam, 66(1): 107-122.

events occurred after the Last Glacial maximum (LGM) and Holocene warming[15];Four large landslides (debris volume more than 10 million m^3) in Holocene period were attributed[16] to an increase in pore water pressure over a period of increased monsoon strength. Thus, historically landscape was vulnerable to climate changes related anomalies, and remains in present time too.



Mountain Perspective of Disaster

(source: UNDRR)

[15] D Nag and B Phartiyal. 2014. Climatic variations and geomorphology of the Indus River valley, between Nimo and Batalik, Ladakh (NW Trans Himalayas) during Late Quaternary. Quaternary International. http://dx.doi.org/10.1016/j.quaint.2014.08.045

[16] Dortch, J, M., et al. 2008. Nature and timing of large landslides in the Himalaya and Transhimalaya of northern India. Quaternary Science Reviews. pp 1–18

2. Regulatory Frameworks and Legal Provisions:

"You cannot manage your disaster risk if you are not measuring your losses."

- Mami Mizutori,
(UN Special Representative of the Secretary-General for Disaster Risk Reduction)

At global level, United Nations Office for Disaster Risk Reduction (UNDRR, formerly UNISDR) is the focal point for disaster risk reduction which oversees and supports countries implementation of the Sendai Framework (2015-2030) for Disaster Risk Reduction[17],and prevention to creation of new risks. The Sendai Framework is the major agreement which provides concrete actions to protect development gains from the risk of disaster to Member States and was endorsed by the UN General Assembly following the 2015 Third UN World Conference on Disaster Risk Reduction. This framework works with the other 2030 Agenda agreements like the '*Paris Agreement on Climate Change*', '*Addis Ababa Action Agenda on Financing for Development*', '*New Urban Agenda*', and the '*Sustainable Development Goals*'. Risk from disaster go beyond national boundaries so inter-governmental collaboration is key to addressing disaster risk reduction at a regional level. Therefore, UNDRR's regional offices serve as the supporting secretariat for regional platforms to provide a forum for all those engaged in disaster risk reduction to showcase practical applications for disaster risk reduction, exchange experience and develop joint statements, strategies and action plans, which guide decision makers and practitioners.[18]. Regional Platforms are multi-stakeholder forums that reflect the commitment of governments to improve coordination and implementation of disaster risk reduction activities while linking to international and national efforts.

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.

State has the primary role to reduce disaster risk but that responsibility should be shared with other stakeholders including local government, the private sector and other stakeholders.

- Sendai Framework

In national context, many milestone steps have been taken in India on natural disaster reduction and sustainable development goals in line with UN resolutions, particularly

[17]https://www.undrr.org

[18]https://www.undrr.org/implementing-sendai-framework/regional-platforms

Hyogo framework (2005-15), Sendai framework (2015-2030), viz., enactment of Disaster Management Act, formulation of Disaster Management Policy and National Disaster Management Plan, etc.

2.1. National Framework:

Ministry of Home Affairs, Govt. of India, is mandated to look after the matters relating to loss of human life and property due to all natural and man-made calamities (other than drought or epidemics). The Disaster Management Division in the ministry is nodal division for disaster management[19].

National Disaster Management Authority has compiled various laws in the country contributing to disaster management[20], and most important is Disaster Management Act, 2005, which provides for the effective management of disaster and for matters connected there with or incidental thereto. It provides institutional mechanisms for drawing up and monitoring the implementation of the disaster management. The Act also ensures measures by the various wings of the Government for prevention and mitigation of disasters and prompt response to any disaster situation[21]. Since 2005, Disaster Management Act is in place in the country which provides a legal and institutional framework at national, state and district levels for the creation of specialized disasters management institutions. At national level, in pursuance of the Act, following national level institutions were created, however, primary responsibility of disaster management rests with the States of country, the Central Government supports to States by providing logistical and financial support for disaster management.

- National Disaster Management Authority (NDMA) which is the apex body (chaired by the Prime Minister of India), and is mandated to lay down the policies, plans and guidelines for Disaster Management to ensure timely and effective response to disasters.
- National Executive Committee (NEC) to assist the National Authority in the discharge of its functions and have the responsibility for implementing the policies and plans of the National Authority and ensure the compliance of directions issued by the Central government for the purpose of disaster management in the country.
- National Institute of Disaster Management (NIDM, earlier known as National Centre for Disaster Management, NCDM) is nodal agency, which is responsible for human

[19]https://www.ndmindia.nic.in

[20]Compendium of Laws on Disaster Management.2015. National Disaster Management Authority, Govt. of India.

[21]Disaster Management in India. 2011. Ministry of Home Affairs. Govt. of India.

resource development, capacity building, training, research, documentation and policy advocacy in the field of disaster management.

- National Disaster Response Force (NDRF) was created for the purpose of specialized response to natural and man-made disasters. Presently, this force consists of 12 battalions placed at different parts of the country.[22]

Under the Disaster Management Act (2005) State Disaster Response Fund (SDRF) has been created with a contribution of 75% or 90% (in some cases) contribution by the Central Government to States by responding as expenditure towards immediate relief to the victims of notified disasters(Cyclone, drought, earthquake, fire, flood, tsunami, hailstorm, landslide, avalanche, cloudburst, pest attack, frost and cold waves), however, a state can use up to 10% of this fund for the victims of natural disaster which has been considered as 'disasters (not included in notified list)' within the local context of that State[23].The Disaster Management Act (2005) also provides specific roles to various bodies in disaster management. It provides constitution of State Disaster Management Authority (SDMA) and State Executive Committee (SEC)as state level institutions in all the states and UTs, and constitution of District Disaster Management Authority (DDMA) as District level Institution for every district of a state. In 2011, The states/UTs were advised to set up their own Specialist Response Force (State Disaster Response Force) for responding to disasters on the lines of National Disaster Response Force. Many states have created such force.

2.2. Coordination and Communication:

To develop the coordination between various stakeholders and agencies, communication platform is an essential tool for effective management and distribution of resources. Such efforts start from involvement of UN agencies to support national plans to district level coordination between departments. The United Nations Disaster Management Team (UNDMT) of India works with key government departments to integrate the objectives of Disaster Risk Reduction and Climate Change Adaptation into broader development plans and programmes[24]. Recognizing such need, Government of India evolved a participatory process of decision making in disaster management with active involvement of the Central & State Governments and other stakeholders[25], and a multi-stakeholders and multi-sectoral National Platform for Disaster Risk Reduction (NPDRR) was constituted in 2013.Main

[22]http://ndrf.gov.in/
[23]https://www.ndmindia.nic.in/response-fund
[24]https://in.one.un.org/page/disaster-management
[25]https://www.ndmindia.nic.in/npdrr-constitution

functions of NPDRR[26] are to review the progress made in the field of disaster management, appreciate the extent and manner in which the Disaster Management Policy has been implemented, review the National Disaster Management Policy, and give appropriate advice on (i) coordination between the Central and State Governments/UT Administrations, local self-governments and civil society organizations for Disaster Risk Reduction, and (ii) *suo-moto* or on a reference made by the Central/State on any question pertaining to disaster management. Need of such platforms have been recognized by several states to reduce the impact of calamities through a systematic and committed approach to disaster risk reduction, and are in process of constituting the State Level Platform for Disaster Risk Reduction (SPDRR). In this line, Government of Himachal Pradesh has constituted a multi-stakeholder State Level Platform for Disaster Risk Reduction (SPDRR) in 2016[27].

National Policy on Disaster Management (NPDM, 2009) is committed to build a safe and disaster resilient Indiaby developing a holistic, proactive, multi-disaster oriented and technology driven strategy through a culture of prevention, mitigation, preparedness and response. The holistic and integrated approach has been envisaged in the policy includes with emphasis on building strategic partnerships at various levels. The themes underpinning the policy are:(i) Community based DM, including last mile integration of the policy, plans and execution, (ii) Capacity development in all spheres, (iii) Consolidation of past initiatives and best practices, (iv) Cooperation with agencies at National and International levels, and (v) Multi-sectoral synergy[28].

The National Disaster Management Plan (NDMP, 2019) provides a framework and direction to the government agencies for all phases of disaster management cycle. The NDMP is a "dynamic document" in the sense that it will be periodically improved keeping up with the emerging global best practices and knowledge base in disaster management. The NDMP recognizes the need to minimize, if not eliminate, any ambiguity in the responsibility framework. It, therefore, specifies who is responsible for what at different stages of managing disasters. It is meant to be implemented in a flexible and scalable manner in all phases of disaster management[29].

[26]http://npdrr.nidm.gov.in/aboutus.asp

[27]https://www.ndmindia.nic.in/state-platform-for-disaster-risk-reduction-spdrr andhttps://www.hpsdma.nic.in

[28]National Policy onDisaster Management. 2009. National Disaster Management Authority. Ministry of Home Affairs.

[29]National Disaster Management Plan, 2019.A publication of the National Disaster Management Authority, Government of India.November 2019, New Delhi.

3. Ladakh - The Case:

The purpose of a Disaster Management Plan is to tell what actions to take to increase the safety and wellbeing of the citizens by persuading all the partners of disaster management to take the actions they already know they should take with respect to natural hazards. Disaster Management Plan for Leh district was developed in year 2011 which has taken account of all possible natural disasters. Plan elaborates measures for prevention and control of various disasters. This plan attempts(i) to study the capacity of various departments, (ii) need assessment for capacity addition, (iii) elaborates Institutional mechanism with roles and duties of different players. (iv) SOP during various stages of disaster is also. The district plan provides checklist developed for major district officials (viz., Deputy Commissioner, Addl. Deputy Commissioner, Sr. Superintendent of Police and SDMs/Tehsildars).The district plan envisages that the purpose can be achieved by taking various pre-disaster preparedness like establishing pre-disaster warning system, dissemination of information, training, rehearsal, etc[30]. The plan has identified vulnerability to following disasters(i) Cloud burst and Flood, (ii)Road Blockade due to landslides (cloud burst) and Snow, (iii) Snow Avalanche, (iv) Earthquake, (v) Locust Menace/ Agriculture Drought. It also identifies local places for various hazards.

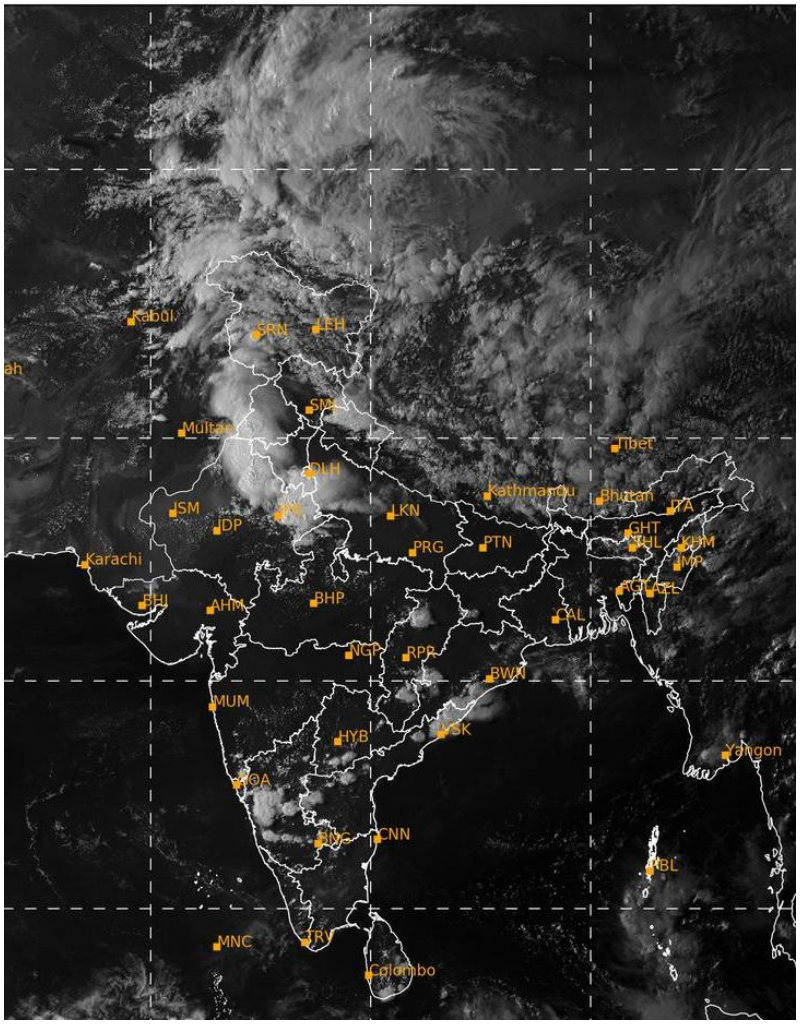
There is need to create a pair of synergistic and invincible forces— the governments and the people that interact to bring about a reduction in the impact of natural hazards in UT of Ladakh. There is need to pay special attention to hazards -

- Disasters will continue to occur.
- Insurance and reinsurance are cyclical. In the recent past insurance premiums were excessively expensive, and they may become so again.
- There are few legally enforceable civil/structural engineering design standards in Ladakh. The codes that do exist provide insufficient standards for critical facilities. Furthermore, they do not adequately address the important question of non-structural elements.
- With appropriate design and construction techniques, facilities can be protected so that they remain in operation after a hazardous event.
- Protection costs are affordable.

[30]Disaster Management PlanLeh District. 2011. Deputy Commissioner Office,Leh

Losses from recent major events indicate that the levels of losses in major disasters demonstrate the economic importance of reducing vulnerability. Given the size of UT of Ladakh, the impact of a major hazard can affect the entire community.

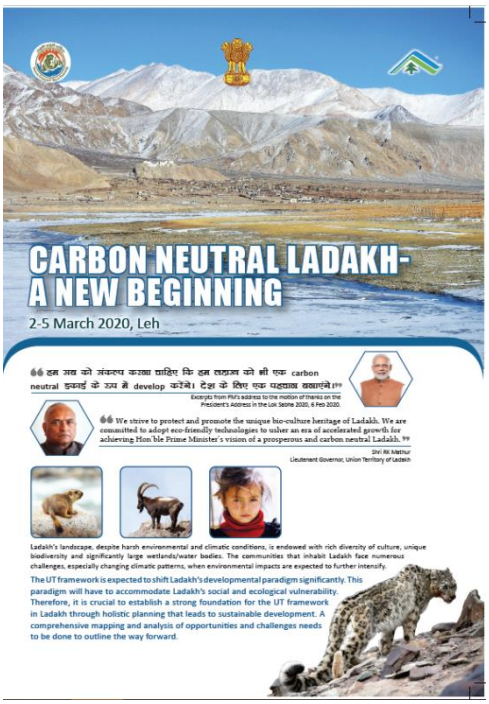
Fig. 7. Aftermath of disastrous flood of 2010 in Leh District



Clouds over Indian Sub-Continent

4. Ladakh Sustainable Development Summit 2020:

4.1. The Summit



In this backdrop, and realizing that the administrative framework of new UTis expected to shift Ladakh's developmental paradigm significantly which will have to accommodate Ladakh's social and ecological vulnerability, Ladakh UT Administration and G.B. Pant National Institute of Himalayan Environment (NIHE) joined hands to organize a four days (2-5 March 2020) summit under the banner of '***Carbon Neutral Ladakh- a New beginning***' at Leh. The Ministry of Environment, Forest & Climate Change (MoEF&CC), GoI, provided the necessary guidance. The detailed programme of the event is placed (Annexure – I). The summit was organized to seek inputs from diverse domain of experts to formulate a strategic plan for the sustainable development of Ladakh. The summit served as a platform for meaningful debate and dialogue to generate inputs for long term strategic development plan to: (i) draw various pathways to achieve Carbon Neutrality in Ladakh, (ii) ensure the conservation, protection, and promotion of Ladakh's unique ecological and bio-cultural heritage without compromising developmental aspirations, (iii) explore possibilities and suggest fora way forward for innovative and sustainable livelihoods for rural communities, and (iv) provide inputs for making Ladakh a smart destination for sustainable tourism and green investments.

4.2. Good Practices adopted in Summit

The summit made an attempt to set examples of good practices that would contribute for sustainable development of Ladakh following carbon neutral path. Some of such good practices included – (i) as a norm of equitable distribution of benefits, the

accommodation for outstation participants was equally distributed amongst three properties with comparable facility (although each property was having enough space to accommodate all the guests), (ii) maximum use of e-media for presentation and distribution of resource material, (iii) use of multi-purpose biodegradable bags to carry conference material, and (iv) the conference kit included: (a) Diary made from eco-friendly form of paper (handmade 100% tree free paper made from using cotton rag waste from the cotton garment industry without using toxic chemicals, and solar dried), and (b) pen and pencils made-up of old newspapers and recycled papers[31].

4.3. Disaster focused sessions

To realize the vulnerability of Ladakh to disasters, impact of climate change, and preparedness to mitigate threats, a dedicated session was organized on "**Vulnerability to Disasters and Mitigation of Risks**" (March 4, 2020) followed by an intensive focus group discussion (FGD) on this subject (March 5, 2020). Expert presentations, intensive deliberations on each presentation, and FGD yielded various recommendations and action points for follow-up on short, mid and long-term basis to provide framework and immediate needs in Ladakh. List of Panellists and participants of focussed group discussion is placed in Annexure – II.

[31]http://www.papernest.in/

5. Recommendations & Action Points:

After detailed deliberations and discussion the key recommendations, action areas and responsibilities and timelines, emerged include the following:

5.1. Policy Level Recommendation

5.1.1. Preparation & adoption of UT Disaster Management Policy in tune to UT Land Use Policy –

A "Multi-agency coordination plan" following Self-Assessment tools along with the multi-agency participation for the ownership and knowledge development concurrently is required. The policy should include (i) a framework for the integration of various departments and agencies with a defined chain of commands to response at the time of disaster, (ii) integration of Disaster Risk Reduction (DRR) with all developmental & climate Change Plans.

Responsibility: The UT Administration to constitute a core group to develop a department/structure for the adoption of DM Act 2005, and formulation of various plans (e.g., Disaster Management Action Plans for Ladakh/District/Village);

Timeline for preparation of policy and framework: Six Months.

5.2. Governance Oriented Recommendation

5.2.1. Adoption of national acts/guidelines/codes and formulation of mitigation/management plans-

Immediate actions are required on the following -

- Formulation of (i) Ladakh Disaster Management Action Plan, (ii) District Disaster Management Action Plans, and (iii) Village Disaster Management Action Plans & VDITs.
- Adoption of laws/guidelines/norms - (i) TCP Act, (ii) Building Bye Laws, (iii) Guidelines for Earthquake Resistant Features in all government/private buildings following BSI Code as relevant to the seismic zones IV & V, and (iv) flood Zoning Regulation Provisions

Responsibility: The UT Administration to constitute a department/agency to initiate adoption/formulation of various plans;

Timeline for creation of department/agency and formulation of plans: One Year.

5.3. Physical Infrastructure and Capacity Building

5.3.1. Establishment of UT Science & Technology Department/Council with facilities of latest technological tools and Department of Disaster Management.

This structure will support to the government in making well informed decision through Decision Support System by doing (i) Carrying Hazard & Risk Vulnerability Assessment (HRVA) of Ladakh landscape for various natural hazards, (ii) ***Baseline data*** on land use/land cover, drainage, urban & rural sprawl, transport, geology & structural, geomorphology, etc., (iii) Preparation of (a) ***Hazard Zonation Maps*** (Floods, Landslides, Earthquakes, Avalanches etc.), and (b) ***Hazard Vulnerability Maps***, and (iv) Vulnerability Assessment of ***Critical Infrastructure*** and its dependencies. The Department/Council will also coordinate with all the line departments of the government for spatial/non-spatial data generation and in developing sectoral management plans. Newly created department will work with National Agencies like DST, MoES, MoEFCC, NDMA, NIDM, IMD, IIRS, GSI, NIH, CWC, SASE & GBPNIHE for experience sharing and learning lessons.

5.3.2. Creation of Union Territory Disaster Response Force.

The force will preparation of relief & rehabilitation manuals as per GOI Norms. A well-trained forceto act when disaster strikes. In peace time the force participates at different levels viz., state, district, block and village levels for training and skill building of local communities at village level to enhance their capacity for preparedness for disaster.

5.3.3. Strengthening of Hydro-meteorological networks in the UT.

Real time observations are very important in developing early warning system. There is need to coordinate and compile all the existing infrastructure (weather towers/AWS) developed by various agencies/departments/universities/research organizations to collate the information and proper dissemination for developing an "early warning system". This will also help in prioritizing the infrastructure in gap areas/

5.3.4. Prepare a comprehensive plan for capacity building of stakeholders and departments

For Field staff of various departments such as Wildlife, Agriculture, Animal husbandry, BMCs, CBOs, *Amchi* Sabha / NRIS, NGOs, Eco-guides, etc.) in disaster mitigation and preparedness. Preparation of (i) Relief & Rehabilitation manuals as

per GOI Norms, (ii) SOPs for all stakeholder departments, (iii) Departmental Disaster Management Plans & Response Plans, and (iv) Capacity building and Plans (human resource), (v) Training Manuals (School and Hospital Safety, etc.), and (vi) Centralized inventories (Shelter, food, medicines, etc.). Capacity building of line agencies and CBOs will help in preparation of village level Safety Plans for mitigation and response at local level.

Responsibility: UT Administration and newly created council/department & UTDR Force; ***Timeline:*** Six months for creation of council/department/force; 2 years for various manuals and Plans.

5.4. Knowledge Generation and Preparedness

5.4.1. Strengthen flow of research based knowledge

- Central repository of research carried out on various aspects of extreme events, impacts of disasters, forecasting and projections of climate change related drivers, etc. to analyse trends and patterns for preparedness and vulnerability mapping for short (2-5 year) and medium (upto 10 year) range advisories.
- Develop mechanism for 'Citizen Science Approach' by involving local people, educational institutions, and filed NGOs to capture climatic data.

Responsibility: Newly created UT Council of Science & Technology;

Timeline: since existence for Repository. For Citizen Science Approach – Two years, this can be done through networking of Institutions.

5.4.2. Information Exchange and Trainings

- Organize Annual Research Seminars/conference for researchers working on various aspects of the mountain disasters, and Training on disaster related topics. Modalities of collaboration involving international institutions for research, training and information exchange on case to case basis (for example, CRED, Belgium; Asian Institute of Technology, Thailand, etc.).

Responsibility: GBPNIHE Ladakh regional centre in collaboration with UT agencies and national agencies (NIDM, ATIs, LBSNAA, NCGG, etc.);

Timeline: Every year.

6. Strategic Recommendations to Reduce Risk of Disasters:

Ladakh, a cold desert area, is prone to various disasters and sparse habitation makes it difficult to response in quick time and provide relief. Impacts of climate change may worsen situation in coming times. Given that Ladakh's vulnerability to existing factors and future projections, immediate actions in the policy framework, formation of statutory bodies, development of SOPs are required to mitigate disasters and develop a preparedness of the system for an effective and quick response at the time of hazard. Keeping carbon neutrality in focus actions and preparedness may have minimum carbon footprints. Strategies have been suggested to place the mechanism and instruments in place for Ladakh UT.

6.1. Twofold strategy for reducing vulnerability to natural hazards in Ladakh

The concept of disaster management has expanded significantly. Originally focussed only on immediate pre-disaster preparedness and post-disaster response, the concept now encompasses the longer-term issues of hazard assessment, risk reduction, and rehabilitation. To further reduce the long-term risk of natural hazards, UT of Ladakh should develop a comprehensive disaster mitigation policy. To reduce vulnerability, structures must be located in areas safe from hazards or be able to resist their impacts. This requires changes in public and private approaches to location, design, construction, and maintenance of structures. Setting appropriate standards and making reasonable decisions about "**safe**" locations, however, requires understanding of the areal distribution, frequency, and magnitude of hazardous events. Since all the Himalayan states of India share most hazards, a coordinated effort to map prevalent hazards and develop regional expertise in risk management can reduce the cost and increase the accuracy of the information necessary for proper decision-making.

Action is difficult because the people, not the political leaders or the technicians, must take the initiative. When the people lead, the leaders will follow. Of course, much can also be done to improve the technical and institutional situation surrounding natural hazards. We propose a twofold approach of mutually supporting strategies.

6.1.1. Political Strategy

On several occasions during the past decade, policy makers have put disaster management on the regional and national agendas. The concept of sustainable

development calls for the integration of natural and environmental disaster policies into development planning processes, and for the development and implementation of public and private sector pre - and post - disaster recovery flaws.

This includes the recognition of the necessity to establish and / or strengthen disaster preparedness, as well as disaster management institutions and their policies and response capabilities. Also, the promotion of the inclusion of disaster planning, preparedness, and mitigation in development plans should be incorporated into the Plan of Action.

Moreover, the need to establish, as appropriate, regional emergency response teams and regularly test district disaster management plans; and promote the establishment of appropriate building construction codes that include regulatory and enforcement mechanisms through the sharing of technical information and expertise is recognized. The Plan of Action should be committed to cooperate in the development, strengthening and implementation of disaster mitigation plans, including contingency and response arrangements.

It is a well-known fact that UT of Ladakh is vulnerable to several forms of natural disasters including earthquakes, landslide, cloudburst and flash flooding. This vulnerability has been compounded by the geographic situation of the state.

The important role of preparedness and mitigation in reducing the vulnerability of UT of Ladakh to such natural disasters is now well recognized. The government pledges to continue to coordinate its efforts and improve its ability to detect, monitor and respond to natural disasters. Moreover, the Government of UT of Ladakh affirms the priority of investment in planning, preparedness and mitigation initiatives, to strengthen the capacity of the region to protect community from disasters and to decrease the need for emergency response resources in the future.

6.1.1.1. Involve stakeholders

Last Mile Connectivity - Strengthen community engagement more aggressively in the locality of less physical and financial resources to make them resilient. Communities must become more aware of natural hazards and demand that measures be taken to reduce their negative effects. Little action will take place until pressure is felt on the political front from victims of inaction. Precedent exists for mobilizing action at the national, state, municipal/panchayat, and local levels, and SFDRR to follow "***Built back better***". Increasing the ***"Risk Behaviour"*** starting from the school education to higher education and even non-formal education.

6.1.1.2. Mobilise action

Disaster mitigation is difficult to sell. Homeowners prefer to invest in the exterior appearances and comfort of their dwellings rather than in improving earthquake resistance. Public-sector decision-makers make investments that fail to consider natural hazards, favouring the distribution of benefits to larger numbers of constituents. Major institutional weaknesses persist in the enforcement of land use and code regulations. The technical challenges of disaster mitigation are well understood. What is less understood is how to address the persistent obstacles of public perception, political expedience, and the myth that "Our State is too poor to afford the required standards". The most difficult part is provoking the interest of the man in the street to back hazard mitigation. Action must start with raising the general population's awareness of natural hazards.

6.1.2. Technical/institutional strategy

6.1.2.1. Develop a disaster mitigation plan

At the UT level, government should incorporate disaster mitigation into all its activities, from the traditional realms of emergency management and development control through economic planning, education, tourism, and infrastructure development. A disaster mitigation plan should be developed as a framework for co-ordinating this UT effort. The plan should be developed in five steps:

1. Develop a proactive disaster mitigation policy for UT of Ladakh. This provides the vision, rationale, and mandate for vulnerability reduction activities.
2. Assess existing hazards and map the hazard risk. Document the location, frequency, severity, and impact of historical hazardous events.
3. Assess existing and future vulnerability to hazards. Identify the areas most at risk by combining information on existing or planned development with maps of areas at risk of hazardous events.
4. Develop Disaster Mitigation Plans (UT, district and village) with programs for implementation. Examine public and private activities in vulnerable areas to ensure that these activities do not increase existing vulnerability. This review will include recurrent activities (e.g., operation and maintenance) and one-time decisions (e.g., development approvals). The plan will encompass all

government activities, such as building codes and regulation of maintenance, education, and land use. It will include instruments that promote the adoption of mitigation behaviour in such areas as fiscal and development incentives, cropping systems, and infrastructure development.

5. Implement, monitor, and update the disaster mitigation plans (state, district and village). No matter how good the plan, it will effect no change unless it is implemented. The policies and recommendations in the plan will be examined and revised periodically.

6.1.2.2. Legally mandate building codes

To improve resistance to the effects of natural hazards, better building practices are essential. Until there are building codes with the force of law, they will not be taken seriously by the construction industry. Such codes must incorporate modern technical standards. The costs of improved standards and codes are minimal[32,33].

Cost implications of new standards and codes

- Analysis of a single-bay, multi-story, reinforced, concrete-framed structure in typical Caribbean conditions indicated that applying levels of earthquake forces like those prescribed by Uniform Building Code, the cost of the structure increased only zero to 14 percent.
- Another study indicated that in Caribbean like conditions the increase in the structural cost related to the overall building cost, ranged between 2 and 5 percent with an additional 1 percent for non-structural items.

6.1.2.3. Enforce codes effectively

Legally mandating codes is not enough; they must be enforced. Great care should be exercised in selecting the enforcement system for the codes, since some are easier to ignore, manipulate, or corrupt than others. There is no need to establish an elaborate inspectorate before implementing building codes. The region cannot afford large bureaucracies, which may not be effective anyway. Instead, education

[32] Ipek, M. 1968. Increase in Building Cost due to Seismic Coefficient. CENTO Conference on Earthquake Hazard Minimization, Ankara, July 1968.

[33] R.V. Whitman, et al., 1974. Seismic Design Analysis. Cambridge, Mass, MIT 1974, Structures Publication No. 381

and economic incentives should be combined with inspection to promote compliance.

6.1.2.4. Improve education and training

Techniques for eliminating or reducing property losses due to earthquakes and landslides are well known. More education and training are needed to transmit these techniques to designers and builders in both formal and on-the-job settings. Improved undergraduate education and structured on-the-job training should lead to professional certification.

6.1.2.5. Strengthen land-use planning

A low-cost way to reduce damage from natural hazards is to locate structures in safe areas. Plenty of information exists in UT Ladakh on the location of fault lines, damage zones, the effect of landslide, and inundation zones of flash flood. Avoiding the use of such areas for buildings or infrastructure vastly reduces the likelihood of damage. When construction in a known hazardous zone is unavoidable, suitable hazard mitigation measures should be incorporated into the design.

The introduction of planning legislation in the Caribbean in the 1960s has led to a growing consciousness among planners of the need for tighter controls on the use of land. However, change will be slow. A greater financial commitment on the part of the governments may be required to ensure that land-use and zoning regulations are properly enforced. Several models are given [34].

6.1.2.6. Improve maintenance of infrastructure and buildings

The physical condition of many infrastructures in Ladakh is poor, suffering from low maintenance and inadequate management practices. In addition, the tendency to make decisions on major investment projects without appropriate information on hazard assessment or mitigation measures contributes to the precarious state of the infrastructure.

Funding of maintenance activities is commonly insufficient to provide for proper execution of this unglamorous but important function. For public buildings, with their expected heavy usage, a normal annual maintenance budget is about four percent

34 Caribbean Disaster Mitigation Project. 1999. Natural Hazards and Economic Development: Policy Considerations Organization of American States General Secretariat Unit for Sustainable Development and Environment, USAID-OAS.

of the contemporary capital cost of the buildings and equipment, assuming that the buildings are in good condition. For zone V infrastructure, the figure is likely to be higher. Obviously, when infrastructure is in poor condition, the cost of maintenance must be higher. Like land-use regulations, maintenance requires greater budget allocations.

A review of the damage caused by recent disasters has shown that an well-operated

Selected regulatory models for checking compliance

- **Singapore Model:** This approach features a considerable degree of self-regulation, with professional engineers certifying that design and construction are in compliance with the specified standards. In-depth audits of a few randomly selected projects are conducted, with bad work leading to penalties.
- **French Model:** An approach inspired by the *Code Napoléon* made the contractor liable for design and construction faults. This led to decennial insurance which, in turn, led to the need for *bureaux de contrôle*. Consideration should be given to this excellent method of quality assurance.
- **Colombian Model:** A system similar to the French model is used in Colombia, where the building owner employs both the designer and the inspector.

https://www.oas.org/cdmp/document/econpoly.htm#6

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m is a very effective disaster mitigation measure in terms of cost and facility usage. It is essential to include a maintenance plan in disaster mitigation plans.

6.1.2.7. Establishment of Emergency Medical Services (EMS) in Union Territory of Ladakh

It is essential that EMS should be implemented within a specified time frame. The appropriate authorities should implement the recommendations enumerated.

(A) For Immediate Implementation (within 06 months)

1. Enunciation of a UT Accident Policy
2. Establishment of a Accident Prevention and Relief Authority (APRA). APRA will be responsible for policy making, planning and implementation of activities to

prevent accidents and provide relief to the accident victims. There should be a multi-disciplinary and multi-sectorial UT Coordinating Committee under APRA, facilitating, monitoring and controlling Expert Group for EMS under the aegis of Department of Health.

3. Designating districts to Medical Colleges/ Base Hospitals, which will act as referral centers to their respective earmarked districts.
4. Establishment of Centralized Accident and Trauma Services (CATS) in all districts along with strengthening infrastructure, pre-hospital care at all government and private hospitals.
5. Development of computerized information base at all levels of health care to help in perspective policy planning and networking.
6. There is a need to establish a UT Trauma Registry for data collection and analysis.
7. Information dissemination to all the existing facilities, legislations, referral system, existing networking to facilitate EMS health care utilization.
8. Develop proposals for up-gradation of EMS with organizational infrastructure and financial details for appraisal by Ministry of Health and Family Welfare and Neeti Ayog.
9. Training in EMS to be organized in the Medical Colleges/Base Hospitals and other regional areas.
10. The expert group constituted by GoUT will further recommend the infrastructure facilities, equipment, staffing and training at various levels of health care delivery viz. PHCs, sub-divisional/tehsil hospitals, district hospitals, base hospitals, medical colleges and teaching institutions.

(B) For Long Term Implementation (within 1 year)

1. Implementation of the proposed recommendations of the UT Accident Policy.
2. The speed and efficiency are the two most vital considerations for any trauma care services. It would be ideal to setup a well equipped and adequately trained staffed trauma center at District and State level. All district hospitals to have specialized multidisciplinary trauma care facilities.
3. Establishment of Emergency Medicine as a specialty.
4. Establishment of fully equipped and trained rescue squad.

5. At least one accident unit for every 500 to 1000 population in low accident density areas and for every 10 sq km radius in high accident density areas needs to be set up.
6. Dedicated communication toll free number to respond for emergency. The access code of such a dedicated number should be such that it is easily remembered by all such as 4444 or 9999 and should be common for entire state. The interface system should be able to receive multiple calls at any one time and also coordinate a speedy response.
7. All the NH and SH should have a communication call center, Ambulance equipped and staffed as per norms standardized by State Accident Policy every 10 Kms. Emergency care centres (ECC) manned by paramedical staff should be established every 20 Kms,

6.2. Disaster Materials Management System

Disaster Materials Management System (DMMS) that assists Disaster Management System (DMS) of GoUT jurisdictions in the development of an emergency infrastructure capable of managing and distributing lifesaving supplies and equipment.

The emergency infrastructure consists of two crucial components.

1. The Disaster Healthcare Network. This network includes all state healthcare organizations and pharmaceutical dispensing organizations.

   Experts of Disaster Management Authority of Union Territory of Ladakh (UToL) will assist District Administration and Public Health planners in setting up an integrated network of treatment centers for symptomatic patients, as well as dispensing centers for supplying non-symptomatic, exposed persons with needed "post exposure" medicines. This will include review of emergency procedures, developing logistical support plans and procedures and implementing the procedures that are approved by Disaster and Public Health, and healthcare organization planners. Once the Disaster Healthcare Network is established, it will need to be supplied during an actual pandemic, epidemic or bioterrorism attack, or during a natural disaster.

2. The Emergency Distribution Center. Each district will need to develop a "stand alone" inventory of lifesaving medical materials, including pharmaceuticals for use during the first hours of a pandemic, epidemic or bioterrorism attack.

These supplies will be stored in a jurisdiction's Emergency Distribution Center and will be issued to the Disaster Healthcare Network when hospital suppliers begin running out of disaster or actual pandemic, epidemic or bio-terrorism-related supplies. Pharmaceutical suppliers stock high cost antibiotics that could be used for actual pandemic, epidemic or biological warfare agents. These drugs are not, however, stocked in the quantities needed to treat the anticipated tens of thousands of persons exposed to pandemic, epidemic or biological warfare agents. This is especially true in the modern "just in time" inventory methodologies used by most hospitals and hospital distributors. The Emergency Distribution Center will need to be tied into the Disaster Healthcare Network in order to accept emergency orders for lifesaving supplies.

DMS will use its Inventory management system to create an automated order processing and distribution system for supply support to hospitals and dispensing centers. Automated Internet accessible "order entry screens" will be installed in materials management offices throughout the Disaster Healthcare Network. Finally, inventory management software will be installed at the Emergency Distribution Center and Internet connections will be completed.

During normal operations, DMS medical logisticians will work with planners and healthcare organizations to establish a stock rotation plan designed to maintain the emergency supplies in ready-for use condition.

Escape from Disaster Events

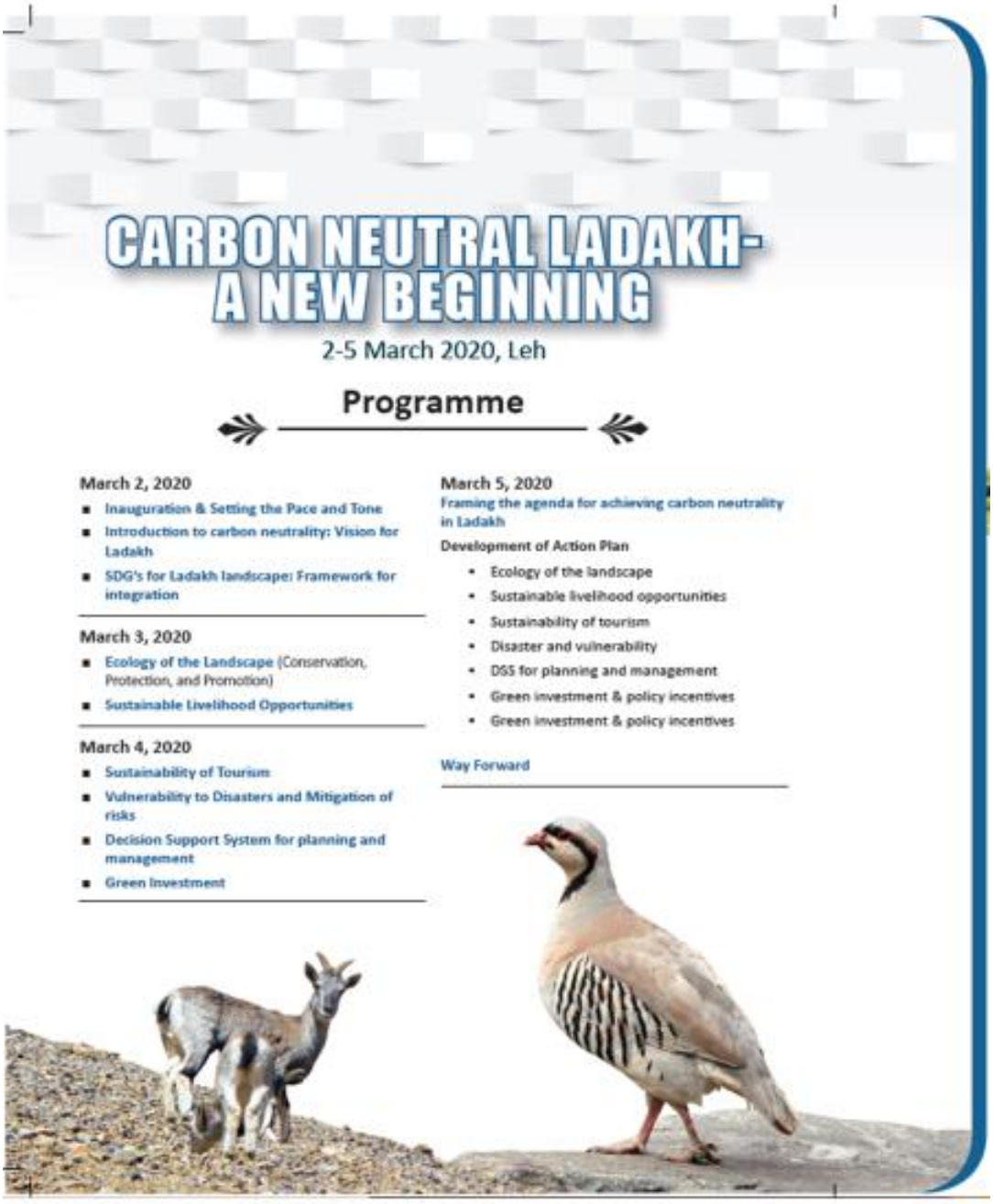
7. Sum-up

Ladakh, a cold desert area, is prone to various disasters and sparse habitation makes it difficult to response in quick time and provide relief. In recent history, recurring flash floods like of August 2010 (one of the worst disasters in recent history of India) causing loss of human lives and destruction to the properties, are major concern. Impacts of global climate change are evident in cold arid region by the observations on anomalies (higher precipitation through rain and warming temperature) than the historical trends, thus increasing chances of related extreme events of floods (flash/ glacial lake outbursts), and landslides, etc.

2005 onwards a recorded history of accidents/events indicates that beside the impact in city areas, larger landscape is affected by extreme events through damage to irrigation infrastructure, and loss of fertile land and clean water sources due to debris/muddy water/slush. Ladakh region is also vulnerable to road blockade due to landslides, snow avalanche, earthquake and drought. In summary, Ladakh is prone to various natural disasters such as Cloud burst and Flood, Snow Avalanche, Earthquake, and Locust Menace/ Agriculture Drought. Impacts of climate change may worsen situation in coming times. Given that Ladakh's vulnerability to existing factors and future projections, immediate actions in the policy framework, formation of statutory bodies, development of SOPs are required to mitigate disasters and develop a preparedness of the system for an effective and quick response at the time of hazard. Keeping carbon neutrality in focus actions and preparedness may have minimum carbon footprints.

The benefits of long-term hazard mitigation go beyond economics, as the reduction in vulnerability to disasters contributes to individual security, social stability and sustainable development. Nevertheless, economic arguments built on a sound benefit-cost analysis are essential when one has to defend the use of scarce resources for investment in mitigation.

Annexure I


CARBON NEUTRAL LADAKH-
A NEW BEGINNING
2-5 March 2020, Leh
Programme
March 2, 2020
Inauguration & Setting the Pace and Tone
Introduction to carbon neutrality: Vision for Ladakh
SDG's for Ladakh landscape: Framework for integration
March 3, 2020
Ecology of the Landscape (Conservation, Protection, and Promotion)
Sustainable Livelihood Opportunities
March 4, 2020
Sustainability of Tourism
Vulnerability to Disasters and Mitigation of risks
Decision Support System for planning and management
Green Investment
March 5, 2020
Framing the agenda for achieving carbon neutrality in Ladakh
Development of Action Plan
Ecology of the landscape
Sustainable livelihood opportunities
Sustainability of tourism
Disaster and vulnerability
DSS for planning and management
Green investment & policy incentives
Green investment & policy incentives
Way Forward

Annexure II

Panellists for Session on "Vulnerability to Disaster and Mitigation of Risks"

March 4, 2020

- Mr. C. Phunsog, University of Ladakh, Leh(Moderator)
- Prof. A.P. Dimri, Jawaharlal Nehru University, Delhi
- Prof. R.K. Pande, Kumaun University, Nainital
- Dr. Reno J Thayyen, National Institute of Hydrology, Roorkee
- Mr. Ajay Bhargava, Ministry of Environment, Forests, and Climate Change, Government of India
- Dr. S. S. Randhawa, Himachal Pradesh Science and Technology Council, Shimla.

Participants of Focus Group Discussion

March 5, 2020

- Prof. R.K. Pande, Kumaun University, Nainital (Moderator)
- Er. Nandan Kumar, Chief Engineer CWC, Chandigarh
- Dr. SS Randhawa, HP Council for ST&E, Shimla
- Dr. Sameer Saran, IIRS, Dehradun
- Dr. Renoj J, Thayyan, NIH, Roorkee
- Dr. Deldan Namgyal, HMAARI, SKAUST-K, Leh
- Mr. Hajira Banoo Balkhang
- Mr. Anwar Hussain

Inner Back Cover Page

"Carbon Neutral Ladakh: A New Beginning"

Ladakh Sustainable Development Summit 2020

2-5 March 2020

Organizing Committee

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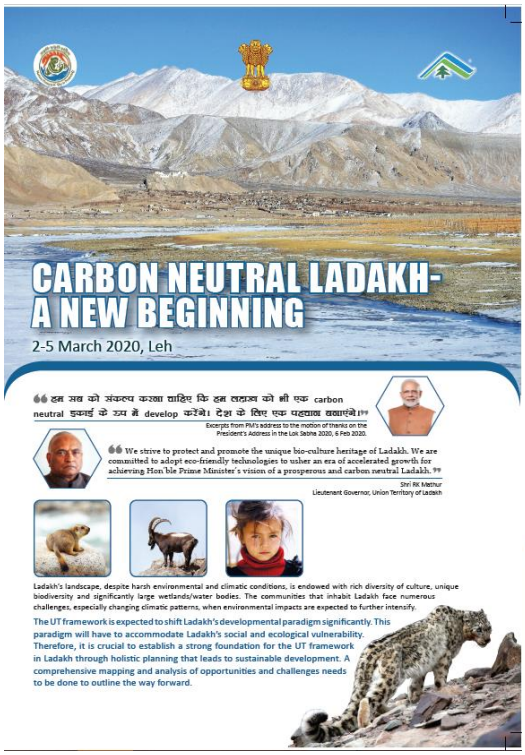

The Summit envisages to:

- Identify the current trajectory of ecological changes in Ladakh for different time frames
- Prepare framework to achieve carbon neutrality in Ladakh in foreseeable future.
- Find the ingredients to develop a strategic plan for different sectors for sustainable livelihoods that are consistent with environmental conservation
- Prioritize action and research needs to effectively address long-term developmental needs

The summit proceedings, along with follow-up focus group consultations, will lead to the development of a Strategy and Action Plan for the Sustainable Development of Ladakh.

EVENT CONVENERS -

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Leh 194 101 Ladakh

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CO-CONVENERS

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Leh & Principal Investigator
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