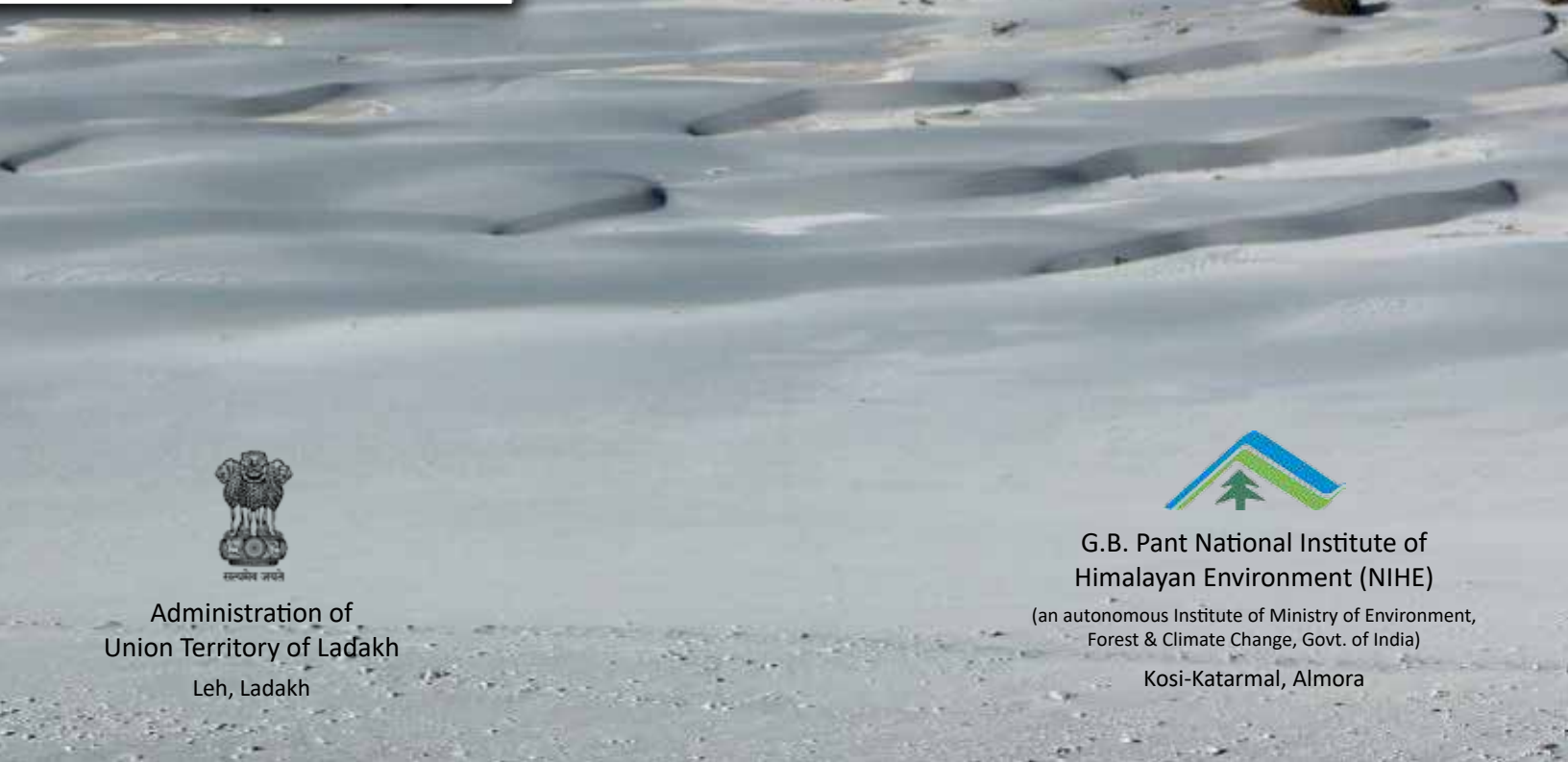


Disasters and Ladakh

*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

Disasters and Ladakh

Action Points for Management and Mitigation

[Document based on the session 'Vulnerability to Disasters and Mitigation of Risks' under 'Carbon Neutral Ladakh - a New Beginning' 2020]

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Administration of
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Lt. Governor
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FOREWORD



It gives me immense satisfaction that the Administration of UT Ladakh and the Ladakh Regional Centre of G.B. Pant National Institute for Himalayan Environment joined hands to organise a successful summit on “Carbon Neutral Ladakh – A New Beginning” at Leh from 2nd to 5th March 2020. Among others, the summit organised a dedicated session on “Vulnerability to Disasters and Mitigation of Risks” followed by an intensive Focus Group Discussion on the subject.

This document, “Disasters and Ladakh: Action Points for Management and Mitigation” not only includes the summit’s recommendations for mitigation of risks of disasters in Ladakh, but also systematically elaborates on actions w.r.t. policy and governance; physical infrastructure and capacity building and knowledge generation and preparedness.

I firmly believe that the development path of Ladakh must be different and boundaries well defined so as to preserve the pristine ecology and fragile eco-system of Ladakh. This summit has made a new beginning of engaging domain experts in drawing up an Action Agenda for policy and practice.

Therefore, I would encourage the Administration of UT Ladakh to take forward the “Carbon Neutral Ladakh” agenda while also making interventions towards reducing disaster risks.

I convey my heartfelt appreciations to Administrations of UT Ladakh and Ladakh Regional Centre of G.B. Pant National Institute of Himalayan Environment for the impactful organization of the summit and the contributors of this document for their sincere efforts.

July 2020

(RK Mathur)



आर पी गुप्ता
R P Gupta



सचिव
भारत सरकार
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
SECRETARY
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

PREFACE



The Himalaya is inherently vulnerable to natural disasters. Intensity of disaster events varies considerably across the region. However, most often, the intense land-use changes and unplanned construction/developmental activities contribute significantly to the increased intensity and scale of devastation. Studies have indicated impact of changing climate in higher Himalayas. Such factors may lead to more natural disasters and associated loss of property. Actions on Disasters Risk Reduction (DRR), therefore, assume high priority in the Himalaya.

In the entire setting of the Himalaya, Ladakh with cold desert landscape is unique in its bio-physical and socio-cultural settings. Therefore, the type, intensity and associated loss from disasters in Ladakh differ considerably from rest of the Himalaya. As in case of many other parts in the region, Ladakh lacks datasets that provide better understanding on disaster events and consequences. Therefore, UT of Ladakh urgently requires experts advice to build its DRR framework and preparedness plans.

It is a matter of great satisfaction that Ladakh UT Administration and GB Pant National Institute of Himalayan Environment partnered to organise a summit on 'Carbon Neutral Ladakh- A New Beginning' at Leh during 2-5 March 2020. As one of the outcomes of summit, this knowledge product 'Disasters in Ladakh- Action Points for Management and Mitigation', addresses the issue of expert advice in building Ladakh's DRR framework. I am confident, the booklet will be immensely helpful to Ladakh UT Administration in following the agenda of carbon neutrality through systematic DRR interventions.

RP GUPTA

New Delhi, the 18th August ,2020

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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 Reduction¹. 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 Subgroup².

Disaster Subgroups & Their Main Types	Definition of Sub-Group
GEOPHYSICAL <ul style="list-style-type: none"> Earthquake Mass Movement (dry) Volcanic activity 	A hazard originating from solid earth. This term is used interchangeably with the term geological hazard.
METEOROLOGICAL <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> Flood Landslide Wave action 	A hazard caused by the occurrence, movement, and distribution of surface and subsurface freshwater and saltwater.
CLIMATOLOGICAL <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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.

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.

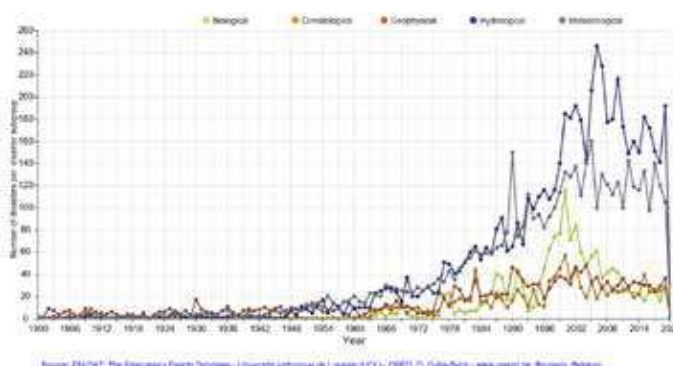


Fig 1. Since 1990, Global trend of disastrous events by Sub-Groups of disaster classification.



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, and (vii) civil strife. India is affected by 33 different types of disasters, and the adopted national classification of disasters is as follows.

Disaster Group	Types of Disaster
Water and Climate related Disasters	Droughts, Floods, Cloudburst, Cyclones, Tornadoes, Hailstorm, Thunder and Lightning, Heat- and cold Waves, Snow avalanches, Sea erosion, Tsunami
Geologically related Disasters	Earthquakes, Landslides and Mudflow, Dam failures / Dam Bursts, Mine Fires
Chemical, industrial and nuclear	Chemical and Industrial disasters, Nuclear disasters,
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
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

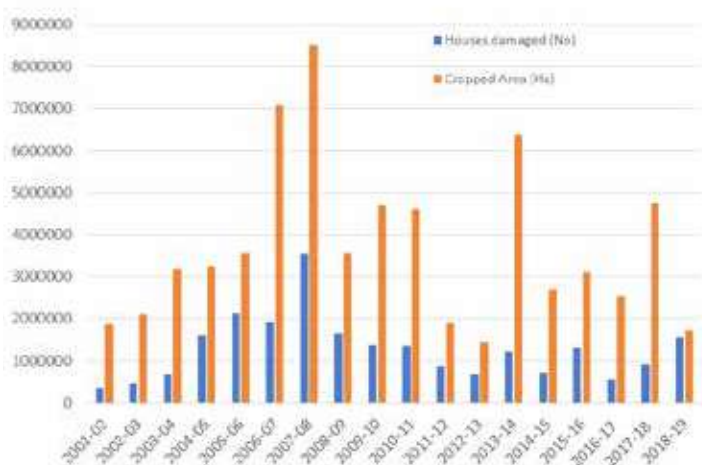


Fig 2. Damage to important assets due to natural extreme events in India.

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) 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 cattle⁵.

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 India⁷ those accounted for a death toll of more than 73 thousand lives of countrymen.

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 casualties of human lives. Some of the details for year 2013⁸, and year 2016⁹ are given.

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).

1.3. Threats of Climate Change in Ladakh:

Vulnerability analysis for country on several disaster and hazard zonation done by national agencies places Jammu and Kashmir State (undivided state) in high risks zones¹⁰, however data deficiency 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 differs in some climatological features¹¹. While Kargil district has wide range of climate from sub-



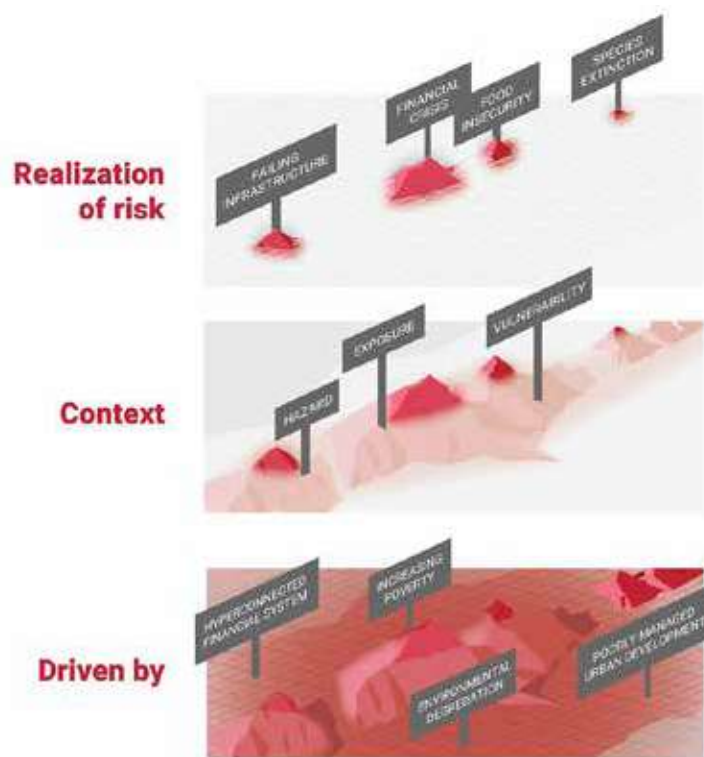
Fig 3. Ladakh: Flood timeline in recent years
Source: Preksha Sharma. 2018. Ladakh Floods: A Timeline of Disaster.
<https://thewire.in/environment/ladakh-floods->

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).

Date	Intensity	Causalities, Cause, and Area
5 Feb 2013	Moderate	22,000 livestockperished in Leh
26 Apr 2013	Heavy	One person died and 6others injured onSrinagar-Leh highwaywhen 3 vehi- cles werehit by the avalanche.
3 Jan 2016	Heavy	4 number due to Snow Avalanche (Southern Glacier)
3 Feb 2016	Heavy	10 number due to Snow Avalanche (Siachin)
19 Mar 2016	Heavy	1 number due to Snow Avalanche (Kargil)
25 Mar 2016	Heavy	2 number due to Snow Avalanche (Turtuk)

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 occurring 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.

Statistical analysis of the climate over Leh using different datasets¹² shows a slight but significant trend of change where a warming with reduced precipitation in the current decades is noticeable, and there 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



Mountain Perspective of Disaster (source: UNDRR)

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 climate. 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 August¹³. Another school suggests that south-west monsoon of India contributed to this event which is contrary to general belief that this monsoon does not reach Ladakh. Report suggests that 40% of all the annual extreme 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) have played a role by enhancing the rainfall associated with westward moving cyclone circulations in the middle troposphere¹⁴. Thus, it can be concluded that whatever the reason it was, landscape of Ladakh is prone to global anomalies created

on the face of climate change.

Long geological records also indicate that Indus River valley region is susceptible to mass movements, catastrophic land sliding, outburst floods and tectonic activity, such events occurred after the Last Glacial maximum (LGM) and Holocene warming¹⁵; Four large landslides (debris volume more than 10 million cubic m) in Holocene period were attributed¹⁶ 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.

¹<http://www.un-spider.org/node/7661> (Visited on 6 April 2020)

²<https://www.emdat.be/classification> (Visited on 5 April 2020)

³MJFroude 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>.

⁴Nair, SS, Gupta, AK, Roder, K. 2013. Databases and Statistics for Disaster Risk Management. National Institute of Disaster Management and Deutsche Gesellschaft für internationale Zusammenarbeit GmbH (GIZ). New Delhi. 228 p.

⁵NSO (2020), EnviStats-India 2020: Vol.I: Environment Statistics, National Statistical Office, Ministry of Statistics & Programme Implementation, Government of India, New Delhi.

⁶Ministry of Home Affairs (MHA); Disaster Management & data.gov.in

⁷EM-DAT: The Emergency Events Database – Country Profile Created on April 5, 2020

⁸Disastrous Weather Events of 2013. Indian Meteorological Department, Pune.

⁹Disastrous Weather Events of 2016. Indian Meteorological Department, Pune.

¹⁰Vulnerability Atlas of India. 2019. Building Materials & Technology Promotion Council, New Delhi.

¹¹Climate of Jammu and Kashmir. 2014. Climatological Summaries of State Series No 20. Indian Meteorological Department, Pune. pp 176.

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

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

¹⁴SC 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.

¹⁵D 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>

¹⁶Dortch, 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 Reduction¹⁷, 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 practitioners¹⁸. 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 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 management¹⁹.

National Disaster Management Authority has compiled various laws in the country contributing to disaster management²⁰, 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 situation²¹. 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 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 State²³. 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 programmes²⁴. 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 stakeholders²⁵, and a multi-stakeholders and multi-sectoral National Platform for Disaster Risk Reduction (NPDRR) was constituted in 2013. Main functions of NPDRR²⁶ 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 2016²⁷.

National Policy on Disaster Management (NPDM, 2009) is committed to build a safe and disaster resilient India by 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 synergy²⁸.

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 management²⁹.

¹⁷<https://www.undrr.org>

¹⁸<https://www.undrr.org/implementing-sendai-framework/regional-platforms>

¹⁹<https://www.ndmindia.nic.in>

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

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

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>

²⁶<http://npdrr.nidm.gov.in/aboutus.asp>

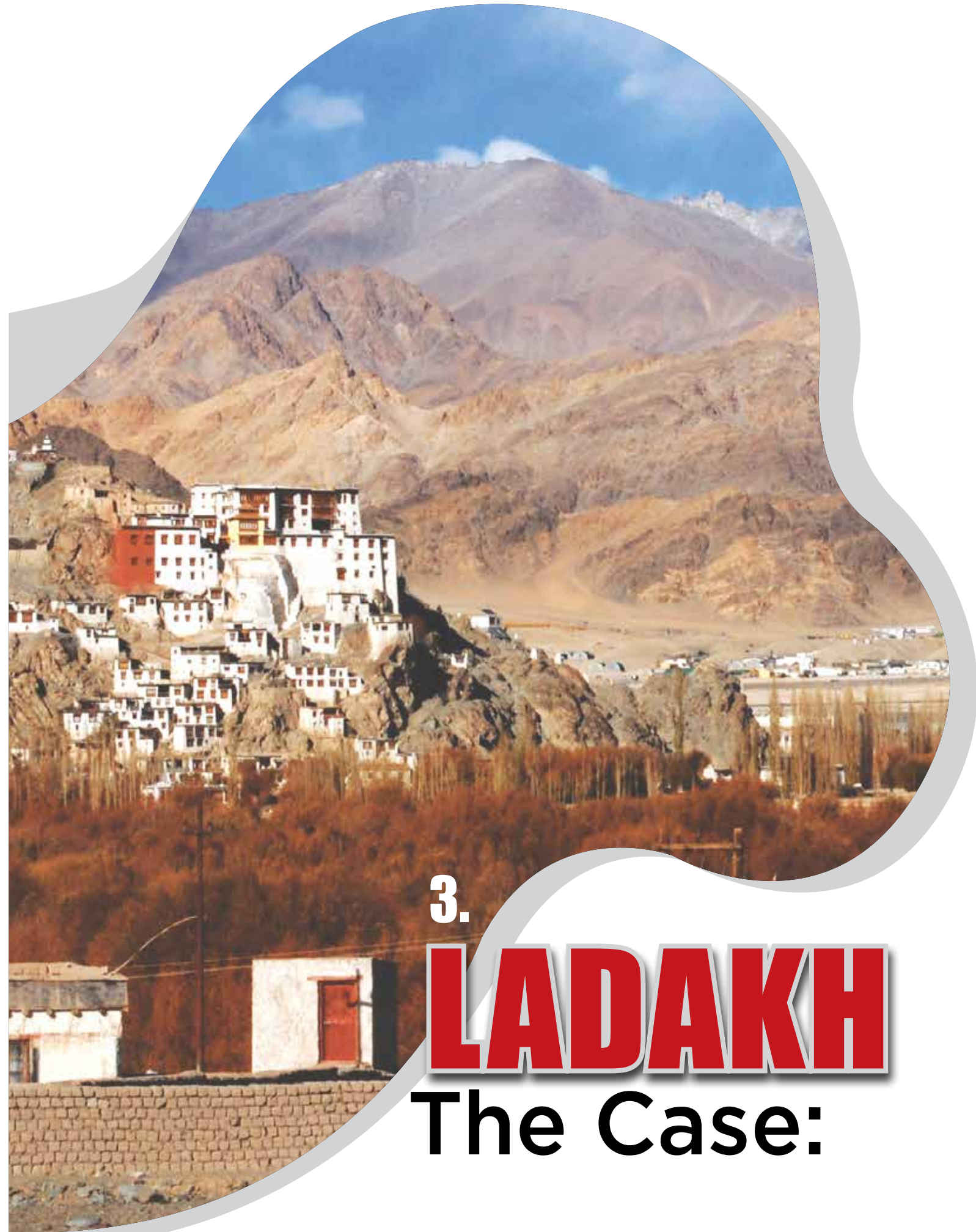
²⁷<https://www.ndmindia.nic.in/state-platform-for-disaster-risk-reduction-spdrd> and <https://www.hpsdma.nic.in>

²⁸National Policy on Disaster Management. 2009. National Disaster Management Authority. Ministry of Home Affairs.

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



Escape from Disaster Events



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, and (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, etc³⁰. 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, and (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 –



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

- 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.

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.

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

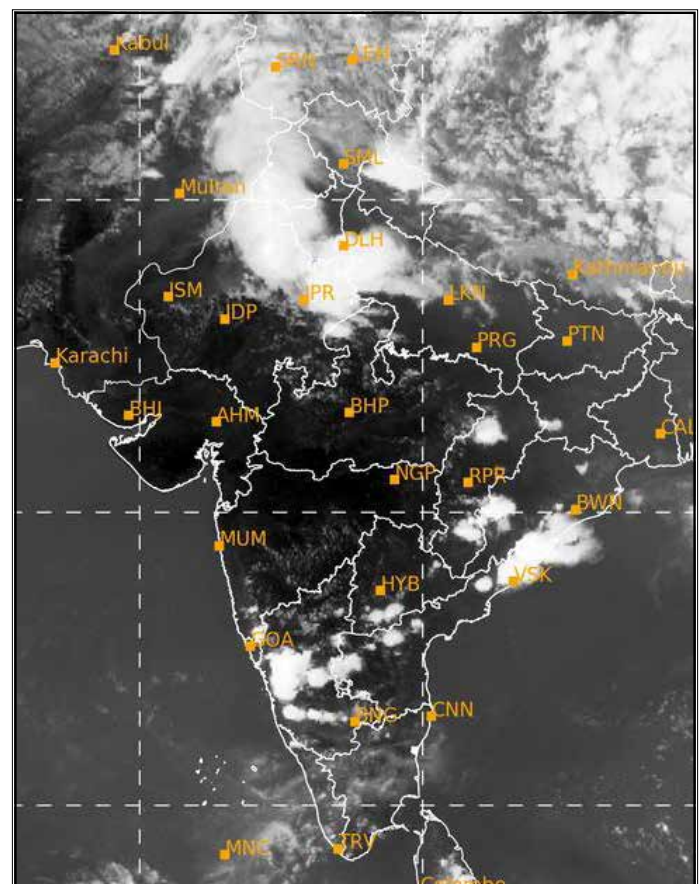


Fig. 8. Cloud cover over Indian Sub-Continent



4. LADAKH

Sustainable Development Summit 2020:

4.1. The Summit

In this backdrop, and realizing that the administrative framework of new UTs is 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 a 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 pap newspapers and recycled papers or (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 papers³¹.

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 & VDTs.
- 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 & GBPNHE 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 force to 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 respond 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:

- Develop a proactive disaster mitigation policy for UT of Ladakh. This provides the vision, rationale, and mandate for vulnerability reduction activities.
- Assess existing hazards and map the hazard risk. Document the location, frequency, severity, and impact of historical hazardous events.
- 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.
- 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.

- 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 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 given³⁴.

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 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 maintenance system 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.

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>

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)

- Enunciation of a UT Accident Policy
- 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.
- Designating districts to Medical Colleges/ Base Hospitals, which will act as referral centers to their respective earmarked districts.
- Establishment of Centralized Accident and Trauma Services (CATS) in all districts along with strengthening infrastructure, pre-hospital care at all government and private hospitals.
- Development of computerized information base at all levels of health care to help in perspective policy planning and networking.
- There is a need to establish a UT Trauma Registry for data collection and analysis.
- Information dissemination to all the existing facilities, legislations, referral system, existing networking to facilitate EMS health care utilization.
- 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.
- Training in EMS to be organized in the Medical Colleges/Base Hospitals and other regional areas.
- 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)

- Implementation of the proposed recommendations of the UT Accident Policy.
- 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.
- Establishment of Emergency Medicine as a specialty.
- Establishment of fully equipped and trained rescue squad.
- 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.
- 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.
- 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.

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

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.

7. Sum-up

Ladakh, a cold desert area, is prone to various disasters and sparse habitation makes it difficult to respond in quick time and provide relief. In recent history, recurring flash floods like that of August 2010 (one of the worst disasters in recent history of India) causing loss of human lives and destruction to the properties, are of 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 avalanches, 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 robust framework of preparedness of the system for an effective and quick response at the time of hazard. Keeping carbon neutrality in focus, the actions and preparedness needs to 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.



ABBREVIATIONS

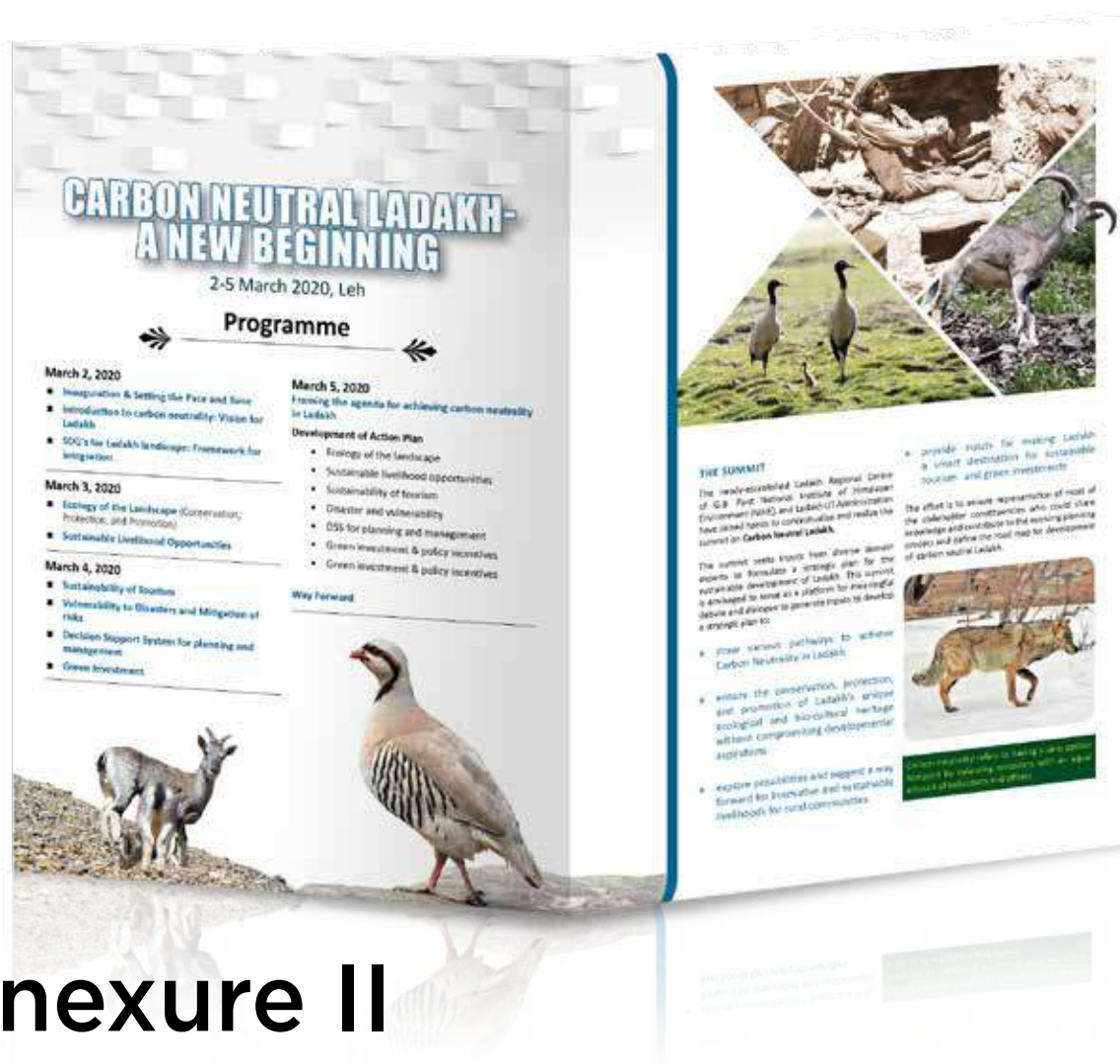
APRA	Accident Prevention and Relief Authority	GoI	Government of India
ATI	Administrative Training Institute	GoUT	Government of Union Territory
BMC	Block Management Committee	HRVA	Hazard & Risk Vulnerability Assessment
CATS	Centralized Accident and Trauma Services	IIRS	Indian Institute of Remote Sensing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

NH	National Highways	SOP	Standard Operating Protocol
NIH	National Institute of Hydrology	SPDRR	State Level Platform for Disaster Risk Reduction
NPDM	National Policy on Disaster Management	TCP	Town and Country Planning
NPDRR	National Platform for Disaster Risk Reduction	UNDMT	United Nations Disaster Management Team
SASE	Center for Snow and Avalanche Study Establishment	UNDRR	United Nations Office for Disaster Risk Reduction
SDMA	State Disaster Management Authority	UNISDR	United Nations International Strategy for Disaster Reduction
SDRF	State Disaster Response Fund	UT	Union Territory
SDRF	State Disaster Response Force	UToL	Union Territory of Ladakh
SEC	State Executive Committee		
SH	State Highways		

NATURAL DISASTERS



Annexure I



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, Leh
- » Mr. Anwar Hussain, Leh

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"Carbon Neutral Ladakh: A New Beginning"

Ladakh Sustainable Development Summit 2020

2-5 March 2020

Organizing Committee

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Shri RK Mathur, Hon'ble Lt. Gov, UT of Ladakh

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Ladakh UT

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Yountan Tharchin



Administration of Union Territory of Ladakh

Ladakh became a Union Territory on 31st of October 2019. In August 2019, a reorganization act was passed by the Parliament of India which contained provisions to reconstitute Ladakh as a union territory, separate from the rest of Jammu and Kashmir. Ladakh is renowned for its remote mountain beauty and distinct culture. Under the terms of the act, the union territory is administered by the Lieutenant Governor acting on behalf of the Central Government of India. Shri Radha Krishna Mathur became the first Lt. Governor of the Ladakh UT. Ladakh UT has its administrative headquarters at Leh. Ladakh UT has two districts viz., Leh and Kargil.

<https://ladakh.nic.in/>



G.B. Pant National Institute of Himalayan Environment

(An autonomous Institute of Ministry of Environment, Forest & Climate Change, Govt. of India)

Kosi-Katarmal, Almora

G.B. Pant National Institute of Himalayan Environment (NIHE, formerly known as G.B. Pant Institute of Himalayan Environment & Development) was established in 1988-89 as an autonomous Institute of the Ministry of Environment, Forest & Climate Change, Govt. of India, which has been identified as a focal agency to advance scientific knowledge, to evolve integrated management strategies, demonstrate their efficacy for conservation of natural resources, and to ensure environmentally sound development in the entire Indian Himalayan Region (IHR).

NIHE has decentralized setup with HQs located in Almora (Uttarakhand), and different regional centres in Indian Himalayan states (Mohal-Kullu in Himachal Pradesh, Srinagar in Uttarakhand, Panthang-Gangtok in Sikkim, Itanagar in Arunachal Pradesh). With creation of Ladakh UT a new centre “Ladakh Regional Center” (LRC) has been established at Leh to ensure NIHE’s R&D outreach in Trans-Himalayan region of IHR with following objectives - (i) To promote alternative livelihoods for climate change vulnerable cold-desert communities, (ii) To facilitate conservation of critical/important cold desert habitats and biodiversity, (iii) To strengthen and establish approaches for addressing issues of water scarcity, and (iv) To foster climate smart communities in the trans-Himalayan landscape.

<http://gbpihed.gov.in>