



**National Guidelines**  
**for**  
*Preparation of Action Plan –*  
*Prevention and Management of*  
*Cold Wave and Frost*  
**2021**



**NATIONAL DISASTER MANAGEMENT AUTHORITY (NDMA)**  
Government of India  
NDMA Bhawan, A-1, Safdarjung Enclave,  
New Delhi-110 029



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For  
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**National Guidelines for Preparation of Action plan -  
Prevention and Management of Cold Wave and Frost  
June 2021**

**Guidance and support**

Dr. V. Thiruppugazh, Additional Secretary (Policy and Plan), NDMA

**Overall Coordination and Drafting**

Shri Anup Kumar Srivastava (Sr. Consultant-Drought, Heat wave, Thunderstorm, Cold Wave & Food Security), NDMA

**Working Group Convener**

Dr. S. K Jena, Joint Advisor (Rehabilitation & Recovery), NDMA

**Subgroup conveners**

Shri Abhishek Shandilya (Consultant- Grad-II - IEC), NDMA

Shri Ajay Katuri (Sr. Consultant- Hazard, Vulnerability and Risk Assessment), NDMA

Shri Anuj Tiwari (Consultant- Grade-II- Policy, Plan & Mainstreaming), NDMA

Shri Anup Kumar Srivastava (Sr. Consultant-Drought, Heat wave, Thunderstorm, Cold Wave & Food Security), NDMA

Shri Manoj Kumar Jangir (Under Secretary - PR&AG), NDMA

Dr. Swati Sulagna (Sr. Consultant - Climate Change), NDMA

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प्रधान मंत्री  
Prime Minister

### संदेश

राष्ट्रीय आपदा प्रबंधन प्राधिकरण (एनडीएमए) द्वारा शीतलहर और पाले से बचाव व प्रबंधन की कार्य योजना बनाने के लिए दिशा-निर्देश तैयार किए जाने के बारे में जानकारी प्रसन्नता हुई। सर्दियां आने से पहले शीत लहर व पाले से निपटने की दिशा में तैयारी और तत्परता की ओर यह कदम सराहनीय है।

विगत दशकों में जलवायु परिवर्तन के प्रतिकूल प्रभाव का वैश्विक स्तर पर व्यापक असर देखने को मिल रहा है। नई चुनौतियों के समक्ष हमारी रणनीति तथा समन्वित व त्वरित प्रयास अहम् हैं। प्राकृतिक आपदाओं व परिस्थितियों से निपटने के लिए बेहतर कार्य योजना, जन जागरुकता और जन भागीदारी के जरिये हम नुकसान की आशंका को कम कर सकते हैं।

एनडीएमए सुरक्षा और बचाव के कार्यों के प्रति हमेशा प्रतिबद्ध रहते हुए राष्ट्र निर्माण में महत्वपूर्ण भूमिका निभाता है। यह दिशा-निर्देश राज्य व जिला स्तर पर शीतलहर और पाले के कारण पशुधन, आजीविका, बीमारी की रोकथाम और जीवन की रक्षा जैसे विषयों पर जन उपयोगी साबित होंगे।

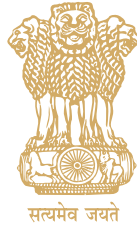
एनडीएमए को इस प्रयास के लिए बधाई व भविष्य के लिए शुभकामनाएं।

(नरेन्द्र मोदी)

नई दिल्ली  
आश्विन 13, शक संवत् 1943  
05 अक्टूबर, 2021







गृह मंत्री  
भारत

## संदेश

यह हर्ष का विषय है कि राष्ट्रीय आपदा प्रबंधन प्राधिकरण (एनडीएमए) ने “शीत लहर और पाला के रोकथाम और प्रबंधन की कार्य योजना बनाने के लिए राष्ट्रीय दिशा-निर्देश” तैयार किया है।

पिछले कुछ वर्षों में शीत लहर/पाला, भारी बर्फबारी, कोहरा, बर्फीला तूफान आदि प्रमुख खतरों के रूप में उभरे हैं, जिसने देश के विभिन्न वर्गों को प्रभावित किया है, विशेष रूप से समाज के गरीब और पिछड़े वर्ग के लोग शामिल हैं। मेरा मानना है कि इस दिशानिर्देश से हितधारकों को शीत लहर जोखिम न्यूनीकरण से संबंधित कार्य योजनाओं की तैयारी में अनेक पहलुओं पर मदद मिलेगी और मानव जीवन, पशुधन एवं आजीविका की रक्षा भी सुनिश्चित होगी।

मुझे विश्वास है कि यह दिशानिर्देश लंबे समय तक शीत लहर के प्रभाव को कम करने में समस्त हितधारकों के बीच जागरूकता सृजन एवं बेहतर समन्वय प्रदान करेगा।

मैं, एनडीएमए को इन दिशानिर्देशों को तैयार करने के लिए शुभकानाएं प्रेषित करता हूँ।

धन्यवाद सहित,

(अमित शाह)





राष्ट्रीय आपदा प्रबंधन प्राधिकरण  
National Disaster Management Authority  
भारत सरकार  
Government of India

## Foreword

The World Meteorological Organization (WMO) statements on global climate during the past few years indicate that the global temperatures are substantially unveiling variations in temperature during the winter or cold wave seasons these events have a significant impact on agriculture, health, livestock, livelihoods, environment, socio-economy and other allied sectors of a country. The management of cold waves/frost remains a challenge with a large number of deaths each year, especially in developing countries. There is a need to develop institutional measures to prepare, mitigate, and respond to cold wave.

Cold wave is a localised seasonal phenomenon prevalent in the country except in southern India. The northern parts of India, especially the hilly regions and the adjoining plain areas comprise of the Core Cold Wave Zone covering 17 states/UTs. In 2020, northern states were highly affected in terms of casualties and recognise loss from cold wave/frost. With effective planning and interventions, such loss of life/damaged could have been easily avoided.

In 2021, NDMA organised a webinar on cold wave risk reduction with broad objectives of sharing experiences, prevention, preparedness, lessons learnt, long-term mitigation measures and future course of action and planning for cold wave. Several recommendations made at the webinar have been incorporated in these guidelines.

The guideline has been prepared through a nine step consultative process which involved stakeholders from state disaster management authorities, central ministries/ departments, experts and non-government agencies. NDMA constituted a Working Group, and many Subgroups for preparation of these guidelines on cold wave. Deliberations among these groups have helped in the formulation of the National Guidelines. The guidelines include specific actions based on experts' opinions, scientific outlook from various research papers, reports, and best practices.

These guidelines aim to facilitate the stakeholders to prepare their Cold Wave Action Plans (CWAPs) by providing insights into various aspects related to cold wave risk reduction. It will also help in the mobilisation of stakeholders and coordination among various ministries/ departments, individuals and communities for mitigating the impact of cold waves, protecting lives, livestock, livelihoods and preventing illnesses.

**Lt. Gen (Retd) Syed Ata Hasnain**  
Member

**Shri Rejendra Singh**  
Member

**Dr. Krishna Vatsa**  
Member

**Shri Kamal Kishore**  
Member

**Sanjeeva Kumar, IAS**  
Member Secretary

# Acknowledgement

The challenging task of preparing these National Guidelines has been accomplished with the support of many such individuals and institutions. We gratefully acknowledge the support of each one of them.

Shri Sanjeeva Kumar, Member Secretary, NDMA, chaired the Expert Group and guided the process towards the preparation of these guidelines. Lt Gen (Retd.) Syed Ata Hasnain, Member, NDMA, Shri Rajendra Singh, Member, NDMA actively participated in all the meetings and provided valuable inputs and suggestions. Members and convener of Sub-Group of the Expert Committee also provided inputs. Several rounds of consultations were held, inputs were sought and drafts were prepared before the guideline was finalised.

Dr. V. Thiruppugazh, Additional Secretary (Policy and Plan), NDMA, led the efforts towards the preparation of first 'National Guidelines on Cold Wave/Frost'. Under his guidance, the guidelines have incorporated latest research and developments with a view to respond to and mitigate the risks of cold wave. The writing of these guidelines and overall coordinated inputs from a range of institutions, experts and individuals was done by Shri Anup Kumar Srivastava, (Sr. Consultant, Drought, Cold wave, Thunderstorm, Cold Wave & Food Security). Significant contributions were made by the Subgroup convener Shri Anuj Tiwari (Consultant II, Policy, Plan & Mainstreaming). Dr. Swati Sulagna (Sr. Consultant, Climate Change), Shri Ajay Katuri (Sr. Consultant- Hazard, Vulnerability and Risk Assessment), Shri Abhishek Shandilya (Consultant II, Information Education and Communication) Shri Manoj Kumar Jangir (Under Secretary- PR&AG) and Dr. S. K Jena, (Joint Advisor) heading Rehabilitation & Recovery division of NDMA have contributed different chapters also provided administrative support.

Significant contributions were made by the Members of the Subgroup, Ministry of Home Affairs (MHA), Ministry of Agriculture and Farmers Welfare (MoA&FW), Ministry of Animal Husbandry and Dairying & Fisheries (MoAH&DF), Ministry of Health and Family Welfare (MoH&FW), Ministry of Earth Sciences (MoES), India Meteorological Department (IMD) and representatives from Jammu & Kashmir, Bihar, Delhi, Punjab, Rajasthan, Uttarakhand and Telangana. Various scientific and technical institutions, eminent experts and Non-Governmental Organisations (NGOs) also gave useful feedback and suggestions on different chapters of the guidelines.

# Abbreviations

The following abbreviations and acronyms appear in the text:

AIR	All India Radio
ATIs	Administrative Training Institutes
CBOs	Community-Based Organisations
CWZ	Core Cold Wave Zone
cCASHh	Climate Change and Adaptation Strategies for Human Health
CHC	Community Health Centre
COR	Relief Commissioner
CW	Cold Wave
CWAP	Cold Wave Action Plan
DDMA	District Disaster Management Authority
DGRE	Defence Geo-informatics Research Establishment
DMD	Disaster Management Department
DRR	Disaster Risk Reduction
DUD	Department of Urban Development
IAF	Indian Air Force
IDSP	Integrated Disease Surveillance Program
IEC	Information, Education and Communication
IIPH	Indian Institute of Public Health
IIT	Indian Institute of Technology
IITM	Indian Institute of Tropical Meteorology, Pune
IMCT	Inter-Ministerial Central Team
IMD	India Meteorological Department, New Delhi
IPCC	Intergovernmental Panel on Climate Change
ISRO	Indian Space Research Organisation
MC	Municipal Corporation
MHA	Ministry of Home Affairs
MNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MoA&FW	Ministry of Agriculture and Farmers' Welfare
MoAH&D	Ministry of Animal Husbandry and Dairying & Fisheries
MoEF&CC	Ministry of Environment Forest and Climate Change
MoES	Ministry of Earth Sciences
MoE	Ministry of Education
MoHFW	Ministry of Health and Family Welfare

MoHUA	Ministry of Housing and Urban Affairs
MoJS	Ministry of Jal Shakti
MoL&E	Ministry of Labour and Employment
MoP	Ministry of Power
MoPR	Ministry of Panchayati Raj
MoR	Ministry of Railways
MoRD	Ministry of Rural Development
MoRT&H	Ministry of Road Transport and Highways
MoT	Ministry of Tourism
NCDC	National Centre for Disease Control
NCMRWF	National Centre for Medium Range Weather Forecasting
NDMA	National Disaster Management Authority
NDRF	National Disaster Response Force
NDVI	Normalized Differential Vegetation Index
NGO	Non-Government Organisation
NIDM	National Institute of Disaster Management
OPD	Out Patient Department
PHC	Primary Health Centre
PHED	Public Health Engineering Department
RH	Relative Humidity
RMM	Risk Mitigation Measures
RRT	Rapid Response Team
SAT	Surface Air Temperature
SCW	Severe Cold Wave
SH	Siberian High
SDMA	State Disaster Management Authority
SDRF	State Disaster Response Force
SEOC	State Emergency Operation Centre
SMS	Short Message Services
SOP	Standard Operating Procedure
$T_{max}$	Maximum Temperature
$T_{min}$	Minimum Temperature
UBH	Ural Blocking High
UGC	University Grants Commission
WMO	World Meteorological Organisation

# Executive Summary

Cold wave, heavy snowfall/rainfall, fog, snow storms etc. have emerged as one of the major weather hazards in recent years affecting different parts of the country. Cold wave is a localised seasonal phenomenon prevalent in the country except in southern India. The northern part of India, especially the hilly regions and the adjoining plain areas comprise of the Core Cold Wave Zone (CWZ), covers 17 states and accounts for a population of 90.90 crores. Out of this, 24.28 crore are either below 10 years or above 60 years of age (Rural 17.9 Cr. and Urban 6.38 Cr.), who are more vulnerable to cold waves.

In 2020, northern states of India were highly affected in terms of casualties from cold wave/frost. In India, cold wave has caused 4,712 deaths from 2001 to 2019 across various states. IITM data shows an increasing trend of cold waves in the last three decades (1991-2019). With effective planning and interventions, such loss of life could have been easily avoided.

As there are no guidelines and action plans on cold wave at the national level, it remains a challenge for disaster managers to take standardised preventive, preparedness, and mitigation measures. There is a need to prepare action plans to take timely actions for prevention, preparedness, mitigation and community outreach to safeguard human lives, livestock and wildlife.

## Genesis

Occurrences of extremely low temperature in association with incursion of dry, cold winds from the north into the subcontinent are known as cold waves. The northern part of India, especially the hilly regions and the adjoining plains, are influenced by transient disturbances in the mid latitude westerlies which often have weak frontal characteristics. A cold wave or frost condition is a rapid fall in temperature within a 24-hour period requiring substantially increased protection for agriculture, health, livestock and other activities. As cold wave/frost is a localised disaster event, location-specific mitigation plans should be developed by the concerned State Governments/district administrations.

Given these past experiences there is a need to formulate “National Guidelines for Preparation of Action Plan – Prevention and Management of Cold Wave” for improving the capacity of the States to deal with cold wave in a planned manner. The guidelines will help develop measures and strategies for assessment, forecast, preparedness and mitigation through coordinated efforts by multiple agencies and undertake long-term mitigation measures for addressing the issues at a broader level by the states/local authorities.

NDMA constituted a Working Group and Nine Sub-groups, comprising representatives of various ministries/departments, State/UTs, academic & research institutions, and experts to build consensus on the content of the guidelines. The Working Group and Subgroups, through successive deliberations, prepared the guidelines with specific actions, based on scientific outlook from various research papers, reports, best practices, cold wave assessments and mapping techniques.

## Objective

The Guideline aims to provide a broad framework for developing Cold Wave Action Plans (CWAPs) at the State level and district level; for implementation, inter-agency coordination and impact evaluation of cold wave response activities.

## Structure of the Guidelines

Sharing of past learning and experiences, academic and institutional research and historical data helped in preparing these guidelines. It has eleven chapters and reporting formats for data collection and documentation.

**Chapter 1 - Background and Introduction:** This chapter examines cause of cold wave occurrences, weather hazards, climatology and trends of cold wave and the impact on various sectors.

**Chapter 2 - Hazard, Vulnerability and Risk Analysis:** This chapter analyses the hazard, vulnerability and risk and classifies the risk prone area as high-risk, average-risk and low-risk to indicate the degree of probability of the occurrence of the incident and impact.

**Chapter 3 - Early Warning and Communication:** This chapter explains the entire system of issuing weather forecast and impact-based colour code early warning. Short to medium range forecast indicates the potential areas at risk with the probability of occurrence of the phenomena. It also explains the early warning dissemination and communication strategy. Now-casting provides specific information about the place and time of cold wave occurrence.

**Chapter 4 -Preparation of Action Plan:**This chapter explains the rationale behind the guidelines and lists major objectives. It also lists the key strategies required to prepare for and respond to a cold wave events at the local level besides the steps involved in developing an action plan.

**Chapter 5 – Prevention and Mitigation Measures:** This chapter deals with the concept of prevention and mitigation measures particularly for agriculture, health, animal husbandry, homeless and urban poor.

**Chapter 6 – Preparedness and Response Measures:** This chapter deals with preparedness and response measures at different levels, minimising the impact of injuries, loss of life and damage to property and the environment.

**Chapter 7 – Information Education and Communication (IEC):** This chapter deals with the key strategy for Information Education and Communication (IEC) and dissemination of early warning to the last person in time. The chapter also discusses IEC activities and awareness campaigns at the National, State/District level, key warning messages, communication and dissemination strategies, public awareness, community outreach.

**Chapter 8 – Capacity Building and Training:** This chapter emphasises on capacity building by making cold wave education a part of educational curriculum. This chapter deals with specific training and capacity building measures/plans for government functionaries and volunteers.

**Chapter 9 - Roles & Responsibilities and Implementation Plan:** This chapter clearly lays down the roles/responsibilities of all stakeholders in a matrix format. It also provides a brief insight into how an SEOC, should function for rapid dissemination of information to all stakeholders to enable effective decision-making and quick response.

**Chapter 10 - Documentation and Reporting Formats (including loss assessment):** The chapter underlines the need and importance of data collection and validation at the district level and compilation of data at the State and Central level, which in turn would feed into the national-level disaster database system to enable policy decisions.

**Annexure 1:** Do's and Don'ts

**Annexure 2:** Cold wave Disorders for Human

**Annexure 3:** Cold wave Disorders for Animals

**Annexure 4:** A case Study of Jammu and Kashmir

**Annexure 5:** List of Concerned Ministries/Departments



# 1 Introduction and Background

## 1.1 Introduction and Background

Cold wave, heavy snowfall/rainfall, fog, snow storms etc. have emerged as major weather hazards in recent years affecting different parts of the country. The World Meteorological Organization's (WMO) statements on global climate during the past few years indicate that the global temperatures are substantially unveiling variations during various seasons and have a large impact on environment, agriculture, health, livestock, livelihoods, socio-economy and other allied sectors. The management of cold wave remains a challenge with a large number of deaths each year especially in developing countries which lack proper heating systems. Around the world, many countries that experience cold wave as a recurrent hazard have developed institutional measures to prepare, mitigate, and respond to cold waves.

In recent years, occurrences of extreme low temperature in association with incursion of dry, cold winds from north into the sub-continent known as cold waves, cause discomfort, illnesses and even loss of lives. Cold wave occurs in the month of December-January every year and sometimes extended cold wave events occur from November to February and are limited mostly to northern India. The cold wave is marked by a well-defined and prolonged period of lower temperatures. The precise criterion for a cold wave is determined by the rate at which the temperature falls and the minimum to which it falls. This minimum temperature depends on the geographical region and time of the year.

Cold wave is a localised seasonal phenomenon prevalent in the country except in southern India. The northern parts of India, specially the hilly regions (Jammu and Kashmir, Himachal Pradesh, Uttarakhand) and the adjoining plains are influenced by transient disturbances in the mid latitude westerlies which often have weak frontal characteristics. States like Punjab, Haryana, Rajasthan, Delhi, U.P., Bihar and Jharkhand are the highly affected. It also includes some met subdivisions of Marathwada, Vidharbha, Saurashtra and Madhya Maharashtra which are affected by cold waves. The extent of damage caused by a cold wave depends on the temperature, length of exposure, humidity levels, and the wind speed at freezing temperature. Indian Institute of Tropical Meteorology (IITM) data shows increasing trends of cold waves from the last three decades (1991-2021 see table 1).

The total population is 90.90 crores reside in the core cold wave zones. Out of this, 24.28 crore are either below 10 years or above 60 years of age (Rural 17.9 Cr. and Urban 6.38Cr.), who may be more vulnerable to cold waves (Census 2011). Cold waves have significant effect on health. In India, cold waves caused 4,712 deaths from 2001 to 2019 across various states (Fig.4). There was significant damage to crops, horticulture, forest, livestock, fisheries, water supply, power supply, transportation, tourism, economy and livelihood systems in these cold wave prone regions that led to economic losses of the state. Cold wave also leads to death of domestic and wild animals, birds, poultry, etc.

In 2019-20, Punjab, Haryana, Rajasthan, U.P. and Bihar were highly affected in terms of casualties from cold wave. This could have been avoided by proper planning and adequate shelters for the outdoor workers, farmers and livestock.

To deal with governance issues related to Disaster Risk Management for cold waves, there is a need for a multi-sectoral and multi-dimensional approach. Especially in the health sector, interventions can be made to address cold wave impacts. Early warnings can help in minimising the loss of lives and economic impacts. An effective early warning system helps the communities to manage risk by generating public awareness, effectively disseminating warnings and ensuring a constant state of preparedness.

As there are no national guidelines for preparation of action plans for coldwave, it is a challenge for disaster managers to take standardised preventive, preparedness, and mitigation measures. There is a need to issue national guidelines to help preparation of action plans for preventive actions, preparedness, and mitigation measures.

## 1.2 Climatology and Cold Wave Season in India

The minimum temperatures (T.min) go down below 8°C over many parts of northern India during November to February months (Fig. 1a to 1d). However, December & January are the coldest months with Tmin below 6°C over most parts of northwest India and below 8°C over the rest parts of northern India.

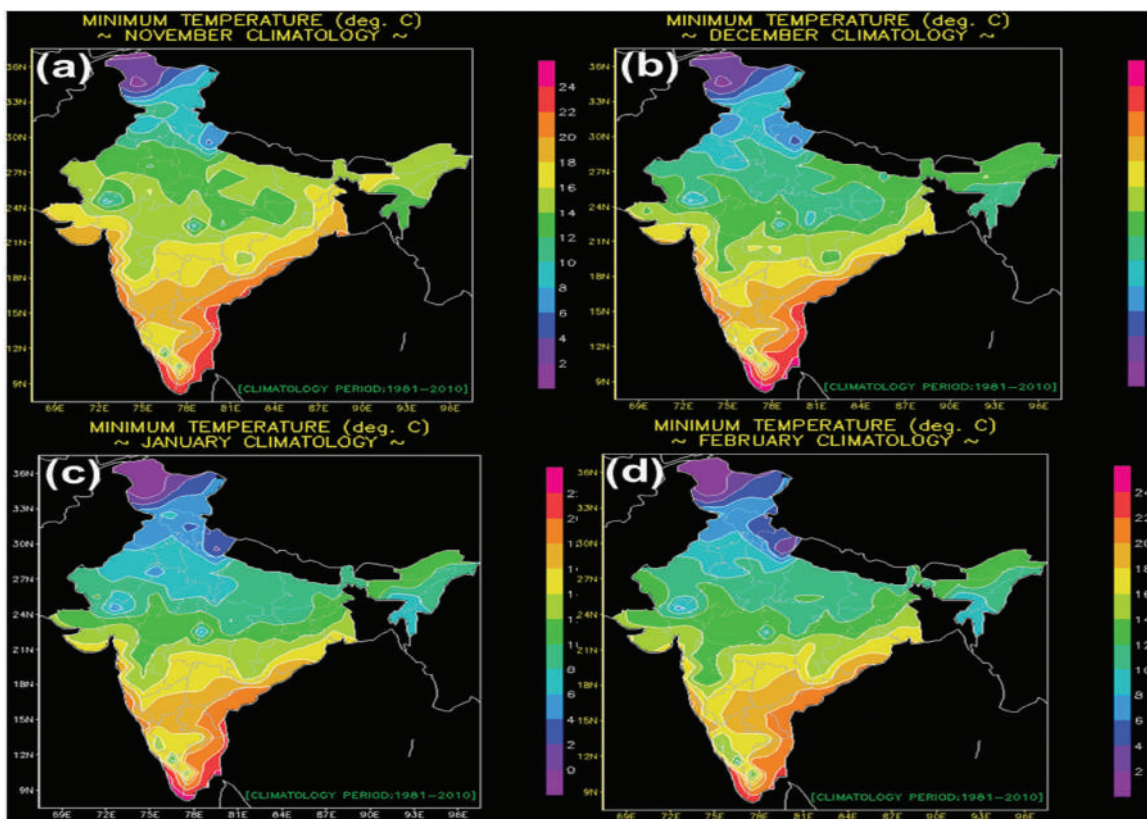
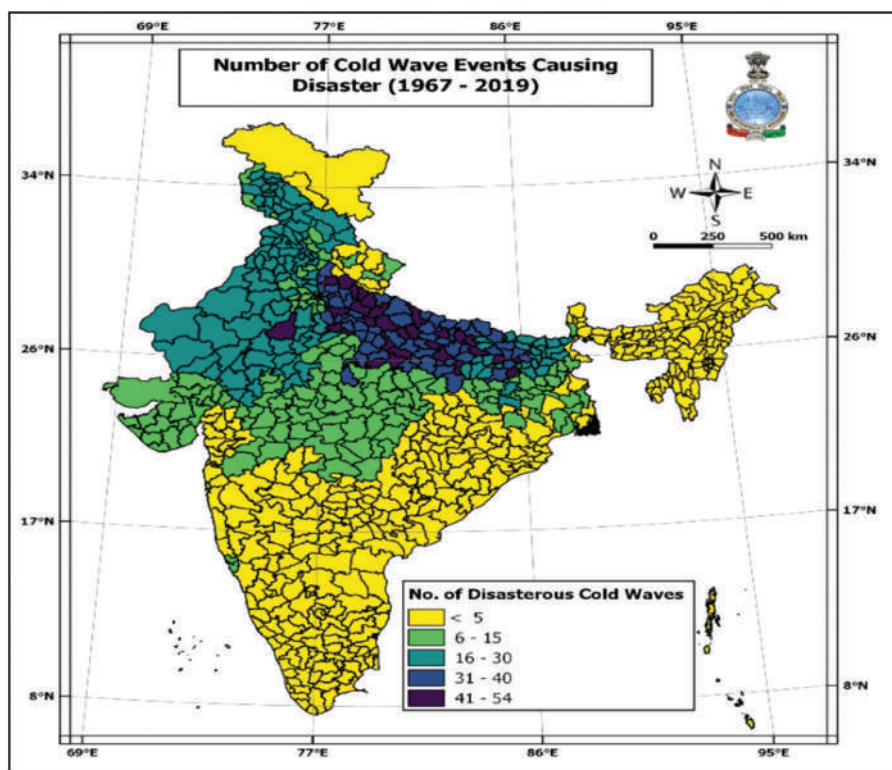


Fig.1: Normal Tmin during November to February (1981-2010) (source:<https://www.imdpune.gov.in/>)

Cold waves are seasonal with more episodes observed from November to March and extreme events mostly experienced during the middle three-month period (Fig. 2).

Normally, in the winter months, after the passage of western disturbances, dry cold northwesterly winds make way into north & central India. As a result, minimum temperatures drop over the regions and sometimes cause cold wave conditions. A cold wave is a meteorological event generally characterised by:

- sharp drop of air temperature near the surface, leading to extremely low values;
- steep rise of pressure;
- strengthening of wind speed; or
- associated with hazardous weather like frost and icing.



*Fig.2: Number of Cold wave events causing disaster 1967-2019 (Source – IMD, New Delhi)*

### 1.3 The major factors for Cold Wave occurrence over India

- A build-up of a ridge (an extended area of relatively high atmospheric pressure) in the jetstream over northwest Asia;
- Formation of surface high-pressure over north & central India;
- Movement of cold air masses in response to steering by upper-level winds;
- Triggering mechanisms like a strong westerly waves approaching northwest India to enhance winds for transporting cold air southeastward; and
- Extensive snow covers over northwest Himalayas.

## 1.4 Cold Wave Trend in India

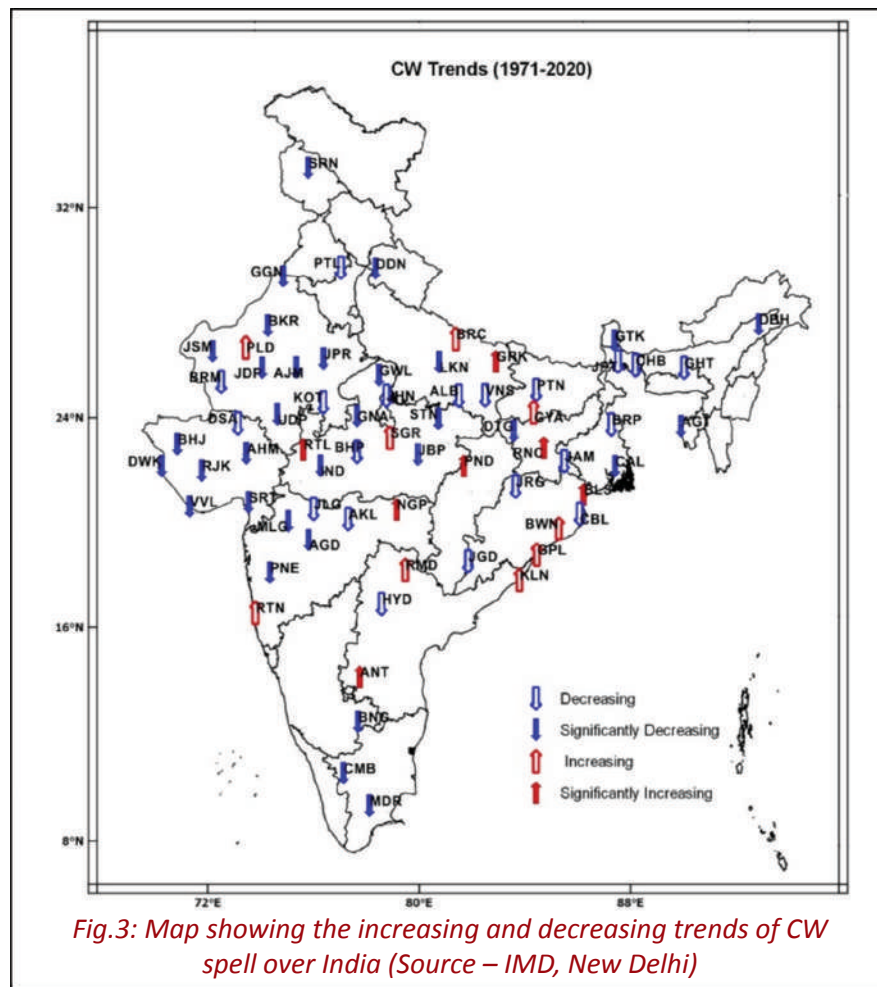
In general, scientists and policy makers across the globe are debating the issue of anthropogenic global warming which may lead to a decrease in the global occurrence of cold waves. However, instances of severe cold waves- in East Asia in 2016 or the recent cold wave in USA in 2021 gave rise to the discussion of cold waves occurring during the winter with the warmest recorded global mean Surface Air Temperature (SAT). While the East Asian cold wave is associated with atmospheric circulation regime, it mainly exhibited an extremely strong anomaly of the Ural Blocking High (UBH) and a record-breaking anomaly of the Surface Siberian High (SSH). However, because of the dynamic effect of Arctic amplification, anthropogenic global warming may increase the likelihood of extreme cold waves by shifting the responsible natural atmospheric circulation regime toward stronger amplitude. The probability of occurrence of extreme anomalies of UBH, SH, and East Asia mean SAT has been increased by 58%, 57%, and 32% respectively, as a consequence of anthropogenic global warming.

During the cold-weather season (November to March), many stations from north, northwest, east and central

India together named as Core Cold Wave Zone (CCZ) experienced the highest number of cold waves/ severe cold waves with relatively higher frequency during December-January.

Over India, the trend of cold wave was observed across 86 weather stations during the December-January-February season for the period 1971- 2020 as shown in Figure 3. It also shows falling/rising (blue/red arrows) trends in frequency of cold wave days in different parts of the country.

The frequencies of the occurrence of incidences of cold waves in different parts of the country for different periods are shown in Table 1.



*Fig.3: Map showing the increasing and decreasing trends of CW spell over India (Source – IMD, New Delhi)*

**Table 1 Average Number of Cold Wave days in India**

SN	State/UT	1991-00	2001-10	2011-19
1	Jammu and Kashmir	5	6	7
2	Himachal Pradesh	2	3	4
3	Punjab	6	7	3
4	Haryana	3	5	9
5	Delhi	4	5	4
6	Uttarakhand	1	1	1
7	Uttar Pradesh	2	4	6
8	Rajasthan	4	5	4
9	Sikkim	0	1	0
10	Assam	0	0	1
11	Madhya Pradesh	4	3	5
12	West Bengal	1	1	2
13	Bihar	3	4	6
14	Gujarat	2	3	1
15	Jharkhand	1	5	4
16	Odisha	1	2	3
17	Tripura	3	1	2
18	Chhattisgarh	3	3	6
19	Maharashtra	5	3	5
20	Telangana	6	4	6
21	Andhra Pradesh	1	7	7
22	Karnataka	0	0	0
23	Tamil Nadu	2	2	0
	<b>Total</b>	<b>59</b>	<b>75</b>	<b>86</b>

Source: IITM, Pune, 2019

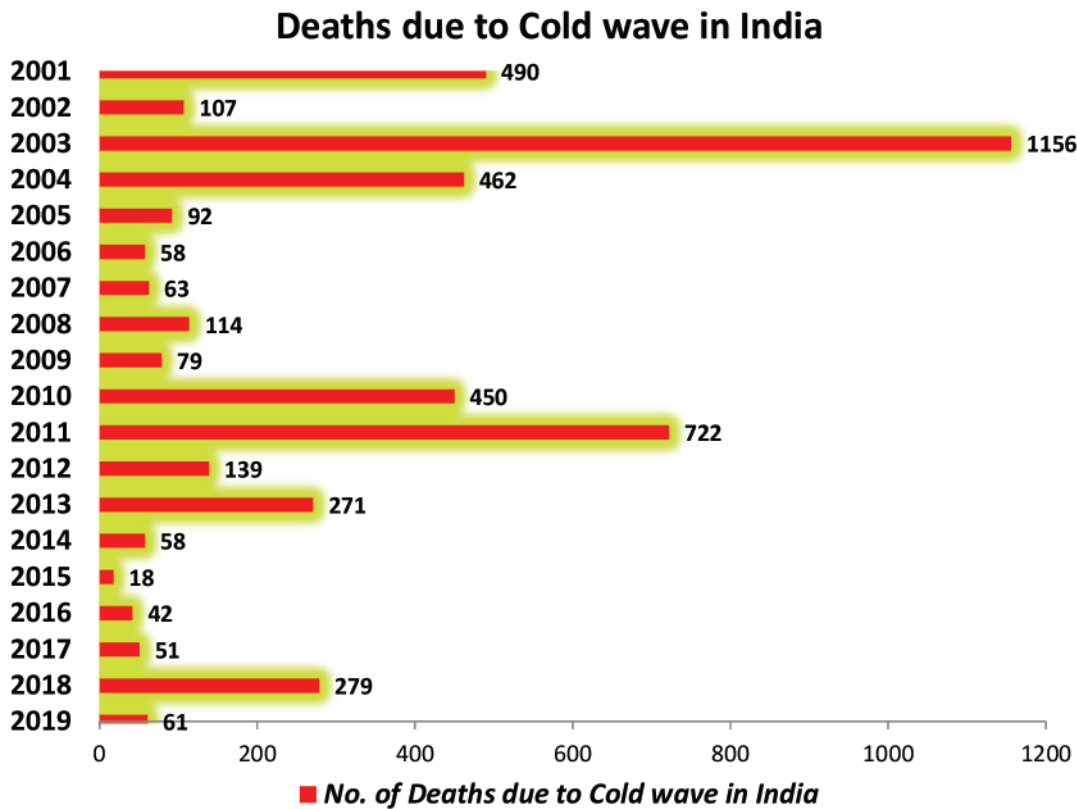
## 1.5 Impact of Cold Wave in India

Historically, cold wave was considered as ‘cold weather’ and treated as a mere seasonal change in India. As the occurrence of cold waves are limited to certain regions in the country, cold waves were more of a State responsibility and were treated as a local disaster that received less disaster preparedness or mitigation attention. Cold waves manifest on human health by increasing morbidity and death. This especially is severe in the homeless population. Cold wave also affects various service sectors including vegetable vendors, rickshaw pullers, daily wage workers, and roadside kiosk operators etc. Apart from impact on the population, it also affects many economic sectors. Details are given below.

### 1.5.1 Health

The impact of the cold wave on human beings can lead to death or injury. The mortality rates show a marked increase in areas with recurrent cold waves. Health issues are observed more commonly in

the elderly and neonates. In India, cold wave caused 4,712 deaths from 2001 to 2019 across various states. (Fig. 4)



*Fig.4: showing deaths from 2001-2019 due to Cold wave in India*

*Source: EnviStats India 2020, Vol. 1 Statement 4.06 (MoSPI),*

### 1.5.2 Agriculture

Cold wave and frost is a major factor that influences crop, horticultural plantations/orchard growth and productivity and has a significant impact on agriculture. As a result, the livelihood of people gets adversely affected. The extent of damage caused by a cold wave depends on temperature, length of exposure, humidity levels, and the speed at which freezing temperature is reached. Several crops and orchards in the north and northeastern regions of the country experienced the damaging effect of cold waves and frost. Low temperatures cause two types of injuries to plants. The first is chilling injury that occurs between 2°C and 0°C. The second type of injury is freezing injury, which occurs when the external temperature drops below the freezing point of water.

Cold waves affect certain stages of growth and development in plants more sensitive to low temperature than other phases, with dormancy generally representing the most tolerant stage. Reproductive organs are comparatively more sensitive to chilling and freezing stress. Likewise, seedlings are more sensitive than adult plants. Both elongation and greening of leaves are affected by cold. Limits of freezing temperatures and plant injury in general are given below:

**Light Frost/Freeze:** -1.7°C to 0.1°C – tender plants killed, with little destructive effect on other vegetation.

**Moderate Frost/Freeze:** -3.9°C to 2.2°C – wide destructive effect on most vegetation with heavy damage to fruit blossoms, tender and semi-hardy plants.

**Severe Frost/freeze:** -4.4°C and less – severe damage to most plants. At these temperatures, the ground freezes solid, with the depth of the frozen ground dependent on the duration and severity of the freeze, soil moisture, and soil type.

### 1.5.3 Livestock

A cold wave can also cause death and injury to livestock. During a cold wave, animals require a higher intake of nutrition which affects the hormonal level and efficiency of production. Often, if a cold wave is accompanied by heavy and persistent snow, grazing animals are unable to graze, hence requiring more fodder to be provided indoors. If the food is inadequate and if there is exposure to low temperatures, animals may die of hypothermia or starvation. Similarly, wildlife also experiences challenges during winter for both shelter and food. Cold wave factors override genetic factors for determining the fertility patterns in buffaloes. The optimum breeding season for buffaloes under north Indian conditions is from October to February. Extreme variations in temperature as experienced during December and January may affect the fertility rate in cattle. Cold environment increases the body glucose turnover and glucose oxidation, thus resulting in less production of ketones.

### 1.5.4 Fisheries

Extreme climatic conditions particularly in winter months when air temperature drops to 2-4°C and water temperature is between 10-15°C, adversely affects the growth of Indian major carps. The effect on overall health of stocked fishes may be more when such conditions prevail for a longer duration.

### 1.5.5 Transport

Cold wave or extreme cold weather affects the transport sector such as airways, river & seaport, roadways, railways, local transport etc. Rivers and lakes also freeze during extreme cold conditions affecting waterways and the resulting dense fog that can sometimes also lead to huge traffic jams, major accidents and delay which may cause health related complications and loss of educational/employment opportunity.

### 1.5.6 Energy or power

Energy or power sector receives too much pressure during extreme winter or cold wave season. During the cold wave season, energy consumption rises significantly. In hilly regions, electricity is the main source of heating in houses. Other energy sources like fuel, oil, coal are also in great demand during the cold wave season.

### 1.5.7 Water

Water sector is directly impacted by cold waves as it gets frozen due to extreme low temperature. Due to freezing, water supply may get disrupted. Other water dependent sectors can also be impacted if water supply gets disrupted. Other infrastructure are also impacted by cold wave conditions to varying degrees.

### 1.5.8 Tourism

Tourism sector bears both positive and negative impacts of cold weather. India receives a large number of tourists in the months of December and January, but extreme cold may also result in less number of tourists as well as additional challenges for the State Government and local administration for their health and safety.

### 1.5.9 Small street vendors

Small street vendors are highly affected due to exposure to cold waves and frost. This may affect their livelihood at the same time increase their physical exposure to cold wave.

## 1.6 Definition of Cold Wave and Frost

As per the India Meteorological Department's criteria, Cold Wave and Cold Day conditions are defined as:

### (A) Cold Wave:

It should be based on the actual minimum temperature of a station. Cold Wave is considered when the minimum temperature of a station is 10°C or less for plains and 0°C or less for hilly regions.

#### Based on Departure

- i) Cold Wave (CW): Negative Departure from normal is 4.5°C to 6.4°C
- ii) Severe Cold Wave (SCW): Negative Departure from normal is more than 6.4°C

#### Based on Actual Minimum Temperature (For plain stations only)

- i) Cold Wave: When the minimum temperature is  $\leq 04^{\circ}\text{C}$
- ii) Severe Cold Wave: When the minimum temperature is  $\leq 02^{\circ}\text{C}$

**Cold Wave conditions for coastal stations** - When minimum temperature departure is  $-4.5^{\circ}\text{C}$  or less over a station, "Cold Wave" may be described if the minimum temperature is  $15^{\circ}\text{C}$  or less.

### (B) Cold Day:

It should be considered when minimum temperature is 10°C or less for plains and 0°C or less for hilly regions.

- i. Cold day: Maximum Temperature Departure is  $-4.5^{\circ}\text{C}$  to  $-6.4^{\circ}\text{C}$
- ii. Severe Cold day: Maximum Temperature Departure is  $< -6.4^{\circ}\text{C}$

### Definition of frost/freeze warnings

Freezing point : The constant temperature in which the solid and liquid forms of pure water are in equilibrium at Standard Atmospheric Pressure. (source- Glossary of IMD, Pune)

Warning	Wind Speed	Air Temperature
Frost	Below 16 kmph	Below 0°C
Frost/Freeze	Below 16 kmph	Below 0°C
Freeze	Above 16 kmph	Below 0°C

Source: Katharine B. Perry, 2002, North Carolina State University



## 2

# Hazard, Vulnerability and Risk Analysis

HVRA analysis includes three basic steps as the name itself indicates – hazard analysis, vulnerability analysis and risk assessment. Hazard analysis includes identification of all hazards (based on historic records and recall of elderly, sometimes based on hazard simulation), analysing and estimating the possible intensity and the return period. Vulnerability analysis includes the vulnerability of various population groups, buildings (including private houses) and economic activities, etc. Risk is the product of the hazard and the vulnerability expressed in terms of 3-5 classes (Fig. 5). However, there are approaches available using community in creation of vulnerability analysis.

HVRA analysis is useful to understand and demarcate the areas which are prone to higher risk. By understanding risk thoroughly, one can analyse if the higher risk is caused by hazard or vulnerability. With this knowledge, the authority can propose risk mitigation measures (RMM), targeting specific hazards or vulnerabilities. In case the available financial resources are limited, prioritisation of RMMs can be carried out, by conducting a cost-benefit analysis.

## 2.1 Hazard Analysis

Due to India's vast geographical area, it is exposed to various kinds of natural hazards, viz., earthquakes, landslides, tsunamis, avalanches, GLOFs, floods, cold waves, wildfires, cyclones, etc. Cold waves are prominent in the northern parts of the country, along the Himalayas and western desert areas. In the current climate change regime, these weather-related events (like cold waves) are further aggravated. As per IMD, India's 'Core Cold Wave Zone' covers 17 States/UTs covering Punjab, Himachal Pradesh, Uttarakhand, Jammu & Kashmir, Ladakh, Delhi, Haryana, Rajasthan, Uttar Pradesh, Gujarat, Madhya Pradesh, Chhattisgarh, Bihar, Jharkhand, West Bengal, Odisha and Telangana. The figure 5 shows the areas affected by CW and SCW.

The maximum numbers of cold waves occur in Jammu and Kashmir followed by Himachal Pradesh, Punjab, Bihar, Haryana and Uttar Pradesh. These State authorities within the CCZ may

analyse the cold wave/severe cold wave durations and prepare SOPs to mitigate cold wave related negative impacts. IMD issues forecasts and warnings before the cold wave season starts. If the State/District authority lacks the technical manpower to conduct HVRA analysis, they can request the IMD for a detailed analysis of their area.

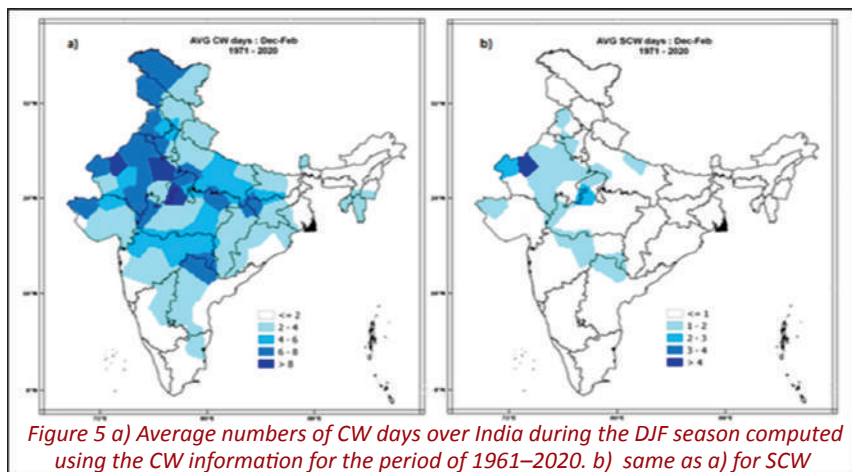


Figure 5 a) Average numbers of CW days over India during the DJF season computed using the CW information for the period of 1961–2020. b) same as a) for SCW

## 2.2 Vulnerability Analysis

The impact of hazard events such as cold waves, extreme cold waves, rainfall, snowfall, is substantial and represents an increasing threat over India. The extent of vulnerability (mild, moderate or intensive) and the probable estimate of damages to agriculture including animal husbandry due to cold wave of varying intensities must be included in the assessment report. Apart from the agriculture sector, many other sectors are affected by cold waves.

When it comes to economic sectors that are vulnerable to cold wave and related hazards; agriculture, animal husbandry and health are of primary importance. Human health is also vulnerable to the temperature drop. State Governments can identify the population in each district/village that are in the vulnerable groups. Population below 6 years and above 60 years can be considered vulnerable to cold wave and can be made beneficiaries to schemes designed for mitigating cold wave risk. Apart from the age groups, care needs to be taken to include people with disabilities, female-headed households, people under psycho-social care, people needing regular medication, etc. Workers who engage in economic activities in open areas need to be considered while disseminating the warnings. Similarly, sellers operating hand/push carts, open to sky shops/markets, also need to be included in the vulnerable groups.

Cold waves may also impact the efficiency and operation of other infrastructure like, Energy/(Power), IT/(Communications), Transportation, Banking & Finance, Government Services, Emergency Services, Water Supply/Management, Food production/security, etc. Assessment of each these sector's exposure to cold waves may be conducted. Action Plan and Standard Operating Procedures need to be prepared in order to minimise the impacts of cold waves and improve business continuity. Impact on each of these sectors will be different and SOPs need to be customised to suit the sector's needs. Transport sector in general and aviation sector in particular are prone to delays and stoppage due to low visibility caused by fog/smog.

## 2.3 Risk Analysis

With respect to a disaster, risk is specifically described using relative terms such as high-risk, average-risk and low-risk to indicate the degree of probability of the occurrence of the incident. Risk assessment includes an evaluation of all elements that are relevant to the understanding of the existing hazards and their effects on a specific environment. There are several steps involved in risk assessment based on the processes of hazard mapping and vulnerability analysis. They establish the nature, location and scale of risks to society and its assets. This information can assist decision makers in deciding what can and should be protected and up to which level.

Cold Wave Risk prone population can be assessed by counting the population in the vulnerable age groups, homeless, people with disabilities, etc., in the cold wave prone districts. Information from the Census of India can be considered for arriving at this number. Apart from this, people enlisted in the Below-Poverty-Line (BPL) population, beneficiaries of various other social schemes (both States and Centre) can also be considered as at-risk population. People engaged in vulnerable economic sectors need to be enlisted and provided information on remedial measures.

Special care needs to be taken to prevent fire accidents caused by heating pots within homes. This heating equipment, when unattended, may trigger fires, which may cause loss of life. These open fire pots may also contribute to carbon monoxide poisoning of the family members. There are many instances of lives lost because of carbon monoxide release in a confined space, as a closed room.

HVRA needs to be taken into consideration while preparing the action plan. Recommendations need to be worked out in consultation with each of the sector and responsible line departments.

# 3

## Early Warning and Communication

### 3.1. Early Warnings and Forecast

The India Meteorological Department (IMD), Ministry of Earth Sciences, is the nodal agency for providing current and forecast weather information, including warnings for all weather related hazards for optimum operation of weather-sensitive activities. It provides warning against severe weather phenomena like tropical cyclones, squally winds, heavy rainfall/snow, thunder-squall, hailstorm, dust storms, heat wave, warm night, fog, cold wave, cold night, ground frost, etc. It also provides real time data and weather prediction of minimum temperature, cold wave warning, extreme temperatures, and cold wave alerts for vulnerable cities/rural areas.

IMD issues forecasts & warnings for all weather related hazards including agromet advisory for farmers at local level in short to medium range (valid for the next five days) every day as a part of its multi-hazard early warning system. IMD has developed various mobile applications to share forecast warnings. These warnings, updated four times a day, are available at <https://mausam.imd.gov.in/>.

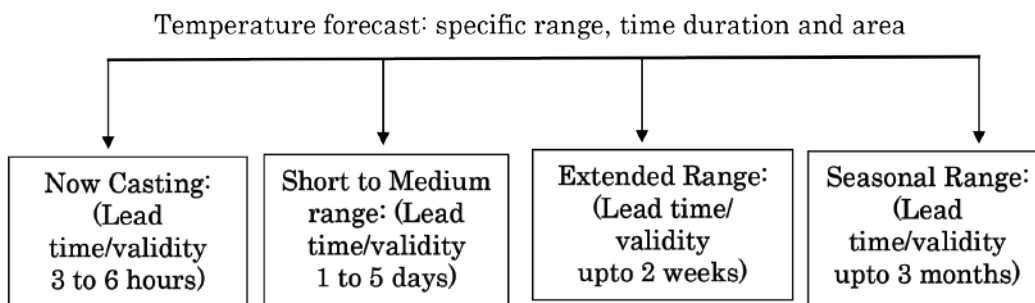
In addition, IMD also provides real time Interactive Map for temperature and cold wave on GIS platform ([http://imdgeospatial.imd.gov.in/Min\\_Temperature/#5/22.752/82.803](http://imdgeospatial.imd.gov.in/Min_Temperature/#5/22.752/82.803)). IMD issues special press releases whenever there is a possibility of severe cold wave conditions over any part of the country.

IMD initiated a multi-institutional initiative for cold wave/day monitoring & forecasting in collaboration with National Centre for Medium Range Weather Forecasting (NCMRWF), Noida, Indian Institute of Tropical Meteorology (IITM), Pune, Indian Space Research Organisation (ISRO) and Indian Air Force (IAF) with effect from 2016. A very detailed report is prepared daily by 1700 hours IST during 1st December to 28<sup>th</sup> February, every year, which includes all meteorological & satellite observations related to minimum temperature, cold wave, cold day, frost, fog, heavy rainfall/snowfall and forecast & warning for next one week. The same is displayed on the IMD website and disseminated to all concerned.

A bulletin in extended range with outlook for the next two weeks (for all hazards including cold wave) is issued every Thursday (available at <http://www.imd.gov.in/pages/extended.php>).

In addition, Seasonal Outlook for 1-3 months ahead for sub-divisional levels for minimum temperatures & its departure are also issued. These seasonal outlooks are issued in the form of a press release on the IMD website, and through electronic and print media. These are also provided to all concerned Chief Secretaries, Disaster Managers and to the health sector through the India Medical Association

(IMA). The operational system of weather forecasts and warnings is summarised in the chart below:



IMD utilises its resources to monitor round the clock forecast and warn against the adverse weather to the general public, disaster managers, media and other stakeholders. For monitoring the weather systems, IMD uses all types of synoptic charts, INSAT-3D Rapid half hourly imagery every 10 minutes, Doppler Weather Radar (DWR) produces for Srinagar, Patiala, Delhi, Lucknow, Jaipur and Bhopal to disseminate short to medium range forecast that indicates the potential areas at risk with the probability of occurrence of the phenomena. It also broadcast snowcast that provide specific information about the place and time of occurrence. Various Numerical Prediction Models like IMD GFS, WRF, ECMWF, NCMRWF, NCUM, GEFS and various international models are utilised for this purpose.

### 3.2. Impact Based Forecast - Warning for Cold Wave

As stated earlier, cold wave has adverse impact on many sectors like agriculture, energy, transportation, infrastructure, in addition to human health. IMD and NDMA have developed an impact-based early warning system using colour coding. IMD currently follows a single system of issuing forecasts & warnings for the entire country through the colour code system as given below. This system advises on the severity of an expected cold wave/cold day hazard and possible actions to be undertaken.

#### Colour Code early warning

Colour code	Alert	Warnings	Impact	Suggested Action
Green (No Action)	Normal day	Minimum temperatures are near normal	Comfortable temperature.	No precautionary action required.
Yellow Alert (Be Updated)	Cold Wave Alert	Cold wave conditions in isolated areas persist for two days.	<ul style="list-style-type: none"> <li>Moderate temperature. Chilly winds may aggravate cold at time.</li> <li>Cold is tolerable but mild health concern for vulnerable people. (Infants, pregnant women, elderly, people with chronic diseases etc.)</li> </ul>	<ul style="list-style-type: none"> <li>Avoid prolonged exposure to cold.</li> <li>Wear several layers of loose fitting, light weight; warm woollen clothing rather than one layer of heavy cloth.</li> <li>Cover your head, neck, hands and toes adequately as majority of heat loss occurs through these body parts.</li> </ul>
Orange Alert (Be Prepared)	Severe Cold Wave Alert	(I) Severe cold wave conditions persist for two days.	<ul style="list-style-type: none"> <li>An increased likelihood of various illnesses like flu, running/ stuffy nose or nosebleed,</li> </ul>	<ul style="list-style-type: none"> <li>Listen to radio; watch TV, read newspaper for weather updates/ forecasts.</li> </ul>

		<p>(II) Though not severe, cold wave conditions persist for four days or more.</p>	<p>which usually set in or get aggravated due to prolonged exposure to cold.</p> <ul style="list-style-type: none"> <li>• Do not ignore shivering. It is the first sign that the body is losing heat. Get indoors.</li> <li>• Frostbite can occur due to prolonged exposure to cold. The skin turns pale, hard and numb and eventually black blisters appear on exposed body parts such as fingers, toes, nose and or earlobes.</li> <li>• Severe frostbite needs immediate medical attention and treatment.</li> </ul>	<ul style="list-style-type: none"> <li>• Wear insulated/waterproof shoes.</li> <li>• Moisturise your skin regularly with oil, petroleum jelly or body cream.</li> <li>• Eat healthy fruits and vegetables rich in vitamin-C and drink lots of fluids to maintain adequate immunity.</li> <li>• Avoid or limit outdoor activities.</li> <li>• Keep dry, if wet, change clothes immediately to prevent loss of body heat.</li> <li>• Warm the affected area of the body slowly with lukewarm water; do not rub the skin vigorously.</li> <li>• If the affected skin area turns black, immediately consult a doctor.</li> <li>• Maintain ventilation while using heaters to avoid inhaling toxic fumes.</li> <li>• Take safety measures while using electrical and gas heating devices.</li> <li>• Don't drink alcohol. It reduces your body temperature.</li> <li>• Drink hot drinks regularly.</li> </ul>
<p>Red Alert (Take Action)</p>		<p>(I) Severe cold wave conditions persist for more than two days.</p> <p>(II) Total number of cold wave/severe cold wave/days exceeding six days.</p>	<ul style="list-style-type: none"> <li>• Severe exposure to cold wave can lead to Hypothermia; a decrease in body temperature which causes confusion, shivering, difficulty in speaking, sleepiness, stiff muscles, heavy breathing, weakness and/or loss of consciousness. Hypothermia is a medical emergency that needs immediate medical attention.</li> </ul>	<ul style="list-style-type: none"> <li>• Along with suggested action for orange alert, extreme care needed for vulnerable people.</li> <li>• Regularly check on elderly neighbours, especially those who live alone. Stay indoors, if possible. Avoid unnecessary exertion.</li> <li>• Locate designated public shelter nearby.</li> <li>• In case of electricity or heating mechanism failure, take the affected person to such designated shelters.</li> <li>• Seek medical attention as</li> </ul>

			<ul style="list-style-type: none"> <li>• Frost and cold wave affect pulse crops and livestock.</li> </ul>	<p>soon as possible for someone suffering from frostbite/Hypothermia.</p> <ul style="list-style-type: none"> <li>• Do not give the affected person any fluids unless fully alert.</li> <li>• Store adequate water as pipes may freeze.</li> <li>• Move pets indoors. Likewise, protect livestock or other big animals from cold weather by moving them to an enclosure.</li> </ul>
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Source: IMD and NDMA

### 3.3. Early Warning Dissemination and Communication Strategy

The early warning of an extreme weather event can lead to enhanced preparedness and response from the local authorities. The efficacy of the early warning systems rests on four key elements namely risk knowledge; an apex technical monitoring and warning service; communication and dissemination of warnings; and community response capability. In any given location the Risk is a combination of hazards and vulnerability. Early warning services relying on science are the mainstay of IMD in India which provides 24-hrs alerts by continuous monitoring of climate data.

In addition, it is equally crucial how the warnings are disseminated by various means to the end user. While popular media is one of the major means of dissemination of early warning, local governments may also innovate on how to disseminate warning. Community being the first responder to any disaster, it is necessary that programmes may be developed to build the capacity of the local community to interpret and act.

Early warning/alert communication and dissemination strategy, capacity building, public awareness, community outreach and Information Education Communication (IEC) at various levels will be discussed in Chapter-7.

## 4

# Dealing with Cold Wave and Preparing an Action Plan

## 4.1. Cold Wave and Disaster Management

“Disaster” is defined under section 2(d) of the Disaster Management Act, 2005 as a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, and is of such a nature or magnitude as to be beyond the coping capacity of the affected area.

Considering the importance of reducing the impact of cold wave, the Government of India notified ‘cold wave’ as a disaster and the Ministry of Agriculture as the nodal Ministry for cold wave/ frost. The Government of India approved the inclusion of cold wave/ frost O.M No. 32-3/2010-NDM-1 dated 13<sup>th</sup> August 2012 in the list of eligible natural calamities in the guidelines for assistance from SDRF and NDRF for damages in agriculture sector only. The following conditions/ criterion will be taken into account while considering the assistance from SDRF/ NDRF for the calamity of cold wave / frost:-

- a. Severe cold wave conditions would be said to prevail in an area:
  - i. If minimum temperature is lower than 7°C in an area where normal minimum temperature is 10° C or above; and
  - ii. If minimum temperature is lower than 5°C in an area where normal minimum temperature is less than 10°C.
- b. Frost conditions would be said to prevail when temperature falls below 0°C in an area where it is an abnormal phenomenon during the kharif/ rabi season.
- c. For declaring a district affected by frost/ cold wave conditions by the State Government concerned, the meteorological data on departure of normal minimum temperature in the affected area, as released by the India Meteorological Department (IMD) shall be taken into consideration, for prevalence of frost/ cold wave conditions.
- d. According to the existing norms, areas which suffer crop loss of 33% or more due to cold wave/frost conditions will be eligible for assistance from SDRF/ NDRF, as allowed in the case of damage due to drought, hailstorm, pest attack and other natural calamities. Similarly, animal husbandry, including the poultry sector, would get assistance from SDRF/ NDRF in the wake of cold wave/frost.

The Inter-Ministerial Central Team (IMCT) needs to make a field visit for assessment of damage to agriculture and horticulture due to cold wave/ frost and shall take into consideration of all factors such as crop cutting experiment, fall in normal production, Normalized Differential Vegetation Index (NDVI), status of crops in the affected area, crops sown in the area affected, the vulnerability of the cold wave/ frost on standing agriculture/ horticulture crops etc. in the guidelines.

## 4.2. Rationale for Cold Wave Action Plan (CWAP)

Cold wave especially affects the health sector; hence health systems and agriculture are required to be given more importance.

Cold waves can lead to injury or death. They also cause enormous financial and economic losses. The impact of cold wave has received immense attention in the media; but, the management aspect of cold wave has not been paid adequate attention. Concerted effort needs to be channelled into the management of cold wave.

## 4.3. Objectives of Guidelines

The guidelines for preparing the Cold Wave Action Plan aims to provide a broad framework for developing an action plan at the State level and local level. The guidelines draw upon on the Sendai Framework on Disaster Risk Reduction emphasises on all aspects of disaster management like mitigation, preparedness, early warning and communication, IEC campaign, capacity building & training. With the focus on different sectors and defined roles and responsibilities, the cold wave guidelines will help the States to limit the mortality and economic loss due to cold wave.

## 4.4. Key Strategy for Cold Wave Management

Severe and extended cold wave can also cause disruption to general, social and economic service. As cold wave/frost is a localised disaster event, location-specific strategies are to be drawn up by the State Governments. Government agencies will have a critical role to play in preparing and responding to cold wave at the local level, working closely with agriculture, health, livestock and other related departments on a long-term strategic plan. The strategy for cold wave management comprises of:

- (i) Identification of cold wave risk and vulnerability assessment;
- (ii) Establishing qualitative early warning, forecasting and alerts dissemination;
- (iii) Develop inter-agency coordination at different levels;
- (iv) Preparedness at the local level;
- (v) Structural & non-structural measures including cold wave related programmes/schemes;
- (vi) Public awareness and community outreach;
- (vii) Capacity building and training programmes;
- (viii) Collaboration with private, non-government organisations and civil society;
- (ix) Research & Development; and
- (x) Assessing the impact
- (xi) Receiving feedback for reviewing and updating the plan.

## 4.5. Acclimatization

Those who come from a hotter climate to a cooler climate, especially during the cold wave season, are at risk. Early warnings of minimise the impact of cold waves. An early warning message helps people to avoid moving out in open area and ensures preparedness, prevention and mitigation measures for cold waves. This helps the body get acclimatized to cold. Acclimatization is achieved by gradual exposure to the cold environment during a winter season.



## 4.6. Steps to Develop an Action Plan

### Step 1: Government Engagement

Preparing a Cold Wave Action Plan requires participation from State and district governments, municipal health agencies, disaster management authorities and local partners. The State should constitute a dedicated cold wave committee chaired by the State Disaster Management Authority and will have representatives from all other relevant departments such as health, agriculture, animal husbandry etc.

### Step 2: Appointing a State Nodal Agency and Officer

The State should appoint a nodal officer at the State or district levels, and depute an agency to oversee the Cold Wave Action Plan. It should also build the capacity of key officials and agencies to recognise their roles in the State Action Plan. The State Nodal Agency and Officer can then conduct table-top exercises, simulations, and drills before the winter season as well as identify and resolve communication gaps between participating departments, partners and the public.

### Step 3: Vulnerability Assessment and Mapping

It is important to identify vulnerable areas and populations in order to establish priorities for wave warning/alerts and activities. The State should coordinate with the India Meteorological Department (IMD) to develop a local forecast warning and alert systems with the help of local government departments. Identifying local academic/research institutes like agriculture universities, medical colleges can provide additional useful partners for coordination.

### Step 4: Drafting and Developing the Cold Wave Action Plan

The State Nodal Officer and Agency can coordinate with the local IMD office for receiving winter season forecasts from November to February and set up the early warning and daily alert system with colour codes based on predicted lower daily temperatures relative to different local normal temperatures.

### Step 5: Team Preparation and Coordination

Governments should ensure that the State officials and agencies are well prepared for the winter season, key officials are well-trained and have information regarding pre, during and post cold wave (winter) season activities. Team members have to develop a clearly defined interagency emergency response plan with roles and information flows clearly marked out.

### Step 6: Implementation and Monitoring

While the government departments (and partners) are responsible for implementing many components of a Cold Wave Action Plan, the public should be made aware of how to prepare and respond to cold wave. Information, Education and Communication (IEC) plays an important role in widely disseminating key messages to communities in advance. Specific messages should be developed to cater to vulnerable groups such as elderly, young children, outdoor workers and slum residents. "Do's and Don'ts" during a cold wave should be available in local languages and disseminated through media, including social media and SMS in a manner that is easily accessible by vulnerable sections of the population.

**Step 7: Evaluating and Updating the Plan**

The approach towards severe cold wave risk reduction must be flexible and the plan should be frequently updated to deal with unintended consequences. There should be frequent evaluation to determine if the strategies to deal with cold wave are effective, such as traditional remedies for mitigating cold that includes eating hot food and drinking water. After every winter season, the State must assess the efficacy of the Cold Wave Action Plan, including the processes, outcomes, and impacts. Stakeholders should then identify changes and improvements needed for managing the next cold wave (winter) season. The plan should be revised and updated as required. The changes carried out should be brought to the notice of key officials and other stakeholders.

**Step 8: Strategies for Reducing Cold Wave exposure and adapting to Climate Change**

States should consider mitigation strategies to reduce the impact of cold wave, such as increasing the number of temporary shelters for homeless with adequate food, water, and medicine; advance planning and uninterrupted power supply; implement crop contingency plan; arrange sufficient food and shelter for animals, and effective traffic management during dense fog. Vulnerability assessment should also consider climate change scenarios wherever possible.

## 5

# Prevention and Mitigation measures

Knowledge of effective prevention and mitigation measures is crucial for survival and to contain damages caused by cold waves. The strategy envisages the development and implementation of a policy framework on disaster risk reduction from a holistic perspective, which emphasizes on prevention, mitigation and preparedness in pre-disaster phase. The guidelines would facilitate effective mitigation in tune with an ecosystem-based approach to disaster risk reduction.

The prevention and mitigation strategies need to be both structural and non-structural. While the former generally indicates investment made on physical constructions or other development works (such as engineering measures and construction of hazard resistant / protective structures), the latter refer to soft measures such as awareness creation and education, policies strengthening techno-legal systems and practices, training, capacity development etc.

## 5.1. Preventives Measures

It has been observed that the States affected by cold waves and frost have been taking necessary measures as per their understanding and experience. Hill States feel that they have a better understanding of local conditions and they are better prepared for cold waves than that of States in northern plains because hilly States know how to live with extreme cold conditions but States in plains face it for a short duration so they face more severe impact of cold waves.

Measures to manage cold wave have been in place by the local state/ district level administration. Some of the general and prevailing measures adopted by cold wave prone states, which may be useful for other States too:

- Identification of vulnerable areas and preparation of Winter Action Plans covering all sectors;
- Timely dissemination of early warning to all concerned stakeholders;
- Regular and frequent meetings of administration at all levels;
- Ensure adequate quantity of supplies of food, drinking water, fuel, and medicines etc.;
- Well planned out and timely arrangements for day and night shelters for the homeless;
- Preparations for necessary medical facilities to handle cases of cold wave victims;
- Arrangements of Rescue Teams linked with CATs Ambulance to facilitate transportation of needy persons to hospitals;
- Creating and publicising helpline numbers for people to contact authorities and get required help;
- Advance planning to ensure uninterrupted power supply;
- Preventing crops from cold waves and also promoting cold weather sustainable crops; and
- Issue of advisories for common people to help them keep safe from cold waves.

## 5.2. Mitigation Measures

It is important for both the hilly States and those in plains to prepare mitigation measures for cold waves and related issues; and develop time-bound strategies accordingly. Some of the important mitigation measures are listed below.

**Agriculture Sector – Prevention and Mitigation Measures:** Farmers are to provide light irrigation as per need, immediately prune damaged tips of branches or shoot, burn leaves/waste material in the orchard to create smoke and manage rejuvenation of damaged crops through pruning of dead material, application of extra doses of fertilizer through foliar sprays. Some important mitigation measures are:

- Thermal insulation by the application of locally available organic mulches will reduce the cooling rate of soil surface and keep the soil warm;
- Air mixing by running fans in orchards will help in breaking inversion layers and allow free mixing of cold air with warm air;
- Provision of heat through heaters/fire between the rows and creating an air blanket of smoke particularly in orchards by collecting and burning dried weeds/wood etc., shall trap the outgoing long-wave radiation and the fall in temperature is reduced to a great extent (greenhouse effect);
- Sprinkler irrigation to release latent heat of fusion by releasing heat into the surrounding air through condensation of water droplets;
- Cultivation of cold/frost resistant plants/crops/ varieties in frost prone areas should be popularised to minimise crop loss;
- Application of growth regulators and chemicals to enhance resistance to cold stress may also prove helpful;
- Planting of wind breaks/shelter belts around orchards in cold wave prone areas. This will reduce the wind speeds and the wind chill effect in the leeward side besides minimising the sensible heat losses from the protected crop;
- Mixed cropping of vegetables, viz., tomato, brinjal with a tall crop like mustard / pigeon pea will provide necessary shelter against cold winds;
- Other agronomic practices such as raising nursery under partial shade of trees or in between tree rows, multi-storey/mixed plantations and pruning of undesirable twigs/branches for in-situ use as mulch. Providing plant cover shade will also give considerable protection (greenhouse effect).

### Practices to Rejuvenate Frost Damaged Orchards

The package of practices for rejuvenating frost damaged plants includes:

- Prune the affected parts of the plants at the end of February or early March. While doing so, also cut a few centimetres of the living tissue of the limb/branch being pruned. Apply Bordeaux paste to the cut ends which are more than 2.5 cm in diameter;
- Spray these plants with Bordeaux mixture (2:2:250) or copper oxychloride @ 1.5 kg/550 litres of water after pruning so as to block infection of the wound;

- Irrigate the frost affected plants soon after pruning, if it is available;
- Apply nitrogenous fertilizer before irrigation to encourage new growth on the affected plants based on soil test results;
- Remove water sprouts from the main trunk of trees to encourage the fresh growth from the top;
- Application of P and K to soil to activate better rooting and sap flow in the plants; and
- Application of farmyard manure also helps in improving nutrient management besides improving soil thermal regime.

### Health Sector – Prevention and Mitigation Measures

In order to minimise cold weather health impacts, high risk groups like senior citizens (>65 yrs) / young children (0 to 5 yrs), homeless citizens, persons with chronic illness (cardiac/respiratory), and psychiatrically debilitated should be given extra care. Also, extra effort needs to be given to the sick, injured, and wounded individuals as they are very susceptible to cold injuries. Director/In-charge of Hospitals CHCs and PHCs in all States/Districts should ensure that the following measures are in place:

- A detailed action plan to tackle cold wave illnesses well in advance of winter months;
- Operational framework - preparing specific health adaptation plan, development of guidelines and response plan for climate sensitive diseases (CSD);
- Need for updating cold wave health action plan, and issuing advisories for hospital preparedness, surveillance and weekly monitoring, including capacity building;
- Promoting strategic media coverage of climate and health linkages at the State level in regional languages to increase support for climate mitigation and adaptation responses;
- Standard Operating procedures to tackle all levels of cold-related illnesses.
- Develop a standard cold wave Treatment Protocol;
- Identify surge capacities and mark the beds dedicated to cold wave affected patients;
- Ensure adequate arrangements of staff, beds, essential medicines and equipment;
- Health centres must undertake awareness campaigns for neighbourhood communities using different means of information dissemination;
- Primary health centres must refer the patients to the higher facility only after ensuring adequate stabilisation and basic definitive care;.
- Hospitals must ensure proper networking with nearby facilities and medical centres to share the patient load which exceeds their surge capacities; and
- All cases of cold-related illnesses (suspected or confirmed) should be reported to IDSP (Integrated Disease Surveillance Programme) unit of the district.

In case, someone is affected by cold wave, the victim may be covered with dry, insulating materials in a warm environment (blankets, sleeping bags, and space blankets). Block any source of cold wind and keep the victim dry. Also, hot water bags, warmed rocks or heat packs may be applied to high circulation areas. Immersing the victim in a hot water bath and sharing body heat from another person helps to manage cold weather-related health impact.

## Animal Husbandry

Some of the preventive measures that can help reduce the impact of cold weather include:

- Improving livestock feeding practice and dietary additives;
- Selecting animal breeds especially fit for cold weather conditions;
- Use of high-quality forage or pastures;
- Fat supplementation in rations;
- Construction of climate-smart sheds that allow maximum sunlight during winters and low radiation during summers;
- Covering the animals especially smaller ruminants during cold days;
- Cover the animal habitat from all sides during the night to avoid direct exposure of animals to cold winds; and
- Using some bedding materials such as dry straw under animals during winters.

**Veterinary infrastructure and expertise need to be arranged/upgraded by the States which may also include:**

- Deployment of adequate number of veterinarians and para- veterinarians in cold prone areas
- Arrangement of mineral mixtures, lifesaving drugs, fluids and other medicines and equipment in veterinary hospitals at all times
- Activation of mobile veterinary units
- Conducting awareness programmes in respect of cold management of animals
- Identifying disposal sites for dead animals
- Liaison with other stakeholders/agencies wherever required

## Homeless and Urban Poor

The urban poor and migratory labourers who are homeless are especially vulnerable to cold waves. In that, the subgroups of aged, children, substance-abusers are especially vulnerable to cold wave spells. As the migration from rural to urban areas increases each year there is an overall deficit in housing and shelters for the urban poor. Following activities are undertaken to mitigate cold weather impacts on urban poor

- To provide shelter to the homeless in Rain Baseras/Vishram Grah throughout the year
- To provide a comfortable stay with basic facilities for homeless residents;
- To put up shelters at a strategic potential location for meeting the requirement of shelter-less
- To make additional arrangements during the winter season under “Winter Action Plan”
- To make arrangements to shift homeless from open area roadsides to nearest shelter during winter season under rescue program

## 6

# Preparedness and Response Measures

The primary focus is to enable the decision makers to find solutions on the availability of equipment and human resources required to combat any emergency situation that may arise. Following preventive and mitigation measures, and in order to address the residual risks of cold waves, various preparedness measures need to be put in place by disaster management authorities, followed by effective response in order to meet the challenges posed by cold wave and related threats. Respective agencies should be prepared to respond in their respective sectors.

India Disaster Resource Network (IDRN) is a web enabled data base that to collect and collate information on resources available in the country/State/District for emergency response and to enhance the decision-making capabilities of Government functionaries. IDRN is accessible to the Emergency Officers, District Collectors and other disaster managers at various levels of Government. The system gives the location of specific equipment/specialist resources as well as the controlling/owning authority for the resource so that it can be mobilised for response in the shortest possible time.

Disaster response measures should aim at rescuing those who are affected or likely to be affected by hazards. This involves minimising the impact of injuries, loss of life and damage to agriculture and other economic activities and the environment. Usually, disaster response is carried amidst periods of heightened stress and often with constraints of time, information and resources. Apart from addressing the immediate needs and functions of search and rescue, it also involves the activation and coordination of various lifeline systems.

Effective preparedness and response requires planned sectoral interventions. Following are the major areas of intervention with some broad action points towards preparedness and response. Details of the required actions are provided in Chapter 9 (Roles and Responsibilities):

- **Advisories and Early Warning:** Timely advisory and early warning in coordination with IMD can prevent likely loss of lives or damages due to cold waves.
- **Health and Medical Facilities:** Saving loss of lives and preventing cold wave related illnesses are top priorities; adequate health and medical facilities are necessary to deal with cold wave impacts.
- **Agriculture:** Impact of cold waves on Agriculture is huge and significant. Protection of crops and plants from cold wave / frosts is crucial.
- **Animals and Livestock:** Protection of animals and livestock is also important as they are part of livelihood for large number of households.
- **Energy:** Role of Power/Energy is vital in management of cold waves. Uninterrupted power supply helps in keeping the internal environment warm and it also helps in medical and health services.

- **Water Supply:** Prevention of water from freezing during extreme cold and to ensure normal water supply is very essential.
- **Transportation and Traffic Management:** Clearing of snow and taking safety measures during fog are some of the important measures to be taken for cold waves.
- **Tourism:** Tourism has both positive and negative impacts of the cold waves. It is important to ensure that positive impacts continue whereas the negative impacts are checked and controlled.

### 6.1. Community/Family preparedness during cold wave

Community/Family should be adequately prepared for meeting the challenges of cold wave. Community/local level preparedness plan, and IEC activities to create awareness among the community members is essential. As part of the awareness or community & families special focus should be paid to the following do's and don'ts. A detailed list of Do's and Don'ts is in Annexure-1

- Assess the risks where you live, work, study and (kids) play
- Assess individual capabilities and needs
- Keep emergency contact and health information available
- Know your building exit routes
- Make hazard-specific plans about whether to stay or go and where to shelter (applicable for other hazards as well). Learn the location of cold wave-shelters or temporary housing.
- Respond to early warnings issued by competent authority. Learn and participate in your community's early warning systems and practise regular emergency mock-drills
- Construct your home in a safe place in compliance with building regulations
- Take annual home maintenance measures to keep your home safe
- Know your building well and identify places that may fail due to snowfall or heavy precipitation
- As keeping hot-pots and other heating mechanisms is common during cold wave, practices home fire prevention methods
- Protect your domestic animals and livestock
- In case of power outage, take fire precautions
- After hazard impact, after making sure you're safe, help those around you.

*Source: IFRC - Key Messages for All-Hazards Household and Family Disaster Prevention*



# 7 Information Education and Communication (IEC) - Strategy for Management of Cold Waves

## 7.1. Key Components of IEC Strategy

Cold Wave related Information Education and Communication should aim to reach the last person as soon as possible.

- The Communication Strategy should be based on insights and needs of the local population while selecting the following:–
  - Messages;
  - Messenger / Medium / Media; and
  - Nature of the Receiver with specific messages for the most vulnerable
- It should aim at promoting a culture of DRR and behavioural change in public.
- It should focus on reaching out to the most vulnerable such as the poor, homeless, elderly, disabled, pregnant or lactating mothers, etc., with specific messages for these groups. In addition, the targeting may be further sub-categorised (if needed) such as Urban Poor and Rural Poor as they are living in different situations.
- Do's and Don'ts / safety tips should be specifically drafted for the first responders for identifying symptoms in affected persons & actions to be taken for different symptoms. Research Methodology, Rapid Appraisals and Communication Gap Analysis techniques should be used for better understanding of-
  - Vulnerable groups;
  - behaviour patterns or tendencies;
  - media consumption; and
  - local trends of the vulnerable population.
- Based on this, the IEC Campaign should identify optimal ways to reach out to the target groups.

## 7.2. IEC Activities and Awareness Campaigns

Communication plans should be prepared based on robust communication strategy and research insights. Following are the salient features of a communication plan:

- Target specific, and implementation oriented;
- It should cover all the phases –research, development of concept, media planning, development of relevant IEC material such as short films, posters, print ads, social media posts, talking points for interpersonal communication, etc.;

- The plan can be divided into pre- cold wave activities, during cold wave and post cold wave phases;
- Since the main objective of the IEC Campaign is readiness and preparedness, the campaign should be planned in a way to start much before the commencement of the cold wave season. It should reinforce its messages during the cold-wave season and should have space for review after the cold wave season.
- The scope of the IEC activities can be defined based on at what level viz; National, State or local, the campaign is organised.

Following are the activities for each of the levels. These activities are suggestive in nature and should be amended as per the need of the hour.

### **National Level**

- If possible, all the stakeholders such as Disaster Management Authorities, departments and agencies of health, municipal administration, education, labour, police, etc., should co-opt a single campaign for consistency of messaging;
- Prototypes of IEC materials of all forms may be shared with the State and local administrations for reproduction in local languages or as reference content for local IEC material; and
- Mass awareness campaigns involving print, TV, radio, social media, etc., reaching out to all the vulnerable areas / regions / States.
- Separate list of Do's and Don'ts and safety tips should be targeting vulnerable sections of the society such as women, pregnant women and lactating mothers, children, poor, homeless, elderly, handicapped, outdoor workers, managers of night shelters, farmers etc. agriculture sector (field and horticulture crops), and livestock sector;
- In case the campaign is to be endorsed, it should be by a nationally renowned eminent personality.

### **State Level**

Apart from the activities planned at the National level above, the State may -

- Carry out mass awareness campaigns in local languages;
- Develop media and communication strategies and plans considering local socio-economic and behavioural factors;
- Involve recognised artists of the state, such as folk singers, dancers, and other performers;
- Conduct regular awareness programmes in all the districts;
- Conduct regular training programmes for interpersonal communication activities; and
- Identification and first-aid of cold disorders in both human beings and animals need to be addressed under all campaigns and State programmes on cold waves.

### **District/Local Level**

The local authorities, due to their proximity to the cold wave prone population are in the best position for carrying out IEC activities and last mile delivery of messages. They may -

- Conduct regular training and awareness programmes including demonstrating the safety tips to the vulnerable population in their local language, using local customs, cultural aspects

and behaviour patterns. Local artists and art-forms may be utilised for entertainment based education programmes;

- IEC tools and materials (such as flyers, calendars, comic books, etc.) should be made available for field level functionaries for dissemination to local people;
- Strengthen and involve local communities such as RWAs, Municipal bodies, NGOs, Civil Society Organizations, Panchayati Raj Institutions, Anganwadis, Gram Sabhas, Police, medical professionals and other local networks;
- Closed group messaging services such as WhatsApp may be extensively used by these local community groups;
- Give special emphasis to dissemination in locations of “closed homogeneous groups” such as schools, colleges, offices, cinema houses, construction sites, agricultural markets etc.;
- Carry out special awareness programmes for specific occupations (farmers, horticulturists, livestock rearers, construction & other outdoor workers, etc.) and vulnerable groups making them aware of impacts and the preventive and curative measures to be adopted in the event of a cold wave.

### 7.3. Dissemination of Warning Messages

In addition to the IEC awareness campaign, activities towards wider dissemination of the early warning for severe cold waves should be undertaken with short, clear and action oriented messages. Some of the points to consider with respect to Early Warning Messages are as follows:

- a. **Content of warning messages:** The warning messages from agencies such as IMD should contain the safety direction to be followed along with generic suggested actions, for example, the messages for Severe Cold Wave may ask the public to remain indoors, use hot beverages etc;
- b. **Dissemination of warning messages:** Target audience specific actions should be undertaken by the Health/Municipal/Labour/ Police/ Education department, Disaster Management agencies based on severity/duration of the warnings for vulnerable groups such elderly, women, children, farmers, outdoor workers etc.;
- c. Multiple mediums should be used for dissemination of the warning messages.

## 8

## Capacity Building

**8.1. Capacity Building and Training Programmes**

Capacity building is an on-going process that equips officials, stakeholders and the communities to perform their functions in a better manner during a crisis/disaster. It includes human resource development, i.e., individual training, organisational development for improving the functioning of groups and organisations and institutional development.

As cold wave/frost is a localised phenomenon, the State Governments must draw up location specific training and capacity building plans, focus on sector specific stakeholders/target groups including senior/middle level officers/staff, media personnel and respective District Disaster Management Authorities (DDMAs), local authorities (PRIs and ULBs) and NGOs. The State ATIs and SIDM /DMI under the guidance of SDMA at state level will also organise training of concerned officials and stakeholders.

Locally generated, owned and sustained capacity is essential for the effective management of cold wave and frost conditions. Sector-specific programmes for various stakeholders including medical officers, community health staff, health care professionals, agriculture officers, veterinary officers, NGOs, District Administration and Community needs to be developed and regular training needs to be imparted. Regular training is also required for Fire Departments, as it has been noticed that during the cold wave period incidences of fire break-out are very high.

Capacity building and training programme additional focus for health care professionals at local level to recognise and respond to cold-related illnesses, particularly during extreme cold events. These training programmes should focus on medical officers, paramedical staff and community health staff so that they can effectively prevent and manage cold-related medical issues to reduce mortality and morbidity.

The local authorities need to retain stock of essential items to tide over the lean period of supply. The dense fog associated with cold wave limits the movement of traffic, both road and air. Hence, particular attention needs to be provided for traffic management. With the onset of winter, disaster management authorities at the State and district level should issue advisories for better management of cold waves. All the institutions involved in cold wave management must document their lessons learned and draw upon them to refine the management this year. Hence, for cold wave management, both change management, as well as knowledge management, is important.

Cold waves are common in the plains of north India with foggy conditions that prevail during the winter season for several days or weeks at a stretch. It affects the day-to-day life of local people. During a cold wave, common issues like electricity failures, roadblocks and health issues are reported commonly in the media. A cold wave with heavy and persistent snowfall causes crop damage and a shortage of food for grazing animals. Fire incidences are also common during the winters.

## 8.2. Capacity Building and Training Measures

- Facilitate: Knowledge & Skills required for Cold wave management through short/medium Training Courses
- Integrate training sessions on Cold Wave management as part of other official training programmes for senior and mid-level government officials from various line departments
- Study ours and training programs for State/District officials.
- Training for Shelter Management including arrangement of essential supplies and medicines for local administration;
- Training of Fire Department for responding to fire situations;
- Awareness campaigns;
- Training of health workers under Integrated Disease Surveillance Programme (IDSP);
- Training programmes for farmers about measures for protecting their crops and livestock.
- Develop Modules on related areas based on NDMA guidelines- enable in training sessions of government offices/states converting into School, College Syllabus, Curriculum etc

## 8.3. Nodal Agency for Capacity Building and Training

NIDM has been assigned nodal responsibilities for human resource development, capacity building, training, research, documentation, and policy advocacy in the field of disaster management. NIDM has built strategic partnerships with various ministries and departments of the Central, State, and local governments, academic, research and technical organizations in India and abroad and other bi-lateral and multi-lateral international agencies. It provides technical support to the State Governments through the Disaster Management Centres (DMCs) in the Administrative Training Institutes (ATIs) of the States and Union Territories.

# 9

## Role and Responsibilities

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The Ministry of Agriculture and Farmers Welfare is the nodal Ministry for cold wave and frost to coordinate all the stakeholder Ministries/ Departments and agencies to work under a unified command to ensure effective implementation of prevention, preparedness and mitigation measures.

The state governments will spell out the priorities and issue policy guidelines. The Relief Commissioner will coordinate the services of various stakeholders, including National/State agencies, and Central Government agencies.

The SEOC is the nerve centre to support, coordinate and monitor disaster management activities at the State level, including training and research. It will, under normal circumstances, work under the supervision of the Relief Commissioner. During an emergency situation, it will work as the centre for decision making as long as the need for emergency relief operations continues until the long-term plans for rehabilitation are finalised. Respective line departments will manage long-term rehabilitation programmes.

The system and procedures of an SEOC should be designed for rapid dissemination of information to all stakeholders to enable effective decision-making and quick response during an emergency.

Academic institutions such as the State's Administrative Training Institute (ATIs), agriculture universities, IITs, the private sector and NGOs also complement the efforts of the government and provide necessary inputs/assistance to concerned Ministry/Department.

A detailed matrix clearly laying down the roles/responsibilities of all stakeholders is given in **Section 9.1**.

### 9.1. Roles and Responsibility Matrix for Management of Cold Wave

S. N.	Tasks/ Activities	Central/ State Agencies & Their Responsibilities		
		Centre	Responsibility	State/District
<b>Understanding Risk</b>				
1	Preparation of policy, guidelines and Action Plan	NDMA	<ul style="list-style-type: none"> <li>Guidelines for preparation of Action Plan</li> <li>Preparation of national action plan for cold wave</li> <li>Preparation of DM plan of the ministry including cold wave hazard</li> </ul>	<ul style="list-style-type: none"> <li>State Governments / SDMA/Commissioner of Relief (COR)/Dept. of Agriculture and other concerned departments</li> <li>Ensure preparation of detailed departmental SOPs by concerned departments</li> <li>Preparing State Action Plan for cold wave management and its implementation</li> </ul>
2	Hazards Risk and Vulnerability Assessment	<b>Nodal Ministry</b> – Ministry of Agriculture and Farmers Welfare (MoA&FW) and other concerned ministries  MoA&FW* / MoES/ MoH&FW/ MoAH&DF / MoHUA/ MoP/MoJS/ MoRTH/ MoPR/MoR/ MoEF&CC/DST	<ul style="list-style-type: none"> <li>Identification of vulnerable areas and preparation of HVRA maps at district level</li> </ul>	<ul style="list-style-type: none"> <li>Identification of vulnerable areas and preparation of HVRA maps for respective states up to sub district/village level</li> </ul>
<b>InterAgency Coordination</b>				
3	Early Warning and Communication	<b>Nodal Agency</b> – IMD (Ministry of Earth Science)  <b>Disseminations</b> 1. Ministry of Agriculture and Farmers Welfare and all concerned central ministries/departments	<ul style="list-style-type: none"> <li>Issue area specific impact based warning/ alerts and weather forecasts</li> <li>Strengthening infrastructure for forecast/ early warning</li> <li>Issue warning and advisory to all the sub-ordinate offices/agencies for necessary action, as per IMD forecast &amp; warning</li> </ul>	<ul style="list-style-type: none"> <li>State Governments/ SDMA / DDMA/ District Adm.</li> <li>State Governments / SDMA/ Dept.of Agriculture and all concerned departments</li> <li>Disseminate information received from IMD to public at large</li> <li>Disseminate <b>impact based colour code early warning</b> at local level</li> <li>Disseminate agro-met advisory, forecast / warning and alert to farmers</li> </ul>

	2. Ministry of Health & Family Welfare	<ul style="list-style-type: none"> <li>Disseminate early warning information to all State health department</li> </ul>	State Governments / SDMA/ State health department	<ul style="list-style-type: none"> <li>Disseminate early warning information to all health professional</li> </ul>
	3. Ministry of Animal Husbandry & Dairying, Fisheries	<ul style="list-style-type: none"> <li>Disseminate early warning information to all State Animal Husbandry department</li> </ul>	State Governments / Department of Animal Husbandry	<ul style="list-style-type: none"> <li>Disseminate early warning information to all veterinary offices/hospitals</li> </ul>
	4. Ministry of Information and Broadcasting (PIB, AIR, Doordarshan)	<ul style="list-style-type: none"> <li>Specific message and information, dissemination to public at large through print/ electronic and social media</li> </ul>	State Governments / SDMA/COR/DDMAs/ Dept. of Public Relation in concerned States	<ul style="list-style-type: none"> <li>Ensure specific message and information, dissemination to public at large through print/ electronic/social and other mass media at local level</li> </ul>
	5. Ministry of Power	<ul style="list-style-type: none"> <li>Specific message dissemination to concerned Power Generation, Transmission, Distribution and Supply offices</li> </ul>	State Governments / SDMA/COR/ Dept. Of Electricity	<ul style="list-style-type: none"> <li>Activate all concerned public/private DISCOM offices/officers</li> <li>To ensure uninterrupted power supply</li> </ul>
	6. Department of Telecommunication	<ul style="list-style-type: none"> <li>Issue necessary direction to its field and Telecom Service Provider (TSPs) for timely dissemination of alerts through various telecom network over Outbound Voice Messages, SMS and cell broadcast</li> </ul>	State Governments	<ul style="list-style-type: none"> <li>Send warning message, preparedness through Bulk SMS to the likely impacted areas – based on IMD warning.</li> <li>Ensure all TSPs to take necessary measures for ensuring business continuity duly extreme cold wave condition.</li> </ul>
<b>Relief &amp; Response</b>				
4	Relief & Response	<p>1. MoA&amp;FW (in Coordination with other concerned Ministries/ Dept. /Agencies)</p> <ul style="list-style-type: none"> <li>Coordination with concerned agencies and stakeholders</li> <li>To ensure all necessary measures required for effective and timely relief and response</li> <li>Issue advisory to save crops and plants from cold waves / frost</li> </ul>	<p><b>Nodal Agency:</b> State Governments /SDMAs /COR / DDMAs. (with other concerned Department/Agencies)</p>	<ul style="list-style-type: none"> <li>Designate a nodal officer for emergency response</li> <li>To ensure all administrative measures required for effective and timely relief and response.</li> <li>Identify and establish Relief Centres/camps.</li> <li>Arrange relief material and supplies.</li> <li>Activate helpline number</li> </ul>



		<ul style="list-style-type: none"> <li>• To discuss in the Crop Weather Watch Group (CWWG)</li> <li>• Provide necessary relief for crops damage as per norms</li> </ul>		<ul style="list-style-type: none"> <li>• Coordinate with all stakeholders.</li> <li>• Initiate counter measures, such as shelter and other logistics necessary at relief centres.</li> <li>• Take necessary measures for saving crops</li> <li>• To provide necessary relief for crops damage as per norms</li> </ul>
	2. Ministry of Health & Family Welfare	<ul style="list-style-type: none"> <li>• Ensure adequate Hospital and medical facilities</li> <li>• Technical support and advisory</li> </ul>	State Governments / SDMA's/COR/DDMA's <b>Dept. of health</b>	<ul style="list-style-type: none"> <li>• Additional hospital and medical facilities if needed for cold wave patient to be activated</li> <li>• Technical advisory and support</li> <li>• Hot room in hospital emergency ward for patient attendant</li> </ul>
	3. Ministry of Animal Husbandry, & Dairying and Fisheries	<ul style="list-style-type: none"> <li>• Issue advisories for the care and protection of animals.</li> <li>• Ensure supply of adequate and sufficient feed, fodder and veterinary medicine</li> </ul>	State Governments / Department of Animal Husbandry	<ul style="list-style-type: none"> <li>• Issue advisories to veterinary hospitals/ professionals for the care and protection of animals.</li> <li>• Ensure supply of adequate and sufficient feed, fodder for livestock to avoid animal deaths.</li> <li>• Establish veterinary clinics to control of foot &amp; mouth disease (FMD)</li> <li>• Involvement of NGOs working for animals</li> </ul>
	4. Ministry of Housing and Urban Affairs	<ul style="list-style-type: none"> <li>• Direction for shelter homes/ Rain Basera with essential service like medical facilities, power, food, water supply in urban areas</li> <li>• Ensure necessary measures of arising if any pandemic situation</li> <li>• Appropriate protocol and additional shelters</li> </ul>	State Governments / DDMA's/ Urban local bodies (ULBs)	<ul style="list-style-type: none"> <li>• Ensure operational shelter homes/Rain Basera with essential service like medical facilities, power, food, water supply in urban areas.</li> <li>• Shift homeless /affected people to shelter homes</li> <li>• Preparation and implementation of Snow Clearance Plan</li> </ul>

			to be ensured during concurrent disasters		<ul style="list-style-type: none"> <li>If concurrent disaster like epidemic/pandemic appropriate social norms and additional shelters may be ensured</li> <li>Ensure traffic management during dense fog conditions</li> <li>Apply advance safety measures during fog</li> <li>Ensure clearing of snow using clearing machines and tools in areas of snow fall</li> <li>Clear road block due to snowfall in hilly / mountainous terrain</li> <li>Assist BRO to ensure functional road</li> <li>Issue Advisories to tourists/ travel agencies/ hotels etc.</li> <li>Authorities to ensure the safety of tourists from any pandemic situation.</li> <li>Ensure maintenance of law &amp; order.</li> <li>To ensure necessary security arrangements for the emergency responders/relief teams who are working at Relief Centres and involved in distribution of relief.</li> <li>Ensure provision of basic food items in Relief Camps and in affected communities.</li> <li>Issue advisory for commerce, industries, and social activities</li> </ul>
	<p>5. Ministry of Road Transport and Highway</p> <p>6. Ministry of Railway</p> <p>7. Ministry of Civil Aviation</p>		<ul style="list-style-type: none"> <li>Directives to effective traffic management during dense fog conditions</li> <li>Technical support and advisory</li> <li>Advise on use of advance safety measures during fog</li> <li>SAR operation for trapped/ stranded persons in hilly / mountainous region</li> <li>To ensure functional road under area of operation</li> <li>Issue Advisories to tourists/ travel agencies/ hotels etc.</li> <li>Support state government on request for maintenance of law &amp; order which may arise due to situation like snow clearance, road clearance, fire service etc.</li> <li>Ensure adequate stock of food and fuel due to additional demand during the cold wave</li> <li>Issue advisory for commerce, industries, and social activities</li> </ul>	<p>Public Works Department / State police</p> <p>State Govt.(PWD)/ District Authority</p> <p>State government / PWD</p> <p>State Governments /State Tourism Department</p> <p>State Governments /SDMAs/ COR / Department of Police/ Civil Defence, and Home Guard</p> <p>State Governments / SDMA/COR Department of food and civil supply</p> <p>State Government/ Department of Industry</p>	
	<p>8. Ministry of Defence (Indian Army and ITBP in coordination with DGRE)</p> <p>9. Border Road Organisation/ NHAI</p> <p>10. Ministry of Tourism</p>				
	<p>11. Ministry of Home Affairs</p>				
	<p>12. Ministry of Food and Consumer Affairs</p>				
	<p>13. Ministry of Commerce and Industry/ MSME</p>				

5	Monitoring and Review	<p><b>Nodal Ministry:</b> 1. Ministry of Agriculture and Farmers Welfare 2. NDMA</p>	<ul style="list-style-type: none"> <li>Implementation of the Guideline</li> <li>Periodic review/update of action plan</li> </ul>	State Government/ COR/ SDMMAs/DDMMAs Agriculture department and all concerned dept.	<ul style="list-style-type: none"> <li>All concerned department/agencies to appoint a Nodal officer' to monitor the implementation of the State/District plan</li> <li>Collect data / information and plan for review/updating</li> </ul>
<b>Investing in DRR</b>					
6	Prevention, Mitigation and Preparedness measures	<p><b>Nodal Ministry:</b> Ministry of Agriculture and Farmers Welfare</p>	<ul style="list-style-type: none"> <li>Issue advisories</li> <li>Give directives to concerned ministries/departments and state governments.</li> <li>Ensure cold wave crop safety measures included in the crop contingency plan</li> <li>Standardize procedure of protection from cold/frost on the Rabi crops</li> <li>Promote cold weather sustainable crops and plants</li> <li>Construction safe crop storage shelters for farmers</li> <li>R&amp;D for cold wave risk reduction</li> </ul>	<p><b>Nodal agency:</b> State Government/ SDMMAs /Agriculture/ Animal Husbandry/ Health and UD/PRIs (with other concerned Department/Agencies)</p>	<ul style="list-style-type: none"> <li>Undertake, preparedness and mitigation measures</li> <li>Review and update precautionary measures and procedures</li> <li>Construction arrangement of shelter homes</li> <li>Strengthening techno-legal systems and practices etc.</li> <li>Preparation and implementation of crop contingency plan</li> <li>Ensure Power supply and Irrigation facilities for farmers</li> <li>Protection of vegetable plants from freezing and absorbing the cold from surrounding air</li> <li>Promotion of crop insurance</li> <li>Formulation of active disaster management teams at panchayat level</li> <li>R&amp;D for cold wave risk reduction</li> </ul>
	1. Ministry of Housing and Urban Affairs		<ul style="list-style-type: none"> <li>Disseminate information to public on mitigation measures</li> <li>Ensure adequate number of shelter homes</li> </ul>		

		<ul style="list-style-type: none"> <li>Issue advisories and direction for arrangements of well-equipped shelter homes with necessary medical facilities, power, food, water and medicine supplies.</li> <li>Strengthening techno-legal regimes and practices etc.</li> </ul>		
	2. Ministry of Panchayati Raj	<ul style="list-style-type: none"> <li>Strengthening techno-legal regimes and practices etc.</li> <li>Issue advisories and direction for essential services and facilities</li> </ul>		
	3. Ministry of Health & Family Welfare	<ul style="list-style-type: none"> <li>Issue directives for Hospital preparedness and mitigation measures including training of human resources</li> <li>Create data base of health professionals and facilities</li> </ul>	State Governments /SDMA/COR/ concerned Dept. Of Health	<ul style="list-style-type: none"> <li>Ensure appropriate medical staff and facilities</li> <li>Create data base of health professionals and facilities</li> <li>Strengthen health centres with a network of paramedical professionals</li> <li>Ensure stock piling of life-saving drugs, de-toxicants, anaesthesia. Ensure availability of Halogen tablets in vulnerable areas</li> </ul>
	4. Ministry of Animal Husbandry, & Dairying and Fisheries	<ul style="list-style-type: none"> <li>Necessary advisory and support for the care and protection of animals.</li> <li>Issue of Advisories with Do's and Don'ts to state governments</li> </ul>	State Governments / SDMA/COR/ concerned Dept. Of Animal Husbandry	<ul style="list-style-type: none"> <li>Stocking of suitable feed or forage before cold wave to feed the livestock.</li> <li>Avoiding exposure of animals to extreme cold.</li> <li>Involvement of NGOs working for animals</li> <li>Promotion of crop insurance and veterinary clinics</li> </ul>

	5. Ministry of Power	<ul style="list-style-type: none"> <li>Advance planning to match with additional demands during cold weather</li> </ul>	State Governments /SDMA/COR/ concerned Dept. of energy & power supply	<ul style="list-style-type: none"> <li>To ensure adequate electricity supply in coordination with DISCOM (distribution company)</li> </ul>
	6. Ministry of Road Transport and Highway/ Ministry of Railways/ Ministry of Civil Aviation	<ul style="list-style-type: none"> <li>Development and application of advanced safety measures during fog</li> <li>Issue advisories to ensure road connectivity and access to vulnerable areas</li> </ul>	State Governments / SDMA/COR/ Public Works Dept. (PWD)/ Traffic Police/ Dept. of Road Transport	<ul style="list-style-type: none"> <li>Ensure road connectivity and access to vulnerable areas</li> <li>Pre-positioning of equipment for route clearance</li> </ul>
	7. Ministry of Jal Shakti	<ul style="list-style-type: none"> <li>Issue instruction for ensuring availability of drinking water supply</li> </ul>	State Governments / SDMA/COR/PHED	<ul style="list-style-type: none"> <li>Advance arrangements to ensure adequate water supply</li> <li>Use protective measures to prevent water where the freezing point goes to below during extreme cold</li> </ul>
	8. Ministry of Environment Forest and Climate Change/ Department Science Technology	<ul style="list-style-type: none"> <li>Promote research monitoring and information system on climate change</li> <li>Ensure risk mitigation / adaptation measures of cold wave in National Action Plan on climate Change</li> </ul>	State Governments / Dept. of Forest	<ul style="list-style-type: none"> <li>Ensure risk mitigation / adaptation measures of cold wave in State Action Plan on Climate Change</li> <li>Integrate adaptive measures towards climate change impacts in cold wave prone area</li> </ul>
<b>Capacity Development</b>				
8	Capacity Building and Training	<ul style="list-style-type: none"> <li>Training programme for all concerned ministries/states</li> <li>Inclusion of cold wave/ frost in various training curriculums</li> <li>Promoting skill development for hazard resistant construction with emphasis on protection from cold in cold wave prone areas for different types of housing and infrastructure</li> </ul>	<p><b>Nodal agency:</b> State Govt. /COR/ SDMAS (with respective /DM institutes/ ATIs) and NGOs</p>	<ul style="list-style-type: none"> <li>Training programme for all concerned department officials/ volunteers</li> <li>Conduct training programmes for specific health care, livestock, traffic police etc</li> <li>Inclusion of cold wave/frost and similar issue in various curriculum</li> <li>Creating ToT teams for different trades relevant to cold wave protection in the construction</li> </ul>

9	Public awareness, and Outreach and IEC activities	Ministry of Information and Broadcasting, NDMA and all concerned Ministries/ Dept.	<ul style="list-style-type: none"> <li>• Extensive IEC campaigns to create awareness through print, electronic and social media</li> <li>• Support public awareness of cold wave</li> <li>• Disseminate information to public on mitigation measures</li> </ul>	<p><b>Nodal agency:</b> State Govt. /COR/ SDMAS (with Department of Information and Public Relations) and NGOs</p>	<p>of different types of housing and infrastructure</p> <ul style="list-style-type: none"> <li>• Engagement of academic institution for capacity building training and research</li> <li>• Capacity building for volunteers, NGOs, AASHA workers etc,</li> <li>• Conducting mock-drills</li> <li>• Creation of public awareness materials and disseminations</li> <li>• Extensive IEC campaigns to generate public awareness through print, electronic and social media Carry out mass media campaigns in cold wave prone area</li> <li>• Disseminate Do's and Don'ts for general public and enable access to safe places.</li> <li>• Awareness generation material in vernacular language</li> </ul>
10	Record of data and Documentation	Nodal Ministry: Ministry of Agriculture and Farmers Welfare and all other concerned ministries/departments	<ul style="list-style-type: none"> <li>• Each concerned ministry to collect data and consolidated database to be maintained by Nodal Ministry</li> <li>• Develop a mechanism for documentation and best practices</li> <li>• Develop a data sharing strategy among all stakeholders</li> </ul>	<p><b>Nodal agency:</b> State Govt. /COR/ SDMAS and Dept. of Agriculture</p>	<ul style="list-style-type: none"> <li>• Collect data on deaths and injuries</li> <li>• Assessment of damage from cold wave and frost</li> <li>• Collecting pre, during and post cold wave data from field and reporting to State/National level authority</li> <li>• Prepare and share lessons learnt and best practices</li> </ul>

# 10

## Documentation and Reporting Formats

To enable policy decisions and to take necessary mitigative action in case of extreme weather events (cold wave and frost), a detailed, uniform and validated data is required. Small and marginal farmers, animal owners, vendors, street hawkers, construction workers, field officials/employees, students, elder, children, women and mostly weaker sections of society are vulnerable to the adverse impacts of these extreme events. Data is needed for better planning and action taking for cold wave risk reduction.

A database of incidences of cold wave and frost; resultant damages; identified and mapped vulnerable areas of frequent cold wave and frost; level of preparedness of the local administration and the general public in the vulnerable areas, needs to be developed and shared with all concerned stakeholders for necessary and appropriate action to mitigate the impact of cold wave and frost. This database will also help in understanding the frequency and severity of these incidents in vulnerable areas, and prioritise and develop customise action plans.

A format for collecting data, to be used by the District/States Authority (DDMAs and SDMAs), is given as **Format 1 to 3**. District Administration/DDMAs will collect district-level data and report the same to respective States/SDMAs which, in turn, will collate all such data and share the same with the Centre (Ministry of Home Affairs/National Disaster Management Authority). MHA/NDMA will maintain the national-level disaster database.





**Format 2: Format for reporting for cold wave & frost assessment**  
 (To be Compiled at the State Level and sent to the Central Government)

Name of the District: .....		Period of Reporting: .....														Year: .....												
SN	Name of the District	Total affected Population					Health		Agriculture				Livestock				Affected social activities				Mitigation measures							
		Farmers	Labourers	Hawkers	Others	Total	Illness	Deaths	No of Affected farmers	Major crops affected	Crop wise area affected (in hect.)	Crop wise percentage of crop loss	Total livestock affected (types of animal)	Livestock deaths (types of animal)	Percentage of Livestock affected/ deaths	Affected institution (No. of days for closed)	Average days for affected essential service	Affected road/rail transport (No. of days)	Average days for affected Closing Shop / reduced labour/employments etc.	No. of Shelters in working	No. of peoples stay in Shelters home	Facilities available in shelter homes	No of Blankets distribution	Early warning Information/dissemination	IEC Campaign/ Do's and Don'ts	Others measures		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		

Others relevant information (if any): .....

Name: ..... Designation: ..... Signature with Date: .....

Submitted to:

**Format 3: Format for reporting for cold wave & frost assessment**  
 (To be communicated at Central Government)

Name of the District: ..... State: ..... Period of Reporting: ..... Year: .....

SN	Name of the States	Total affected Population			Health		Agriculture			Livestock			Essential Service				Mitigation Measures							
		APL	BPL	Total	Illness	Deaths	No of Affected farmers	Total area of Crop affected	Percentage of crop loss	Total livestock affected (types of animal)	Livestock deaths (types of animal)	Percentage of Livestock affected/ deaths	Affected Institution (No. of days for closed)	Average days for affected essential service	Affected road/rail transport (No. of days)	Average days for affected Closing Shop / reduced labour/ employments etc.	No. of Shelters in working	No. of peoples stay in Shelters home	No of Blankets distribution	Early warning Information/disseminations	IEC Campaign	Others measures		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	

Name: ..... Designation: ..... Signature with Date: .....

Submitted to:

# Annexure -1

## Cold Wave/ Frost

### Do's and Don'ts

#### Before

- Listen to the radio, watch TV, read newspapers for local weather forecast to know if a cold wave is round the corner.
- Stock adequate winter clothing. Multiple layers of clothing are more helpful.
- Keep emergency supplies ready.
- An increased likelihood of various illnesses like flu, running/ stuffy nose or nosebleed, which usually set in or get aggravated due to prolonged exposure to cold. Consult the doctor for symptoms like these.

#### During

- Follow weather information and emergency procedure information closely and act as advised.
- Stay indoors as much as possible and minimise travel to prevent exposure to cold wind.
- Wear multiple layers of loose fitting, lightweight, windproof warm woollen clothing rather than one layer of heavy clothing. Tight clothing reduces blood circulation.
- Keep yourself dry. If wet, then cover your head, neck, hands and toes adequately as the majority of heat loss occurs through these body parts.
- Prefer mittens over gloves. Mittens provide more warmth and insulation from cold, as fingers share their warmth and expose less surface area to the cold.
- Use hats and mufflers to prevent heat loss, Wear insulated / waterproof shoes.
- Eat healthy food to maintain the equilibrium of body temperature
- Eat fruits and vegetables rich in Vitamin-C to maintain adequate immunity.
- Drink hot fluids regularly, as this will maintain body heat to fight cold.
- Moisture your skin regularly with oil, petroleum jelly or body cream
- Take care of elderly people and children and check on neighbours who live alone, especially the elderly about their well-being.
- Store essential supply as per requirement. Store adequate water as pipes may freeze.
- Follow the guide on heat insulation for non-industrial buildings and take necessary preparedness measures.
- Watch out for symptoms of frostbite like numbness, white or pale appearance on fingers, toes, earlobes and the tip of the nose, while exposed to cold waves.

- Prolonged exposure to cold can turn skin to pale, hard and numb, and black blisters on exposed body parts such as fingers, toes, nose and/ or earlobes. Immediately consult the Doctor.
- Treat the areas affected by frostbite in warm (not hot) water (the temperature should be comfortable to touch for unaffected parts of the body).
- Do not ignore shivering. It is an important first sign that the body is losing heat and is a signal to quickly return indoors.
- Seek medical attention as soon as possible for someone suffering from Frostbite/Hypothermia.
- Move pet-animals indoors. Likewise, protect livestock or domestic animals from cold weather by moving them inside.
- Severe exposure to cold wave can lead to Hypothermia – a decrease in body temperature which can cause shivering, difficulty in speaking, sleepiness, stiff muscles, heavy breathing, weakness and/or loss of consciousness. Hypothermia is a medical emergency that needs immediate medical attention.
- Consult doctor for symptoms like various illnesses, running/stuffy nose particularly during the period of COVID -19.
- Download NDMA’s mobile application: First Aid for Students and Teachers (FAST) for information on first aid.

### **In the case of hypothermia**

- Get the person into a warm place and change clothes.
- Warm the person’s body with skin-to-skin contact, dry layers of blankets, clothes, towels, or sheets.
- Give warm drinks to help increase body temperature. Do not give alcohol.
- Seek medical attention if the condition worsens.

### **Don’ts**

- Avoid prolonged exposure to cold,
- Don’t drink alcohol. It reduces your body temperature, it actually narrows your blood vessels, particularly those in the hands, which can increase the risk of hypothermia.
- Do not massage the frostbitten area. This can cause more damage.
- Do not ignore shivering. It is the first sign that the body is losing heat - get indoors.
- Do not give the affected person any fluids unless fully alert.

## **Agriculture**

### **Do’s and Don’ts**

Cold wave and frost damages crops by causing illnesses including diseases of black rust, white rust, late blight etc. Cold wave also causes a variety of physiological disruptions in germination, growth, flowering, yield and storage life.

### **Do’s**

- Undertake curative measures for cold illness/injury like spray with Bordeaux mixture or Copper Oxi-chloride, phosphorus (P) and potassium (K) to activate better root growth.

- Do light and frequent surface irrigations (high specific heat of water) during the cold wave wherever it is possible.
- Sprinkler irrigation (condensation-release heat into surrounding).
- Cultivate cold/frost resistant plants/crops/varieties.
- Use intercropping farming in horticulture and orchards.
- Mixed cropping of vegetables, viz., tomato, brinjal with a tall crop like mustard / pigeon pea will provide necessary shelter against cold winds (shelter against cold).
- Increase radiation absorption and provide warmer thermal regime through covering of nursery and young fruit plants during winter by plastic or by making thatches (jhuggies) of straw or sarkanda grass etc.
- Organic mulching (for thermal insulation).
- Planting of wind breaks/shelter belts (to reduce wind speed).

## Animal Husbandry/Livestock

### Do's and Don'ts

During Cold waves animals and livestock require more food for sustenance as the energy requirement goes up. Extreme variations in temperature may affect the fertility rate in animals during the optimum breeding season for buffaloes /cattle.

#### Do's

- Cover the animal habitat from all sides during night in order to avoid direct exposure of animals to cold winds.
- Cover the animals, especially smaller ones, during cold days.
- Protect livestock and poultry from cold weather by keeping them inside.
- Improving livestock feeding practice and dietary additives.
- Use of high-quality forage or pastures.
- Provide fat supplements - concentrate ratio on feed intake, feeding, and chewing behaviour.
- Construction of climate smart sheds which allow maximum sunlight during winters and low radiation during summers.
- Selecting animal breeds especially fit for these conditions.
- Apply some bedding materials such as dry straw under animals during winters.

#### Don'ts

- Do not leave animals tied/roam in open area during cold wave
- Avoid animal fares (pashumela) during cold wave
- Avoid giving cold feed and cold water to the animals
- Avoid dampness and smoke in animal shelter
- Do not keep the animals in open during night and cold hours
- Carcasses of dead animals should not be discarded on the regular grazing routes of the animals.

# Annexure -2

## Cold wave Disorders: Symptoms and First Aid for Human beings

Disorder	Symptoms	Prevention	First Aid/Treatment
<p><b>HYPOTHERMIA:</b> Defined as a lowered core body temperature usually below 34.4 degree C. (94 degree F.)</p> <ol style="list-style-type: none"> <li>Mild Hypothermia (90 degree to 95 degree F.)</li> <li>Moderate Hypothermia: (82 degree to 89 degree F.)</li> <li>Severe Hypothermia (less than 82 degree F.)</li> </ol>	<ul style="list-style-type: none"> <li>Shivering</li> <li>Dizzy, drowsy</li> <li>Irritability</li> <li>Confusion</li> <li>Slowed, slurred speech</li> <li>Altered vision</li> </ul>	<ul style="list-style-type: none"> <li>Avoid exposure to cold.</li> <li>Eat properly &amp; often.</li> <li>Warm liquids &amp; water.</li> <li>Wear uniform/clothes properly &amp; preferably in layers.</li> <li>Wear cap and socks.</li> <li>Keep active.</li> <li>Use warming tents.</li> <li>Get plenty of rest.</li> </ul>	<ul style="list-style-type: none"> <li>Remove wet clothing.</li> <li>Warm the centre of their body first followed by chest, neck, head and groin region using an electric blanket if available.</li> <li>Use skin to skin contact under loose, dry layers of blankets, clothing, towels, or sheets.</li> <li>Warm beverages may help increase the body temperature, but do not give alcoholic beverages.</li> <li><b>Do not give fluids orally if the person is unconscious.</b></li> <li>After their body temperature has increased, keeps the victim dry and wrapped in a warm blanket including the head and neck.</li> <li>If victim has no pulse, begin Cardiopulmonary Resuscitation (CPR).</li> </ul>
<p><b>FROSTBITE:</b> Frostbite is freezing of body tissue often accompanied with hypothermia. When ice crystal form between the cells of the skin and grow by extracting fluid from the cells, the circulation is obstructed, causing additional damage to the tissue affected. It commonly affects hands, feet, ears, nose and cheeks.</p> <p>Frostbite</p>	<ul style="list-style-type: none"> <li>Initially manifests as redness in light coloured skin or greyish in dark coloured skin.</li> <li>Tingling, stinging sensation.</li> <li>Turns numb, yellowish, waxy or grey color.</li> <li>Exposed body parts feel cold, stiff and woody</li> </ul>	<ul style="list-style-type: none"> <li>Wear uniform/ clothes properly and in layers.</li> <li>Keep socks, gloves and clothing dry.</li> <li>Protect yourself from wind-chill.</li> <li>Drink hot fluids and eat often.</li> <li>Insulate yourself from the ground.</li> <li>Prevent skin contact with super cooled metal or fuel.</li> </ul>	<ul style="list-style-type: none"> <li>Get into a warm room as soon as possible.</li> <li>Unless absolutely necessary do not walk on frostbitten feet or toes as this increases the damage.</li> <li>Immerse the affected area in warm but not hot water (the temperature should be comfortable for unaffected parts of the body). Ask an unaffected person to test the water temperature as patient may not be able to feel correct</li> </ul>

			<ul style="list-style-type: none"> <li>Seek medical aid for suspected cases.</li> </ul>	<p>temperature due to numbness of body parts and end up getting burnt.</p> <ul style="list-style-type: none"> <li>Warm the affected are using body heat; for example, the heat of an armpit can be used to warm frostbitten fingers.</li> <li>Do not rub or massage the frostbitten area; doing so may cause more damage.</li> <li>Do not use a heating pad, heat lamp or the heat of a stove, fireplace, or radiator for warming. Affected areas are usually numb and can be easily burnt.</li> </ul>
<p><b>CHILBLAINS:</b> Caused due to exposure to cold, wet and humid conditions (between 32-60 degree F). Repeated, prolonged exposure of bare skin lead to development, only in a few hours. Ears, Nose, Cheeks, Fingers and toes are most commonly affected.</p>				
Chilblains	<ul style="list-style-type: none"> <li>Skin is initially pale and colourless.</li> <li>Worsens to achy, prickly sensation followed by numbness.</li> <li>Red, swollen, hot, itchy, tender skin upon rewarming.</li> <li>Blistering in severe cases</li> </ul>	<ul style="list-style-type: none"> <li>Keep dry and warm.</li> <li>Cover exposed skin.</li> <li>Wear uniform/clothes properly.</li> <li>High risk during wet weather, in wet areas or sweat accumulated in boots or gloves.</li> </ul>	<ul style="list-style-type: none"> <li>Prevent further exposure</li> <li>Avoid scratching</li> <li>Slowly warm the skin, Don't massage or rub</li> <li>Use corticosteroid creams to relieve itching and swelling</li> <li>Dry sterile dressing</li> <li>Keep blisters and ulcers clean and covered</li> <li>Seek medical aid</li> </ul>	
<p><b>DEHYDRATION:</b> Loss of body fluids to the point of slowing or preventing normal body functions. Dehydration increases chance of becoming a cold weather casualty.</p>				
Dehydration	<ul style="list-style-type: none"> <li>Dark urine</li> <li>Headache, Dizziness, nausea and Weakness</li> <li>Dry mouth, tongue, throat, lips</li> <li>Lack of appetite</li> <li>Irritability</li> <li>Stomach cramps or vomiting</li> <li>Increased or rapid heartbeat</li> </ul>	<ul style="list-style-type: none"> <li>Monitor urine color</li> <li>Do not wait until you are thirsty</li> <li>Drink hot liquids for warmth</li> </ul>	<ul style="list-style-type: none"> <li>Drink water or other warm liquids</li> <li>Avoid caffeinated liquids</li> <li>Do not eat snow</li> <li>Rest</li> </ul>	

<p><b>CARBONMONOXIDE POISING (CMP):</b> Carbon monoxide is a colourless, odourless, tasteless gas resulting from incomplete combustion of fuel from engines, stoves, heaters etc. In conditions of inadequate ventilation such as falling asleep in a motor with running engine in a closed garage, inhalation of excessive amount of carbon monoxide may lead to poisoning.</p>		
<p><b>CMP</b></p>	<ul style="list-style-type: none"> <li>• Headache</li> <li>• Dizziness</li> <li>• Weakness</li> <li>• Ringing in ears</li> <li>• Nausea</li> <li>• Drowsiness</li> <li>• Bright red lips, eyelids</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure proper ventilation.</li> <li>• Turn heaters off when not needed.</li> <li>• Never sleep in vehicle with engine running.</li> <li>• Ensure heaters are regularly serviced.</li> </ul>
<p><b>SNOW BLINDNESS:</b> Inflammation and sensitivity of the eyes caused by ultraviolet rays of the sun reflected by the snow or ice.</p>		
<p><b>SNOW BLINDNESS</b></p>	<ul style="list-style-type: none"> <li>• Gritty feeling in eyes.</li> <li>• Redness and tearing.</li> <li>• Eye movement will cause pain.</li> <li>• Headache.</li> </ul>	<ul style="list-style-type: none"> <li>• Eye protection.</li> <li>• Dark UV protective glasses.</li> <li>• Do not wait for discomfort to begin.</li> </ul>
<p><b>TRENCH FOOT:</b> A painful condition of the feet caused by prolonged immersion in cold water or mud and marked by blackening and death of surface tissue.</p>		
<p><b>TRENCH FOOT</b></p>	<ul style="list-style-type: none"> <li>• Reddening of skin.</li> <li>• Numbness, leg cramps, swelling.</li> <li>• Tingling pain, Blisters or ulcers, bleeding under the skin, gangrene(the foot may turn dark purple, blue or grey).</li> </ul>	<ul style="list-style-type: none"> <li>• Thoroughly clean and dry your feet.</li> <li>• Put on clean, dry socks daily.</li> </ul>
<p><b>RECOVERY:</b> Recovery may take 2-3 days.</p>		
<p><b>TREATMENT:</b> Remove shoes/boots and wet socks. Dry their feet. Avoid walking on feet, as this may cause tissue damage. Treat the affected part by applying warm packs or soaking in warm water (102° to 110° F) for approximately 5 minutes. Obtain medical assistance as soon as possible.</p>		



## Annexure - 3

### Cold wave disorders for Animals

The animals under the following categories are more risk during cold wave /frost and need to special attention.

1. Newly born and young animals
2. Sick animals with history of respiratory disease
3. Lactating animals
4. Weak animals

**Identification and first Aid of cold disorders in animals** - Some cold wave illness of animals includes like hypothermia, frostbite, loss of appetite, Arthritis in heavy animals, kennel cough in pet dogs, and respiratory illness.

### Cold wave disorders with symptoms and first Aid for Animals:

Cold wave disorder	Symptoms	First Aid
Hypothermia	Low body temperature (by extended exposure to cold), shivering lethargy, listlessness and shock	<ul style="list-style-type: none"> <li>• Limit the time spent outside during winter months</li> <li>• Swaddle animal in warm blankets</li> </ul>
Frostbite	Pale hard skin, blisters on skin with further darkening of skin and possibility of gangrene	<ul style="list-style-type: none"> <li>• Limit the time spent outside during winter months</li> <li>• Swaddle animal in warm blankets</li> <li>• Applying warm water to affected area</li> </ul>
Kennel cough	Symptoms of respiratory infection	Vaccination and approach for veterinary care as soon as possible
Shock	Irregular heart area, weak pulse, low body temperature, pale gums	<ul style="list-style-type: none"> <li>• Prevent loss of body heat and cover the animal with blankets.</li> <li>• Approach for veterinary care as soon as possible.</li> </ul>

## Annexure - 4

### A case Study of Jammu and Kashmir

In Kashmir Valley, there are places where snow adversely impacts life for about seven months in a year. In the outer hilly region of the Jammu Province, climate has three main seasons:

- Hot weather from April to June;
- A rainy season from July to September; and
- Cold weather from October to March.

The altitude of the State rises steeply from sea level. The area has different weather conditions at different places because of the lofty mountains like the Pir Panjal, the Zaskar and the Karakoram that check the moisture-laden winds from entering the valleys. In summers, the outer plains and the outer hills receive rainfall from monsoon winds, while in winters, winds from the Mediterranean cause snowfall and rainfall in the Valley of Kashmir. The moisture-laden winds cause rainfall in the forests on the hills causing the temperature to fall in summer; hence, the thickly-wooded areas such as Pahalgam and Gulmarg have milder weather conditions than that of Srinagar.

Similarly, the climate of the valley of Kashmir is comparatively milder than that of the outer plains as it is on higher altitude therefore making it one of the most liked tourist destinations during summer. As stated above, the unique climatic conditions found in the zone of the Middle Mountains and its valleys, are determined by the altitude, which in turn determines the degree of coolness. Winters are cold and of long duration and with increasing altitude, it gets colder until there is snowfall in the higher mountains. Summers, however, are milder but are very short. Winters last from November to March. Spring begins after 15<sup>th</sup> of March and there is heavy rainfall during the season. Humidity in the monsoon season stretching over July and August is as high as 70% and with increasing temperature, summers at times become uncomfortable. In the Kashmir Province there is not much rise in the temperature up to the end of May, but in June, July and August the temperature can rise up to 90°F (32.20C) in shade. After August there is a decrease in the temperature, by the end of October it becomes cold and by January it becomes colder along with snowfall. The snowy period lasts for 2½ months, beginning from Magh (December-January) to the middle of Chaitra (March). During the winter, Dal Lake sometimes gets frozen, enabling people to skate over it.

The winters in Kashmir are very cold and of long duration. It gets colder until there is snowfall in the higher mountains. From 21<sup>st</sup> December to 31<sup>st</sup> January, a period of almost 40 days, is considered very cold in the Kashmir valley and it is locally known as “ChillaiKalan”. During this phase the temperatures reach as low as -15°C in high altitude areas, and between -7°C in the plains.

India Meteorological Department, an agency of the Ministry of Earth Sciences of the Government of India is the principal agency responsible for meteorological observations, weather forecasting and seismology for the J&K IMD.

In J&K every year, preparedness meetings are held at all levels before the onset of winter season. All the departments are directed to play their role and are accordingly provided with various roles and responsibilities so that people would not suffer during the season.

# Annexure- 5

## List of Ministries/Departments for Cold Wave /Frost Management

1	India Meteorological Department, New Delhi
2	Ministry of Home Affairs
3	Ministry of Agriculture and Farmers' Welfare
4	Ministry of Animal Husbandry and Dairying
5	Ministry of Consumer Affairs, Food and Public Distribution
6	Ministry of Environment Forest and Climate Change
7	Ministry of Earth Sciences
8	Ministry of Health and Family Welfare
9	Ministry of Education
10	Ministry of Housing and Urban Development
11	Ministry of Jal Shakti
12	Ministry of Labour and Employment
13	Ministry of Power
14	Ministry of Panchayati Raj
15	Ministry of Railways
16	Ministry of Rural Development
17	Ministry of Road Transport and Highways
18	National Disaster Management Authority
19	National Institute of Disaster Management

# Appendix-1

## List of Working Group for formulation of Guidelines on preparation of Action Plan for prevention and management of Cold Wave/frost

Sl.No	Name/Designation	Chairman/ Member
1	Member Secretary, NDMA	Chairman
2.	Lt. Gen. Syed Ata Hasnain (Retd.), Member, NDMA	Member
3.	Dr. V. Thiruppugazh, Additional Secretary, NDMA	Member
4	Brig. Ajay Gangwar, Advisor (Ops & Communication), NDMA	Member
5.	Dr. M. Mohapatra, DGM, IMD	Member
6.	Director, IITM, Pune	Member
7.	Representative of Govt. of Bihar	Member
8.	Representative of Govt of Chhattisgarh	Member
9.	Representative of Govt. of Punjab	Member
10.	Representative of Govt. of Rajasthan	Member
11.	Representative of Govt. of Uttarakhand	Member
12.	Representative of Govt of Uttar Pradesh	Member
13.	Representative of Govt. of NCT of Delhi	Member
14.	Representative of Govt. of Jammu & Kashmir	Member
15.	Representative of Govt. of Ladakh	Member
16.	Director, Snow and Avalanche Study Establishment	Member
17.	Representation of Indian Mountaineering Foundation	Member
18.	Representative of Goonj	Member
19.	Representative of Students Educational and Cultural Movement of Ladakh (SECMOL)	Member
20.	Shri Padma Tashi, Himalaya Glacier Water Keeper, Ladakh	Member
21.	Dr. S.K. Jena, Joint Advisor, NDMA	Convener

## Appendix-2

### List of drafting committee members

1. Shri P.N. Rai, Member, Bihar State Disaster Management Authority (BSDMA), Government of Bihar, Patna
2. Dr. M. Mohapatra, DGM, India Meteorological Department, Ministry of Earth Science, Government of India
3. Dr. S. D. Attri, Scientist-'G', India Meteorological Department, Ministry of Earth Science, Government of India
4. Dr. S. C. Bhan, Scientist-'F', India Meteorological Department, Ministry of Earth Science, Government of India
5. Dr. R. K .Jenamani, Scientist-'F', India Meteorological Department, Ministry of Earth Science, Government of India
6. Dr. Naresh Kumar, Scientist-'E', India Meteorological Department, Ministry of Earth Science, Government of India
7. Ms. Manorama Mohanty, Scientist-'E', India Meteorological Department, Ministry of Earth Science, Government of India
8. Mr. Akhil Srivastava, Scientist-'C', India Meteorological Department, Ministry of Earth Science, Government of India
9. Mr. Krishna Mishra, Scientist-'C', India Meteorological Department, Ministry of Earth Science, Government of India
10. Dr. A.K. Sahai, Scientist-'G', Indian Institute of Tropical Meteorology, Pune, Maharashtra
11. Dr. M. Prabhakar, Principal Investigator, NICRA, CRIDA, Hyderabad, Ministry of Agriculture and Farmers Welfare, Government of India
12. Dr. Vijay Kumar Teotia, RO, Department of Animal Husbandry, Dairying & Fisheries
13. Dr. Yogesh Kumar, Ministry of Health and Family Welfare
14. Dr. Sushma Guleria, Asst. Professor, National Institute Disaster Management (NIDM), Ministry of Home Affairs, Government of India
15. Dr. P.K. Satyawali, Sc-G, Associate Director, Defence Geo Informatics Research Establishment, Chandigarh
16. Dr. Pavan Kumar Singh, Joint Advisor (Ops), National Disaster Management Authority, Ministry of Home Affairs, Government of India
17. Shri Nawal Prakash, Joint Advisor (CBT), National Disaster Management Authority, Ministry of Home Affairs, Government of India
18. Mr. Anurag Rana, Joint Advisor (IT), National Disaster Management Authority, Ministry of Home Affairs, Government of India

19. Shri Anup Kumar Srivastava, (Sr. Consultant-Drought, Heat wave, Thunderstorm, Cold Wave & Food Security)
20. Shri Anuj Tiwari (Consultant- Gread-II, Policy, Plan & Mainstreaming)
21. Dr. Swati Sulagna (Sr. Consultant, Climate Change)
22. Shri Ajay Katuri (Sr. Consultant- Hazard, Vulnerability and Risk Assessment)
23. Shri Manoj Kumar Jangir (Under Secretary- PR&AG)
24. Shri K. S. Meena, Special CEO, DDMA, Government of Delhi,
25. Shri S.A. Murugesan, Secretary, Department of Disaster Management, Government of Uttarakhand
26. Shri Amir Ali, Nodal Officer - EOC, J&K SDMA, Government of Jammu and Kashmir
27. Mr. Waseem Shafi, Sr. Consultant, J&K SDMA, Government of Jammu and Kashmir
28. Mr. Suhail Mohmad Wani, Consultant, J&K SDMA, Government of Jammu and Kashmir
29. Shri Saugat Biswas, Secretary/ Divisional Commissioner, UT Secretariat, Ladakh
30. Ms. Aditi Umrao, Project Director, Uttar Pradesh State Disaster Management Authority (UPSDMA), Uttar Pradesh
31. Mr. Vishwajeet Khanna, FCR- Government of Punjab, Chandigarh
32. Shri Bijender Singh, OSD-Disaster Management, Relief and Civil Defence, Govt of Rajasthan
33. Col. S.P. Malik, Hony Secretary, Indian Mountaineering Foundation, New Delhi
34. Shri Padma Tashi, Field Expert, Himalaya Glacier Waterkeeper, Ladakh
35. Mr Anshu Gupta, Founder Member, GOONJ, New Delhi
36. Dr. Dileep Mavlankar, Director, Indian Institute of Public Health (IIPH), Gandhinagar, Gujarat

# Contact US

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**For more information on these “National Guidelines for Preparation of Action Plan – Prevention and Management of Cold Wave and Frost 2021”**

**Please contact us:**

National Disaster Management Authority (NDMA),  
NDMA Bhawan, A-1,  
Safdarjung Enclave, New Delhi -110029

Telephone: +91-11-26701707

Fax: +91-11-26701816

e-mail: [jspp@ndma.gov.in](mailto:jspp@ndma.gov.in)

Web: [www.ndma.gov.in](http://www.ndma.gov.in)

