



सत्यमेव जयते
Government of Rajasthan



RAJASTHAN HEAT WAVE ACTION PLAN 2024

DISASTER MANAGEMENT, RELIEF AND CIVIL DEFENCE

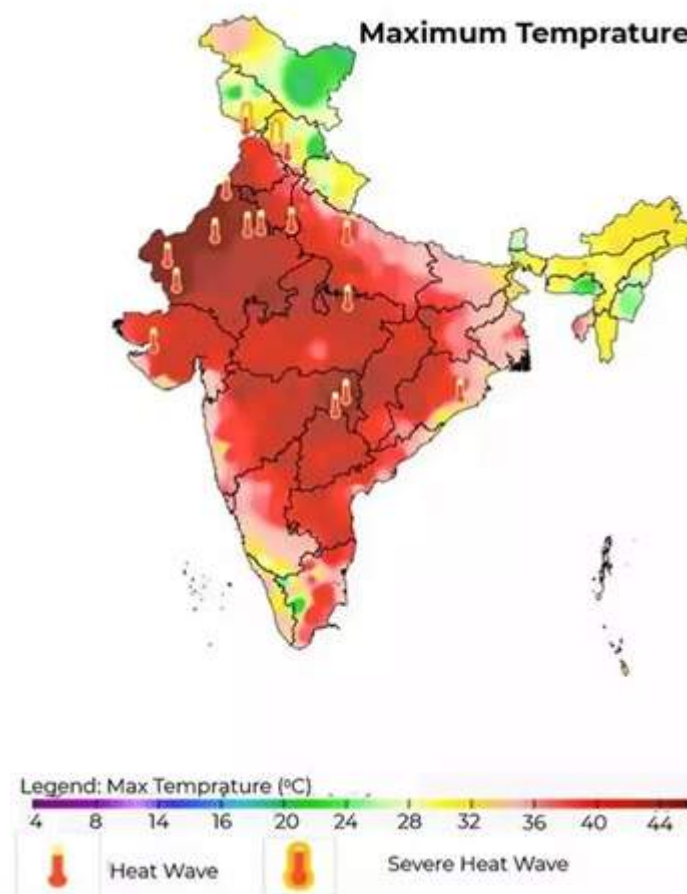
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Executive Summary

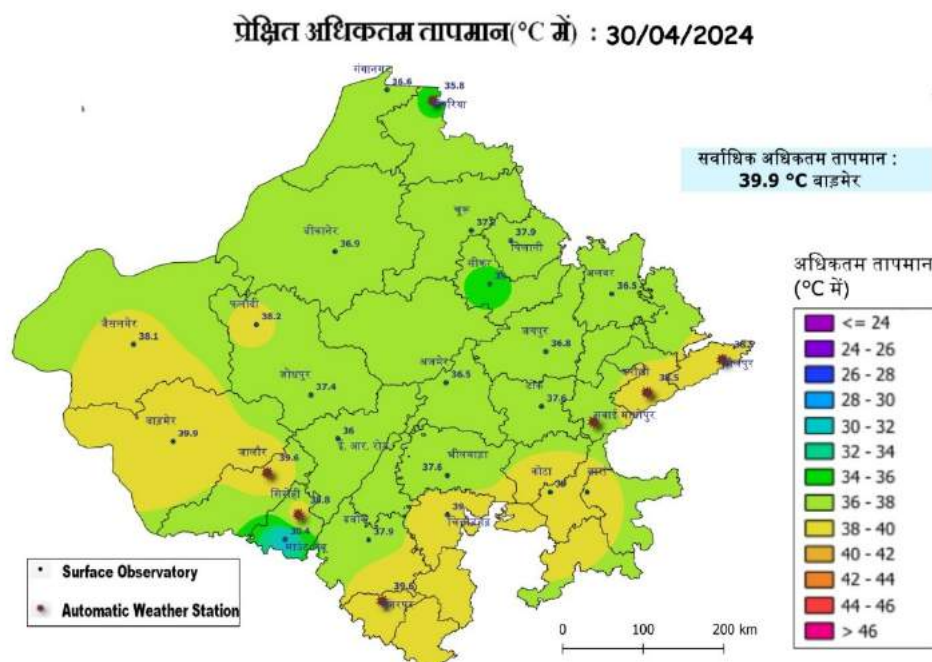
The heat wave has emerged as one of the major weather hazards in India. Heat Wave is a period of abnormally high and more than the normal maximum temperature that occurs between March and June. This is also called a “Silent Disaster” as it develops slowly and kills humans and animals. The frequency of daily peak temperatures of longer duration has been increasing in recent years due to global warming. These extreme temperatures combined with the existing atmospheric conditions such as humidity, wind speed and radiation adversely affect people living in these regions causing physiological stress, sometimes resulting in death.



Source:-IMD Jaipur

According to an India Meteorological Department (IMD) report, the state average summer mean maximum temperatures have been increasing over **Rajasthan**, Andaman and Nicobar, Goa, Himachal Pradesh, Karnataka, Kerala, Lakshadweep, Maharashtra, Mizoram, Andhra Pradesh, Sikkim and Tamil Nadu. These increasing trends in the mean maximum temperature over the Indian region are shown below.

The extreme temperatures combined with high humidity and resultant atmospheric conditions adversely affect people living in these regions leading to physiological stress, sometimes even death. This unusual and uncomfortable hot weather can impact human and animal health and also cause major disruption in community infrastructure such as power supply, public transport and other essential services. The heat wave action plan is now formulated to enable administrators to take appropriate measures and action for being in a state of preparedness for the heat wave during the months of March, April and May.



*Figure 1- Maximum Observed Temperature Of Rajasthan on 30th April
(Source IMD)*

Northwest Rajasthan region is prone for extreme temperatures. Highest ever Maximum temperature 50.8 °C recorded at Churu on 1st June, 2019. Month wise extreme maximum temperatures observed at different stations are depicted.

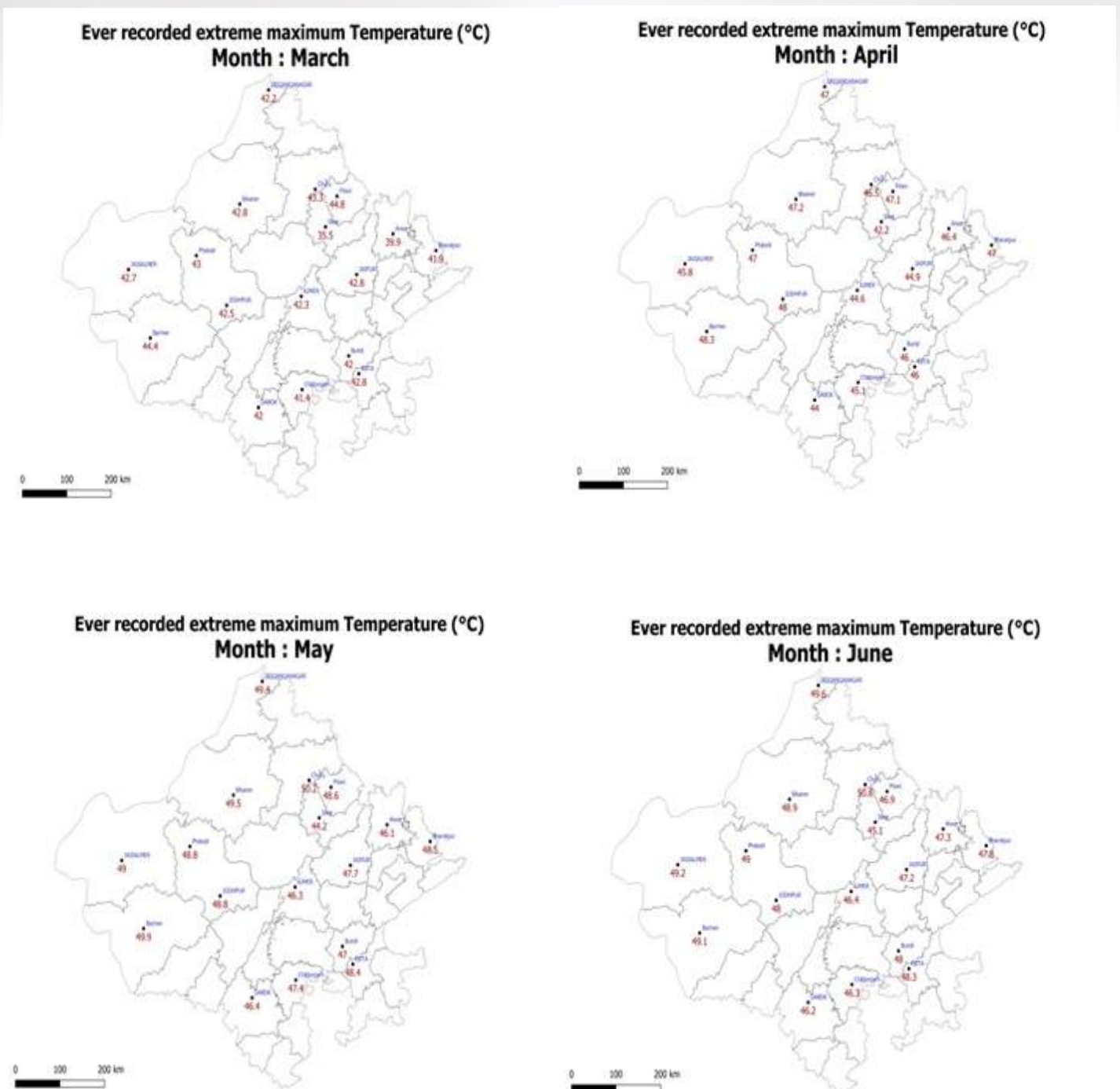


Figure 2: Extreme Maximum Temperature Recorded in Districts (Combined 70 Years Data)Source: IMD Jaipur

There is a strong and global scientific consensus that the climate is changing and this change will cause an increase in average global temperatures, as well as the number and intensity of heat-waves. Heat-waves are significant cause of death and morbidity across the world, and the impacts of heat events are likely to increase due to changing frequency, severity, and intensity of heat-waves caused by climate change.

Heat waves have caused more deaths than any other natural disaster in Rajasthan and represent a significant risk to public health. Heat wave action plan of Rajasthan adopted two criteria:

- The Increased occurrences of summer heat wave conditions in recent years are affecting the human life. Prior information about the possible heat wave conditions will help in reducing the risk to human life besides helping in taking precautionary action, the government agencies to be vigilant and allow them to plan outreach activities to save the lives of the public.

Relative Humidity %	Temperature °C																	
	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	
40	27	28	29	30	31	32	34	35	37	39	41	43	46	48	51	54	57	
45	27	28	29	30	32	33	35	37	39	41	43	46	49	51	54	57		
50	27	28	30	31	33	35	36	38	41	43	46	49	52	55	58			
55	28	29	30	32	34	36	38	40	43	46	48	52	54	58				
60	28	29	31	33	35	37	40	42	45	48	51	55	59					
65	28	30	32	34	36	39	41	44	48	51	55	59						
70	29	31	33	35	38	40	43	47	50	54	58							
75	29	31	34	36	39	42	46	49	53	58								
80	30	32	35	38	41	44	48	52	57									
85	30	33	36	39	43	47	51	55										
90	31	34	37	41	45	49	54											
95	31	35	38	42	47	51	57											
100	32	36	40	44	49	56												

Cautious

Extreme Caution

Danger

Extreme Danger

What is a Heat Wave?

Heat wave is defined as a condition of increased atmospheric temperature that leads to physiological stress, which sometimes can claim human life. Quantitatively Heat Wave can be defined as any increase from the normal temperature. Again, depending on the deviation from the normal temperature it can be moderate or severe heat wave. If the maximum temperature of any place continues to be 45° C for consecutive two days, it is called as Heat wave conditions.

Physiologically human body can tolerate environmental temperature of 37°C. Whenever the environmental temperature increases above 37°C., the human body starts gaining heat from the atmosphere. In the case of humidity being high along with high temperature, a person can suffer from heat stress disorders even with the temperature at 37° or 38° C.

As per India Meteorological Department (IMD), following criteria is used to declare a heat wave condition prevailing:

i)	Based on Departure from Normal <ul style="list-style-type: none">➤ Heat Wave: Departure from normal is 4.5°C to 6.4°C.➤ Severe Heat Wave: Departure from normal is > 6.4°C.
ii)	Based on Actual Maximum Temperature (For plains only) <ul style="list-style-type: none">➤ Heat Wave: When actual maximum temperature ≥ 45°C.➤ Severe Heat Wave: When actual maximum temperature ≥ 47°C.
iii)	if maximum temperature of a station reaches at least 40°C or more (for plains)
iv)	if maximum temperature of a station reaches at least 37°C or more (for coastal areas)
v)	if maximum temperature of a station reaches at least 30°C or more (for hilly regions)

Table 1: Heat Wave Criteria by IMD

To declare a heat wave, one of the above criteria should be met for at-least two consecutive days. A heat wave will be declared on the second day. Department Of Disaster Management, Relief and Civil Defence (DMRCD), Government of Rajasthan follows the first criterion given above.

Colour codes for Heat wave Alert: Currently follows a single system of issuing warnings for the entire country through colour coded system as given below. The heat waves are classified into different severity categories bearing on the temperatures with colour codes as given in Table 1:

Colour Code	Alert	Warning	Impact	Suggested Actions
Green (No action)	Normal Day	Maximum temperatures are near normal.	Comfortable temperature. No cautionary action required.	Nil
Yellow Alert (Be updated)	Heat Alert	Heat wave conditions at isolated pockets persists on 2 days	Moderate temperature. Heat is tolerable for general public but moderate health concern for vulnerable people e.g. infants, elderly, people with chronic diseases	<ul style="list-style-type: none"> • Avoid heat exposure. • Wear lightweight, light-coloured, loose, cotton clothes. • Cover your head: Use a cloth, hat or umbrella
Orange Alert (Be prepared)	Severe Heat Alert for the day	(i) Severe heat wave conditions persist for 2 days (ii) Through not severe, but heat wave persists for 4 days or more	High temperature. Increased likelihood of heat illness symptoms in people who are either exposed to sun for a prolonged period or doing heavy work. High health concern for vulnerable people e.g. infants, elderly, people with chronic diseases.	<ul style="list-style-type: none"> • Avoid heat exposure–keep cool. Avoid dehydration. • Drink sufficient water–even if not thirsty. • Use ORS, homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. to keep yourself hydrated
Red Alert (Take Action)	Extreme Heat Alert for the day	(i) Severe heat wave persists for more than 2 days. (ii) Total number of heat/severe heat wave days exceeding 6 days.	Very high likelihood of developing heat illness and heat stroke in all ages.	Extreme care needed for vulnerable people.

Table 1-Colour Code Signal for Heat Wave Alert and Suggested Actions (NDMA 2019)

1.1 CLIMATE CHANGE AND EXTREME HEAT IN RAJASTHAN

Background

The State of Rajasthan is situated in the western part of India, which faces severe water scarcity, poor rainfall, and is classified as arid/semi-arid region. Administratively, the State comprises of 33 districts, 39753 inhabited villages, 249 Panchayat Samities and 9168 Gram Panchayats. Geographically, deserts in the State constitute a large share of landmass. The forest cover of the State contributes 4.19% to the national forest cover (Table 2). There are three major rivers flowing through Rajasthan, the Chambal and seasonal rivers Tapi and Luni. The state is severely deficient in the most important resource, that is, water. With 10.4 percent of the country's area and 5.5 percent of its population, Rajasthan has only about 1 % of the country's water resources. On the basis of climatic conditions and agricultural practices, Rajasthan has been divided into 10 agro-climatic zones ranging from arid western to flood prone eastern. Rajasthan is the largest state of India, comprising 10.4 % of the country's total area. Nearly 76 % of the state's population resides in rural regions. Rajasthan produces 5.49% of the nation's total food grains production and 21.31 % of its oil seeds. The state has 49 million livestock—mainly cows, buffaloes, and goats—comprising 10.13 % of the country's livestock population.

S.No.	Indicators	Rajasthan	% of India
1	Area	3,42,000 sq. km.	10.4
2	Population	56.5 million	5.49
3	Rural population	43.2 million	5.8
4	Total forest cover	32,627 sq. km.	4.19
5	Gross cropped area	2,16,99,000 hectare	11.25
6	Net sown area	1,68,36000 hectare	11.87
7	Net irrigated area	62,94,000 hectares	10.46
8	Livestock	49 million	10.13
9	Food grain production	1,14,45,000 tonnes	5.49
10	Oilseed production	59,64,000 tonnes	21.31
11	Rainfall 57.5 cm (annual average)		

Table 2: An Overview of Rajasthan (Source- Rajasthan State Action Plan on Climate Change)

Uneven distribution of socio-economic and cultural factors affects various population groups and capacity to respond as well as to adapt to the hazards. Lack of adequate provision of many essential determinants of health such as access to safe drinking water, adequate sanitation systems, diet and

nutrition, safe housing and gender equality play a crucial role in establishment of vulnerability among the population. The rural Rajasthan is dually vulnerable than the urban because of lack of awareness, poor access to healthcare and access to cooler places. Rajasthan is one of those states having hottest districts of India.

Children and elderly are most affected by the climate change and climate sensitive diseases. The developing bodies of children are sensitive to environmental hazards such as heat waves and the spread of infectious disease and damage experienced during these initial years can have lifelong impacts. In 2007, it is found that more than 200 million children under five years of age in developing countries do not reach their development potential due to poverty, malnutrition and poor health which disrupts their cognitive, physical and socio-emotional development after exposing to hazardous pathogenic agents. Apart from that, lower resistance and poor access to preventive interventions contributes to major part of these causes. Older persons are at risk because of higher rates of co morbidity medications use, immobility and blood volume depletion.

Heat Waves is one of the biggest issues facing the world today it is not a new phenomenon in the Earth's history. It's a one of the most seen reactions of Climate Change. Climate Change refers to a significant variation in either the mean state of the climate or in its variability, persisting for an extended period, typically, decades or longer. Climate change scenario has notable detrimental effects such as droughts resulting into food insecurity and increased malnutrition, migration, and diminished water resources etc. Studies indicate that the decade (2007-2017) across the globe recorded the warmest years during the past century, the three years viz. 2015, 2016, and 2017 recording warmer conditions, increasing in sequence. It is predicted that by year 2099 earth average temperature will rise 3-6 ° C, which will lead to many more severe heat waves.

Situational analysis:

As per census 2011, the area of Rajasthan state 3, 42,239 sq. km and the total population is 6.86 crores (5.66 percent of Indian population). Out of which more than 2/3rd people live in rural part. 'Thar' desert area consists of 12 districts

covering, 60 percent area of the state and 40 percent of the entire state population. Rajasthan contributed 9.1 percent of India's total livestock emissions. In the matter of transport, total number of registered motor vehicles in Rajasthan State, increase from 8985568 as on 31 march, 2012 to 20223021 as on 31 March, 2021. The growth in vehicle population stood at 125.06% during 10 years.

Looking at the larger picture, In Rajasthan the rural areas are largely neglected in terms of climate change and its impact on health. And, very less work is done about Community perception and awareness, which is important for developing adoption strategies.

The concept of "Climate Change" is relatively new in rural areas although they had clear perceptions about changes in heat, cold and rainfall patterns that had occurred over the last five to ten years. Local perceptions of climate change include overall warmer winter and increased heat in summer with changing patterns of precipitation. The effect of climate change was mostly related to decrease in ground water level and its effect on livelihoods, livestock and health. Most local perceptions are consistent with the evidence regarding the vulnerability of rural areas to Climate change. Rural Rajasthan has dual burden of Climate change because of absence of awareness and second lack of resources for treatment and adaptation. The systemic collection of these information will enable policy makers, researchers and scientists to design and implement different action plans and strategies for climate change in rural areas which are more vulnerable.

Rajasthan is located in north-western parts of India and has frequent hot and dry weather conditions during summer season. Annual maximum, minimum and mean land surface temperature anomalies averaged over Rajasthan for the period 1901-2022 is shown in figure 4. The anomalies were computed with respect to the base period of 1981-2010. The dotted black line indicates the linear increasing trend in the annual mean temperature over Rajasthan (Rajasthan climate report 2022, India Meteorological Department). The month wise mean maximum temperatures based upon 1991-2020 data over Rajasthan

are depicted in figure 2 and 3. May is the warmest month with highest mean maximum temperature 43.7 °C at Bundi followed by 42.7 °C at Phalodi.

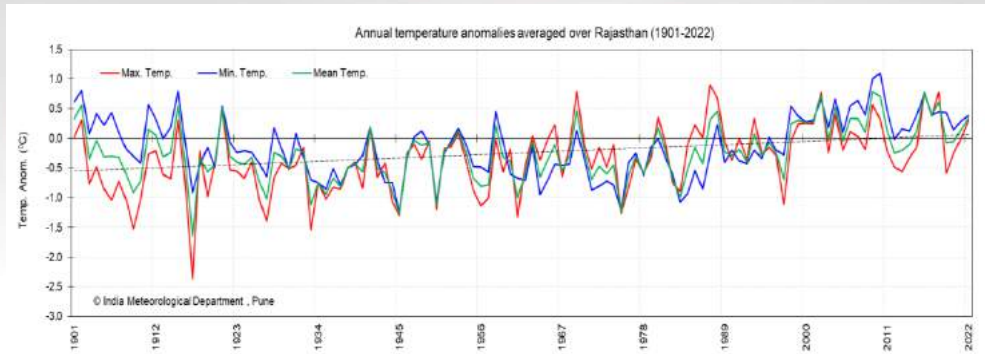


Figure 4: Annual maximum, minimum and mean land surface temperature anomalies averaged over Rajasthan for the period 1901-2022

Mean Maximum temperature:

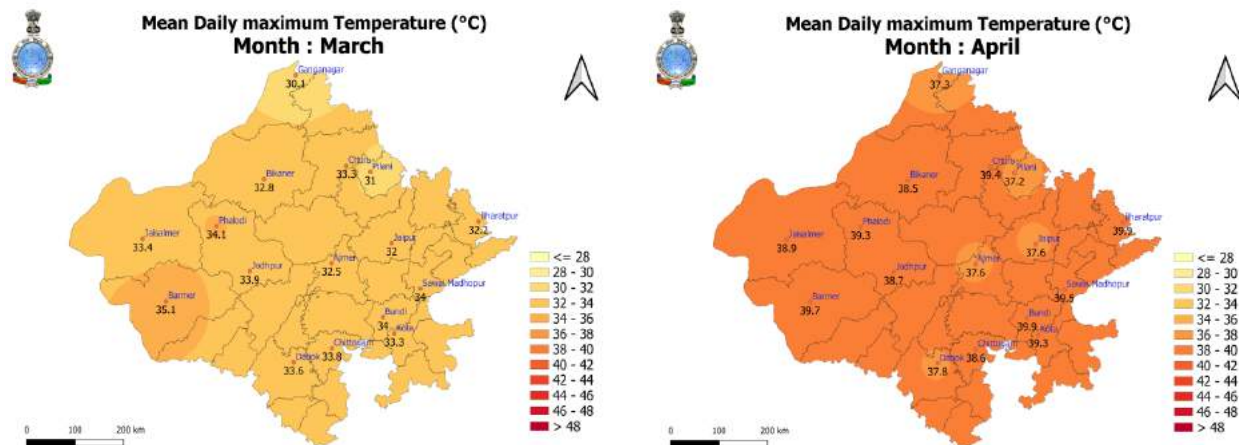


Figure 5- Daily mean maximum Temperatures (1991-2020) for March and April.

Source- IMD

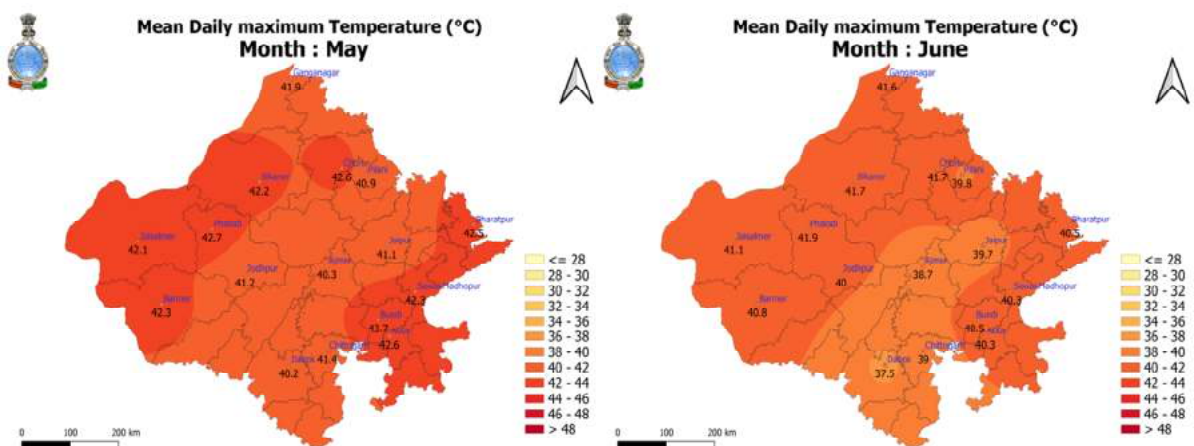


Figure 6- Daily mean maximum Temperatures (1991-2020) for May and June.

Source- IMD

Indicators	Year	Unit	Rajasthan	India
Geographical Area	2011	Lakh sq. km	3.42	32.87
Population	2011	Crore	6.85	121.09
Decadal Growth Rate	2011	%	21.3	17.7
Population Density	2011	Population/sq.km	200	382
Urban Population to total population	2011	%	24.9	31.2
Scheduled caste Population	2011	%	17.8	16.6
Scheduled Tribe Population	2011	%	13.5	8.6
Sex Ration	2011	Females/1000 males	928	943
Child Sex Ratio (0-6 Years)	2011	Females Children per 1000 male children	888	919
Literacy Rate	2011	%	66.1	73.0
Literacy Rate (male)	2011	%	79.2	80.9
Literacy Rate (Female)	2011	%	52.1	64.6
Work Participation Rate	2011	%	43.6	39.8
Crude Birth Rate	2020*	Per 1000 midyear population	23.5	19.5
Crude Death Rate	2020*	Per 1000 midyear population	5.6	6.0
Infant Mortality Rate	2020*	Per 1000 live births	32	28
Maternal Mortality Ratio	2018-20*	Per Lakh Live Births	113	97
Life Expectancy Birth	2016-20*	Year	69.4	70.0

****SRS bulletin: Office of Registrar General of India***

Table 3: Demography of Rajasthan

1.2 HISTORY OF HEAT WAVE IN DISTRICTS OF RAJASTHAN

May is typically the hottest month in India and Rajasthan with temperatures reaching up to 45°C in certain areas before the cooling southwest monsoon rains arrive in July. In this season, it is an utmost priority to prevent heat related illnesses in the vulnerable population especially, children, elderly as well as the slum population. The need of the moment is to have a plan to help them for adaptation to the temperature changes. As climate change as well as Global warming, are the broad issues needed the coordinated action. Human induced climate change increases the probability of occurring the heat events as well as susceptibility to such heat events.

On 19th May 2016, Phalodi in Jodhpur district of Rajasthan recorded the day time temperature indicating 51°C. It ranked as third highest temperature globally. Most of the places in Rajasthan recorded day temperature more than 46 ° C on that day and top seven highest day time temperatures in India were found from Rajasthan state. Heat related deaths and increased admissions in hospitals are reported in Rajasthan on the day of highest temperature. Hence, the necessity of having a proper action plan on priority basis is ratified during the dialogues.

The mean frequency of Heat Wave and coefficient of variation based upon 1969-2022 data is depicted in Table 4. Lowest mean HW frequency of 0.2-1.9 days with high coefficient of variation is found in March. The highest mean HW frequency of 0.4-5.9 days with low coefficient of variation is observed in May. More than five days mean frequency is observed in May over Bikaner, Churu and Ganganagar followed by Kota and Jaisalmer with mean Heat Wave days 4.4 & 3.6 days respectively. As the south west monsoon approaches in the month of June, the high frequency zone of Heat Wave shifted from central parts of west Rajasthan to extreme west Rajasthan towards Sri Ganganagar. Highest mean frequency of Heat Wave is observed 1.9 days at Barmer in March, 3.0 days at Ganganagar in April, 6.6 days at Churu in May and 5.3 days at Sri Ganganagar in June.

Station	Mean Heat Wave Days				Coefficient of Variation			
	March	April	May	June	Mar ch	April	May	June
Ajmer	0.2 ± 0.6	0.7 ± 1.5	0.7 ± 1.9	1.3 ± 2.0	3.19	2.07	2.51	1.56
Dabok	0.5 ± 2.1	0.4 ± 1.2	0.4 ± 1.1	1.2 ± 1.7	3.94	3.15	2.86	1.47
Jaipur	0.2 ± 0.8	1.0 ± 2.0	1.1 ± 1.8	1.3 ± 1.8	3.29	2.07	1.66	1.38
Kota	0.8 ± 1.6	1.1 ± 2.2	4.4 ± 4.4	2.6 ± 3.1	2	1.93	1	1.21
Bikaner	1.1 ± 2.1	2.1 ± 3.2	5.1 ± 4.8	3.6 ± 3.6	2.01	1.51	0.94	1.01
Barmer	1.9 ± 3.1	1.7 ± 3.0	3.4 ± 3.8	2.0 ± 2.7	1.6	1.76	1.12	1.36
Churu	1.4 ± 2.4	2.2 ± 3.4	6.6 ± 5.5	5.1 ± 4.4	1.76	1.55	0.83	0.87
Sri Ganganagar	0.2 ± 1.0	3.0 ± 4.2	5.9 ± 4.9	5.3 ± 4.1	4.3	1.41	0.83	0.76
Jodhpur	1.1 ± 1.8	1.0 ± 1.6	1.8 ± 2.8	1.8 ± 2.4	1.65	1.65	1.56	1.37
Jaisalmer	1.1 ± 2.0	1.3 ± 2.5	3.6 ± 3.7	2.5 ± 2.8	1.8	1.88	1.01	1.11

Table 4: Month wise mean frequency of HW and Coefficient of variation

Source: - IMD Jaipur

District	Heat Wave (No. of days)	Severe Heat Wave (No. of Days)	Total (No. of Days)
Ajmer	10	1	11
Barmer	32	8	40
Bikaner	28	16	44
Churu	26	13	39
Jaipur	6	5	11
Sri Ganganagar	29	21	50
Jodhpur	19	2	21
Kota	18	1	19
Jaisalmer	20	11	31

Table 5: Number of Heat Wave days measured in various IMD stations of Rajasthan in year 2022

(Source: - IMD Jaipur)

1.3 NECESSITY OF HEAT WAVE ACTION PLAN

There is a need of a coordinated multi-agency approach to the state's management of Heat wave. At present, the problem of Heat waves is being managed at an operational level but it needs to be managed at a strategic level. There is a need for clear roles and responsibilities in the management of Heat waves, sufficient strategic monitoring, and greater clarity around triggers for activation and sharing of data across multiple systems and mapping or analysis of the extreme heat impacts across the community. Earlier, efforts of the State Government to reduce mortality and mitigate the suffering of public due to Heat waves even after implementing some of the recommendations of the State Level Committee have not proved sufficient measures. This may be seen from the fact that 448 deaths were reported due to Heat wave / Sun Stroke during summer-2014 which increased to 1369 in Summer-2015 and subsequently decreased to 723 in Summer -2016, 236 in Summer-2017, 08 in summer- 2018, 28 deaths in summer – 2019 and zero deaths in summer 2020 and 2022. Taking cognizance of the serious situation arising out of the intense Heat waves on public leading to high fatalities. The after deliberations on studying the Heat wave Action Plans of other states and best practices, prepared a Comprehensive Plan entitled '**Rajasthan Heat wave Action Plan**'.

1.4 IMPACT OF HEAT WAVE

Impact of Heat Wave on Life and Livelihood

The human thermoregulatory system has limits. Our muscles generate heat, which must be shed to the environment to maintain our core temperature of about 36.7° C. Evaporation of sweat helps human bodies to keep cool when it is hot, however, when there is excessive sweating, it leads to dehydration with consequent rise in internal body temperature which is fatal. More or less, Rajasthan population might be acclimatized to heat and humidity but there is an upper level of heat tolerance limit. However, acclimatization to heat can only offer limited protection. When temperature soars beyond the tolerance limit, precautionary measures like avoiding the sun and physical exertion, maintaining hydration, and resting in a cool place are suggested.

However, serious challenges arise when extreme heat events linger for prolonged periods, as cessation of activities for weeks is often not an option.

Impact of Heat Wave on Agriculture

A part from, impact on human life, the Heat Wave has also been found to profoundly affect crop production both in terms of quantity and quality. Primarily, crop loss happened due to flower drop and higher mortality in new plantations. Rabi and Zaid crops are more impacted. Any extreme change in temperature would affect the productivity.

Loss of Labour Hours due to Heat Wave

Extreme weather events, including heat waves, heavy rainfall, and snowfall, have a detrimental impact on the productivity and efficiency of the informal workforce, particularly agricultural workers and manual labourers such as rickshaw pullers, construction workers, and fruit sellers (Li et al., 2016). According to the International Labour Organization (ILO, 2019), if the current global warming trends persist, the overall percentage of lost working hours is projected to rise to 2.2% by 2030. This translates to the equivalent of losing 8 crore full-time jobs or approximately US\$ 2,400 billion (ILO, 2019). However, the distribution of lost working hours is not uniform across regions. Southern Asia and Western Africa are expected to experience a loss of 5.3% and 4.8% of total working hours, respectively, corresponding to around 4.3 crore and 90 lakh full-time jobs.

In India alone, between the years 2001 and 2020, approximately 259 billion labour hours were lost annually due to humidity and heat waves, resulting in a total cost of Rs. 46 lakh crores. Heat waves impede labour efficiency by hindering workers in physically demanding occupations from operating at their full potential due to excessive sweating, exhaustion, and dehydration. The ILO (2019) further estimates that by 2030, India will lose approximately 5.8% of its total labour hours due to the combined effects of heat and humidity.

The loss of labour hours caused by heat stress has severe repercussions for India, considering that roughly 90% of the country's labour force is employed in the informal sector, with a significant portion engaged in physically demanding occupations (Barthwal et al., 2022; ILO, 2019).

This vulnerability exposes the Indian economy to the adverse consequences of heat waves. The agricultural sector is expected to bear the

brunt of the impact from lost work hours, followed by the construction sector (ILO, 2019a). The implications of these losses extend beyond immediate economic consequences, affecting the livelihoods and well-being of individuals and communities dependent on these sectors. Additionally, heat stress exacerbates existing social and economic disparities, as marginalized groups and those engaged in informal labour are disproportionately affected by the consequences of extreme heat (Barthwal et al., 2022).

In conclusion, extreme weather events, particularly heat waves, pose a significant threat to the productivity and efficiency of the informal workforce in India. The projected increase in lost working hours due to heat and humidity highlights the urgent need for measures to mitigate and adapt to the effects of climate change. Addressing this issue requires a comprehensive approach that encompasses both immediate interventions, such as improved working conditions and access to protective measures, as well as long-term strategies focused on sustainable development and climate resilience (ILO, 2019). By prioritizing the protection of workers and implementing effective policies, India can work towards reducing the impact of extreme heat on labour hours and securing a more sustainable and inclusive future.

India, the nation hit hardest by heat stress, experienced a reduction of 4.3 percent in working hours in 1995, and it is projected that this number will increase to 5.8 percent by 2030 (Table-6). Additionally, due to its large population, India is expected to suffer a substantial loss of approximately 34 million full-time jobs in 2030 as a direct consequence of heat stress.

While the agricultural sector will bear the brunt of the impact in India, the construction sector is also anticipated to face a growing loss of working hours as heat stress affects both male and female workers.

	1995						2030					
	Agriculture	Industry	Construction	Services	Total	Total (thousand full-time jobs)	Agriculture	Manufacturing	Construction	Services	Total	Total (thousand full-time jobs)
India	5.87	2.95	5.87	0.63	4.31	15519	9.04	5.29	9.04	1.48	5.8	34056

Table 6: Total working hours lost due to heat stress, by sector and country Southern Asia, 1995 and 2030 projections (Source: ILO)

1.5 KEY STRATEGIES- RAJASTHAN HEAT WAVE ACTION PLAN

1. To monitor climate conditions and initiating an Early Warning System and Inter-Agency Coordination to alert stakeholders of predicted high and extreme temperatures.
2. Building Public Awareness and increasing Community Outreach to communicate the risks of Heat waves and implement practices to prevent heat-related deaths and illnesses. Special efforts will be made to reach vulnerable populations through inter-personal communication as well as other outreach methods which include posters, brochures and information sheets.
3. Identifying vulnerable populations and the health risks specific to each group.
4. Developing effective strategies, agency coordination and response planning that addresses health risks.
5. Capacity Building among Health Care Professionals to recognize and respond to heat- related illnesses, particularly during extreme heat events.
6. Reducing Heat Exposure and Promoting Adaptive Measures by launching new efforts including mapping of high-risk areas, assess to potable drinking water and cooling spaces during extreme heat days.
7. Collaboration with non-governmental organizations as a means to expand outreach and communication with the most vulnerable communities. Evaluating and updating the Heat Action Plan regularly.

1.6 PURPOSE OF HEAT WAVE ACTION PLAN

The Rajasthan Heat Wave Action Plan aims to provide a framework for the implementation, coordination, and evaluation of extreme heat response activities in the State for reducing the negative impact of extreme heat event. The Plan's primary objective is to develop and implement heat health communication specially targeted towards vulnerable population, those most at risk of heat-related illness. This plan will also involve the interdepartmental coordination framework, which is multidimensional in nature for enhancing collaboration and coordination between all line departments for efficient implementation of State Heat Action Plan.

Establish Early Warning System and Inter-Agency Coordination: To alert residents on predicted high and extreme temperatures- Who will do what, when, and how is made clear to individuals and units of key departments, especially for health.

Capacity building / training programme: These are very important for mitigation and disaster Risk Reduction. Training of the medical community on various aspects of heat wave related health hazard is essential to recognize and respond to heat-related illnesses, particularly during extreme heat events. Heat stroke is the medical emergency and training on the identification of heatstroke cases and the process of patient stabilisation before further evacuation should be imparted to the medical community.

Public Awareness and community outreach Disseminating public awareness messages on how to protect against the extreme heat-wave through print, electronic, social media and Information, Education and Communication (IEC) materials such as pamphlets, posters and advertisements, short video film and Television Commercials (TVCs) on Do's and Don'ts and treatment measures for heat related illnesses.

Collaboration with Non-Government Organisation and Civil Society:

Collaboration with non-governmental organizations and civil society organizations to improve bus stands, building temporary shelters, wherever necessary, improved water delivery systems in public areas and other innovative measures to tackle Heat wave conditions.

1.7 OBJECTIVES OF HEAT WAVE ACTION PLAN

1. To develop and implement various strategies for extreme heat events.
2. To develop and implement an early warning system in partnership with IMD for alerting those populations at risk and carrying out activities by the line departments.
3. To take appropriate measures for the Prevention and Mitigation against Heat Related Illness.
4. To build capacity of state and district level inter-department officials for efficient and coordinated implementation of state heat action plan.

5. To make more and appropriate use of adaptation and mitigation strategies for reducing heat waves and its impact on human health, livelihood and economy.
6. To identify vulnerable population and heat hotspots.
7. To reduce the heat related illnesses.
8. To enhance resilience of communities against extreme heat events.
9. To make Rajasthan state more resilient against extreme heat wave.

1.8 RAJASTHAN HEAT WAVE ALERT WARNING SYSTEMS

Early warning systems can enhance the preparedness of decision-makers and their readiness to harness favourable weather conditions. Early warning systems for natural hazards is based both on sound scientific and technical knowledge.

Accurate and timely alert systems are essential. Collaboration with India Meteorological Department (IMD) is needed to develop heat warning systems (HWS), trigger a warning, determine the threshold for action and communicate the risks.

The IMD provides warnings based on heat index (based on temperature and humidity).

It disseminates information to Disaster Management, Relief and Civil Defence Department, District Magistrates and all other concerned authorities including Doordarshan, All India Radio (AIR) by email. Immediately upon receipt of such a warning, the State and District Emergency Operation Centres make necessary arrangements for flashing the warning through all forms of media. Simultaneously, departments of Health and Family Welfare, Education, Labour, Transport, and Rural and Panchayati Raj, Local self-government and Urban Development and other related departments remain alert and put necessary emergency measures in place.

During a Heat Wave condition SEOC issues directives to all the concerned governmental organizations for a prompt action. Apart from this, department is also involved in establishing the Heat Wave related mortality recording system.

Heat wave forecast is transmitted to Divisional Commissioners, District Magistrates and all other concerned authorities through email, by calls and WhatsApp and other social media platforms by State Control Room SEOC. The warning is sent through mass SMS to all. Apart from this IMD gives this data to

All India Radio and also to Doordarshan. AIR and Doordarshan widely displays this alert through their mediums.

Department of Disaster Management publishes Do's and Don'ts & Hindi/English Daily Newspapers and other electronic media. IMD issues forecasts and warnings for all weather-related hazards in short to medium range (valid for the next five days) every day as a part of its multi-hazard early warning system. These warnings updated four times a day.

- The operational system of weather forecasts and warning is summarized in the chart below:

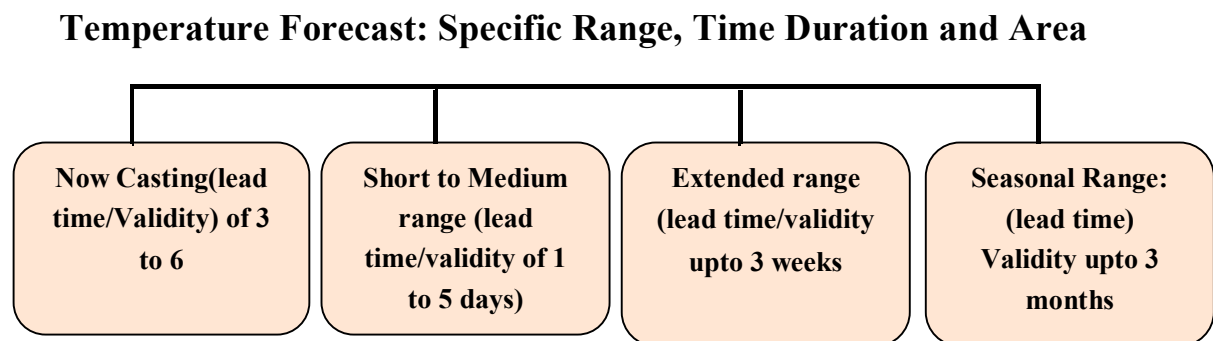


Figure 5: Temperature Forecast

1.9 Declaring Heat wave for the Rajasthan During 2024

For declaring the heat wave, the above criteria (Table 1) should be met for at least at two stations in a Meteorological sub-division for at least two consecutive days. A heat wave will be declared on the second day. The early warning would be communicated to line department from State Emergency Operation Centre (SEOC) through Heat Wave Early Warning Communication System.

Government of India
Ministry of Earth Sciences
India Meteorological Department
Meteorological Centre Jaipur



भारत सरकार
पृथ्वी विज्ञान मंत्रालय
भारत मौसम विज्ञान विभाग
मौसम विज्ञान केंद्र जयपुर

RAJASTHAN HEAT WAVE BULLETIN

दिनांक: 28 मार्च, 2024
समय: 1500 IST

1. वर्तमान तापमान परिस्थितियां/ Current temperature conditions:

- अधिकतम तापमान (Maximum Temperature): पिछले 24 घंटों में जोधपुर, बीकानेर संभाग में एक-दो स्थानों पर उष्ण लहर दर्ज की गई है। जोधपुर व कोटा संभाग के कुछ स्थानों पर अधिकतम तापमान 40-42 °C (सामान्य से 3-5 °C ऊपर) तथा कुछ भागों में 38-40 °C (सामान्य से 2-4 °C ऊपर) दर्ज किया गया। राज्य के शेष भागों में अधिकतम तापमान 36-38 °C (सामान्य से 2-3 °C ऊपर) दर्ज किया गया।

- जोधपुर, बीकानेर, कोटा व जयपुर संभाग के कुछ भागों में अधिकतम तापमान औसत जलवायु डाटा से 95 Percentile से ऊपर दर्ज किया गया है।

- सर्वाधिक अधिकतम तापमान : 42.0 °C फलोदी, जोधपुर में दर्ज किया गया है।




Maximum Temp. Departure from normal	Area
Markedly above normal (5.1°C or more)	Jodhpur division at isolated pockets
Appreciably above normal (3.1°C to 5.0°C)	Jodhpur, Bikaner, Jaipur, Kota divisions at few places
Above normal (1.6°C to 3.0°C)	Ajmer, Bharatpur divisions at few places

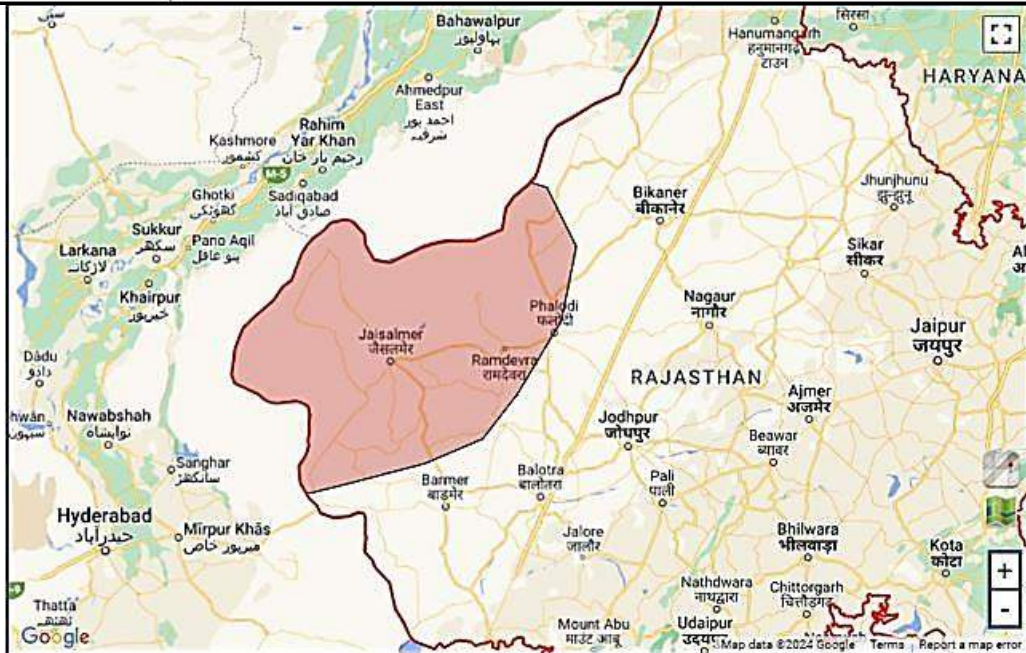
- न्यूनतम तापमान (minimum Temperature):

Minimum Temp. Departure from normal	Area
Markedly above normal (5.1°C or more)	Jodhpur, Jaipur divisions at isolated pockets
Appreciably above normal (3.1°C to 5.0°C)	Jodhpur, Bikaner, Jaipur, Kota divisions at few places
Above normal (1.6°C to 3.0°C)	Ajmer, Bharatpur divisions at few places

वेबसाइट: <https://mausam.imd.gov.in/jaipur/>
Contact Number: 0141-2790194 / 2793254, email: mejaipur@rediffmail.com

FN I

Generated by:	IMD Jaipur	Entry Date & Time:	27 Mar 2024, 1:14 PM	
Effective Date & Time:	27 Mar 2024, 1:00 PM	Expiry Date & Time:	28 Mar 2024, 1:00 PM	
Area Description:	Heat wave	Area covered:	61145.61 Sq. Km (approx.)	
Event Description:	Heat Wave	Urgency:	Expected	
Severity:	WATCH	Certainty:	Very Likely	
Dissemination Status:	Media Category	Media Name	Status	Message (Language)
	Internet Users	Web Browser	CAP XML Sent Successfully	Heat Wave is very likely to occur at few places ov...  (English)
		Mobile App	CAP XML Sent Successfully	Heat Wave is very likely to occur at few places ov...  (English)
	Satellite Media	GAGAN	CAP XML Sent Successfully	Heat Wave is Very Likely to occur over Heat wave a...  (English)
Message Body:	Message in English:	Heat Wave is very likely to occur at few places over Balotra, Jaisalmer, Phalodi in next 24 hours.State Emergency Operation Centre Secretariat DM, Relief and CD Department Secretariat Jaipur		
Warning Generated By:	Organisation:	IMD Jaipur		
	Contact No:	8789162105		
Description:				
Instruction:	Avoid heat exposure and keep your body cool.			



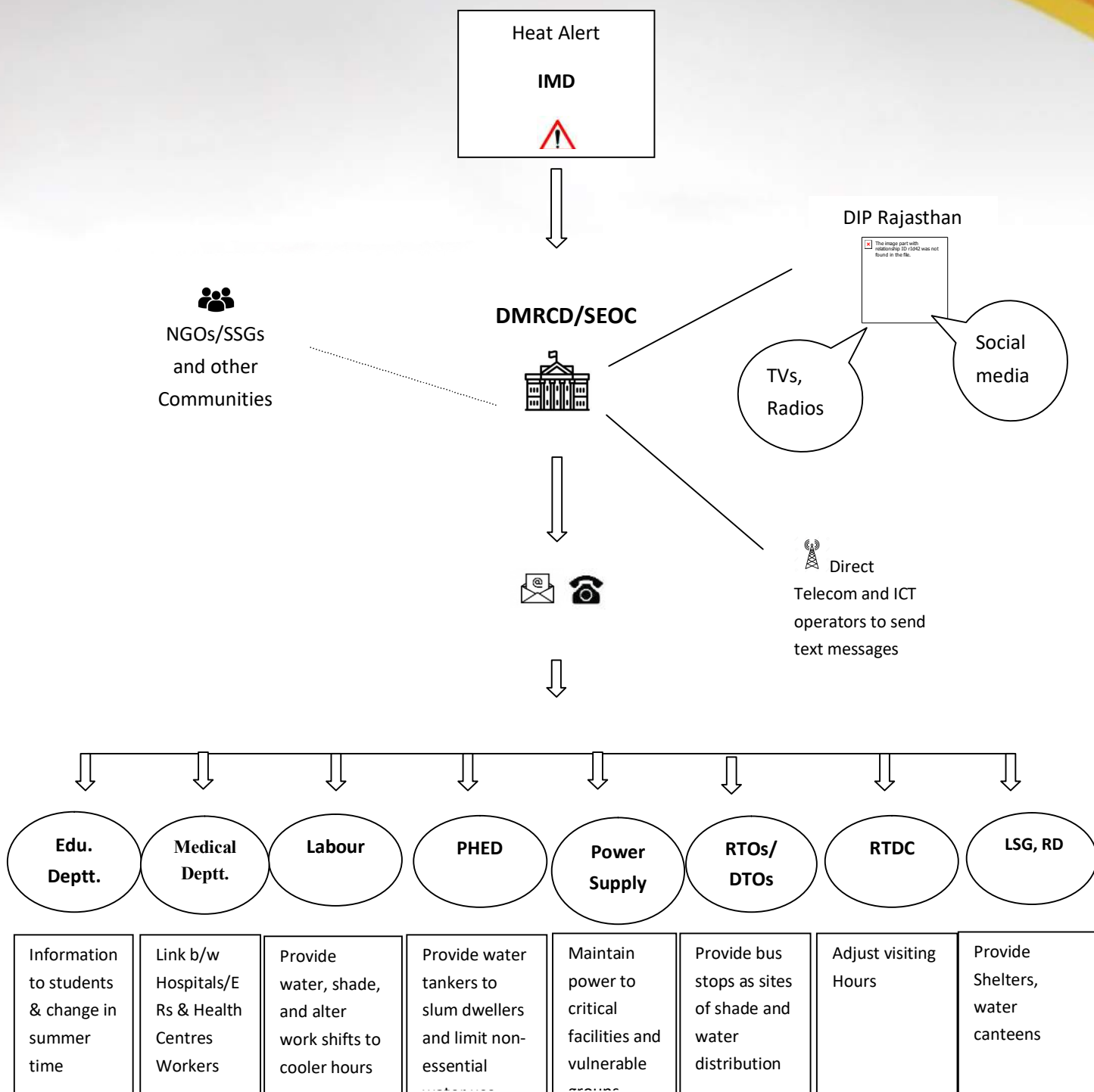


Figure 6: Inter Departmental Coordination Plan

Heat Wave and Early Warning System Coordination Plan

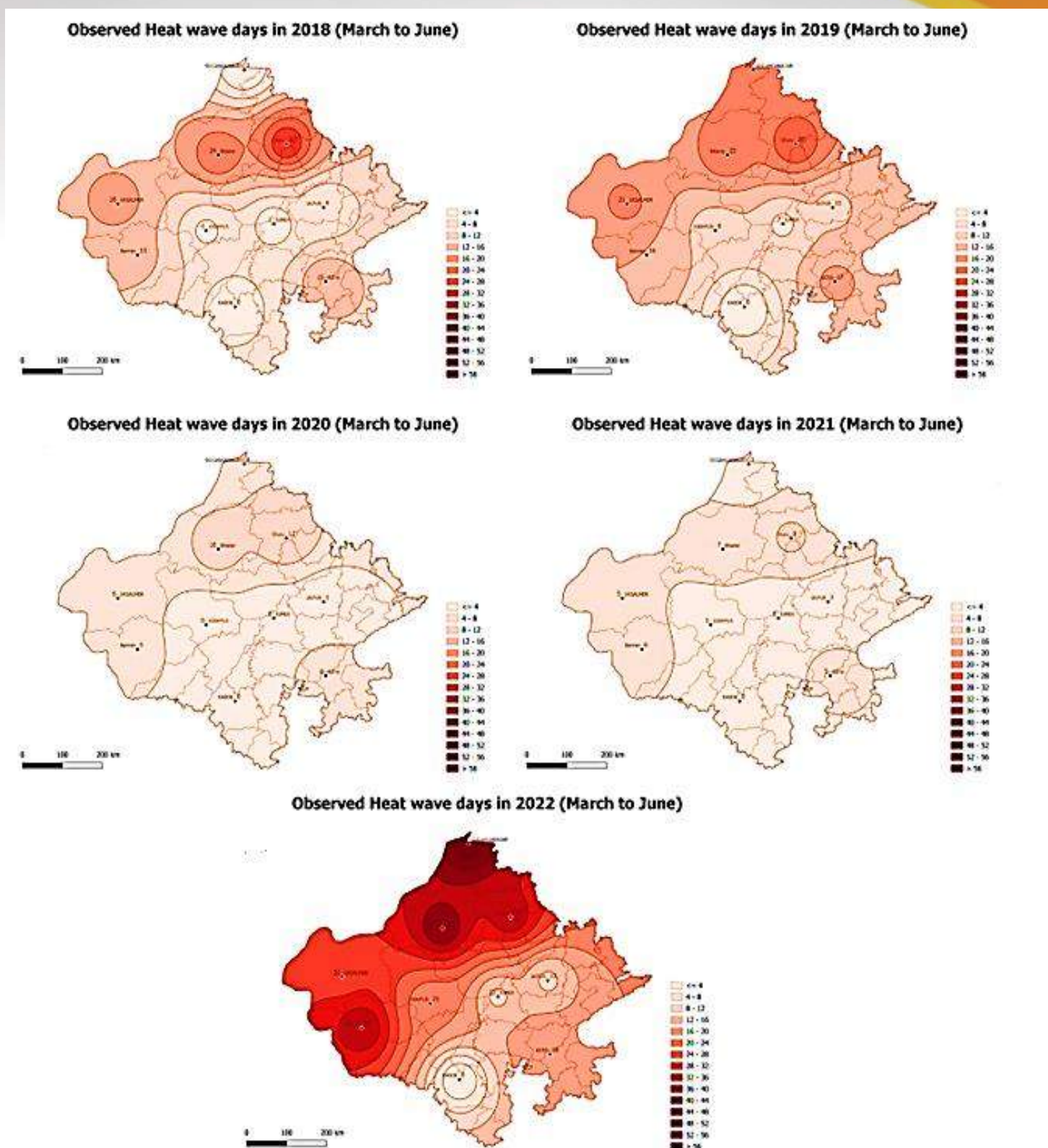


Figure 7-Heat Wave Maps of Rajasthan from year 2018-2022(source IMD)

2. Vulnerability Assessment of Heat Risks in Rajasthan

2.1 Context

Heat waves, whether they occur in India or elsewhere, often result in more deaths and illnesses. However, the impact of these heat waves depends on how vulnerable the population is. Vulnerability, as defined by the Fourth Assessment Report of the IPCC, means how likely it is for people to be negatively affected. It includes factors like how easily they can be harmed and if they can handle and adapt to the situation.

One common way to understand vulnerability is by using vulnerability indices. These help us identify areas where people are more at risk. This information is crucial for planning how to reduce the chances of negative effects from events like deaths, illnesses, or damage to property and infrastructure.

These indices help pinpoint areas that need extra attention so we can create plans to protect people and property. Understanding vulnerability to heat at a detailed level is crucial for making decisions about where to allocate resources to get ready for and respond to extreme heat events. So, the first step in making cities better prepared for heat waves is identifying the risks at a detailed level.

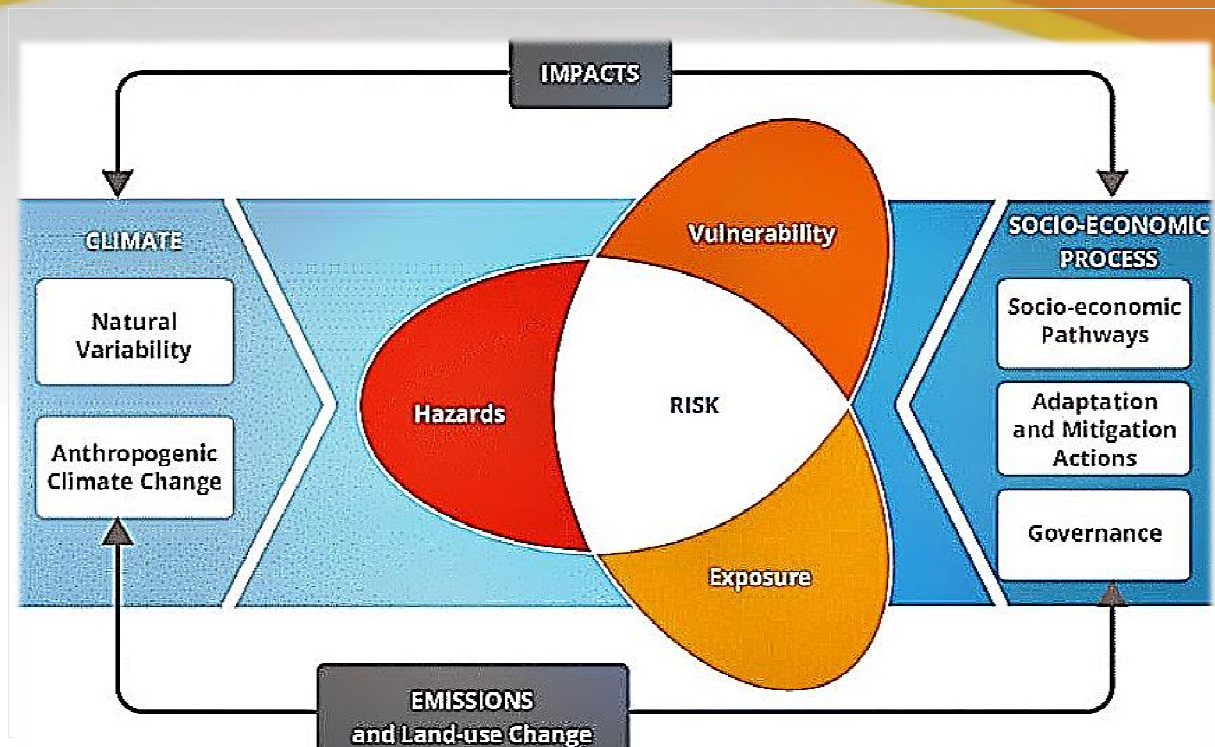


Figure 8-Illustration of the IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) framework for components risk and vulnerability. Source: IPCC, 2014

2.1.1 Heat Vulnerability Assessment

One adaptation response to heat as a hazard in cities has been the development of heat health warning systems. The purpose of these warning systems is to provide information on the health implications of hot weather conditions in a particular area. However, these warnings are often given at very broad regional scales. Heat Action Plans that provide detailed, sub-city scale warnings, and that incorporate key population risk factors, are the most useful for planning response actions.

Vulnerability to heat waves is a combined result of the socio-economic, physiological, climatologically, as well as behavioural variables. Any change in one of these variables can lead to a minor or major change in the state of the system, which can either amplify or attenuate vulnerability. These variables can often be classified into exposure, sensitivity, and adaptive capacity. While an increase in exposure and sensitivity leads to an increase in vulnerability, an increase in adaptive capacity leads to a decrease in overall vulnerability.

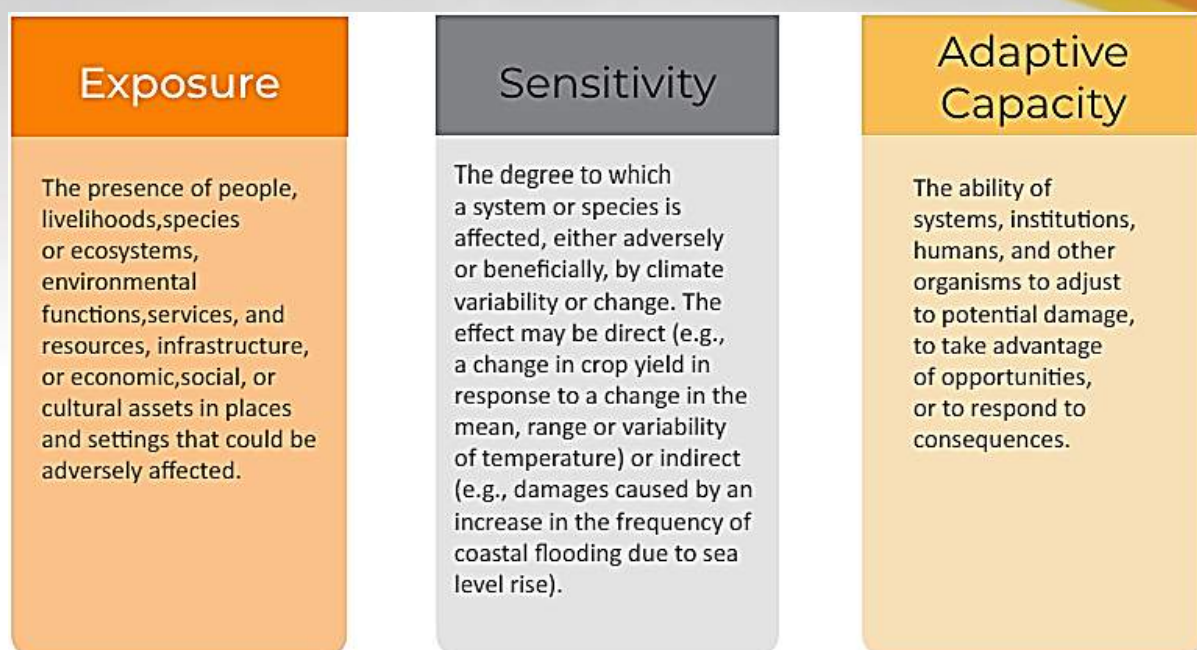


Figure 9-Diagrammatic representation of IPCC's Assessment Report 5 (AR5) categorization for three components of vulnerability: Exposure, Sensitivity and Adaptive Capacity (Source, IPCC 2014)

2.1.2 Data Sources and Methodology

For the preliminary analysis, vulnerability to heat is conceptualized as a function of exposure to heat and the sensitivity of people. There are different parameters (indicators) such as physical, land use, land surface temperature, and socio-economic-related parameters. Except for satellite-derived parameters, all other parameters were directly obtained from Census or local sources. (Table 7)

Category	Indicators
Exposure	Land Surface Temperature (LST)
	Population Density
Sensitivity	Slum Households
	Female Population
	Illiteracy Rate

	Sites of Labor Chowks
	Land use
Adaptive Capacity	Access to Urban Health Centres
	Access to Parks
	Access to Baoris
	Access to Roads

Table 7 -Vulnerability Parameters

2.1.3 Exposure

- Land Surface Temperature: LST as a parameter for exposure helps to identify areas where heat conditions are more likely to occur.
- Population Density: High population concentration in India can be associated with poverty and a low standard of living (including poor quality housing) which contributes to heat exposure.

2.1.4 Sensitivity

• Number of Slum Households: Slum populations are often sensitive to higher temperatures due to poor nutrition, poor housing quality and inadequate housing conditions. Additionally, they may lack access to basic amenities such as clean water and sanitation, which can exacerbate the impacts of extreme heat.

• Female Population: Females are generally more sensitive to heat-related health impacts than males especially in developing countries. Additionally, social and economic factors can exacerbate the impacts of extreme heat on females, such as gender-based inequalities in access to healthcare, education, and economic opportunities.

• Illiteracy Rate: People with lower literacy rate could be more sensitive to extreme heat events, as they are less aware of these events' potential danger or have less access to heat alerts.

• Labour Chowkati: These are places where the informal workers come together and spend considerable amount of time looking for work. These

chowks do not provide adequate shelter or other measures of protection from extreme heat. More generally, workers in informal sectors often have limited access to protective measures and healthcare services, and they may work in open spaces or poorly ventilated areas, which can increase their sensitivity to heat. Therefore, including sites of informal work as a parameter for sensitivity helps to identify sensitive populations that may require targeted interventions to reduce their risk to heat-related health impacts.

- Land use: Areas with high levels of industrial activity or mining may have a higher concentration of informal workers who may be at increased risk of heat-related health impacts due to their working conditions. Areas with high levels of impervious surfaces such as roads and buildings may experience higher temperatures due to the urban heat island effect. Areas with sparse or no vegetation, such as barren land or cremation grounds, may also be more prone to high temperature.

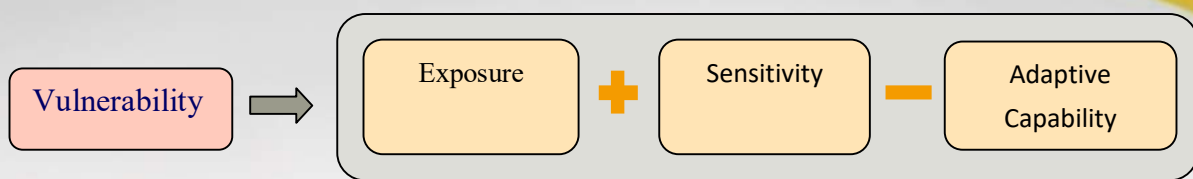
2.1.5 Adaptive Capacity

- Access to Urban Health Centres: Urban health centres can play a crucial role in reducing the health impacts of extreme heat by providing medical treatment, counselling, and information about how to stay safe during periods of high heat. Having adequate good access to health services can help individuals and communities to better cope with the effects of extreme heat and reduce the severity of health impacts.

- Access to Parks: Communities with better access to parks and open spaces have higher adaptive capacity to cope with extreme heat. These areas can provide relief from high temperatures by reducing the urban heat island effect, leading to a cooler and more comfortable environment for residents.

- Access to Baoris: Baoris can provide a source of cooling and drinking water during heat waves and can also serve as a social gathering place for the community.

- Access to Roads: The indicator of Road density is associated with adequacy of road infrastructure. High road density means better accessibility and mobility, which can enable people to access essential services and resources during extreme heat events, such as medical care, water, and cooling centres.



2.2 Derivatives from Risk Assessment

- Investigate how the presence of old water structures could aid short-term mitigation measures as well as long-term adaptation measures.
- Strengthen risk governance mechanisms by informing the responsible stakeholders of the risks associated with each district, which could lead to targeted attention.
- Regular monitoring during the summer season in the city and setting city-based thresholds for temperature-triggered response actions.

3. Prevention and Management of Heat Related Illness

3.1 Introduction

Heat Waves characterized by long duration and high intensity have the highest impact on morbidity and mortality. The impact of extreme summer heat on human health may be exacerbated by an increase in humidity. There is growing evidence that the effect of Heat Wave on mortality is greater on days with high levels of ozone and fine particulate matter. The frequency, severity, intensity and duration of heat wave and related mortality is going to increase further due to rapid global climate change.

Thermoregulation is the process that enables our body to maintain a normal core temperature. The hypothalamus regulates body temperature. It causes us to shed heat and maintain a normal core temperature by activating receptors in your skin and other organs. Our body uses sweat evaporation to release heat when it becomes really warm (make the heat go away). If the heat entering person body is more than the rate of heat leaving the body, the core temperature will rise and the person will be at risk for a heat-related illness.

The risk of heat-related illnesses is determined by heat exposure (ambient and internally produced heat from exertion), individual vulnerability (influenced by age, pregnant status, and concurrent disorders), and socio-cultural variables (including environmental exposure, poverty, lack of social cohesion, lack of access to health care, and limited worker protections).

Geographical location, employment (e.g., farming, construction, driving deliveries), social isolation, and time spent outdoors or in hot spots, such as urban heat islands and places with less greenery, all affect how much each person is exposed to heat-related dangers.

Heat-related illnesses range from mild to life-threatening, and heat exposure exacerbates many common health conditions, including cardiac, respiratory, and kidney diseases.

Heat related illnesses can be best prevented if the vulnerable populations/communities are made aware of prevention tips basic Do's and Don'ts through effective use of various media.

Physicians and pharmacists must have knowledge of effective prevention and first-aid treatment of heat related illnesses. It is also crucial to have an awareness of potential side-effects of prescription drugs during hot weather, to ensure the mitigation of heat illnesses.

Acclimatization

Those who come from cooler climatic conditions to warmer places face the risk of Heat Wave illnesses and need to be acclimatized. Acclimatization is achieved by gradual exposure to the hot environment during a Heat Wave. They should be advised not to move out in the open for at least one week to help the body acclimatize to the heat. They should also be advised to drink plenty of water.

3.2 Livestock Preparedness during Hot Weather

Extreme heat causes significant stress to livestock. There is a need to plan well for reducing the impact of high temperatures on livestock. Keeping an eye on the weather forecasts and developing a mitigation plan for high to extreme temperature can be effective in ensuring that the livestock has sufficient shade and water on hot days.

3.3 Vulnerable Population:

Heat waves and hot weather can be deadly and make pre-existing medical issues worse. All age groups and a variety of conditions can have an impact on one's health, but some people are more susceptible than others are to heat-related illnesses and even mortality. Children, elderly individuals, homeless people, persons with pre-existing ailments, outdoor and indoor labourers, emergency responders, members of low-income communities, pregnant women, athletes, and others are among the groups most at risk from heat.

VULNERABLE POPULATION: EXTREME HEAT

INFANTS AND CHILDREN



The risk of heat related is highest among is highest among infants and young and infants. Their bodies are less able to adapt to heat than adults.

PREGNANT WOMAN



Pregnant woman is more likely to get heat exhaustion, heat stroke, or other heat related illness sooner than non-pregnant women. This is because their bodies must work

harder to cool down both the pregnant woman's body and the developing baby.

OUTDOOR WORKERS



Regardless of the weather, many profession demand employees to operate in hot environment. Anyone working outside in hot weather without the proper protection especially if it requires strenuous physical activity is more likely to have heat related health problems.

THE ELDERLY



The elderly (and extremely elderly) make up the biggest identified vulnerable group at risk of heat wave. The elderly suffer due to the diminished ability to perspire.

3.4 Hospital Preparedness Measures for Managing Heat related Illness

Director/In-charge of hospitals, CHCs, PHCs and UHCs should ensure the following measures:

- A detailed action plan to tackle Heat related illnesses well in advance of hotter months.
- Operational framework-preparing specific health adaptation plan, development of guidelines and response plan for climate sensitive diseases.
- Need for updating Heat Health Action Plan and issuing Advisory 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.
- Long term measures such as adopting cool roof, improving green forest coverage and analysing health impacts in urban planning.
- Capacity Building measures for doctors, nurses and other staffs should be undertaken.
- Cases with expected heat stroke should be rapidly assessed using standard treatment protocols.
- Identify search capacities and mark the beds dedicated to heat stroke victims and enhance emergency department preparedness to handle more patients.
- Identify RRT (Rapid Response Team) to respond to any exigency call outside the hospital.
- Ensure adequate arrangements of staff, beds, Intravenous (IV) Fluids, ORS, essential medicines and equipment's to cater to management of volume depletion and electrolyte imbalance.
- May try to establish outreach clinics at various locations easily accessible to the vulnerable population to reduce the number of cases affected. Health Centres must undertake awareness in campaigns for

neighbourhood communities using different means of information dissemination.

- Primary Health Centres must refer the patients to higher facility only after ensuring adequate stabilization and basic definitive care (cooling and hydration).
- Hospitals must ensure proper networking with nearby facilities and medical centres to share the patient load which exceed their search capacities.

3.5 Case Definitions of Various Heat Related Illness

Clinical Entity	Age Range	Setting	Cardinal Symptom	Cardinal Signs	Pertinent negatives	Prognosis
Heat Rash	All, But frequently children	Hot environment; +/-insulating clothing or swaddling Itchy Rash with small red bumps at pores in setting of heat exposure; bumps can sometimes be filled with clear or white fluid	Itchy Rash with small red bumps at pores in setting of heat exposure; bumps can sometimes be filled with clear or white fluid	Diffuse maculopapular rash, occasionally pustular, at hair follicles; pruritic	Not focally distributed like a contact dermatitis; not confluent patchy; not petechial haemorrhages	Full recovery with elimination of exposure and supportive care
Heat Cramps	All	Hot environment typically with exertion; +/-insulating clothing or swaddling	Painful spasms of large and frequently used muscle groups	Uncomfortable appearance may have difficulty fully extending affected limbs /joints	No contaminate wound/tetanus exposure; no seizure activity	Full recovery with elimination of exposure and supportive care
Heat Exhaustion	All	Hot environment; +/- exertion; +/-insulating clothing or swaddling	Feeling overheated, lightheaded, exhausted and weak, unsteady, nauseated,	Sweaty/Diaphoretic; Flushed skin; hot skin; normal core temperature; +/-dazed, +/-generalized weakness, slight	No coincidental signs and symptoms of infection, no focal weakness, no aphasia, /Dysarthria, no	Full recovery with elimination of exposure and

			sweaty and thirsty, inability to continue activity	disorientation	overdose history	supportive care; progression if continued exposure
Heat Syncope	Typically, adult	Hot environment; thing clothing or swaddling	Feeling hot and weak; light-headedness followed by brief loss of consciousness	Brief Generalized loss of consciousness in hot setting, short period of disorientation if any	No seizure activity, no loss of bowel or bladder continence, no focal weakness, no aphasia/dysarthria	Full recovery with elimination of exposure and supportive care, progression if continued exposure
Heat Stroke	All	Hot environment; +/- exertion; +/- insulating clothing or swaddling	Severe overheating, profound weakness, disorientation, obtundation, seizures or other altered mental status	Flushed dry skin (not always), core temperature ≥ 40 -degree C, altered mental status with disorientation, possibly delirium, coma, seizures, tachycardia, +/- hypotension	No coincidental signs and symptoms of infection; no focal weakness; no aphasia/dysarthria, no overdose history	25-50% mortality even with aggressive care, significant morbidity if survive

3.6 SYMPTOMS AND FIRST AID FOR VARIOUS HEAT RELATED ILLNESS

Heat Disorder	Symptoms	First Aid
Heat Rash	Skin redness and pain, possible swelling, blisters, fever, headaches.	Take a shower using soap to remove oils that may block pores preventing the body from cooling naturally. If blisters occur, apply dry sterile dressings and seek medical attention
Heat Cramps	Painful spasm usually in leg and abdominal muscles of extremities. Heavy sweating.	Move to cool or shaded place. Apply firm pressure on cramping muscles or gently massage to relieve spasm. Give sips of water if nausea occurs, discontinue.
Heat Exhaustion	Heavy sweating, weakness, skin cold, pale headache and clammy extremities, weak pulse. Normal Temperature possible. Fainting, vomiting	Get victim to lie down in a cool place. Loosen clothing. Apply cool, wet clothes. Move victim to air-conditioned place, give sip of water slowly and if nausea occurs, discontinue. If vomiting occurs, seek immediate medical attention, call 108 and 112 for ambulance.
Heat Stroke (sun stroke)	High body Temperature. Hot, dry skin. Rapid, strong pulse. Possible unconsciousness or altered mental status. Victim will likely not sweat.	Heat stroke is a severe medical emergency. Call 108 and 112 for ambulance and emergency medical services to take the victim to health centres or hospitals immediately. Delay can be fatal. Move victim to a cooler environment. Try a cool bath or sponging to reduce body temperature. Use extreme caution. Use fans/ air-conditioners. Do not give fluids orally if the person is not conscious

3.7 Heat Illness Treatment Protocol as Per NDMA

Recognizing that treatment protocols may vary slightly in different categories (EMS, health centres, clinics, hospital emergency departments, etc.), the following should apply in general and to all patients with heat related illnesses:

1. Initial assessment and primary survey of patient (airway, breathing, circulation, disability, and exposure), vital signs including temperature.
2. Consider heat illness in differential diagnosis if:
 - Presented with suggestive symptoms and signs.
 - Patient has one or more of the following risk factors:
 - i. Extremes of age (infants, elderly).
 - ii. Debilitation/physical reconditioning, overweight or obese.
 - iii. Lack of acclimatization to environmental heat (recent arrival, early in summer season).
 - iv. Any significant underlying chronic disease, including psychiatric, cardiovascular, neurologic, hematologic, obesity, pulmonary, renal, and respiratory diseases.
 - v. Taking one or more of the following:
 - ❖ Sympathomimetic drugs.
 - ❖ Ant cholinergic drugs.
 - ❖ Barbiturates.
 - ❖ Diuretics.
 - ❖ Alcohol.
 - ❖ Beta blockers.
3. Remove from environmental heat exposure and stop physical activity.
4. Initiate passive cooling procedures.
 - Cool wet towels or ice packs to maxillae, groin, and around neck; if patient is stable, may take a cool shower, but evaluate risk of such activity against gain and availability of other cooling measures.
 - Spray cool water or blot cool water on to the skin.
 - Use fan to blow cool air onto moist skin.
5. If temperature lower than 40°C, repeat assessment every 5 minutes; if improving, attempt to orally hydrate (clear liquids, ORS can be used but not necessary; cool liquids better than cold). If temperature is 40°C or above, initiate IV rehydration and immediately transport to emergency department for stabilization.

3.8 Heat stroke treatment (Sorensen and Hess, 2022)

Heat stroke is a medical emergency that needs to be treated urgently in order to avoid permanent complications and death. Without prompt treatment, mortality from classic heat stroke approaches 80% and from exertional heatstroke approaches 33%. Central nervous system dysfunction and a core body temperature of more than 40°C are the defining features of heat stroke.

Heat stroke, treatment need to be started with maintaining the airway, breathing, and circulation, immediately followed by rapid cooling. The delay in cooling can be associated with worse outcomes. Initial management should always be focused on rapidly reducing the core body temperature between 38° to 39°C, ideally within 30 minutes after presentation. The most effective cooling methods are cold-water immersion and ice-water immersion. A combination of evaporative and conductive cooling techniques, such as the infusion of cold fluids, the application of ice packs to the neck, groin, and axillae, and fanning, are used as treatment if resource availability, ongoing cardiopulmonary resuscitation, airway compromise, or other factors prevent cold-water immersion.

Antipyretic medications should not be used since they make heat stroke patients worse and can exacerbate coagulopathy and end-organ damage. Dantrolene is not often used to treat heat stroke; however, it has been linked to a shorter cooling time without an improvement in recovery rates. Agitation, pain, and shivering can be managed with benzodiazepines.

Successfully cooled patients who make it through the hyperthermia-neurologic phase are at a high risk of progressing to the late hepatic-renal and hematologic-enzymatic stages.

The most effective care for these patients should be provided by a multidisciplinary team in an Intensive Care Unit.

4. INTER-DEPARTMENTAL COORDINATION FRAMEWORK WITH ROLES AND RESPONSIBILITIES OF LINE DEPARTMENTS

4.1 Introduction

Inter-department coordination is very essential for successful implementation of Heat Action Plan. As Heat Action plan strategies and activities are multi-dimensional in nature, therefore, active participation of various line departments is essential for effective implementation of heat action plan.

Every department is equally important and have some role to play in order to save loss of lives, livelihood and economy due to extreme heat events.

In this chapter, the roles and responsibilities of key line departments have been enlisted.

4.2 Phases of Heat Action Plan Implementation

Phase-I: - Pre -Heat Season (February to March)

Pre-Heat Season is devoted to develop early warning systems, communication plan of alerts to the general public, health care professionals and voluntary groups (care givers) with emphasis on training and capacity building of these groups.

Phase-II: - During the Heat Season (April to June)

High alert, continuous monitoring of the situation, coordination with all the departments agencies concerned on one hand and general public and media on the other hand is the focus of this phase.

Phase-III: - Post -Heat Season (August to October)

In Phase - III concentration is on evaluation and updating of the plan. It is important at the end of the summer to evaluate whether the heat health action plan has worked. Continuous updating of plan is a necessity. Global climate change is projected to further increase the frequency, intensity and duration of heat-waves and attributable deaths. Public health prevention measures need to take into consideration the additional threat from climate change and be adjusted over time.

4.3 Roles and Responsibilities of the Departments

4.3.1 State Disaster Management Authority/DDMA

Phase-I: - Pre Heat season (February to March)

- State Executive Committee: Prevention and Mitigation of Impacts of Heat Wave, with representatives of all departments as member of this committee.
- Committee should meet at-least 3 times in year, once in pre-heat, during-heat and post-heat season.
- Establish heat mortality tracking system and update datasets.
- Designate point of contact for each department for heat wave.
- To review preparedness instructions to all concerned departments for the heat season.
- Develop and Implement State Heat Action Plan- Capacity Building initiative at state level.
- Preparation of a list of high-risk areas in the State / District vulnerable to heat waves for more focus in planning to mitigate adverse effects of Heat wave.
- Convene meetings at state /district level with the concerned Departments/ Agencies/NGOs involved in response mechanism to Heat waves to review the action plan periodically.
- Develop and Distribute pamphlets and posters with tips to prevent heat stress in local language to hospitals, schools, and professional associations.

Phase-II: - During the Heat Season (April to June)

- Led the implementation of State/District Heat Action Plan.
- Monitoring of implementation of various activities of Rajasthan State/District Heat Action Plan.
- Establishing emergency management teams.
- Monitoring district level heat action plan implementation.
- Organizing meeting with concerned departments during heat season.
- Awareness relating to prevention and management of heat related illnesses.

- Advertisements on safety tip through local newspapers, radio and television channels.
- Issue of timely information and warnings to all key Departments/ Agencies through State Emergency Operation Centre (SEOC), etc.
- Communicate locations of emergency facilities and cooling centres/shaded areas with each Department / Organization.
- Inform power supply Companies to prioritize maintaining power to critical facilities (such as hospitals) during extreme heat events.
- Notify all the stakeholders when the heat alert is over.

Phase-III: - Post -Heat Season (July to October)

- Review of quantitative and qualitative data for process evaluation and improvements.
- Annual evaluation of Heat Action Plan by organizing a meeting with key Departments/agencies and relevant stakeholders.
- Evaluate the Plan process based on the reach and impact.
- Revision of Plan based on the feedback and suggestion received from stakeholders.
- Revision of Action Plan ahead of summer season next year for information of all stakeholders.

4.3.2 MEDICAL AND HEALTH DEPARTMENT

Phase-I: - Pre Heat season (February to March)

- Designing and initiating targeted training programs, capacity building efforts and communication on heat illness for medical and other staff at Community Health Centres (CHCs), Public Health Centres (PHCs) / including nursing staff, paramedics, field staff and link workers (ANMs, ASHA Workers, etc.), while paying special attention to the susceptibility of Districts.
- Updation of admissions and emergency case records in Hospitals to track heat-related morbidity and mortality and also to create simple, user-friendly means to track daily heat-related data and behavioural change impacts. Train hospitals to record information on education and

communication (IEC) efforts and to ensure recording of cause of death in death certificates.

- Adopt heat-focused examination procedures at local hospitals and urban health centres.
- Developing of SMS facility to reach the field level staff during emergency periods.
- Checking of inventories of medical supplies including ORS powder in PHCs and other Local Hospitals.
- Purchase and distribute reusable soft plastic ice packs for the Community Health Centres (CHCs), 108 emergency centres, ambulances and hospitals.
- Explore creation of ice pack dispensaries to increase access to vulnerable communities in high risks areas.
- To provide following services through 108 Emergency Service
- Ensure adequate supply of IV fluids.
- Prepare handouts for paramedics about heat related illness.
- Create displays on ambulances to build public awareness during major local events.
- Identifying routes to high risks areas and to reach vulnerable sections of population in shortest time possible by utilizing the list of high-risk areas.

Phase-II: - During the Heat Season (April to June)

- Display of heat-related illness prevention tips and how to stay cool around hospitals, Primary Health Centres (PHCs) and Community Health Centres (CHCs).
- Equip all hospitals/ PHCS/ CHCs with additional supplies of medicines and commodities.
- Ensure adoption of Heat illness treatment and prevention protocols at health facilities.
- Deploy additional staff at hospitals and PHCs/CHCs to attend to the influx of patients during a heat alert, if feasible.
- Keep emergency wards ready in all PHCs / CHCs and Hospitals
- Increase outreach of community health workers in at-risk neighbourhoods during a heat alert.

- Report Heatstroke patients to Nodal Officer on daily basis and generate weekly reports on public health impacts of Heat wave for Nodal Officer, during a heat alert.
- Expedite recording of cause of death certificates.
- Ensure that 108 EMERGENCY SERVICE:
- Activate dynamic strategic deployment plan for ambulances.
- Adequate supply of ice packs, IV fluids and medicines.
- Keep accurate records of pre-hospital care.
- Adequate staff on duty and restrict leave if necessary.

Phase-III: - Post -Heat Season (July to October)

- Perform an epidemiological case review of heat-related mortalities during the summer.
- Conduct and gather epidemiological outcomes from the data on heat risk factors, illness and death, based on average daily temperatures.
- Measure mortality and morbidity rates based on data before and after the Plan's interventions.
- Provide data to key Agency / Department.
- Incorporate data and findings into future versions of the Heat Action Plan.
- Participate in annual evaluation of Heat Action Plan review the revised Heat Action Plan.
- To ensure 108 Emergency Service.

4.3.3 EDUCATION DEPARTMENT

Phase-1: - Pre Heat season (February to March)

- Circulate the heat wave action plan with concerned department officials and others stakeholders (School/Colleges, etc.).
- Organize awareness camps and classes on heat wave related illness/sunstrokes for teachers and also students.
- Prepare SOP for hot weather impact reduction to education system and safe environment for students.
- Explain importance of proper shade, availability of drinking water and other facilities for Students.

- Distribute pamphlets/posters on heat related illness prevention; Do's and Don'ts for display and further distribution to students in Schools and Colleges.
- Ensure availability of ceiling fans in class rooms and proper shade.
- Ensure availability of ORS, Ice pack and Cool drinking water.

Phase-II: - During the Heat Season (April to June)

- Display posters and distribute pamphlets on prevention of heat related illness in Schools and Colleges.
- Identify shelter space, shade, drinking water, ORS facilities with signs.
- Restrict working hours as per the weather conditions and monitor early warning when heat wave is declared.
- No open-air classes to be conducted.
- Ensure school buses are parked in sheds, sprinkle water on the roof of the buses, before commuting.
- Distribute heat protection materials at local schools and orient school teachers to equip them with knowledge of heat protection tips and activities which they can disseminate in classrooms.
- Scheduling of examinations before starting of heat period normally and also avoid examination during orange and red alert.
- Hostels operated by Social Welfare, Minority, and by Private Institutions to ensure proper measures are adopted to provide sufficient water and arrangements to keep the environment in the hostels cool. Ensure sufficient power supply is available, access to health facility is available, and fans/coolers are installed.

Phase-III: - Post -Heat Season (July to October)

- Review implementation and effectiveness of Plan.
- Obtain and give feedback for further improvement of Plan.

4.3.4 INDIAN METEOROLOGICAL DEPARTMENT (RAJASTHAN REGIONAL OFFICE)

Phase-I: - Pre Heat season (February to March)

- Issue prior warnings with details of temperature and districts.
- Establish system of early warning and forecasting in collaboration with Disaster Management, Relief and Civil Defence Department.

Phase-II: - During the Heat Season (April to June)

- Provide daily/ weekly forecasts.
- Communicate Heat wave alerts/warnings promptly.
- Update heat wave details regularly in their website.
- Determine threshold district wise e.g. Percentile method.

Phase-III: - Post -Heat Season (July to October)

- Provide season report containing duration of Heat wave and location-wise maximum temperatures.
- Participate in annual evaluation of heat action plan.

4.3.5 INFORMATION AND PUBLIC RELATIONS (I & PR)

DEPARTMENT

Phase-I: - Pre Heat season (February to March)

- Identification of areas to post warnings and information during heat season.
- Securing advertisement / scrolling slots for announcements regarding Heat
- Designing information and awareness material in the form of pamphlets, posters etc. on Heat waves in local language for distribution to the general public, especially focusing on identified high risk areas in the State and vulnerable groups of population.

Phase-II: - During the Heat Season (April to June)

- Create awareness among public through advertisements in regional languages
- Display hoardings at important places.
- Create awareness through TV and Radio spots and jingles.
- Conduct regular press conferences at the State level and District level through concerned Ministers, Secretaries and Collectors on the risks and dangers of heat related illness.

- Circulate heat wave warnings i.e. text alerts or WhatsApp messages in collaboration with private sector telecom companies in addition to traditional media.
- Send warnings in bulk to the public via centralized email databases during heat waves.
- Develop SMS alert system from time to time on treatment systems to send messages to private doctors and medical professionals at Government hospitals including PHCs and UHCS.
- Utilize local radio FM broadcast through special programmes and during popular programmes to alert the public.
- Explore other means of communication like Face book, Twitter and WhatsApp.
- Collect all news items/reports on Heat waves daily and report to Government.
- Conducting regular press conferences at the state level and District level on the risks and dangers of heat related illness.

Phase-III: - Post-Heat Season (July to October)

- Evaluate reach of advertising / public messages and other means of communication like social media (Face book, Twitter etc.) to target groups.
- Participate in annual evaluation in Heat Wave Action Plan.

4.3.6 LABOUR AND EMPLOYMENT DEPARTMENT

Phase-I: - Pre Heat season (February to March)

- Organize training for employers, outdoor labourers and workers on health impacts of extreme heat and protective measures to be taken during high temperature periods.
- Utilize maps of construction sites and outdoor work spots preferably overlaying with irradiation map from IMD or heat island map to identify more high-risk outdoor workers and to conduct publicity campaigns during high-risk days.

- To regulate construction/work site contractors to provide drinking water, ORS and shelter to worker's labourers.
- To Instruct Factory/industry managements to provide cool drinking water, ORS and shelter to worker's labourers.
- Preparing a list of factory medical officers, contractors and house side non-factory workers to include in heat alert and action communication.
- Heat illness orientation planning for factory medical officers.

Phase-II: - During the Heat Season (April to June)

- Encourage employers to shift outdoor workers schedules away from peak afternoon hours (12 - 4pm) during a heat alert.
- Ensure provision of shelters/ cooling areas, water and supply of emergency medicines like ORS, IV fluids etc. at work sites by employers.
- Report cases of heat related illnesses to nearest public health facilities.

Phase-III: - Post -Heat Season (July to October)

- Obtain feedback on cases, plan, and measures taken.
- Participate in annual evaluation of Heat Action Plan.

4.3.7 RURAL DEVELOPMENT DEPARTMENT

Phase-I: - Pre Heat season (February to March)

- Collecting information on the works sanctioned under MGNREGS (Mahatma Gandhi National Rural Employment Guarantee Scheme) programme and other schemes in high-risk areas to plan for mitigation effort during heat period.
- To ensure shade and supply of adequate drinking water at work spots.
- Ensure adequate drinking water supply.

Phase-II: - During the Heat Season (April to June)

- Reschedule of working hours to avoid intense heat timings in all the works sanctioned under MGNREGS on red alert days.
- Provision of additional drinking water in heat vulnerable areas.
- Training of local volunteer in first aid for heat related illnesses.
- Shelters / cooling areas wherever necessary.

Phase-III: - Post -Heat Season (July to October)

- Participate in annual evaluation of heat action plan.

4.3.8 URBAN DEVELOPMENT DEPARTMENT / PANCHAYATI RAJ DEPARTMENT

Phase-I: - Pre Heat season (February to March)

- High Risk Area mapping and identification of vulnerable groups particularly destitute, homeless, beggar homes and old age homes to concentrate on mitigation efforts during heat alert period.
- Identification of areas to provide shelters and drinking water during heat alert period.
- Special care in restricting outdoor activities and functions during heat period.
- Identification of NGOs / Rotary Clubs / Lions Clubs and Corporate houses (under Corporate Social Responsibility) to provide shelters, drinking water, medical supplies and temporary homes during heat days.
- Adequate drinking water supply.

Phase-II: - During the Heat Season (April to June)

- Disseminate SMS text messages to warn residents of high risks areas and vulnerable sections of population during a heat alert.
- Activate "cooling centres," such as public buildings, malls, and temples, schools and State Government or Local body, run temporary night shelters for those without house or access to water and/or electricity at home.
- Expand access to shaded areas for outdoor workers, slum communities, and other vulnerable sections of population.
- Keep open the parks for a longer duration during evenings.
- All non-essential uses of water (other than drinking, keeping cool) may be suspended, if necessary.
- Distribution of fresh drinking water to the public by opening water centres at people congregation points like market places, labour addas,

etc. Water may be distributed through pouches to the poor in the identified high-risk areas.

- Actively involve NGOs and Corporate houses in providing shelter and drinking water facilities to vulnerable population.

Phase-III: - Post -Heat Season (July to October)

- Collect data related to implementation of Action Plan and provide feedback to key agency / department.
- Participate in annual evaluation of Heat Action Plan.

4.3.9 ANIMAL HUSBANDRY DEPARTMENT

Phase-I: - Pre Heat season (February to March)

- Review and discuss implementation of Heat Wave Action Plan for safeguarding cattle.
- Prepare material like Posters and pamphlets for tips to take care of cattle and poultry during heat waves.
- Conduct training for department, field workers as well as for cattle and poultry farmers on heat wave management plan in Animal Husbandry sector.
- Review availability of necessary medicines for treatment of cattle / poultry affected by Heat wave.
- Prepare plan for drinking water for cattle with water department.

Phase-II: - During the Heat Season (April to June)

- Display posters and distribute pamphlets on the precautionary measures to be taken to safeguard cattle and poultry birds during heat period in villages and important junctions.
- Ensure adequate stock of medicines in all veterinary hospitals.
- Ensure visit of field staff during heat wave to villages for follow up action in treatment of cattle / poultry birds.

Phase-III: - Post -Heat Season (July to October)

Participate in annual evaluation of heat action plan.

4.3.10 TRANSPORT DEPARTMENT

Phase-I: - Pre Heat season (February to March)

- Review the departmental action plan with concerned officials and others stakeholders.
- Review plan with Depot Managers/Zonal Managers.
- To create awareness among the staff and passengers through meetings, pamphlets, posters and banners on the ill effects of Heat Wave and Sunstroke during summer.
- Organize heat wave risk awareness programmes for bus drivers, staff at bus stands.
- Explain importance of proper shade, availability of drinking water and other facilities for passengers in bus stations.
- Distribute pamphlets/posters on heat related illness prevention; Do's and Don'ts for display further distribution to passengers at bus stations, bus shelters.
- Ensure supply of safe drinking water to its Staff and Passengers in the depots and bus stations.
- Planning to provide ORS, Ice packets etc. and medical services in Bus stations.

Phase-II: - During the Heat Season (April to June)

- Display posters and distribute pamphlets on prevention of heat related illness in bus stands, auto stands etc.
- Ensure availability of shade / shelters, drinking water, ORS packets etc., in bus stands, auto stands etc.
- Ensure availability of water and ORS packets in long distance buses.
- Do not run buses as far as possible during peak hours (12-4 PM) when heat wave is declared.
- Report heat related illnesses to nearest health facilities.

Phase-III: - Post -Heat Season (July to October)

- Participate in annual evaluation of heat action plan.

4.3.11 AGRICULTURE DEPARTMENT

Phase-I: - Pre Heat season (February to March)

- Review the departmental action plan with concerned officials and others stakeholders.
- Ensure heat wave action plan is revised and all the officials are trained in implementing preparedness measures under the department.
- Organize stakeholder meeting and capacity building programmes for the farmers on implementation of contingency plans.
- Organize convergence meetings and prepare policy needs for plan implementation.

Phase-II: - During the Heat Season (April to June)

- Monitor the implementation of the action plan.
- Ensure support to farmers for documenting and prepare for availing risk transfer facilities for reducing impacts to agriculture due to heat waves.
- Ensure early warnings, dissemination and its last mile connectivity.

Phase-III: - Post -Heat Season (July to October)

- Participate in annual evaluation of heat action plan.

4.3.12 WOMEN AND CHILD DEVELOPMENT DEPARTMENT

Phase-I: - Pre Heat season (February to March)

Women, children and infants are most vulnerable to heat wave seasons. WCD has to take essential precautionary measures to ensure that essential nutritional services will not get affected during the time of heat waves.

- Setting up of nutritional resource
- centres at Anganwadi centres to supplement
- Nutritional deficiency in children.
- Pre heat wave necessary precautionary methods such as provision of proper stock of ORS, buttermilk and other rehydration methods may be arranged well in advance.

- Create surveillance mechanism on tracking children, lactating mothers and women through Integrated Child Development Services (ICDS) and Anganwadi centres in the state.
- Capacity building of Anganwadi Sevikas, Asha workers, ANM nurses and ICDS workers to identify symptoms in women and children and to report it when necessary.

Phase-II: - During the Heat Season (April to June)

- Use opportunities, such as nutrition day, Self Help Group (SHG) meetings for creating awareness and educate young girls and mothers regarding the dangers of Heat Waves, its related health impacts and the precautionary measures to be taken.
- Display IEC materials at Anganwadis and encourage integrated child development Service (ICDS) scheme workers to disseminate Heat Wave related information with special focus on infants, children below five years, pregnant and lactating mothers to protect them from heat related illnesses.
- Provision of drinking water and first aid at all the Anganwadi Centres.
- Ensure that visits to homes by Aanganwadi Workers are done early mornings, so as not to be exposed to high temperatures.
- ORS, buttermilk and other dehydration methods should be provided to all the school going children under Anganwadi centres and mid-day meal scheme.

Phase-III: - Post -Heat Season (July to October)

- Evaluate the reach of Anganwadi workers and ICDS (Integrated Child Development Services) programme in reducing the heat related illnesses in all heat wave affected districts.
- Participate in annual evaluation of heat action plan.

4.3.13 LOCAL SELF GOVERNMENT (LSG)

Phase-I: - Pre Heat season (February to March)

- Check the readiness of vehicles and fire fighting equipment to face any emergency situations.

- Ensure capacity building activities of staff and officials.
- The department shall coordinate community and school children capacity building activities on heat wave preparedness.
- Prepare SOP for managing heat related health casualties. (Handling of the patient's transpiration etc.)

Phase-II: - During the Heat Season (April to June)

- Obtain feedback on Fire calls, plan, and measures taken.
- Monitor the weather situation and early warnings.

Phase-III: - Post -Heat Season (July to October)

- Participate in annual evaluation of heat action plan.

4.3.14 TOURISM DEPARTMENT

Phase-I: - Pre Heat season (February to March)

- Ensure capacity building activities of staff and officials working at tourist places.
- Prepare SOP for managing heat related health casualties. (Handling of the patient's transpiration etc.).
- Ensure coordination with DDMA and Local IMD office for timely communication about early warning.

Phase-II: - During the Heat Season (April to June)

- Ensure availability of ORS, Drinking water at various tourist sites.
- Ensure awareness pamphlets, hoarding about prevention from heat related illnesses are available at tourist sites.
- Ensure tourist sites have enough cooling equipment like Air Coolers, AC etc.
- Monitor the weather situation and early warnings.
- During Re-alert change the timing of site visit.

Phase-III: - Post -Heat Season (July to October)

- Participate in annual evaluation of heat action plan.

4.3.15 PHED DEPARTMENT

Phase 1: Pre-Heat wave Season (February-March)

- Conducts assessment of all drinking water facilities to identify any maintenance or repair needs.
- Conduct routine checks to ensure that all drinking water facilities are operational and ready to meet increased demand during the upcoming heat wave season.
- Identify vulnerable areas that are prone to water scarcity or inadequate drinking water facilities during heat waves.

Phase 2: During Heat wave Season (April-June)

- Deploying mobile water tanks, establishing temporary water distribution points, and coordinating with local authorities for additional support.
- Keeps the public informed about the availability of drinking water facilities and any temporary measures put in place to address water shortages during heat waves.
- Provide guidance to residents on water conservation measures and encourage responsible use of water resources to alleviate pressure on the water supply system.

Phase 3: Post-Heat wave Season (July-October)

- Conduct a post-heat wave assessment of drinking water facilities to identify any damage or issues that arose during the heat wave season.

4.3.16 NGOS, SHGS, COMMUNITY GROUPS AND OTHER SOCIAL ORGANISATIONS

Phase-I: - Pre Heat season (February to March)

- Identification of NGOs, Voluntary Organizations in reaching out to the Public, especially vulnerable groups.
- Conduct training programmes, workshops and outreach sessions with NGOs/CSOs/ Self-help groups and mobilizes such as ASHA workers, Anganwadis, and Ward Committees in Municipalities to inform.

- Encourage discussions for finding early signs of heat exhaustion with local doctor or Health Centre.
- Inform fellow community members about how to keep cool and protect oneself from heat.

Phase-II: - During the Heat Season (April to June)

- Take all precautions to avoid Heat related illness.
- Awareness and community outreach on prevention and management of heat related illnesses.
- Keep cool and hydrated during the heat season by drinking water, staying out of the sun, and wearing light clothing.
- Check on vulnerable neighbours, particularly during a heat alert.
- Limit heavy work in direct sun or indoors, if poorly ventilated, especially during a heat alert.

Phase-III: - Post -Heat Season (July to October)

- Participate in annual evaluation of heat action plan.

4.3.17 DISTRICT COLLECTOR/ MUNICIPAL COMMISSIONER

Phase-I: - Pre Heat season (February to March)

- District Heat Action Plan Committee: Prevention and Mitigation of Impacts of Heat Wave, with representatives of all departments as member of this committee.
- The committee should meet at-least 3 times in year, once in pre-heat, during-heat and post-heat season.
- Collector should monitor all-cause death and all hospital admission cases during heat season.
- To review preparedness for the heat season in the district.
- To issue necessary instruction to all concerned departments for better inter-sartorial co-ordination.

Phase-II: - During the Heat Season (April to June)

- Meeting of District Heat Action Plan Committee.

- Collector at district should monitor all-cause death and all hospital admission during heat season.
- To monitor the implementation of the Heat Action Plan.
- To issue necessary instruction regarding strict adherence of the plan.
- To ensure mid-course correction.

Phase-III: - Post -Heat Season (July to October)

- To review the implementation of the heat action plan.
- Participate in annual evaluation of heat action plan.

5. INFORMATION, EDUCATION AND COMMUNICATION (IEC)

5.1 INTRODUCTION

Information Education and Communication (IEC) is an important tool in health promotion for creating supportive environment and strengthening community action. The IEC in health programmes aims to increase awareness, change attitude and bring about behaviour change.

IEC provides a platform for the discussion of important health issues to foster an understanding of concepts, underlying principles, and benefits of health initiatives. IEC is essential to achieving better health outcomes in all public health interventions.

It is recognised as a viable and cost-effective approach to addressing broader determinants of health, risk factors, building trust and commitment, fostering community participation, and empowerment towards development and implementation of health initiatives.

Recognising importance of IEC, IEC pamphlet has been developed under Rajasthan Heat Action Plan for creating awareness regarding prevention and management of heat related illnesses.

It is important to note that these are preventable deaths. Informing the public on the preventive actions to be taken, reporting early to health facility, timely diagnosis and treatment, would reduce the deaths attributable to heat waves. IEC can play an important role in preventing mortality and morbidity due to heat related illnesses.

The IEC- posters can be used in crowded places Bus Station, Railway Station, Schools, Cinemas and for larger awareness. Health advisories can also be circulated through socialmedia- Facebook, WhatsApp, Mass emails etc.

5.2 AWARENESS AND OUTREACH



क्या आप घर से बाहर

“लू”

में काम करते हैं?






निम्नलिखित सावधानियाँ बरतें

- स्थानीय मौसम संबंधी खबरों के लिए रेडियो सुनें, टीवी देखें, और समाचारपत्र पढ़ें।
- यथासंभव मात्रा में पानी पिएं – बले ही प्यास न लगी हो।
- ओआरएस (ओरल रीहाइडेशन सॉल्यूशन) घर में बने पेय जैसे जलरसी, चौरानी (पायल का मसि) नींबू पानी, शीशु आदि का सेवन कर तरसाला रहें।
- हल्के रंग के ढीले सूती कपड़े पहनें।
- अपना सिर ढककर रखें, कपड़े, हैट अथवा छतरी का उपयोग करें।
- नंगे पांव बाहर न जाएं।
- गर्मी से राहत के लिए हाथ का पंखा अपने पास रखें।
- काम के बीच में थोड़ा-थोड़ा विश्राम लें।
- फेस या छाया में छी आरुक्ष हों।



आपदा प्रबंधन, सहायता एवं नागरिक सुरक्षा विभाग Toll Free No. - 112/1070 <https://dmrelief.rajabsthan.gov.in>



अपने जानवरों को

“लू”

से बचाएं






लू के दौरान पालतू जानवरों के लिए सावधानियाँ

- जहाँ तक संभव हो, रोब गर्मी के दौरान उन्हें घर के भीतर रखें।
- यदि उन्हें घर के भीतर रखा जाना संभव न हो तो उन्हें किसी छावरदार स्थान में रखें, जहाँ वे आराम कर सकें। स्थान रखें कि जहाँ उन्हें रखा हो वहाँ दिन भर छाया रहे।
- जानवरों को किसी बंद जगह में न रखें, क्योंकि गर्म मौसम में उन्हें जल्दी गर्मी लगने लगती है।
- स्थान रखें कि आपके जानवर पूरी तरह साफ हों, उन्हें ताकत देने का पानी दें, पानी की छुप में न रखें। दिन के समय उनके चानी में बर्फ को डुबके रखें।
- गीनें के घागी के दो बाउल रखें ताकि एक में पानी रखें छेने पर दूसरे से वे पानी पी सकें।
- अपने पालतू जानवर का खाना ठूपा में न रखें।
- यदि आपके गारा फूटता है तो उसे गर्मी में न रहने दें। उसे दूध के लिए आग को दूधारे जाय मौसम में रखा हो।
- फुफे को गर्म सतह (पट्टी, तारकोल की सतह, गर्म रेत) पर न बसाएं।
- किसी भी स्थिति में जानवर को बाहर से न छोड़ें।

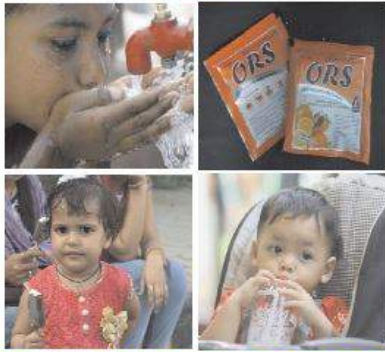


आपदा प्रबंधन, सहायता एवं नागरिक सुरक्षा विभाग Toll Free No. - 112/1070 <https://dmrelief.rajabsthan.gov.in>



शिशुओं को “लू” से बचाएं

बच्चों के लिए सावधानियाँ



- उन्हें पर्याप्त मात्रा में पानी पिलाएं।
- शिशुओं में गर्मी की वजह से होने वाली बीमारियों का पता लगाना सीखें।

- यदि बच्चे के पेशाब का रंग गहरा है तो इसका मतलब है कि वह डीहाईड्रेशन (पानी की कमी) का शिकार है।
- बच्चों को बिना देखरेख रखी गाड़ी में छोड़ कर न जाएं, वाहन जल्दी गर्म होकर खतरनाक तापमान पैदा कर सकते हैं।



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अपने बच्चों को तेज “लू” से बचाएं

बच्चों के लिए सावधानियाँ



- हमेशा अपने साथ पानी रखी बोटल रखें। गर्म पानी / ठंडा / नारियल पानी / ताजे फलों के रस का नियमित रूप से सेवन करें।
- हल्के रंग की क्रीसें सूती कपड़े पहनें।
- अपना सिर ढांककर रखें, कपड़े, हैट जल्दा खिली का उपयोग करें।
- गर्मी के मौसम में जंक फूड का सेवन न करें। लाले कल, सलाद तथा घर में बना खाना खाएं।

- खासतौर से दोपहर 12 बजे से शाम 4 बजे के बीच धूप में सोने न जाएं। शाम के समय खेलें।
- यदि बच्चे को जकड़ आए, उल्टी, घबराहट अथवा तेज शिरदर्द हो, रीने में बंद हो अथवा सांस लेने में कठिनाई हो रही हो तो तुरंत डॉक्टर को दिखाएं।



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5.3 DO'S AND DON'TS

Heat Wave conditions can result in physiological strain, which could even result in death. To minimize the impact during the heat wave and to prevent serious ailment or death because of heat stroke, the following measures are useful:

Do's

For general population

Stay hydrated:

- Drink sufficient water whenever possible, even if you are not thirsty. Thirst is not a good indicator of dehydration.
- Carry drinking water when travelling
- Use Oral Rehydration Solution (ORS), and consume homemade drinks like lemon water, butter milk/lassi, fruit juices with some added salt.
- Eat seasonal fruits and vegetables with high water content like water melon, musk melon, orange, grapes, pineapple, cucumber, lettuce or other locally available fruits and vegetables.

Stay covered:

- Wear thin loose, cotton garments preferably light coloured
- Cover your head: use umbrella, hat, cap, towel and other traditional head gears during exposure to direct sunlight
- Wear shoes or chapels while going out in sun

Stay alert:

- Listen to Radio; watch TV; read Newspaper for local weather news.

Stay indoors/in shade as much as possible:

- In well-ventilated and cool places
- Block direct sunlight and heat waves: Keep windows and curtains closed during the day, especially on the sunny side of your house. Open them up at night to let cooler air in.

- If going outdoor, limit your outdoor activity to cooler times of the day i.e., morning and evening
- Reschedule or plan outdoor activities during cooler parts of the day.

For vulnerable population

Although anyone at any time can suffer from the heat stress & heat-related illness, some people are at greater risk than others and should be given additional attention. These include:

- Infants and young children
- People working outdoors
- Pregnant women
- People who have a mental illness
- Physically ill, especially with heart disease or high blood pressure

Travellers from colder climate to a hot climate should allow one week's time for their bodies to acclimatize to heat, avoid overexertion, and should drink plenty of water. Acclimatization is achieved by gradual increase (over 10-15 days) in exposure/physical activity in hot environment

Other precautions

- Elderly or sick people living alone should be supervised and their health monitored on a daily basis.
- Keep your home cool, use curtains, shutters or sunshade and open windows at night.
- Try to remain on lower floors during the day.
- Use fan, spray bottles, damp cloths, ice towels to cool down body.
- Immersing feet in 20°C water above ankle provides rapid cooling by reducing dehydration and thermal discomfort.

For a cooler home

- Use solar reflective white paint, cool roof technology, air-light and cross ventilation and thermos cool insulation for low-cost cooling. You can also keep haystacks or grow vegetation on roofs.

- Install temporary window reflectors such as aluminium foil-covered cardboard to reflect heat back outside.
- Keep your home cool, use dark colour curtains, tinted glass/ shutters or sunshade and open windows at night. Try to remain on the lower floors.
- Green roofs, green walls and indoor plants: reduce heat by cooling the building naturally, reducing air-conditioning requirements and release of waste heat.
- Maintain AC temperature at 24 degrees or higher. This will reduce your electricity bill and make your health better.
- While constructing a new Home
 - Cavity wall technology instead of regular walls.
 - Construct thick walls. They keep the interiors cool.
 - Construct lattice walls and louvered openings. They allow maximum air flow while blocking the heat.
 - Use natural materials like lime or mud to coat walls.
 - Avoid glass, if possible.
 - Consult a Building Technology expert before construction
- Animal Husbandry
 - Keep animals in shade and give them plenty of clean and cold water to drink.
 - Do not make them work between 11 a.m to 4 p.m.
 - Cover the shed roof with straw, paint it white or plaster with dung-mud to reduce temperature.
 - Use fans, water spray and floggers in the shed.
 - During extreme heat, spray water and take cattle to a water body to cool off.
 - Give them green grass, protein-fat bypass supplement, mineral mixture and salt. Make them graze during cooler hours.
 - Provide curtains and proper ventilation in poultry house.

DON'TS

- Avoid getting out in the sun, especially between 12:00 noon and 04:00 p.m
- Avoid strenuous activities when outside in the afternoon
- Do not go out barefoot
- Avoid cooking during peak summer hours. Open doors and windows to ventilate cooking area adequately.
- Avoid alcohol, tea, coffee and carbonated soft drinks or drinks with large amount of sugar- as these actually, lead to loss of more body fluid or may cause stomach cramps.
- Avoid high-protein food and do not eat stale food.
- Do not leave children or pets in parked vehicle. Temperature inside a vehicle could get dangerous.
- Avoid grazing / feeding of cattle during noon hours.

6. PROVEN TECHNIQUES

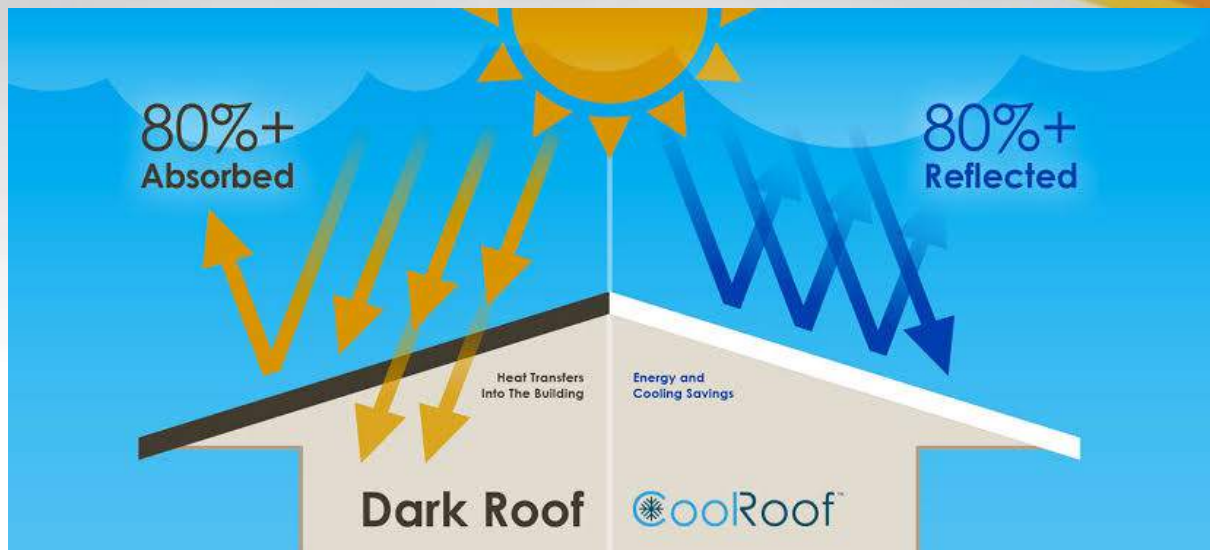
Extreme heat events are on the rise, but there are things you can do now- in your own home, workplace, or neighbourhood- to reduce your current and future risks. Here are some ways through which we can reduce the impact of Heat Wave to some extent. In this chapter, some of the best practices are mentioned and these can be implemented at various levels.

6.1 COOL ROOF (NDMA, 2021)

Now majority of the population is migrating to urbanising cities, where development is soaring and turning open space into paved, heat-retaining roads and roofs. The urban heat island effect is exacerbated, temperatures rise, poor air quality results, and more energy is required to maintain a comfortable temperature through the use of fans and air conditioning. A straightforward and affordable answer to these problems with urbanisation is the use of cool roofs. Reflecting sunlight, cool roofs release less heat. Compared to standard roofs, cool roofs can assist keep indoor temperatures down by 2 to 4°C (3.6 - 9°F) depending on the environment.

The roof is a crucial part of the building envelope since it directly affects the structure's energy requirements and the inhabitants' thermal comfort. The main way cool roofs work is by reflecting more sunlight that strikes the roof back into the atmosphere than a typical roof surface would. Internationally, cool roofs are recognised as an efficient way to save energy and money, keep cities cooler, and lessen the impact of urban heat islands. Cool roof initiatives have been implemented in major cities throughout the globe, including New York City.

According to research, planting shade trees and installing highly reflecting pavement and roofs around the city will, on average, lower a city's ambient air temperature by 2 to 4 degrees Celsius during the summer.



Cool Roof Demonstration (Source- Lawrence Berkeley National Laboratory)

Cool roofs techniques can be broadly divided into following major categories and building owners can choose from these techniques as appropriate for implementing cool roofs.

Coated cool roofs: these roofs involve the coating of a material or paint with high reflectivity on top of a conventional roof material to increase the roof surface's solar reflectance index.

These are liquid applied coatings made of simple materials such as lime wash or an acrylic polymer or plastic technology and are usually white in colour.

Membrane cool roofs: these roofs involve using pre-fabricated materials such as membranes or sheeting to cover an existing roof in order to increase the roof surface's SRI. These types of roofs can be polyvinyl chloride (PVC) or bitumen-based.

Tiled cool roofs: these roofs involve the application of high albedo, China mosaic tiles or shingles on top of an existing roof or to a new roof.

Special cool roof materials such as Mod Roof: these roofs, made of coconut husk and paper waste, have been installed in households around Gujarat and Delhi and can serve as an alternative to reinforced cement concrete roofs.

The cost implications vary by the type of material used for cool roofing. However, most of these materials have been applied locally in India and are available through local vendors.

6.2 Cool Driving pavement Material

Hot pavement also transfers heat to the surrounding air, adding to the urban heat island effect. Cool pavement stays cooler in the sun than traditional pavement by reflecting more solar energy or enhancing water evaporation. Cool pavement can be created from asphalt and concrete, as well as through the use of coatings or grass paving.

6.3 Green Infrastructure for reducing impact of Urban Heat Island

Cities create "urban heat islands" when there are dense clusters of pavement, buildings, and other surfaces that absorb and hold heat in place of natural land cover. This has the impact of raising energy expenditures (for air conditioning, for instance), air pollution levels, and illnesses and deaths brought on by the heat.

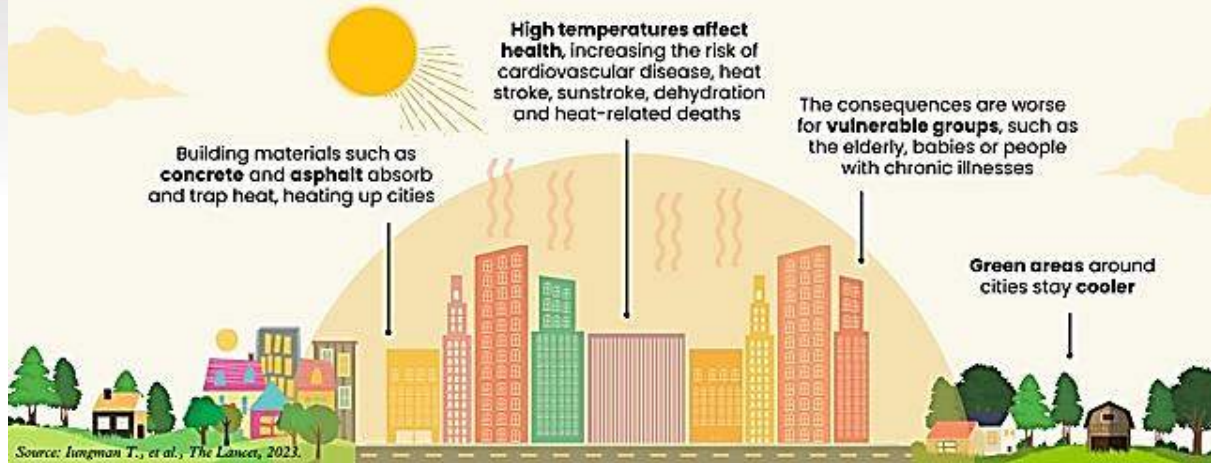
For those who live in cities, the Urban Heat Island (UHI) effect is one of the most dangerous environmental risks. The UHI impact is anticipated to become more intense due to climate change. Urban green infrastructure (UGI) may be implemented in this situation to help promote a resilient urban environment and aid in the adaptation and mitigation of climate change.

Urban Green Infrastructure (UGI), which is defined as "a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services, is acknowledged as one of the most crucial (LUNGMAN ET AL 2023)

BITS Pilani Campus is a wonderful example maintains lush **green** gardens with a rich collection of flora and fauna with terrace gardening architecture.

The urban heat island effect

Refers to the **increase in temperature** in **urban environments** compared to surrounding areas.



Over 4% of summer mortality in European cities is attributable to urban heat islands



The Urban Heat Island Effect and Impact of Tree Cover on Mortality

6.4 Heat-Resilient – Long Term Measures

Green and Climate Resilient Measures (Adaptation/Mitigation)

- Energy conservation
- Solarisation
- Cool/green roof
- Rainwater harvesting, water conservation
- IPHS standards updated to include climate-resilient measures
- Kitchen gardening
- Vetiver blinds



Heat Wave capacity building at Districts & at State level in Rajasthan



7. LIST OF DISTRICT MAGISTRATES

List Of DMS					
Sr.	District Name	Officer's Name	Office Address	Contact Detail	Mobile No.
1	Ajmer	Dr. Bharti Dikshit	Collectorate Office, Ajmer	0145-2627421 0145-2623780	9968291498
2	Alwar	Sh. Ashish Gupta	Collectorate Office, Alwar	0144-2337565	9899737259
3	Banswara	Dr. Inderjeet Yadav	Collectorate Office, Banswara	02962-240001	8743080729
4	Barmer	Sh. Nishant Jain	Collectorate Office, Barmer	02982-220003	9412700922
5	Baran	Sh. Rohitash Singh Tomar	Collectorate Office, Baran	07453-237001	9810524888
6	Bharatpur	Dr. Amit Yadav	Collectorate Office, Bharatpur	05664-223086	9996237788
7	Bhilwara	Sh. Namit Mehta	Collectorate Office, Bhilwara	01482-232601	9414132812
8	Bikaner	Smt. Namrta Varshan	Collectorate Office, Bikaner	0151-2226000	8696887733
9	Bundi	Sh. Akshay Godara	Collectorate Office, Bundi	0747-2443000	7073329899
10	Chhittograh	Sh. Alok Ranjan	Collectorate Office, Chhittograh	01472-240001	9414676635
11	Churu	Smt. Pushpa Satyani	Collectorate Office, Churu	01562-250806	9829062471
12	Dausa	Sh. Devendra Kumar	Collectorate Office, Dausa	01427-224666	9717180139
13	Dholpur	Sh. Nidhi B.T.	Collectorate Office, Dholpur	05642-220871	9449725585
14	Dungarpur	Sh. Ankit Kumar Singh	Collectorate Office, Dungarpur	02964-231002	9725136544
15	Hanumangarh	Sh. Kanaram	Collectorate Office, Hanumangarh	01552-260001	9950525303
16	Jaipur	Sh. Prakash Rajpurohit	Collectorate Office, Jaipur	0141-2209000 0141-2209001	9983934283
17	Jaipur Rural	Sh. Prakash Rajpurohit	Collectorate Office, Jaipur	0141-2209000 0141-2209001	9983934283
18	Jaisalmer	Sh. Pratap Singh	Collectorate Office, Jaisalmer	02992-252201	8447370171
19	Jalore	Smt. Pooja parth	Collectorate Office, Jalore	02973-222207	8079061914
20	Jhalawar	Sh. Ajay Singh Rathore	Collectorate Office, Jhalawar	07432-230403	9414350377
21	Jhunjhunu	Ms. Chanmi Gopal	Collectorate Office, Jhunjhunu	01592-234201	9818883264
22	Jodhpur	Sh. Gorav Agarwal	Collectorate Office, Jodhpur	0291-2650322	7568597500
23	Jodhpur Rural	Sh. Gorav Agarwal	Collectorate Office, Jodhpur	0291-2650322	7568597500
24	Karauli	Sh. Nilabh Saxena	Collectorate Office, Karauli	07464-250100	8090651676
25	Kota	Dr. Ravindra Goswami	Collectorate Office, Kota	0744-2451200	9971141943
26	Nagaur	Sh. Arun Kumar Purohit	Collectorate Office, Nagaur	01582-2412444	9828251345
27	Pali	Sh. Laxmi Naryan Mantri	Collectorate Office, Pali	02932-252801	9414201828
28	Pratapgarh	Dr. Anjali Rajoriya	Collectorate Office, Pratapgarh	01478-223366	9711320451
29	Rajsamand	Dr. Bawarlal	Collectorate Office, Rajsamand	02952-220536	8890453322
30	Swai Madhopur	Dr. Khushal Yadav	Collectorate Office, Swai Madhopur	07462-220444	9414616333
31	Sikar	Sh. Kamar Ual Jamal Choudhary	Collectorate Office, Sikar	01572-250005	7409812252
32	Sirohi	Sh. Subham Choudhary	Collectorate Office, Sirohi	02972-221187	7073877727
33	Shri Ganganagar	Sh. Lok bandhu	Collectorate Office, S. Gangapur	0154-2445001	9582433213
34	Tonk	Dr. Soniya Jha	Collectorate Office, Tonk	01432-246377	9643654920
35	Udaipur	Sh. Arvind Kumar Posawal	Collectorate Office, Udaipur	0294-2410834	9660422065
36	Balotra	Sh. Sushil Kumar Yadav	Collectorate Office, Balotra	02988-294610	9711088480
37	Sanchor	Sh. Shakti Singh Rathore	Collectorate Office, Sanchor	02979-294900	9414002900
38	Didwana-Kuchaman	Sh. Bal Mukand Asawa	Collectorate Office, Didwana-Kuchaman	01580-222000	9413357125
39	Kekri	Sweta Chauhan	Collectorate Office, Kekri	01467-220001	7080600108
40	Kothputli-Bahrore	Smt. Kalpna Agarwal	Collectorate Office, Kothputli-Bahrore	0141-299177	941331811
41	Neem Ka Thana	Sh. Sarad Mehra	Collectorate Office, Neem Ka Thana	01574-230045	9414056000
42	Gangapur city	Dr. Gaurav Saini	Collectorate Office, Gangapur City	07463-236136	9968432960
43	Anupgarh	Sh. Avedash Meena	Collectorate Office, Anupgarh	01498-294401	9582852336
44	Deeg	Ms. Suruti Bhardwaj	Collectorate Office, Deeg	05641-294000	9829051174
45	Khetral-Tijara	Dr. Artika Sukla	Collectorate Office, Khetral-Tijara	01460-298200	7311130030
46	Phalodi	Sh. Hajari Lal Atal	Collectorate Office, Phalodi	02925-222323	9414890094
47	Salumber	Sh. Jasmit Singh Sandhu	Collectorate Office, Salumber	02906-294900	9079313972
48	Sahapura	Sh. Rajendra Singh Shekhawat	Collectorate Office, Sahapur	01484-299451	9413315936
49	Beawar	Sh. Utsav Kausal	Collectorate Office, Beawar	01462-257336	9024297734
50	Dudu	Sh. Hanuman Mal Dhaka	Collectorate Office, Dudu	01428-294651	9929597474

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