



2019

Heat Action Plan



Standard Operating Procedure for Heat Wave in Gorakhpur

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District Disaster Management Authority (DDMA), Gorakhpur

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This document solely mentions the efforts that can contribute in mitigation of heat wave in the vicinity of Gorakhpur. The data mentioned in this report must not be plagiarized in any of the ways to elaborate the measures for mitigation of Heat Wave.

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Executive Summary

Climate change is the most challenging issue of the 21st century as climate change not only in India but also across the world is majorly responsible for increasing the global average temperature and causing an extremely erratic rainfall creating unfavorable conditions for humans to live with. India is the sixth largest GHGs emitter of the world as Greenhouse gas emissions from India contribute extensively to global warming leading to climate change. Few most effective variable of Climate Change Adaptation :

1. Identification of the vulnerable areas through HRVA technique.
2. Capacity building of the stakeholders (laying down the actions for strengthening of governance to deal with the climate change).
3. Confrontation of Climate Change by making ways for rehabilitating or relocating a vulnerable community.
4. Measures to strengthen the response to deal with a severe climatological event.

India submitted an INDC in UNFCCC's Paris Agreement, which is a benchmark that can be achieved by 2030 with the incorporation of research & advocacy in the area of climate change & disaster risk reduction [2]. Major aspects of INDC submitted by India are -

- Reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.
- Achieve 40 % percent of electric power from an installed capacity of non-fossil fuel based energy resources by 2030 with the help of technology transfer and low-cost international finance.
- Create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through an additional forest and tree cover by 2030.

Integration of Climate change adaptation and Disaster Risk Reduction is the most promising step that can effectively monitor & control the greenhouse gas emissions such as carbon dioxide, methane, water vapor, CFC, HCFC, freon, oxides of nitrogen & sulfur, and can help in achieving the target of Paris Agreement, 2015 for limiting the global temperature rise to $1.5^{\circ}C$.above preindustrial level for this century. Severe heat waves from the month of March till July signifies the presence of GHGs present in the atmosphere of the urbanised area.

Heat wave

Heat wave is a condition when the abnormally maximum temperature in a region exceeds the normal maximum temperature, majorly in the northern India during the summer season.

IMD- According to IMD, Heat wave need not be considered till the maximum temperature in the plain region reaches 40 degree centigrade, 37 or more for coastal regions & 30 degree centigrade or more for hilly regions.

WMO- According to World Meteorological Organization (WMO), Heat wave is said to have occurred when the daily maximum temperature in a region exceeds the normal maximum temperature of that region by 5 degree centigrade for 5 consecutive days.

Probable period of occurrence of heat waves is mid-march to June & may extend to July

Heat Wave is said to have occurred when the maximum temperature in a region exceeds 45 degree centigrade for a minimum of 2 days or more.

Based on Departure from Normal

- Heat Wave: Departure from normal is 4.5°C to 6.4°C
- Severe Heat Wave: Departure from normal is >6.4°C

Based on Actual Maximum Temperature (for plains only)

- Heat Wave: When actual maximum temperature $\geq 45^{\circ}\text{C}$
- Severe Heat Wave: When actual maximum temperature $\geq 47^{\circ}\text{C}$

To declare heat wave, the above criteria should be met at least in 2 stations in a Meteorological sub-division for at least two consecutive days, and it will be declared on the second day [1].

In addition to the above, Climate Forecast System based forecasts maps of daily maximum temperatures and their departures from normal for the next 21 days (issued every Thursday) are also available on IMD website. [3, 4]

Table 1: Criteria for a heat wave as per IMD [1]

Green Alert	No action required	Maximum temperatures are near normal	No precautionary action required
Yellow Alert (Be updated)	Heat wave alert	Conditions likely to persist for 2 days.	Tolerable temperature for general public & moderate concern for infants, pregnant women, elderly people with chronic disease.
Orange Alert (Be Prepared)	Severe heat alert for the day	Severe heat wave condition may persist for 2 days or if longer then may persist for 4 days.	High temperature, increase the likelihood of heat illness & higher concern for infants, pregnant women, elderly people with chronic disease. Avoid heat exposure & drink a substantial amount of water to avoid dehydration.
Red Alert (Take Action)	Extreme heat alert for the day	Severe heat wave may persist for 2 days. Total number of heat/ severe heat wave days likely to exceed 6 days.	High likelihood of developing heat illness & heat stroke in all ages. Extreme care needed for vulnerable people.

Need for the Heat Wave Action Plan (HAP)

UNFCC Paris Agreement, 2015 identified objective was to limit the global temperature rise to 1.5°C by this century below pre-industrial levels, which would substantially reduce the risks of climate change. According to various published news report & article, Gorakhpur is one of the most polluted cities of UP (City having pollution level even more than Lucknow) having a concentration of $PM_{2.5}$ (the most significant pollutant responsible for causing respiratory and cardiac problems) as $225 \mu g/m^3$ as per the report of Climate Agenda Group in which is more than 4 times of the permissible level of $60 \mu g/m^3$ as prescribed by Indian standards [5, 6, 7].

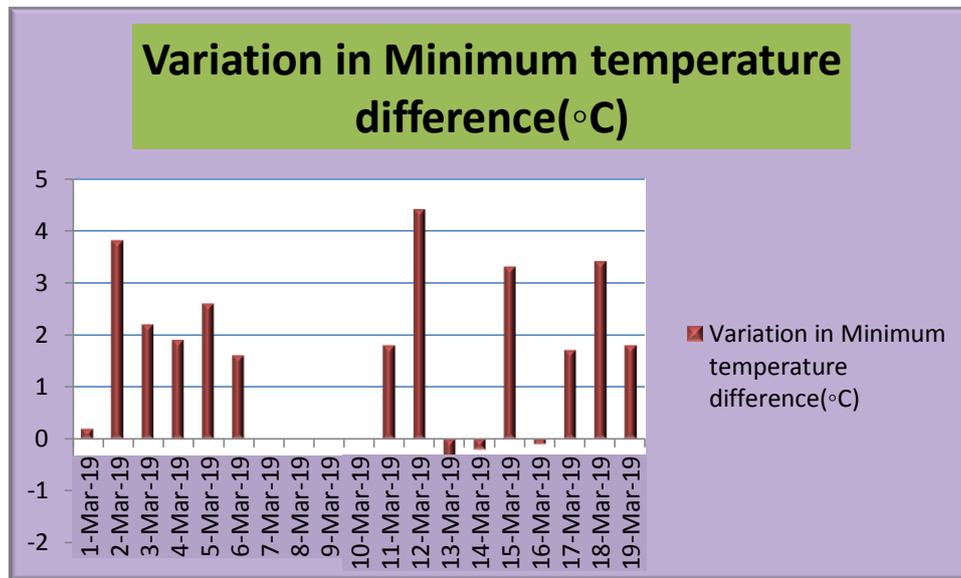


Figure 1: Dominated upside variation in minimum temperature of the Sadar area of Gorakhpur & rest of the Gorakhpur recorded by Climate Cell

An upside variation in minimum temperature of the Sadar (Subdivision of Gorakhpur) can be observed when compared with the overall minimum temperature of district Gorakhpur & the same is continuously being deduced from the recorded values of AWS. The above graph implicates that amount of greenhouse gases, or atmospheric pollutants present in the Sadar sub-division of Gorakhpur are higher when compared to the rest of the Gorakhpur. Also, Gorakhpur in its past had experienced severe variations in the rainfall pattern. Gorakhpur is a district of Uttar Pradesh having an area of $3483.8 km^2$. Population of Gorakhpur as per 2011 census is 44,36,275 having urban population as 8,34,370 & rural population as 36,01,905. Total number of males and females present in Gorakhpur as per 2011 census is 22,81,783 & 21,54,512 respectively.



Figure 2: Deaths due to the heat wave in India from 2010-2018 [15]

India being an equatorial country is severely exposed to heat waves during the season heat wave (March-July). Major states & UT of India exposed to heat waves are Odisha, Telangana, Bihar, Maharashtra, Gujarat, Andhra Pradesh, Jharkhand, Karnataka, Haryana, Delhi & Uttar Pradesh. Major areas of UP possessing a risk to heat waves are Allahabad, Varanasi, Gorakhpur, Bareilly & Lucknow. The above figure 2 depicts the significant losses that India had gone through in the recent past due to heat waves.

IMD is the apex body for monitoring of weather and publishing information related to daily weather conditions. As it is a well-known fact that lesser is the domain of area being studied, better is the understanding of the area being studied. Gorakhpur district in its past suffered a lot due to unprecise weather predictions and adverse weather conditions such as Cyclone- Hudhud (2014), Unprecedented rainfall of 2014, Floods, 2017. After considering the previous chain of the events and getting into the depth for exploring the solution for accurate weather predictions, Automatic Weather Stations (AWS) is installed in the collectorate of Gorakhpur to monitor the weather-related events in & around the periphery of Gorakhpur. Installation of AWS was the very initial initiative of Climate Cell of DDMA-Gorakhpur & the same is being used for regular issuance of adverse weather advisories. Weather advisories are frequently being uploaded on the NIC portal of Gorakhpur & in case of any forthcoming extreme weather events; weather forecast is immediately disseminated to identified major stakeholders such as-

- Chief Medical Officer, Gorakhpur
- Sub-Divisional Magistrates of Gorakhpur
- Chief Veterinary Officer, Gorakhpur
- Chief Agriculture Officer, Gorakhpur

- District Information officer, Gorakhpur



Figure 3: AWS installed at Tehsil-SADAR of Gorakhpur

In response to the above-issued forecast, a response report is submitted by stakeholders regarding damage caused in their specific domain. Now the integration of monitored atmospheric variables & IMD's forecast can be effectively utilized for issuance of weather-based advisories in Gorakhpur & the same can be implemented in a widespread manner provided that implementation of the same gets integrated with an action plan.

Aim of the Heat Wave Action Plan of Gorakhpur

Development of a dynamic early warning dissemination network for the creation of alertness among the communities based on heat wave related forecast issued by IMD. IMD regularly disseminates the daily 5 day weather forecast for heat waves during heat season, which needs immediate action in the case of any severity.

Entrusting stakeholders with responsibilities for enabling communities to combat heat waves in Gorakhpur by laying down the precise & focused responsibilities of various department as 'What they will be supposed to do in their domain within a pre-identified lead time?' like provision for making heat wave relief shelters & drinking water facilities by Municipal Corporation of Gorakhpur & GIDA, effective functioning of health facilities by hospitals & UHC in the affected community etc; for mitigation of the aftermath of heat waves on vulnerable ones like children, pregnant women, elderly with chronic disorder & differently abled .

Catalyzed preparedness of the schools & community level responders like Aapda Mitra by providing them adequate training to give an immediate response by taking proper care of the vulnerable communities living in their specific domain by doing a pre-preparation of data bank of vulnerable communities within their domain, when preceded by early warning disseminated to them by usage of press media, electronic media & social media.

Promoting adaptive & economical CCA related measures to combat heat waves in Gorakhpur by suggesting the various techno-managerial type of innovative & economic measures to deal with the heat waves & mitigate its aftermath *on the exposed communities*.

Formulation of a system for public outreach for the dissemination of forecast by involving the enhanced usage of radio frequencies, text messages, NIC website of Gorakhpur, WhatsApp groups, letter & fax to give an immediate response after receiving an early warning by DDMA Gorakhpur & Municipal Corporation of Gorakhpur.

Impact of the Heat Wave on Livelihood or Homo-Sapiens

Heat waves being mostly generated due to adverse weather events are likely to affect the humans, agriculture & livelihood adversely. The human body is highly susceptible to heat index which is obtained after integration of dry bulb temperature with relative humidity. Human body is greatly affected by convection & radiation modes of heat transfer. When the relative humidity is high, the rate of perspiration from the body decreases due to which the human body feels warmer in humid conditions. Adaptive measures focusing on humans have been discussed comprehensively in this SOP. Though acclimatization can only offer a limited level of protection to human beings but when implemented in a planned way can act as Savior. Avoiding sun, physical exertion & resting in the cooler places are must conditions to survive but for those who can't follow the regular precautionary measures like slum communities, workers, children's needs to be taken care of by administration of Gorakhpur.

Impact of the Heat Wave on Agriculture

Apart from the adverse impact of the heat wave on human beings, crop's quality & quantity both are affected adversely by the impact of a heat wave. There is a requirement of minimum temperature during the nighttime for the certain plant to grow in an efficacious way with adequate quality/crop yield. Crops being greatly affected by heat waves are Kharif and that too rice. When rice or Kharif crops get exposed to variable rainfall with highly variable temperature during May-June, then their crop yield reduces. Kharif crops are a major source of staple diets in some states of the country. Heat waves leads to the deaths of certain flowering plants. Various strategies that may be adopted to mitigate the impact of heat wave are

- Adoption of better water saving techniques.
- Legume crops with increased tolerance to heat.
- Changing seed pattern.
- Awareness of farmers on schemes like Gramin Krishi Mausam Sewa, Pradhan Mantri Fasal Beema Yojna (PMFBY), Soil Health Cards, Revenue Insurance Schemes for plantation crops, etc. followed by implementation of it in their domain.

Components of HAP

- Recognition of vulnerable groups

- Developing Interagency coordination among the stakeholders of HAP
- Precise response planning addressing the mitigation of the aftermath of adverse health impacts due to the heat wave.
- Dissemination of precise early warning to the specified groups
- Regularly updating the HAP preceded by its evaluation.

Precautionary measures for citizens of Gorakhpur [8]

- As far as possible, avoid going out in the hot sun, especially between 12.00 P.M. and 4.00 P.M.
- Wear light-colored, loose, cotton clothes. Use protective goggles, umbrella, cap, towel or cloth to cover head, shoes, and chappals while going out in the sun.
- Avoid strenuous activities in the scorching sun, when the outside temperature is high.
- If you have to work outside, use a damp cloth or an umbrella to cover your head.
- Eat light meals and fruits rich in water content like melons, cucumber, and citrus fruits.
- Use home-made and traditional healthy beverages like lemon water, butter milk and juices etc.
- Avoidance of excessive protein-rich food during heat season (March-July) like egg, chicken, Almond, Yogurt, Cottage Cheese, etc.
- Never leave children and pets alone in parked vehicles.
- Keep animals in the shade and give them sufficient water to drink.
- Keep your home cool, use curtains, shutters or sunshade, etc. Open windows at night. Maintain adequate ventilation.
- Listen to local weather forecasts and be aware of upcoming temperature changes.
- In case of illness and fainting, consult a doctor/ seek immediate medical help.
- Avoid dehydration by drinking 3-3.5 liters of water per day for people working in open atmosphere & for people exposed to AC should drink 2 to 2.5 liters of water per day.
- Listening to daily weather news on electronic media & reading the same in the newspaper.
- Remember all the motor /electricity/ fuel based equipment in the starting condition generate substantial heat within the home. Avoid using the cooking & usage of electric appliances during heat wave period & if using then allow space for cross ventilation.

What to do in Heat Stroke:

- Get the person indoors or into a cool/shady area, make him lie down with feet slightly elevated.
- Wipe the body with a damp cloth with a wet cloth or spray cold water to the skin.
- Give the person ORS to drink, lemon water, salt-sugar solution or juice to re-hydrate the body.
- Do not give anything to eat or drink to a person if he is not fully conscious.
- Take the person to the nearest health center if symptoms do not improve in one hour.

Strengthening of HAP [8]

- It is proposed that strengthening of the heat action plan can be carried out in the following phases

- Phase I- Mapping and documenting the current initiatives and activities undertaken against Heat Waves
- Phase II- Assessment of the magnitude of the Heat Wave related morbidity and mortality
- Phase III- Determination of threshold values (thermo-hygro-metric index) which cause Heat Wave related adverse health outcomes and support IMD in developing an Early Warning System (EWS) based on the threshold values.
- Phase IV- Community vulnerability assessment to identify the most vulnerable sections of the society to Heat Wave and suggest alternate models for resiliency building which are contextual.
- Phase V- Strengthen the existing Heat action plan by incorporating the EWS, alternate livelihood strategies for vulnerable populations and involvement of various stakeholders/ sectors to support in the implementation of Heat action plan.
- Phase VI- Review and update the Heat Action Plan annually by incorporating the EWS and inputs of various stakeholders/ sectors and evaluate its implementation

Roles & responsibilities of Stakeholder

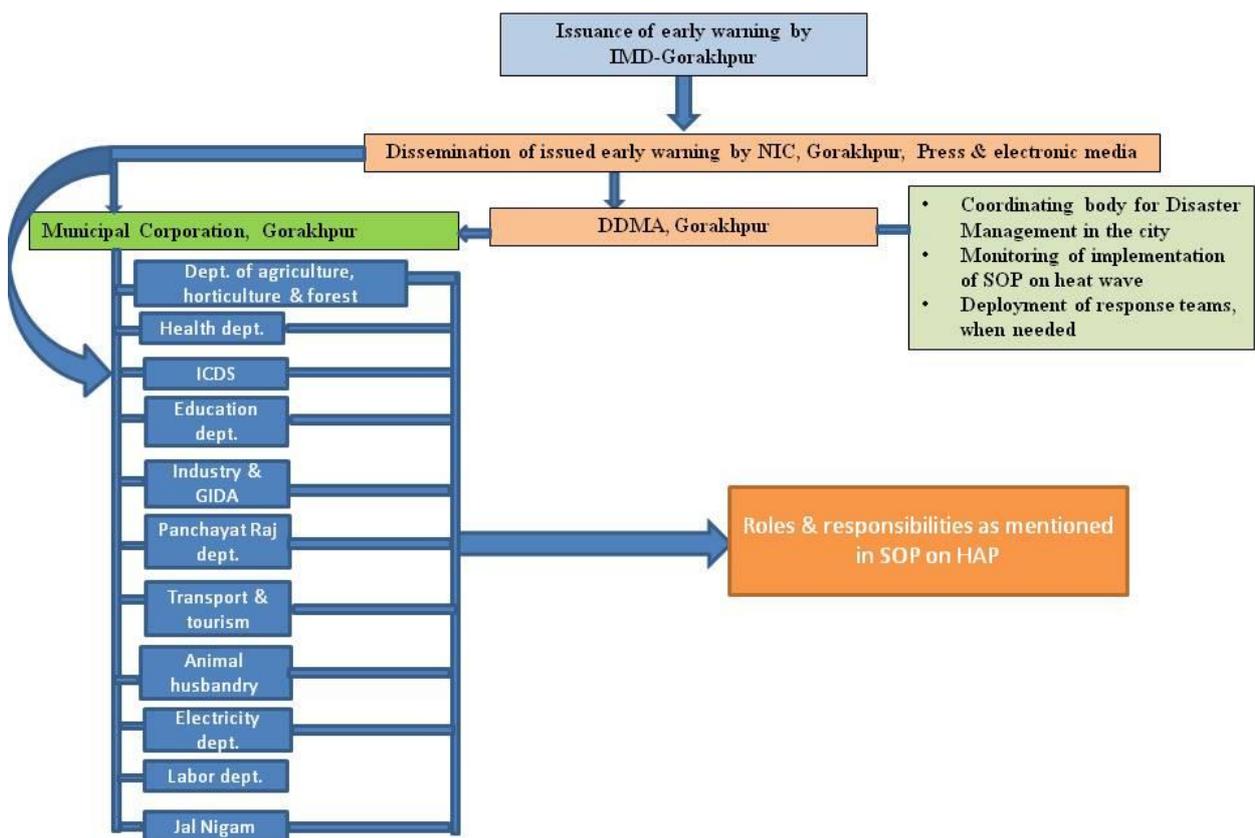


Figure 4: Operability chart for SOP on heat wave

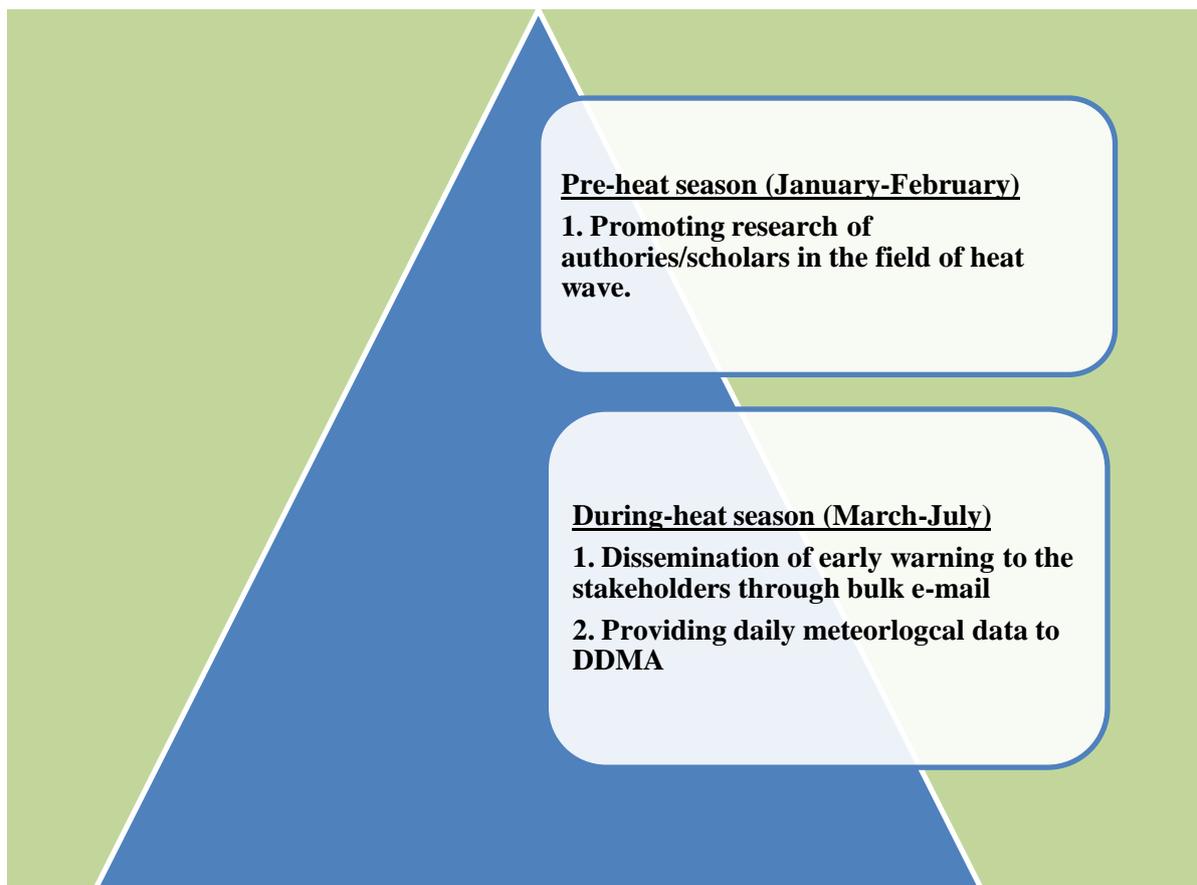
Pre-heat Season (January–February)

- Providing related meteorological data of Gorakhpur to NIC & DDMA, Gorakhpur & institutional scholars pursuing research in the field of a heat wave for enhancing preparedness & mitigation in the context of a heat wave.

During-heat season (March–July)

- Issuance of precise early warning (email-based alert) of heat wave alert & disseminates it to the NIC head.
- Providing daily meteorological data of Gorakhpur to DDMA.

Actionable functions of IMD in the perspective of Heat Wave



Pre-heat Season (January –February)

- Prepare a list of the areas of the sub-divisions of Gorakhpur likely to get affected by the heat waves and followed by identification of areas requiring more focused activities for heat prevention.
- Organizing a preventive training programme & CBP in the exposed community to mitigate the aftermath of a heat wave.
- Developing ICT activities in coordination with stakeholder departments for spreading awareness on precautionary measures to be adopted, by the distribution of IEC materials like posters, pamphlets, bookmarks, etc. in schools, hospitals & professional associations.

During-heat season (March –July)

- Monitoring the implementation of heat wave action plan on a daily basis
- Develop a social media & SMS based alert system to disseminate the warning from DDMA to the stakeholders ranging from DM to Gram Pradhan (DM, Municipal Commissioner, CMO & CMS of the district, Press & electronic media, ICDS, Education department, PRIs, CEO of GIDA, labor dept., NIC, Transport & tourism, Chief Veterinary Officer & heads of link departments.).
- Issuance of precise directives to the concerned departments depending upon the criticality of the situation for mitigation of heat wave apart from their defined SOP in HAP
- Engage local agencies to facilitate efficacious dissemination of forecast of heat wave & internal communication.
- ADM (F/R) of Gorakhpur will be the nodal monitoring & implementing authority to manage heat wave condition.
- Holding of a daily conference call/ phone call with all the stakeholders regarding the progress of the departments during heat alert & ensure operability of communication channel

Post-heat season (July-December)

- Yearly impact evaluation of the plan based on the performance of all the stakeholders of district administration followed by any revision, if needed.
- Gratuitous relief in the form of ex-gratia payment of 4 lac rupees per person will be provided to the family of deceased person after the authority gets satisfied on the basis of certificate mentioning the cause of death as the heat wave.
- Post the revised plan to the website of Gorakhpur. (www.gorakhpur.nic.in) & inform about the updated changes to press & electronic media.

Actionable functions of DDMA-Gorakhpur in the perspective of Heat Wave



Municipal Corporation of Gorakhpur

Pre-heat Season (January –February)

- Identification of cooling centers such as doss houses, temples, roof covered public places, for specific areas that would become active depending upon the heat alert.
- Promotion of the concept of energy efficient building, green infrastructure, albedo paint on roofs & reduction in the burning of fossil fuels.
- Implementing the usage of mechanized building codes for accelerating the usage of energy saving equipment in the building, green roof, etc. majorly in SADAR area of Gorakhpur which will ultimately lead to absorption of pollutants by adequate plant leading to reduction of Greenhouse gases within the atmosphere.
- Provision of funds for in the departmental budget for capacity building.
- Adequate plantation to minimize the exposure of heat wave.

During-heat season (March-July)

- Maintain close coordination with DDMA, Gorakhpur and keep following updates of IMD-Gorakhpur for continuous surveillane of temperature forecast & prevailing weather.
- Develop a social media (Whatsapp or Facebook) & SMS based alert system to disseminate the warning to their departmental stakeholders, based on warning issued by IMD & disseminated by NIC, Gorakhpur.

- Provision for arranging shaded areas for slums, vulnerable communities & outdoor workers of all the concerned sub-divisions of Gorakhpur depending upon the exposed population. Ensure activation of cooling centers like doss houses/heat wave relief shelters etc. remains open for all day, majorly for the migratory population.
- Setup public displays/electronic screens showing the value of temperature & other atmospheric variables along with do's & don'ts at busy public places & urbanized area within the Gorakhpur.
- Regular monitoring of water requirement followed by immediately sorting out the issues related to water scarcity in slums, rural areas & vulnerable communities by supplying water through tankers into the affected communities.
- Immediate suspension of insignificant usage of water being done in the entire district after making a rigorous analysis of the same.
- Arrangement for distribution of fresh drinking water to the vulnerable communities in the form of pouches of water, pyau or water kiosks near the public concentrated places of various subdivisions of Gorakhpur (Golghar of SADAR, Bank road of SADAR, Tehsil –Campierganj, Paidleganj of SADAR, area near Khajini Police station, Kauriram chauraha in Bansgaon, Shajanwa station road etc.) temples, mosque depending upon the issuance of heat alert.
- Provision for delivering relief to the victims of heat waves by the opening of public parks during peak hours of a heat wave.
- Water supply in the slums by utilizing tanks.
- Provision for making the announcement publicly through the public address system.

Post-heat season (July-December)

- Promoting the greenery of the district by engaging student volunteers from the respective blocks or schools for establishing tree plantation from June either by incentivizing the volunteers or by making arrangements for awarding the best group/individual.
- Discussion of suggested innovative measures mentioned in HAP among the communities/concerned departments to deal with the heat waves.
- Suggestion on the improvisation of SOP in the perspective of their identified role & responsibilities while combating heat waves followed by implementing the revised HAP.

Actionable functions of Municipal Corporation in the perspective of Heat Wave



NIC, Press & Electronics media

Pre-heat Season (January–February)

- Developing methodology for catalyzing public outreach by publishing precautionary measures on the cover page of newspaper focusing on prevailing atmospheric variables in Gorakhpur & measures to be adopted for mitigation of heat wave impact based on suggestion of health department & details mentioned in the SOP.

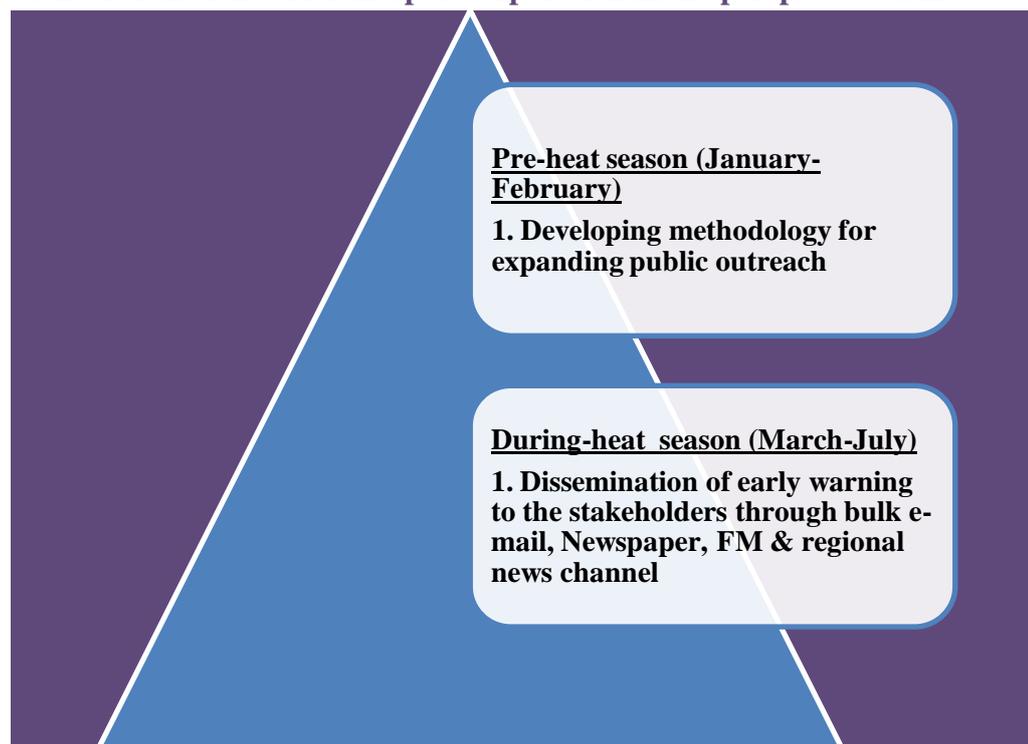
During-heat season (March – July)

- Dissemination of early warning by IMD & do's & don'ts on heat wave stakeholders & public through radio frequencies/FM, newspapers, social media & regional news channel of Gorakhpur.
- Development of a database of email by NIC for e-mailing the warning related alert to all the major industrialist/employers, DM, Municipal commissioner, ADM, SDM of all the tehsils, CEO of GIDA, CMO & CMS of the district, ICDS, Education department, PRIs, labor dept., Transport & tourism, Chief Veterinary Officer & all the Gram Pradhan, MLAs & MP's of Gorakhpur.

Post-heat season (July-December)

- Assessment of the implemented heat action plan followed by participation in revision of the HAP and thereby, reviewing & implementing the revised HAP.

Actionable functions of Municipal Corporation in the perspective of Heat Wave



Health department & Medical Professional

Pre-heat Season (January–February)

- Distribution of image-based pamphlets, brochures, leaflets on awareness of the community on steps for mitigation of heat stress by focusing mainly on urban poor or rural areas of Gorakhpur risk. Ex-the pamphlet should contain the most fruitful info in an brief way accompanied by an image.
- Capacity building programme of emergency health workers related to 108 emergency services & Mobile Health Unit(MHU), paramedics, staffs of health centers, nurses, ward boy/ward girl, link workers (ASHA worker, Aarogya Mitra) to deal with the heat wave.
- Installation of adequate banners/ posters outside the PHC, SHC, CHC of Gorakhpur with banner content as precautionary measures for a heat wave.
- Identification of most of the health centers lying in severely heat wave affected areas through risk mapping/any technique being used.
- Heat shelters in hospitals or centers with an earmarked bed along with identified cooling space for heat wave affected patient.
- Adoption of heat focused examination procedures at health centers of the district.
- Must dissemination of IEC about Do's & Don'ts among the vulnerable communities regarding the heat wave.

During-heat season (March-July)

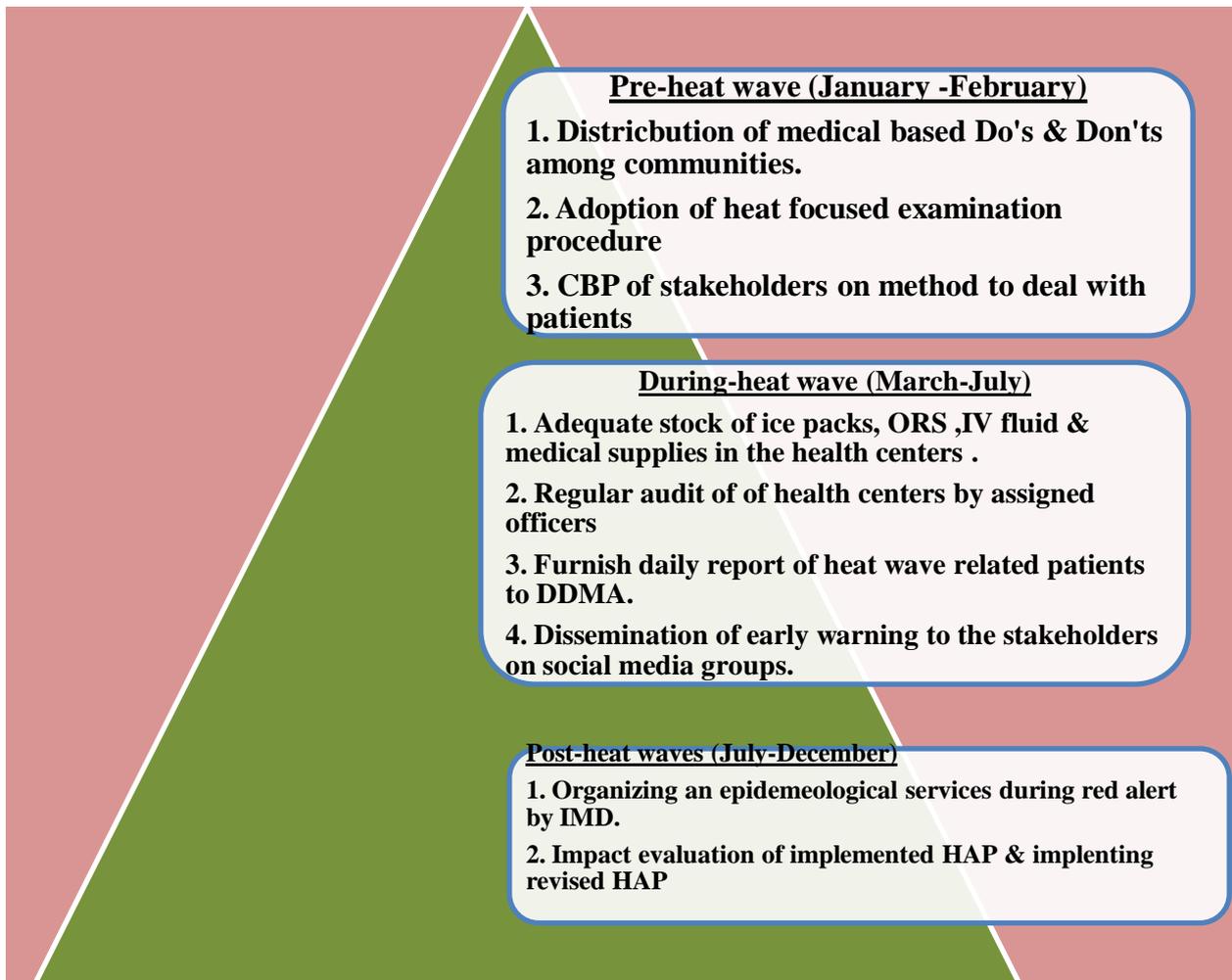
- Ensure the readiness of the emergency ward in SHC, PHC, CHC & 108 emergency ambulances to deal with the emergency cases.
- Developing of social media groups on Whatsapp to immediately disseminate the information related to alert to the concerned officials & field staff/link workers, on the basis on information conveyed by IMD & disseminated by NIC, Gorakhpur.

- Distribution of soft plastic ice packs within the district by creating ice pack dispensaries for providing the same to the selective & vulnerable groups at a subsidized cost.
- Maintain sufficient supply of ORS & IV fluids in coordination with NGOs & CSR initiatives.
- Increase staffing at the health centers of the most vulnerable regions of the district depending upon the medical risk mapping of Gorakhpur.
- Assigning a zonal heat officer to visit & audit the health centers within the district.

Post-heat season (July-December)

- Organizing an epidemiological survey of the district to gather data & findings on account of mortality & morbidity rate by organizing operational research-based studies & followed by submittal of the simulated & signed report from the CMO of Gorakhpur to the DDMA, Gorakhpur.
- Making an action plan for the next phase to mitigate the previous year's aftermath of the heat wave within the district followed by its effective implementation within the district.
- Integration of identified & explored innovative measures in Heat Action Plan for the next phase.
- Assessment of the implemented heat action plan followed by participation in revision of the HAP and thereby, reviewing & implementing the revised HAP.

Actionable functions of Municipal Corporation in the perspective of Heat Wave



Pre-heat Season (January–February)

- Capacity building of communities (Gram Pradhan, Anganwadi workers with special focus on infants, children below five years, pregnant, lactating mothers and geriatric population) by spreading awareness among them on heat wave & its precautionary measures.
- Distributions of IEC material like do's & don'ts in the form of pamphlets issued by the department of health & family welfare must be done among them.
- Focused training of Anganwadi workers on the identification of health risks and its management during heat waves.
- Spreading awareness among vulnerable communities on impact of heat waves like dehydration, heat cramp, heat strokes, etc. accompanied by the method of prevention.

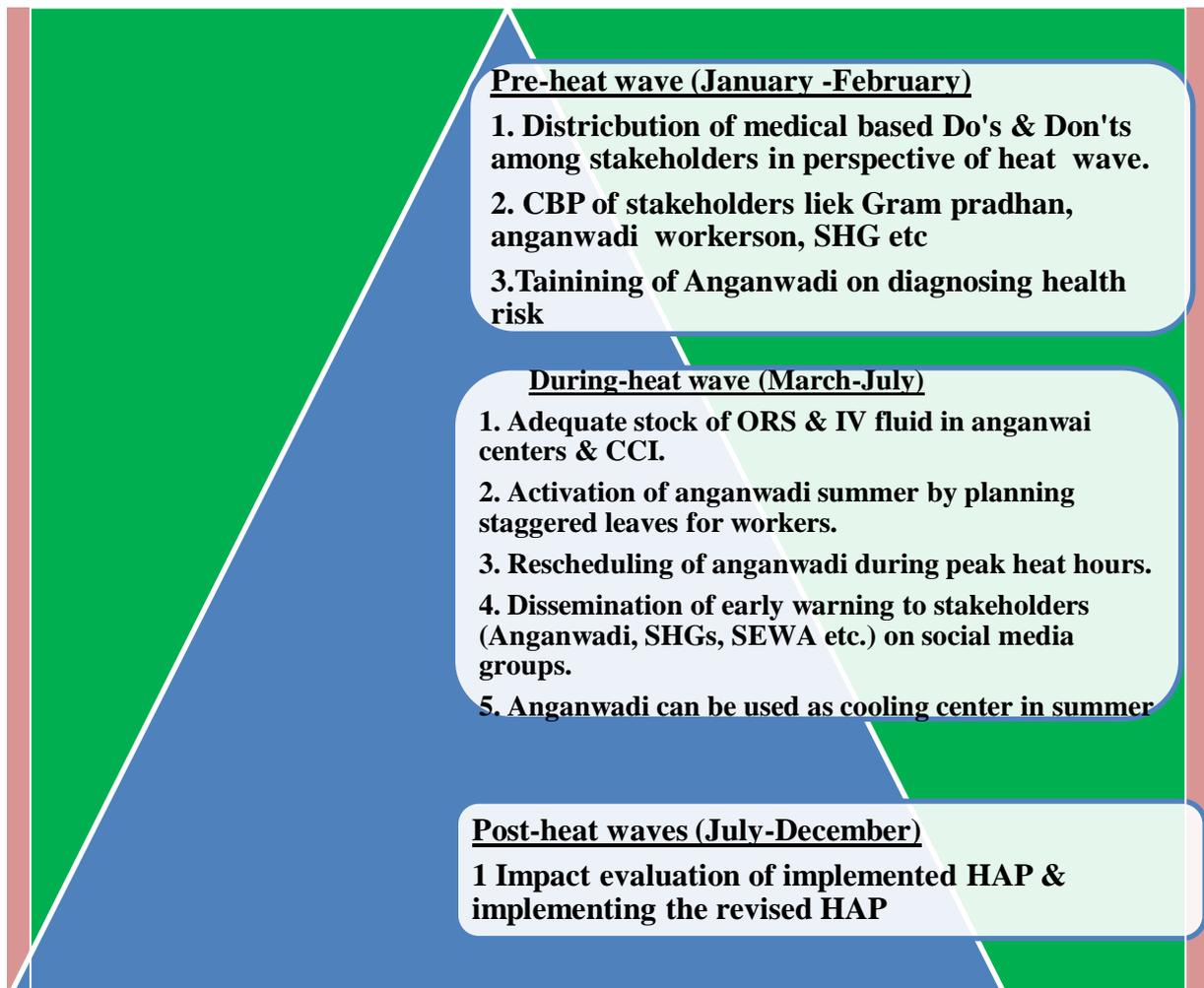
During-heat waves (March–July)

- Provision of drinking water and first aid, adequate stockpiling of ORS & IV fluids at all the Anganwadi Centers, old age homes, Child Care Institutions (CCIs).
- Developing of social media groups on Whatsapp to immediately disseminate the information related to alert to the concerned officials & field staff/link workers, based on information conveyed by IMD & disseminated by NIC, Gorakhpur.
- If needed, provision for saving buttermilk must be made in Anganwadi centers instead of milk during summer season.
- Anganwadi must become functional immediately during the summer after issuance of an alert issued by IMD & disseminated by NIC for acting as a cooling center. Provision for staggered leaves must be planned for Anganwadi helpers/supervisors.
- Anganwadi timing to be rescheduled to avoid peak heat hours.
- Avoidance of outdoor activities during peak hours of a heat wave (12:00 pm to 04:00 pm) by engaging children indoors.

Post-heat waves

- Assessment of the implemented heat action plan followed by participation in revision of the HAP and thereby, reviewing & implementing the revised HAP.

Actionable functions of Municipal Corporation in the perspective of Heat Wave



Education department, Gorakhpur

Pre-heat Season (January–February)

- Efficacious capacity building of school staff who will trickle down their training to school children on the basis of child friendly training.
- Distribution of IEC materials among children like bookmarks mentioning the do's & don'ts in the context of heat waves & using posters, pamphlets within the premises of schools to disseminate the info regarding heat waves.
- Adoption of Indoor & Outdoor plants as recommended by DDMA, Gorakhpur for mitigation of atmospheric pollutants.
- Issuing directives to the schools for Albedo painting on school roofs.
- Promote School Safety Plan & encourage Plantation of trees and promote green campus by encouraging plantation of trees, kitchen gardening & roof gardening within the campus.

During-heat season (March-July)

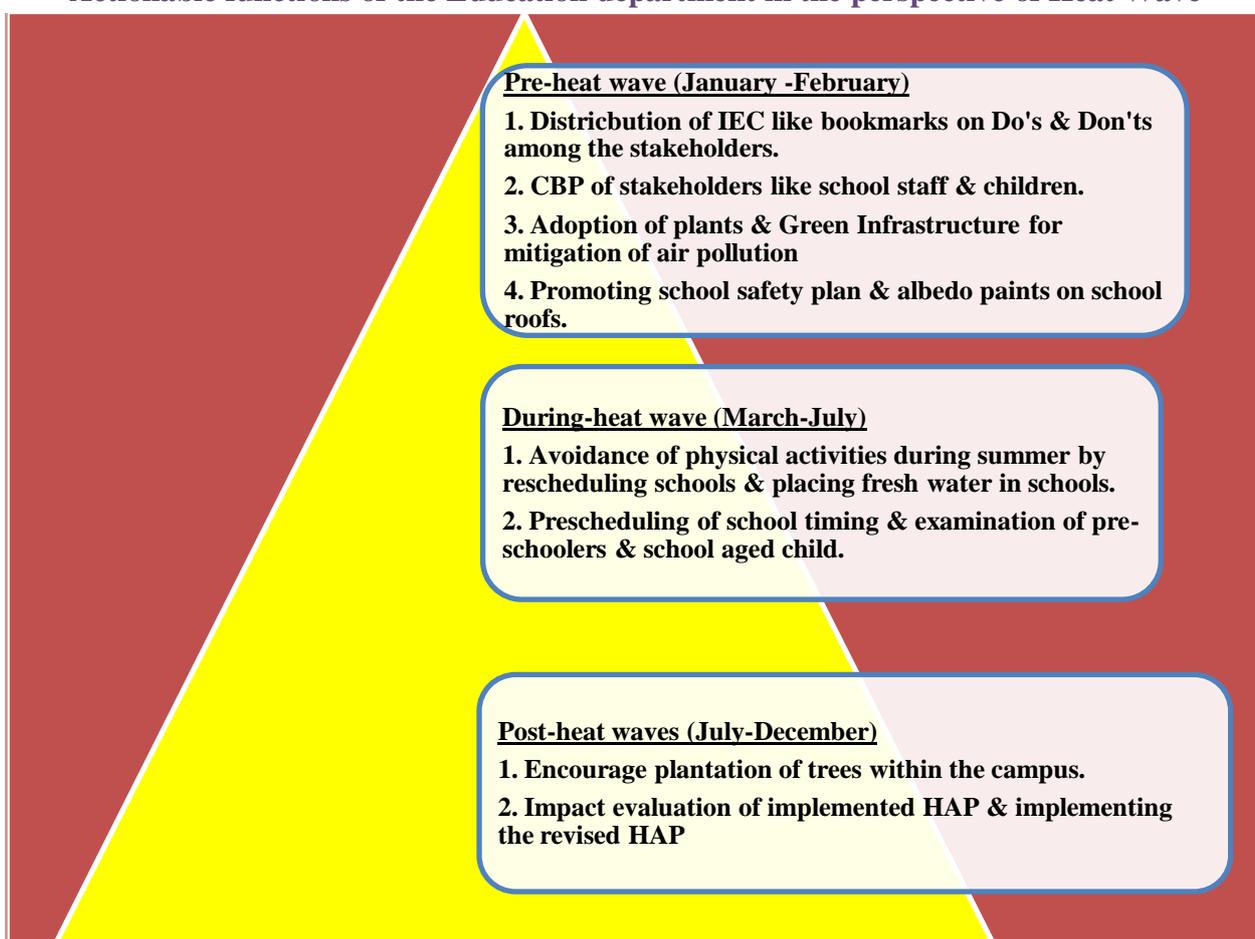
- Avoidance of outdoor physical activities during summer & provision for the creation of cool & fresh drinking water.

- Reschedule school timing (07:00 am to 11:00 am) in heat wave prone villages, block, and district during summer especially for preschoolers (4-6 years) & school-aged child (6-10 years), to minimize their exposure to the heat wave.
- Scheduling of examination of preschoolers (4-6 years) & school-aged child (6-10 years) before the period of heat waves.
- Dissemination of Early warning issued by IMD & disseminated by NIC to all the concerned stakeholders by utilizing social media like What Sapp.
- Ensure a supply of water for students and teachers if the school is functioning. ii. If school is not functioning, permit the use of school premises as a shelter during day time.

Post-heat season (July- December)

- Assessment of the implemented heat action plan followed by participation in revision of the HAP and thereby, reviewing & implementing the revised HAP.
- Encourage plantation of trees within the campus.

Actionable functions of the Education department in the perspective of Heat Wave



Panchayat Raj Department

Pre-heat Season (January–February)

- Capacity building programme on the impact of Heat wave & method for prevention organized by RIRD, Gorakhpur for Gram Pradhan, link workers, Aapda Mitra, lekhpals & school staff.
- Identify the vulnerable area & most vulnerable population by utilizing the skills of Gram Pradhan, link workers & 200 trained Aapda Mitras of Gorakhpur.
- Sensitization among the vulnerable population communities about heat wave impact.

- Public announcement and distribution of leaflets/pamphlets about the do's and don'ts on heat wave.
- Capacity building of farmers of the specific region to do the cropping depending upon the suitability of weather & utilize govt. Schemes like PMFBY, soil health cards, etc.
- Restoration of ponds, artificial lakes for enhancing the cooling of the environment by evaporation.

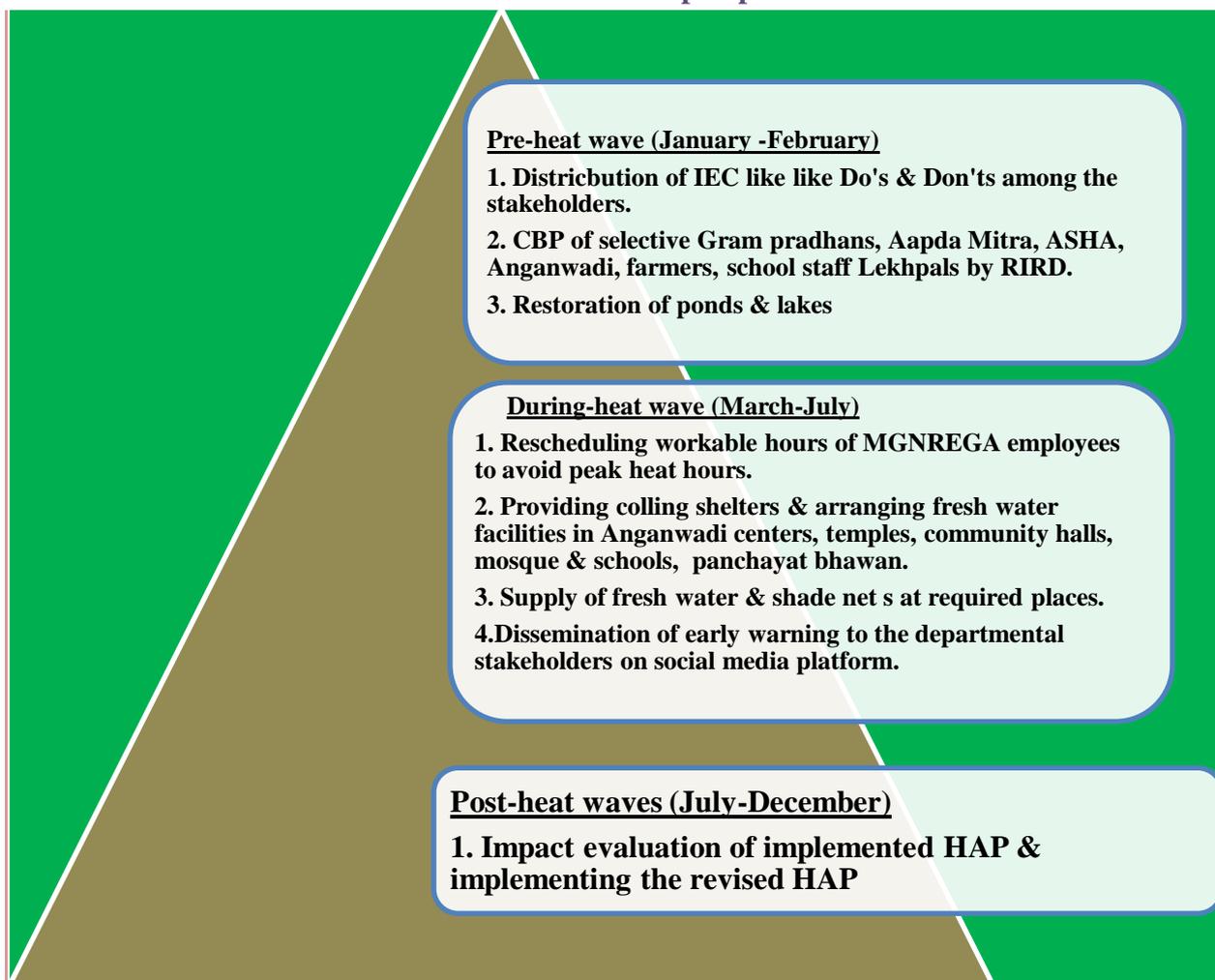
During-heat season (March-July)

- Provision for providing cooling centers in temples, community halls, schools & Panchayat Bhawan.
- Restructuring the workable hours (hours to minimize the exposure of workers during 12:00 pm to 04:00 pm) by the adoption of flexible working hours for an employee under MGNREGA act.
- Dissemination of Early warning issued by IMD & disseminated by NIC to the concerned Gram Pradhan, Lekhpals, link workers, SHG, SEWA & Aapda Mitras, by creating a data bank of all the concerned stakeholders for disseminating information by utilizing social media like What Sapp.
- Supply of fresh water & shade nets at required places.
- Provision for providing tube wells, water kiosks, & water tankers at strategic locations followed by adequate monitoring of the same to deal with any obstruction in relief work.

Post-heat season (July- December)

- Assessment of the implemented heat action plan followed by participation in revision of the HAP and thereby, reviewing & implementing the revised HAP.

Actionable functions of PRIs in the perspective of Heat Wave



Labor Department

Pre-heat Season (January–February)

- Preparation of high-risk map of the region having with the workers exposed to the outer atmosphere. Also, distribution of IEC material must be done majorly among the labors to mitigate the aftermath of heat waves among the labors.
- Capacity building of employers, employee, indoor & outdoor labor regarding the impact of a heat wave followed by spreading awareness among them on adoptable measures to mitigate the impact.
- Enforce relevant labor laws to lessen the exposure of workforce to heat wave & if gets affected then enforce it in a way that incurs NIL/minimal expense of the labor for treatment of his/her in case he gets affected during the tenure of his work — providing adequate health insurance to workers.

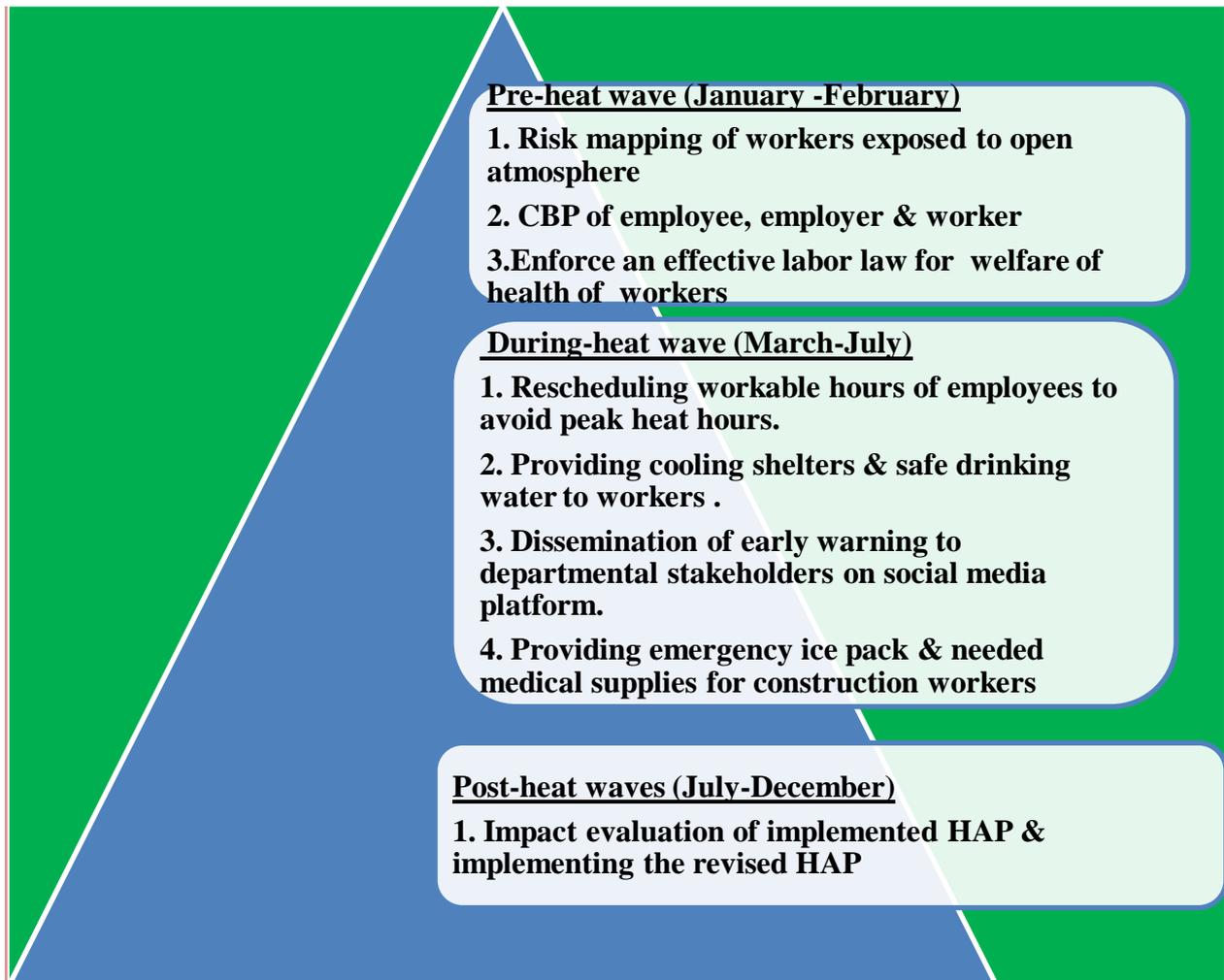
During-heat season (March – July)

- Encourage employer to minimize the exposure of outdoor workers during peak hours (12:00 pm to 04:00 pm).
- Develop a social media (WhatsApp) & SMS based alert system to disseminate the warning to their departmental stakeholders like factory medical officers, contractor & neighborhood communities, etc. for ensuring an efficacious response based on warning issued by IMD & disseminated by NIC.
- Provision for providing emergency ice packs to the construction workers.
- Clean & safe drinking water must be provided at the place exposed to the heat wave.
- Ensure provision of shelters/cooling areas & emergency medicines like ORS, IV fluids, etc. at work site by employers.

Post-heat season (July-December)

- Assessment of the implemented heat action plan followed by participation in revision of the HAP and thereby, reviewing & implementing the revised HAP.

Actionable functions of Labor dept. in the perspective of Heat Wave



Industrial department & GIDA

Industries are the major sources of pollution within a region as they are one of the largest contributors of Greenhouse gases in the atmosphere, which can absorb the heat thereby leading to an increase in temperature. Greenhouse gases are mostly released due to the burning of fossil fuels, and the same is being majorly used by the industries as their source of fuel. Hence, it becomes the prime responsibilities of industries to contribute & join hands with the stakeholders to make their life of neighborhood communities appeasing & healthy. Most of the industries of Gorakhpur are lying in GIDA, and so GIDA has been focused greatly on the development of SOP for Industries to combat heat waves.

Pre-heat Season (January–February)

- GIDA should prepare a high-risk map of their overall area based on regions having industries with a greater amount of labors working in the roofless atmosphere within its boundaries.
- Provision for construction of at least an emergency A/C relief chamber in industries having a minimum of 1 worker exposed to more than 2 hours in peak hours of the outer atmosphere within the boundaries of industries.

- Each industry should prepare a list of factory medical officials, contractors & house side workers to include in the channel for dissemination of early warning for giving an effective response towards the community.
- CBP of factory medical officials, contractors & house side workers.

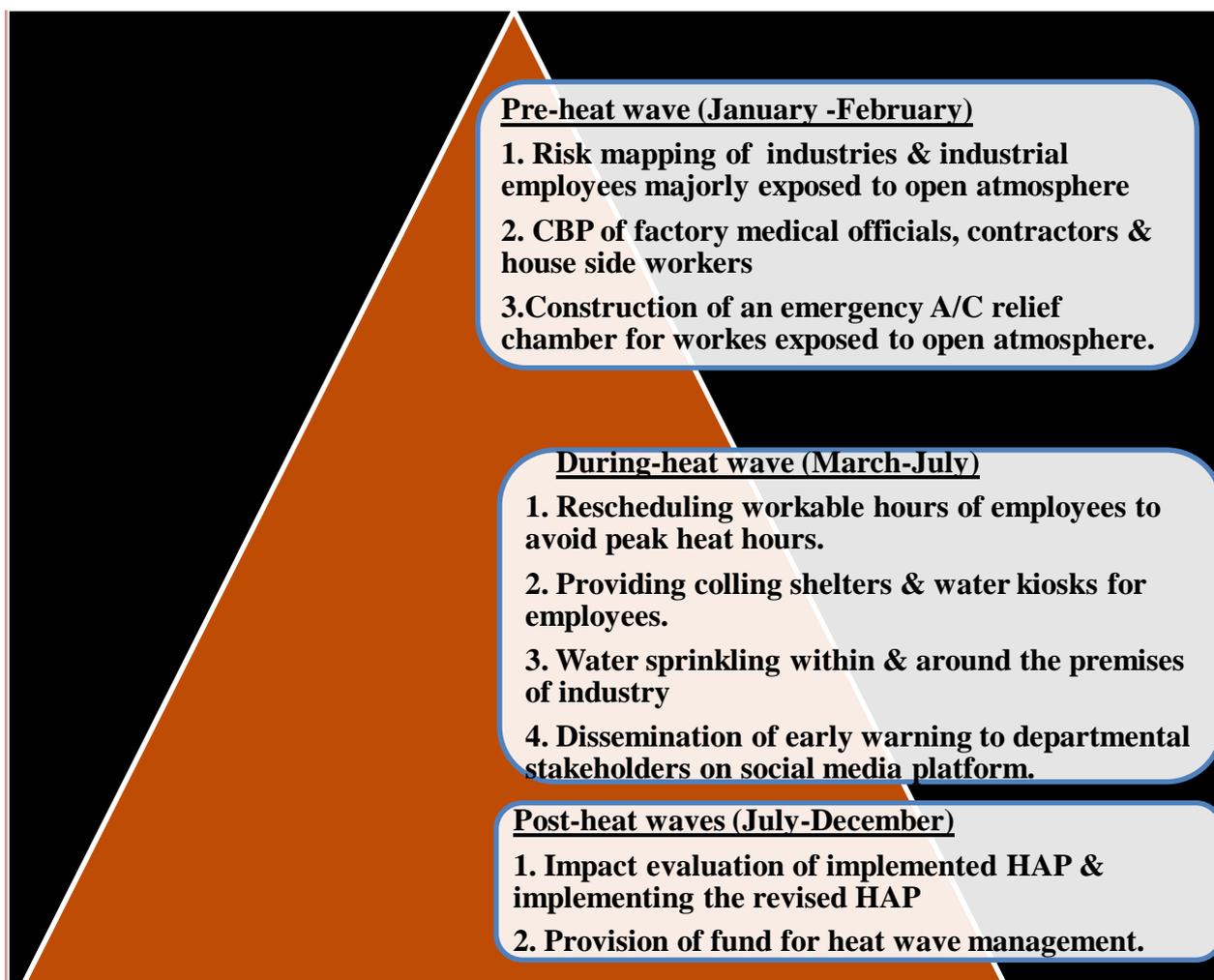
During-heat season (March – July)

- Adoption of measures to mitigate the heat wave by settling of water kiosk even at locations outside the plant/industry followed by regular monitoring of their working condition, purity & water level present within it.
- Provision for water sprinkling within & around the premises of industries.
- Creation of measures for temporary heat-relief shelters after receiving the orange alert from IMD, Gorakhpur.
- Develop a social media (Whatsapp or Facebook) & SMS based alert system to disseminate the warning to their departmental stakeholders, based on warning issued by IMD & disseminated by NIC.

Post-heat season (July-December)

- Provision of funds for heat wave management.
- Assessment of the implemented heat action plan followed by participation in the revision of HAP and thereby, reviewing & implementing the revised HAP.

Actionable works of GIDA in the perspective of a heat wave



Transport & Tourism

Pre-heat Season (January–February)

- Capacity building of drivers & conductors on the realization of the severity of heat waves followed by immediate measures to be adopted for providing relief to the passengers.

During-heat season (March - July)

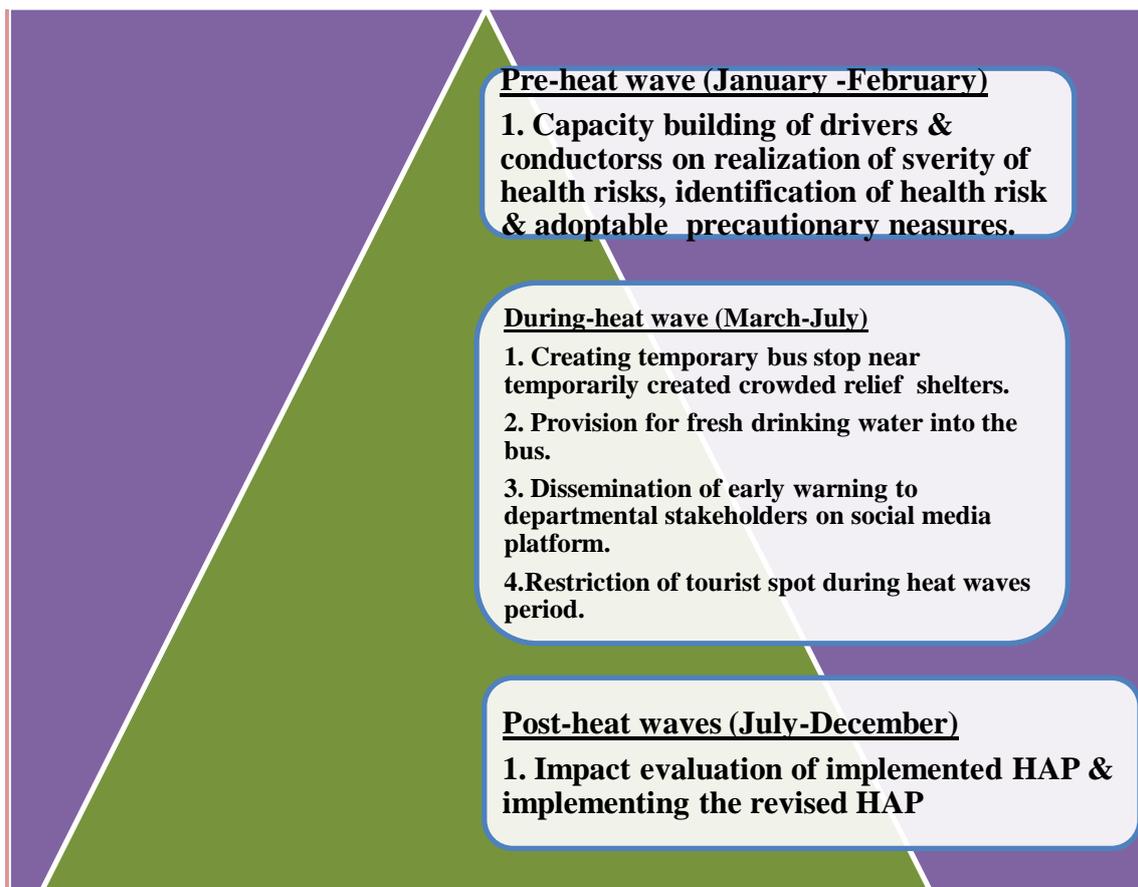
- Provision for creating bus stop at the temporarily created relief shelters (crowded shelters) on the advice of municipal corporation of Gorakhpur, after receiving heat alert related warning from DDMA, Gorakhpur & press & electronic media., during heat waves.
- Develop a social media (Whatsapp or Facebook) & SMS based alert system to disseminate the warning to their departmental stakeholders, based on warning issued by IMD & disseminated by NIC.
- Provision of fresh drinking water (1 glass & 4 jars of 20 liters each provided that jars must be fully covered with wetted jute bag & the same bag must be wetted at the start of every trip of the bus), first aid & adequate stockpiling of ORS & IV fluids in all the buses being run for common public including school buses. Also, ORS & IV fluids must be present in an adequate amount at the tourist places.

- Restriction of tourist spot for tourist during peak heat hours from April to June as they may face the adverse impact of heat wave instantaneously because they may not be acclimatized with Indian weather.
- Restriction of a bus plying times during peak hour & provision of cool resting spaces at bus stops, water kiosk on highways.
- Display of heat wave related precautionary measures for passengers & tourist during summer/heat wave period at the buses, bus-stops & tourist places respectively.

Post-heat season (July-December)

- Assessment of the implemented heat action plan followed by participation in the revision of HAP and thereby, reviewing & implementing the revised HAP.

Actionable works of GIDA in the perspective of a heat wave



Animal Husbandry

Pre-heat season (January-February)

- IEC activities to save the cattle & poultry during the heat by the distribution of pamphlets among livestock farmers & **animal management teams** during heat wave conditions.
- Provision for constructing vats near water tanks or tube wells for providing drinking water to nearby roaming animals.
- CBP of farmers, cattle & poultry owner on the adverse impact of a heat wave on their animals followed by training of them on adoptable precautionary measures to safeguard their animals.

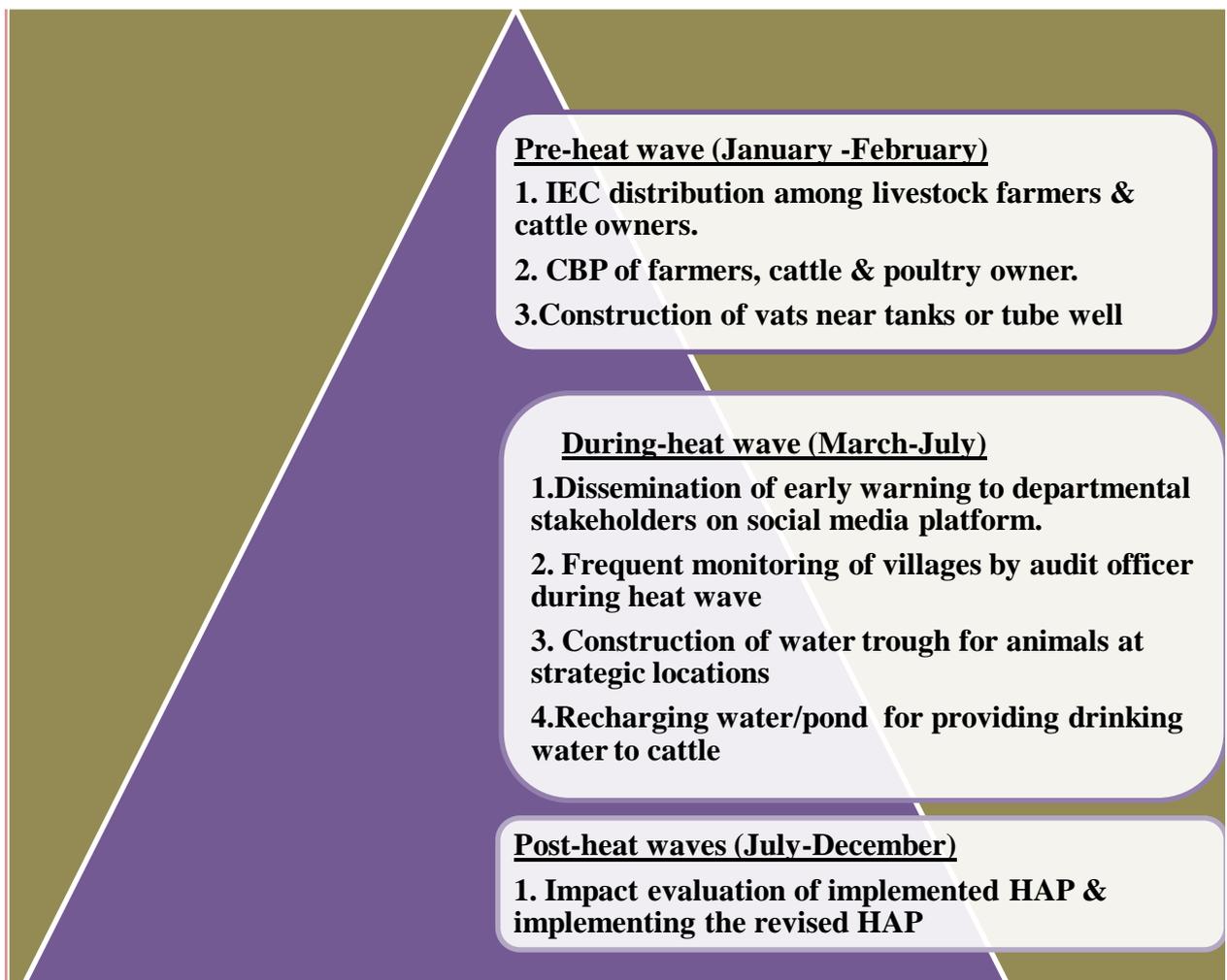
During-heat season (March-July)

- Preparation of plans to provide drinking water for cattle in case of an orange alert issued by NIC & district EOC to Chief Veterinary Officer. Recharging ponds/water bodies for providing drinking water to wild life.
- Thorough check of available inventory of medical supplies with veterinary centers, under the supervision of Chief Veterinary Officer.
- Dissemination of early warning to all the major livestock farmers & poultry owners of all the 7 sub-divisions of Gorakhpur, by creating a social media & text message-based platform under the supervision of CVO, based on warning issued by IMD disseminated by NIC
- Displaying pamphlets & posters at busy crowdly places on the precautionary measures to be taken for animal care during a heat wave by installing the same in villages & at the road junctions of the city.
- Ensure frequent monitoring of villages during a heat wave by a field officer of the veterinary department.
- Construct water trough for animals in a strategic location.

Post-heat season (July-December)

- Assessment of the implemented heat action plan followed by participation in the revision of HAP and thereby, reviewing & implementing the revised HAP.

Actionable works of Animal husbandry in the perspective of a heat wave



Electricity department

Pre-heat season (January-February)

- Capacity building of people on energy conservation
- Measures for providing IEC on do's & don'ts on energy conservation on the backside of electricity bill provided to house/industry owners.
- Develop a policy for power cuts depending on vulnerable areas (slums) and population.

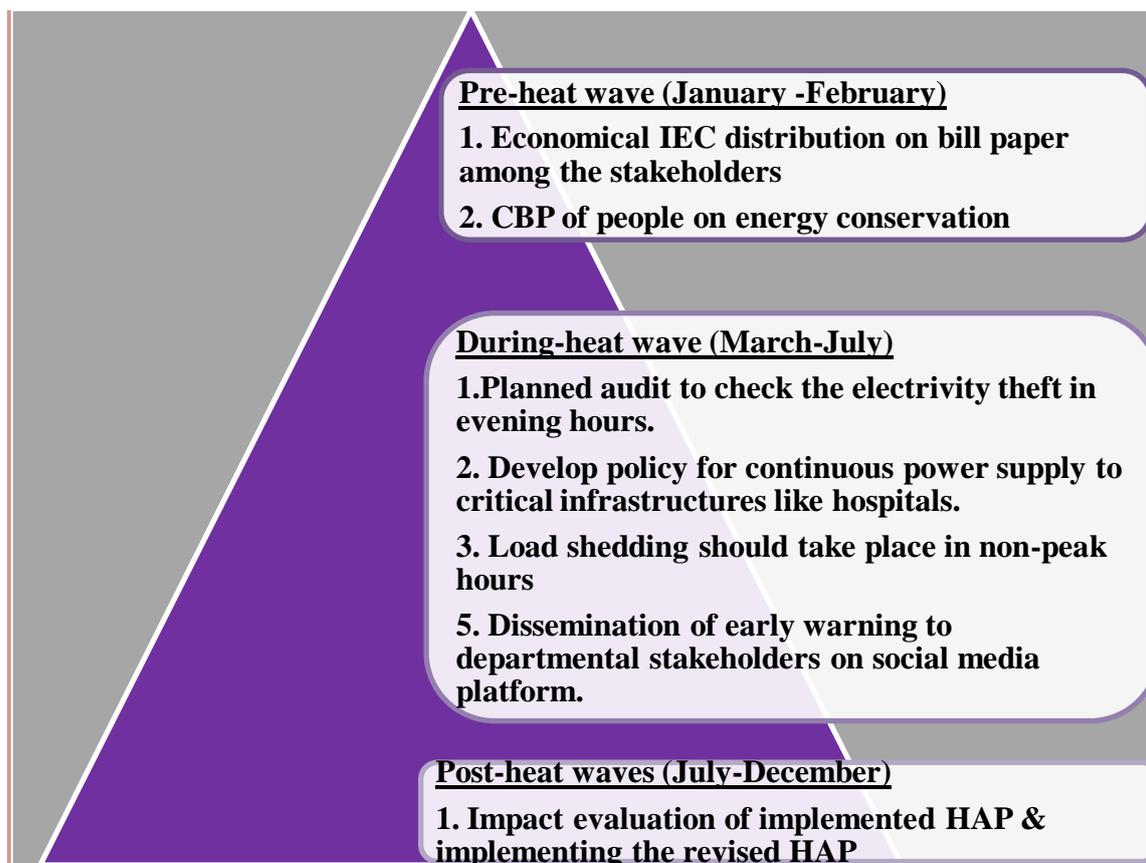
During-heat season (March-July)

- Audit to check the electricity theft of the identified & suspected communities transparently must take place in the evening, under the supervision of meter reading collector/any employees designated by Electricity dept., which will ultimately reduce the requirement of load shedding.
- Dissemination of early warning to departmental stakeholders on the social media platform.
- Development of policy for ensuring continuous power supply to critical infrastructure such as hospitals, Jails, Veterinary hospitals, schools, etc.
- Load shedding must take place during non-peak heat waves period (load shedding in critical infrastructure must not take place between 12:00 pm to 04:00 pm).

Post-heat season (July-December)

- Assessment of the implemented heat action plan followed by participation in revision of the HAP and thereby, reviewing & implementing the revised HAP.

Actionable works of electricity dept. in the perspective of a heat wave



Pre-heat season (January-February)

- Promotion of Indoor plants by Horticulture dept. followed by the promotion of outdoor plants by GDA in the city & by forest dept. in rural areas, which play a key role in the mitigation of atmospheric pollution contributing to Global warming. Also, agriculture dept. should spread awareness on measures for mitigating agriculture fire
- CBP of communities on the adoption of planned green infrastructure at home & public premises.
- Policy planning & implementation of the same for mitigating water scarcity in the forest for animals.
- Issuance of directives for Zoo Authorities for special arrangements for the animals in the zoo to protect them from the effect of Heat Wave.

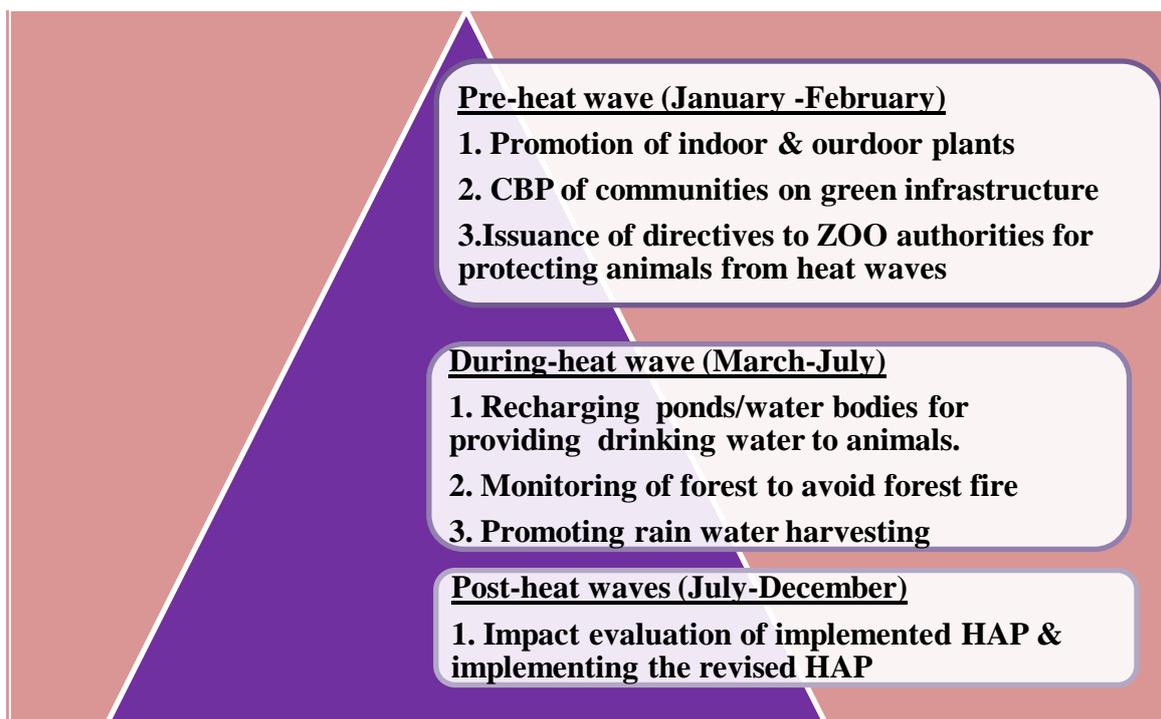
During-heat season (March-July)

- Directives for provision of water to human habitations facing water scarcity inside reserved forests.
- Continuous monitoring of forest to avoid forest fires.
- Promote rainwater harvesting €

Post-heat season (July-December)

- Assessment of the implemented heat action plan followed by participation in revision of the HAP and thereby, reviewing & implementing the revised HAP.
- Provision of funds for Heat Wave management.

Actionable works of electricity dept. in the perspective of a heat wave



Jal Nigam

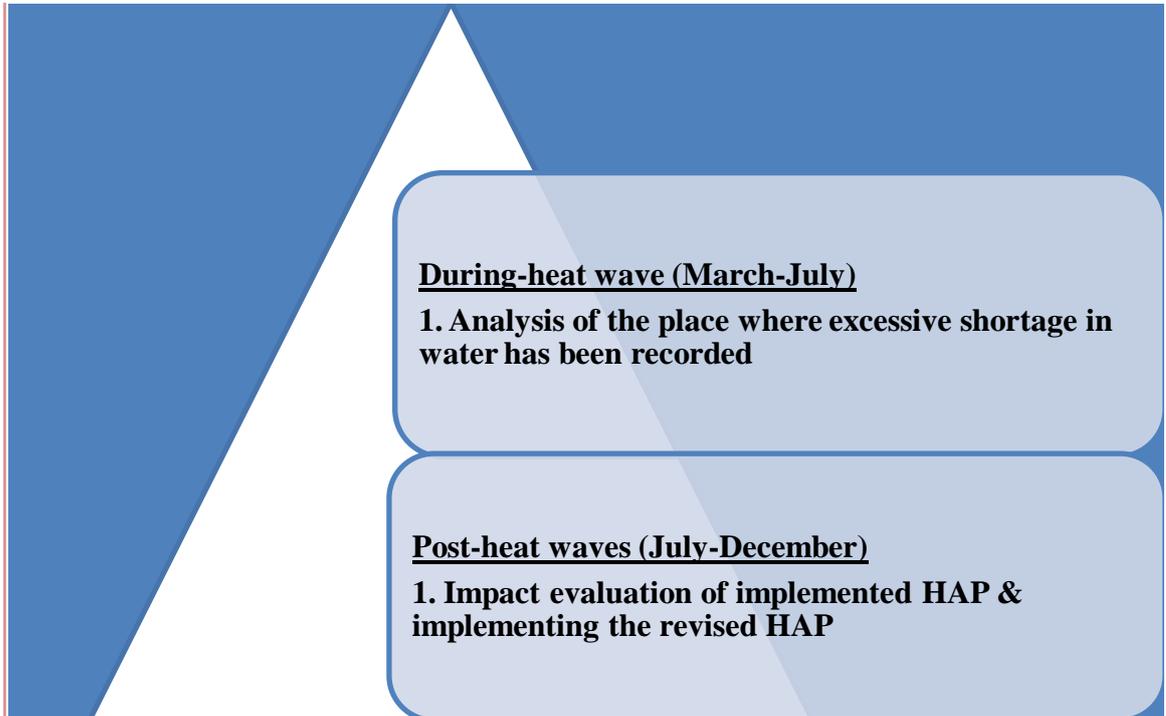
During heat waves (March-July)

- Conduct critical analysis of places where excessive water shortage has been recorded followed by constructing overhead tanks or needed structures to cater the need of affected community.

Post-heat wave (July-December)

- Assessment of the implemented heat action plan followed by participation in revision of the HAP and thereby, reviewing & implementing the revised HAP.

Actionable works of electricity dept. in the perspective of a heat wave



Note:

All the departments whose Annexure has been attached below in the SOP, have to submit the same according to the frequency of period mentioned in the respective Annexure.

Apart from the annexure submission, all the departments who are responsible for identification & activation of cooling center have to submit their report mentioning the address of the cooling center

with their images at an interval of every 1 day during heat wave on the mail id of DDMA, Gorakhpur (ddmagorakhpur@gmail.com).

Table 2: Symptoms & first aid for various heat disorders [22]

Heat Disorders	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 spasms usually in leg and abdominal muscles or extremities. Heavy sweating.	Move to a 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 is possible. Fainting, vomiting.	Get the victim to lie down in a cool place. Loosen clothing. Apply cool, wet cloth — fan or move victim to air-conditioned place. Give sips of water slowly and if nausea occurs, discontinue. If vomiting occurs, seek immediate medical attention; call 108 and 102 for an 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 102 for an ambulance for emergency medical services or take the victim to a hospital immediately. Delay can be fatal. Move the victim to a cooler environment. Try a cool bath or sponging to reduce body temperature. Use extreme caution. Remove clothing. Use fans and air conditioners. DO NOT GIVE FLUIDS ORALLY if the person is not conscious.

Innovative measures to combat the heat wave

Planting shade trees on the western & eastern side of the structures

Planting the adequate trees at adequate places conserves the energy, electricity bill & combats global warming majorly in summer. Shade trees considered for plantation should be Peepal, Saptparni, Jamun, Deodar & Champa. Shades trees should be planted around the periphery of temples, hospitals, offices, malls & houses, majorly on the eastern & western side of the house & if possible, then on the southern side too [9].

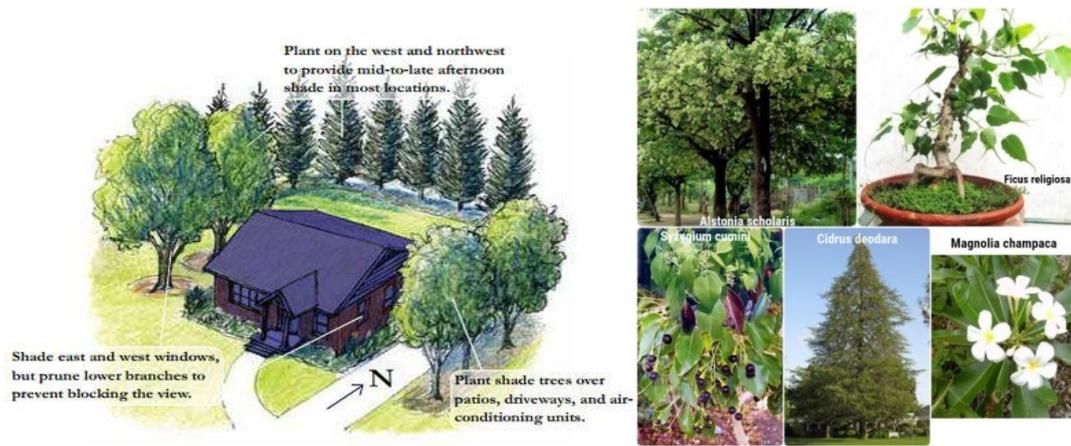


Figure 5: Benefits of plantation done at Outdoor [9]

Closure of Blinds

Closure of windows pane & doors will mitigate the 30 % of unwanted heat coming from the same & will contribute to a substantial reduction of indoor temperature. Closing the windows of the southern & western side prevents the home from becoming a miniature Greenhouse. Also, the closing off unused rooms without cross ventilation will prevent the heat from permeating into the houses. [10]

Facilitation of Cross Ventilation in the home

Rooms should be designed in a way to facilitate the cross ventilation of the houses in summer by the installation of doors, windows, vents & louvers on the opposite faces of the wall so that hot air gets flush out in the evening from the home when windows of both sides will be opened in morning & evening. Make sure that windows of the opposite faces should be opened only in the morning & evening when outdoor air is cooler than indoor air. [11]

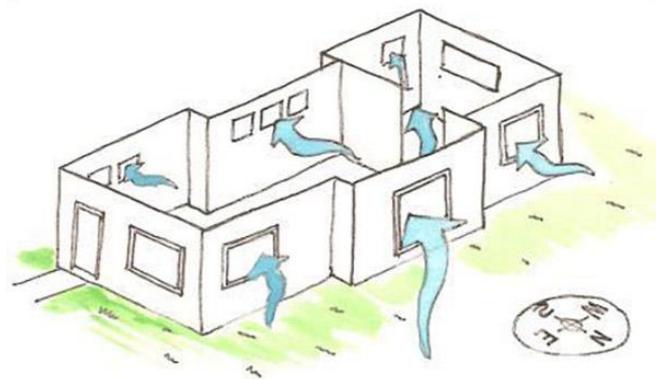


Figure 6: Cross Ventilation[12]

Planting Indoor plants

There are plants which contribute insufficient mitigation of indoor pollution by planting the indoor plants & will ultimately lead to absorption of greenhouse gases followed by reduction of indoor air temperature [13]. These plants are

- Aloe barbadensis (Aloe vera)
- Chlorophytum comosum (Spider)

- Bambusa vulgaris (Bamboo)
- Sansevieria trifasciata (Snake)
- Warneck dracaena



Figure 7: Indoor Plants

Usage of right fabric inside the houses

Avoid using faux leather on sofas, satin bed sheets, silk cushions & normal pillow in summer as they trap a considerable amount of heat within their fabric. Use only cotton or alike material as they absorb the sweat of the body without absorbing body heat followed by regular cleaning of the same & bed sheets must be swap around the mattress to catalyze the cooling effect. As an added advantage one can use buckwheat pillow as they have naturally occurring space between when compared with the conventional pillow, thereby don't trap heat at all [11].



Use blackout curtains

Blackout (foam based opaque fabric to block sunlight) curtains reduces the indoor temperature by reducing the energy cost by cutting the amount of sunlight & UV rays that enter the room. Neutral colored curtains with white plastic backings reduces the heat gain up to 33 %. [10]

Usage of cool lighting

If you are using conventional bulbs, incandescent bulb then immediately replace the same by the LED bulb as they consume significantly lesser heat followed by lowering the generation of heat. Also, switch off all the lights & various types of motor requiring electric/battery supply as all the electrical appliances in the starting condition generate some heat. [11]

Application of white paint/reflective tiles on the top floor

Normal bricks because of their low albedo (20% to 40%) change an urbanized area into Urban Heat Island in summer. Although, reflective roof that starts with an albedo of 0.9 reaches values between 0.6 and 0.7 in two years[14]. To mitigate the heat wave, New York city has painted 7 million square feet of rooftops as white which resulted in lowering of the temperature of a specific area by 2 to 3 degree Celsius [15]. Also, according to research done in a specific area, white cement tiles & rooftop was found to reduce 5°C to 6°C temperature more than equivalent fired bricks rooftops [16]. Hence, it is recommended to use white reflective paints/tiles to reflect the short wave radiations falling on the object from the sun.



Figure 8: White rooftops to enable the reflection of sunlight [15]

Usage of AWNINGS (PIC)

Install awnings on the south & west direction of the house to reduce the solar heat gain by up to 77%, says the U.S. Department of Energy [17].

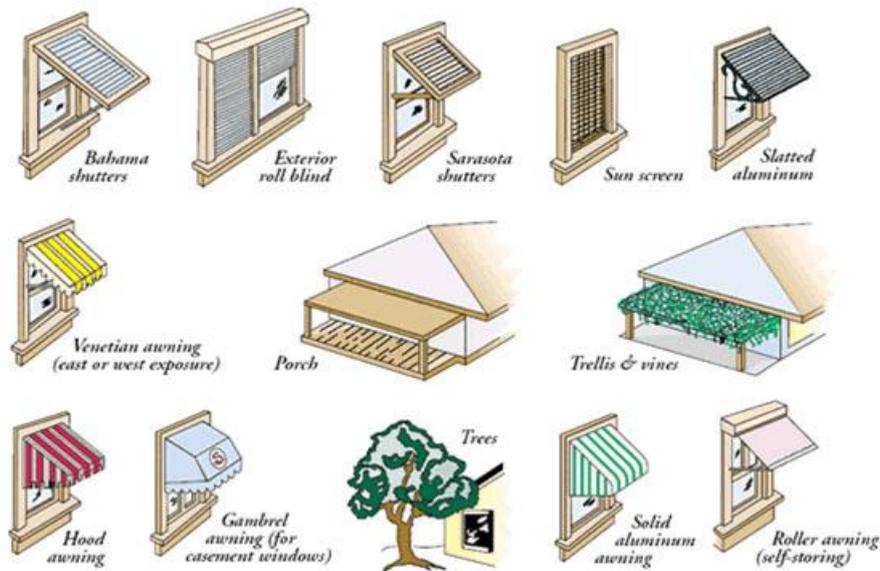


Figure 9: Awnings [18]

Energy Saving Films for Window (PIC)

Installation of energy saving the film on window pane & if possible then use mirror-like films which catalyze the reflection of sunlight falling on the window. [17].

DIY Air Conditioner

Make a DIY air conditioner by placing a pan (used for roasting) or bowl of ice/chilled water in front of a table fan thereby, the fan breeze will pick up the cold water from the ice's surface as it melts leading to the creation of a

Cooling mist [11]



Figure 10: DIY AC [19]

Annexure 1: Municipal Corporation, Gorakhpur

Note: The report has to be submitted along with the photograph to District Disaster Management Authority, Gorakhpur alternatively after every 1 days till the persistence of heat wave.

Tehsil	Blocks	Number of Cooling Centers activated in each block	Number of places arranged with fresh drinking water facility	No. of public places installed with do's & don'ts on heat wave	Capacity building of communities on green infrastructure, heat waves & pollution(In Numbers)
Sadar	Jungle Kaudia (Partial)				
	Chargawa				
	Bhathat				
	Khorabar				
	Pipraich				
Campierganj	Jungle Kaudia (Partial)				
	Campierganj				
Sahjanwa	Sahjanwa				
	Pali				
	Piprauli				
Khajni	Khajni				
	Belghat				
Chauri Chaura	Brahmpur				
	Sardar Nagar				
Bansgaon	Bansgaon				
	Kauriram				
	Gagaha				
Gola	Gola				
	Barhalganj				
	Uruwa				

Annexure 2: Health department & Medical Professionals

Note: The report has to be submitted to District Disaster Management Authority, Gorakhpur on daily basis till the persistence of heat wave

Tehsil	Blocks	Capacity building of personnel from hospitals, ASHA & health centers as mentioned in the SOP (In numbers)	Number of patients reported due to a heat wave in all the health centers & hospitals	Number of health centers & hospitals installed with do's & don'ts on heat wave	Number of deaths reported due to the heat wave	Is there adequate stockpiling of ORS, Icepacks, IV fluid & needed medical supplies in the health centers & hospitals? (Yes/No)
Sadar	Jungle Kaudia (Partial)					
	Chargawa					
	Bhathat					
	Khorabar					
	Pipraich					
Campierganj	Jungle Kaudia (Partial)					
	Campierganj					
Sahjanwa	Sahjanwa					
	Pali					
	Piprauli					
Khajni	Khajni					
	Belghat					
Chauri Chaura	Brahmpur					
	Sardar Nagar					
Bansgaon	Bansgaon					
	Kauriram					
	Gagaha					
Gola	Gola					
	Barhalganj					

	Uruwa					
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Annexure 3: ICDS, Gorakhpur

Note: The report has to be submitted to District Disaster Management Authority, Gorakhpur on daily basis till the persistence of heat wave

Tehsil	Blocks	Capacity building of personnel from Anganwadi, local communities & children as mentioned in the SOP (In numbers)	Rescheduling of Anganwadi during peak heat hours (Yes/No)	Activation of Anganwadi during summer by planning staggered leave of supervisor & staff. (Yes/No)	Distribution of IEC among local communities, Anganwadi workers & children (Yes/No)	Is there adequate stockpiling of ORS, Icepacks, IV fluid & Buttermilk within Anganwadi? (Yes/No)
Sadar	Jungle Kaudia (Partial)					
	Chargawa					
	Bhathat					
	Khorabar					
	Pipraich					
Campierganj	Jungle Kaudia (Partial)					
	Campierganj					
Sahjanwa	Sahjanwa					
	Pali					
	Piprauli					
Khajni	Khajni					
	Belghat					
Chauri Chaura	Brahmpur					
	Sardar Nagar					
Bansgaon	Bansgaon					
	Kauriram					
	Gagaha					
Gola	Gola					
	Barhalganj					
	Uruwa					

Annexure 4: Education Department, Gorakhpur

Note: The report has to be submitted to District Disaster Management Authority, Gorakhpur on daily basis till the persistence of heat wave

Tehsil	Blocks	Capacity building of school staff & children as mentioned in the SOP (In numbers)	Rescheduling of school timing & examination of pre-schoolers & school-aged children (Yes/No)	Adoption of outdoor & indoor plants, kitchen gardening & compost pit within the schools (Yes/No)	Distribution of IEC among School staff & children & awareness among school staff on roles & responsibilities of the team mentioned in SDMP (Yes/No)	Is there adequate stockpiling of ORS, Icepacks, IV fluid & Buttermilk within the campus? (Yes/No)	Number of children affected due to heat waves (In numbers)
Sadar	Jungle Kaudia (Partial)						
	Chargawa						
	Bhathat						
	Khorabar						
	Pipraich						
Campierganj	Jungle Kaudia (Partial)						
	Campierganj						
Sahjanwa	Sahjanwa						
	Pali						
	Piprauli						
Khajni	Khajni						
	Belghat						
Chauri Chaura	Brahmpur						
	Sardar Nagar						
Bansgaon	Bansgaon						
	Kauriram						
	Gagaha						
Gola	Gola						

	Barhalganj						
	Uruwa						

Annexure 5: Panchayat Raj departments

Note: The report has to be submitted to District Disaster Management Authority, Gorakhpur on daily basis till the persistence of heat wave

Tehsil	Blocks	Capacity building of Gram Pradhan, link workers, SEWASHG, Aapda Mitra & farmers on heat wave & GKMS, PMFBY, Soil health card, etc. (In numbers)	Rescheduling of workable hours of MGNREGA employee to peak heat hours (Yes/No)	Restoration of ponds/dried lakes (Yes/No & if Yes then In numbers)	Arrangement of Fresh drinking water facility & activation of cooling center (In numbers)	Installation of banners at do's & don'ts during the heat wave at strategic locations within villages (In number)
Sadar	Jungle Kaudia (Partial)					
	Chargawa					
	Bhathat					
	Khorabar					
	Pipraich					
Campierganj	Jungle Kaudia (Partial)					
	Campierganj					
Sahjanwa	Sahjanwa					
	Pali					
	Piprauli					
Khajni	Khajni					
	Belghat					
Chauri Chaura	Brahmpur					
	Sardar Nagar					
Bansgaon	Bansgaon					
	Kauriram					
	Gagaha					
Gola	Gola					
	Barhalganj					
	Uruwa					

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