Heat Action Plan (HAP)

Dhangadhi

Short version

2025

Nepal Red Cross Society

IFRC

BritishRedCross

Climate Centre

CONTENTS

LIST OF FIGURES AND TABLES

1. INTRODUCTION

1.1. DHANGADHI HEAT ACTION PLAN (HAP) 2025

The Heat Action Plan (HAP) outlines a series of steps aimed at reducing seasonal heat risks, alongside long-term urban planning to tackle extreme heat affecting vulnerable populations. It details the coordinated actions of relevant stakeholders and the necessary interventions needed before, during and immediately after heatwaves to minimize health risks and the fatalities associated with extreme heat.

1.2. RATIONALE – HAP IN DHANGADHI

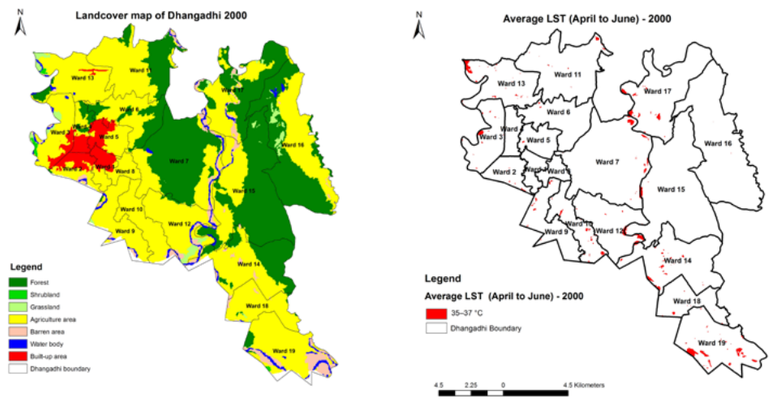
Extreme heat is a silent killer that has persisted for years, particularly in the Terai region of Nepal, where summer temperatures can reach up to 45°C during heatwaves. Reports indicate instances of annual heat-related mortality (Kandel & Shyangtan, 2024).[1] Due to its geographical location in the Terai plains, Dhangadhi Sub-Metropolitan City is vulnerable to high temperatures and is currently facing the adverse effects of extreme heat, which poses significant risks to health, productivity and economic growth. The Urban Heat Island (UHI) effect exacerbates these challenges, making certain wards of Dhangadhi considerably hotter than the surrounding rural areas, particularly in densely populated wards.

The highest maximum temperature, 46.4°C, was recorded in 1995, while the lowest, 40.2°C, occurred in 1997. Notably, for the past 33 years, the maximum temperature has exceeded 40°C every year.

Furthermore, in Dhangadhi, the annual average maximum temperature has been increasing by approximately 0.02°C per year (DHM, 2024a). This gradual rise indicates that heatwaves are likely to become more frequent, leading to increased impacts on both health and the environment.

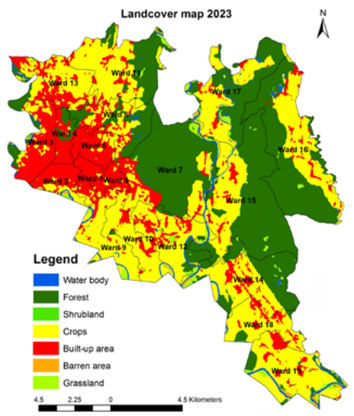
Rapid urbanization in Dhangadhi has led to an increase in concrete infrastructure, the expansion of impervious surfaces and a shift from agricultural activities to urban income-generating activities such as commerce and industry (also shown in Figure 1), all of which contribute to the heat island effect. As a result, the city faces a heightened risk of heatwaves. Figure 1 shows how changes in land-use patterns in Dhangadhi in 2000–2023 are one of the factors contributing to increasing the land surface temperature (LST) from April to June during those years.

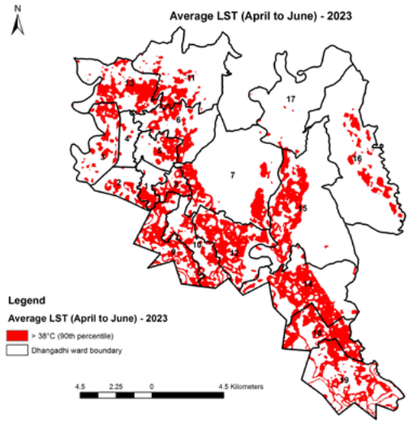
FIGURE 1. LANDCOVER AND LST MAP OF DHANGADHI



Source: Author's illustration based on satellite image

1 Kandel, S., & Shyangtan, S. 'Why focus on 'heat'? A silent disaster unfolding in Nepal', *International Journal of Urban and Regional Research*, 2024. https://bit.ly/4gwisuA





Source: Author's illustration based on satellite image

1.3. APPROACH FOR DEVELOPING THE HAP

In this HAP study, a holistic and inclusive approach has been followed. The Figure below shows the detailed processes and methodologies used.

FIGURE 2. STUDY APPROACH

Literature review
Review and analyse scientific databases (e.g., Google Scholar, Web of Science, ScienceDirect), government reports, NGO publications, and newspaper articles to understand specific heat-related risks and impacts.

Weather data
Understanding temperature and humidity variation from 1990–2023 and define heatwaves according to the DHM classification of mild, moderate and extreme.

Stakeholder workshop (launching)
Identify key stakeholders and present the heatwave risks in Dhangadhi based on desk research; obtain buy-in from key stakeholders, including the Dhangadhi municipality.

Heat steering committee formation
Forming a heat action core team with the key city stakeholders to conduct regular consultations for planning and decision-making. This includes facilitating data collection, engaging with various city stakeholders, and organizing workshops.

Heat hotspots analysis — where to act
Exposure analysis; socioeconomic vulnerability analysis; physical vulnerability analysis; adaptive capacity analysis; heat hotspot mapping and vulnerability ranking.

Stakeholder workshop (outlining the actions)
Orienting stakeholders about heat-risk, its impact, and their roles; presenting heat risk findings alongside heat threshold analysis and gathering stakeholders' input; and outlining measures for heatwave preparedness, response, adaptation, and long-term urban planning.

Community engagement
A community heat perception study was conducted, involving 986 household surveys and 25 focus group discussions (FGDs) to collect primary data. The aim was to understand the perspectives of various vulnerable groups and to incorporate the community's knowledge and aspirations regarding heat risks and their impacts on health, livelihoods, and well-being.

Identification of heat threshold — when to act
Meteorological data (ambient near-surface air and dew point temperature) from ERA5 analysis; trigger for the heatwave alert.

Key informant interviews (KII)
Identifying key stakeholders and interviewing them to gain in-depth insights on their understanding of heatwave risk, its impacts on communities, different urban systems, coping mechanisms, and suggested interventions.

Stakeholder workshop (validation)
Validating the findings and actions regarding heat risks over various timescales by city stakeholders and the heat steering committee, and developing a holistic and inclusive Heat Action Plan for Dhangadhi city.

Finalization of HAP
Incorporate feedback from stakeholders and officially hand over the HAP to the municipality.

Source: Author's illustration

2. HEATWAVE AND ITS RISK IN DHANGADHI

According to the Department of Hydrology and Meteorology (DHM) in Nepal, the hottest months in Dhangadhi are April to June. In 1990–2023, there were 421 days when temperatures reached 40°C or higher. Following the DHM definition, the classifications of these heatwaves in Dhangadhi are summarized in the table below:

MILD HEATWAVE
(90th percentile)

Occurs when maximum temperature exceeds **37.7°C** for three or more consecutive days

MODERATE HEATWAVE
(95th percentile)

Occurs when maximum temperature exceeds **39.4°C** for three or more consecutive days

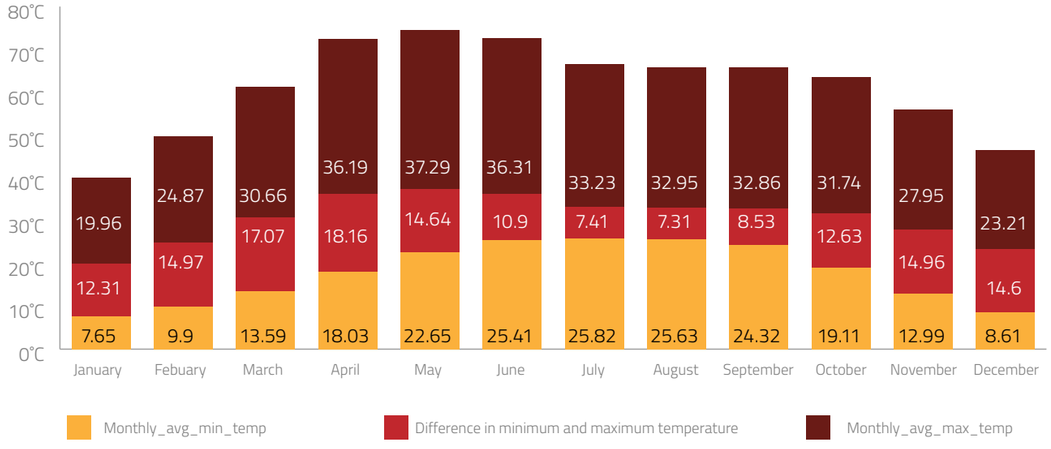
EXTREME HEATWAVE
(99th percentile)

Occurs when maximum temperature exceeds **41.7°C** for three or more consecutive days

Source: Author's illustration based on DHM data

The city has experienced several heatwave events over the years, with numerous instances of mild heatwaves. The highest number of days with temperatures exceeding 37.7°C for three consecutive days was observed in 2017 and 2019. Each year experienced seven separate heatwave events lasting 37 days in 2017 and 54 days in 2019 (). This is followed by 1992, 2003 and 2016, with six heatwave events, lasting for 42 days, 47 days and 28 days, respectively. The count of heatwave events per year varies, with some years experiencing multiple heatwaves. In contrast, some years, such as the year 2000, did not see any heatwave events. This indicates that, while individual years may vary, the overall rise in average maximum temperatures can lead to frequent and intense heatwaves.

FIGURE 3. MONTHLY AVERAGE MAXIMUM AND MINIMUM TEMPERATURE (1990–2023)



Source: Author's illustration based on data obtained from DHM

The highest monthly average maximum temperatures are recorded in April, May and June with values exceeding 35°C. In contrast, the lowest monthly average maximum temperatures occur in December, January and February. Similarly, the peak monthly average minimum temperatures are observed in June, July and August, averaging around 25°C, while the lowest monthly average minimum temperatures are found in December, January and February.

The difference between the monthly average maximum and minimum temperatures – known as the diurnal temperature range (DTR) – is illustrated in Figure 3. According to the DHM, April, May and June are the hottest months in Dhangadhi and, during this period, the DTR is significantly high. This temperature difference, often exceeding 10°C, indicates that nighttime temperatures are considerably cooler than those during the day. The cooler nights provide relief from the heat for the most vulnerable individuals, allowing them to recover from the extreme daytime temperatures.

During July and August, daytime temperatures offer some relief, with the average maximum reaching around 33°C. However, the difference between the average maximum and average minimum temperatures during these months is relatively low, at just 8°C. The average minimum temperature is about 25°C, indicating that nighttime temperatures are also elevated. This lack of cooling at night significantly impacts vulnerable populations, who suffer greatly because there is little to no relief from the heat when trying to sleep.

The human body relies on cooler nighttime conditions to recover from heat exposure accumulated throughout the day. When nighttime temperatures remain high, the risk of heat-related illnesses increases, sleep patterns can be disrupted, and cardiovascular stress is elevated, particularly among susceptible populations such as individuals with pre-existing heart or respiratory conditions, the elderly, infants and low-income populations who may lack access to cooling solutions (Tao *et al.,* 2023).[2]

3. VULNERABLE GROUPS IN DHANGADHI

Extreme heat can have serious health impacts on everyone; however, certain groups are at a higher risk. The city has identified eight vulnerable population groups, as detailed in the Figure 4. These vulnerable groups in Dhangadhi are particularly susceptible to the dangers of extreme heat due to their limited access to shade, water and cooling devices, which increases their risk of experiencing heat-related illnesses.

FIGURE 4. VULNERABLE GROUPS IN DHANGADHI

Children under five years old
Dhangadhi city has about 14,052 infants. Since babies haven't fully developed their ability to cool down through sweating, they are more vulnerable to heat stress. They also depend on caregivers to notice and respond to signs of heat-related illness.

Elderly population (over 65 years old)
Dhangadhi city has around 10,703 elderly residents. Many of them have pre-existing health conditions like heart disease or diabetes, which can get worse during extreme heat. This increases their risk of heat-related illnesses such as heat exhaustion or stroke. Additionally, older adults may find it harder to cope with extreme heat and may not always recognize it as a danger.

Individuals with chronic medical conditions
People with chronic conditions like heart disease, asthma, or diabetes struggle to regulate body temperature, making them more sensitive to heat. For example, someone with heart disease may experience a faster heartbeat or chest pain during extreme heat.

Individuals with disabilities
People with disabilities in Dhangadhi often depend upon caregivers for daily tasks, including staying cool and hydrated. Limited mobility can make it harder for them to access cooler spaces, and they may not get help quickly during heatwaves.

Individuals with low socioeconomic status
People with low socioeconomic status, including those living in slums and poorly built homes with thatched roofs, are especially vulnerable during extreme heat. Most slum areas are in Wards 5, 6, 12,13, and 17. Many lack fans or coolers, leading to higher indoor temperatures and a greater risk of heat-related illnesses during heatwaves.

Outdoor workers
Outdoor workers in Dhangadhi, like construction workers, street vendors, traffic police, farmers, and auto drivers, often do heavy work in direct sunlight and heat. This exposure, along with air pollution, makes them more prone to dehydration and heat-related illnesses.

People living in densely built areas
Densely built urban areas, such as Wards 1, 2, 3, 4, 5, and 8, absorb and retain more heat, creating what's known as the urban heat island effect. With many people and buildings, these areas produce more heat, raising temperatures further.

Pregnant and lactating women
Pregnant women are also more sensitive to heat due to increased blood volume, making them prone to dehydration and a higher risk of early labour after a heatwave. Lactating women need extra water since breastfeeding causes significant fluid loss.

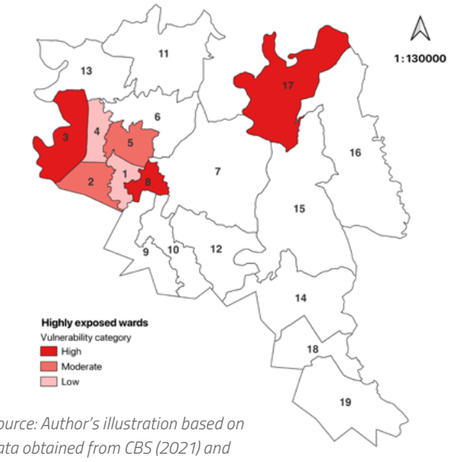
Source: Author's illustration

2 Tao,J., Zhnag, Y., Li, Z., Yang, M., Huang, C., Hossain, M.Z., Xu, Y., Wei, X., Su, H., Cheng, J., Zhang, W. 'Daytime and nighttime high temperatures differentially increased the risk of cardiovascular disease: A nationwide hospital-based study in China', *Environmental Research*, 236 (1), 2023. https://doi.org/10.1016/j.envres.2023.116740

4. HEAT HOTSPOTS IN DHANGADHI

Heat hotspots identify areas where action is needed due to a population's significantly higher exposure to heat risks and vulnerability, compared to those living in surrounding regions. This increased risk arises from a combination of natural and human-made factors. The determination of these heat hotspots is based on three main components: exposure, vulnerability and adaptive capacity. For Dhangadhi, each component includes specific indicators that have been identified through careful analysis and consultations with experts.

FIGURE 5. HEAT HOTSPOTS



Source: Author's illustration based on data obtained from CBS (2021) and Landsat imagery

Among all the wards, Ward 3 and Ward 8 have been identified as the most vulnerable, followed by Wards 17, 2, 5, 1 and 4 respectively. The primary factors contributing to the presence of heat hotspots in these wards – particularly in Wards 1, 2, 4 and 5 – include high population density, extensive built-up areas and busy highways with blacktop surfaces and heavy traffic. These wards represent the main urbanized sections of the city. Similarly, the heat hotspots in Ward 17 are primarily associated with the presence of socioeconomically vulnerable populations who have limited capacity to cope with extreme heat. The hotspots map can help the Dhangadhi Municipality and other public and emergency services in prioritizing their resources and efforts.

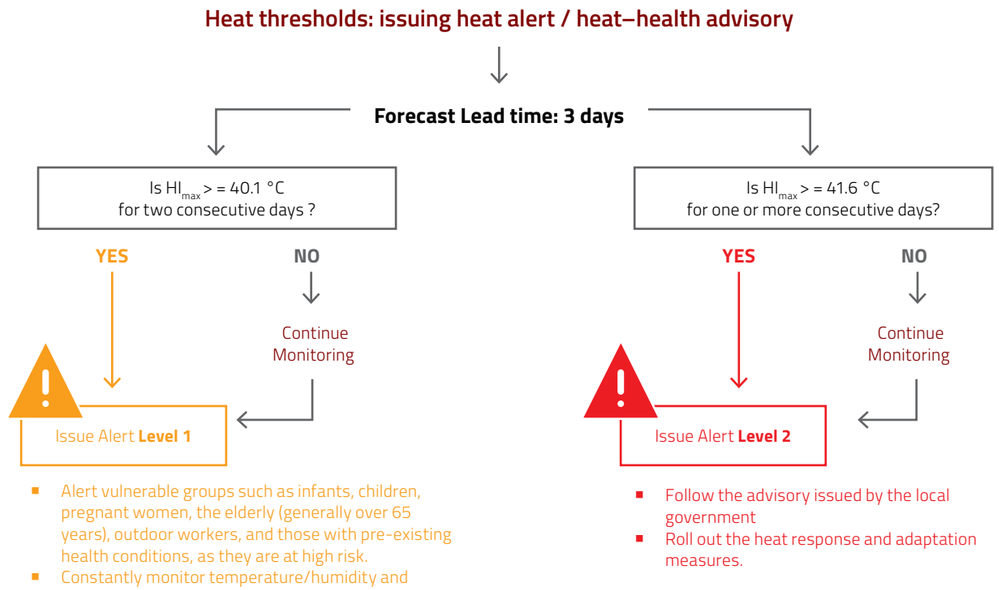
5. HEAT EARLY WARNING AND ALERT COMMUNICATION

5.1. HEAT THRESHOLD FOR EARLY WARNING

Determining when to act before or during heatwave days is critical. A heat threshold was established through a comprehensive assessment of dangerous ambient heat stress conditions. This analysis utilized historical hourly records of near-surface temperature (T_{air}, units: °C) and relative humidity (RH, units: %) from 1 January 1979 to 31 December 2023 across the wider Kailali district, including the Sub-Metropolitan city of Dhangadhi. These two factors were combined to create the hourly near-surface Heat Index (HI, units: °C), which is commonly used in operational heat alerts to indicate ambient heat stress conditions.

Additionally, in accordance with standard practices among environmental epidemiologists, daily all-cause mortality counts were examined in relation to exposure to daily HI. This analysis helps identify the heat thresholds relevant for health impacts in this region.

FIGURE 6. SCHEMATIC OF THRESHOLD CRITERIA IN DHANGADHI



Source: Author's illustration

TABLE 1. POSSIBLE HEAT DISORDERS FOR PEOPLE IN HIGH-RISK GROUPS WHEN EXPOSED TO DIFFERENT THRESHOLDS OF HEAT INDEX

CATEGORY	HEAT INDEX	POSSIBLE DISORDER FOR PEOPLE IN HIGH-RISK GROUPS
Extreme danger	130°F or higher (54°C or higher)	Heatstroke or sunstroke likely.
Danger	105–129°F (41–54°C)	Sunstroke, muscle cramps, and/or heat exhaustion lightly. Heatstroke possible with prolonged exposure, and/or physical activity.
Extreme caution	90–105°F (32–41°C)	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure, and/or physical activity.
Caution	80–90°F (27–32°C)	Fatigue possible with prolonged exposure, and/or physical activity.

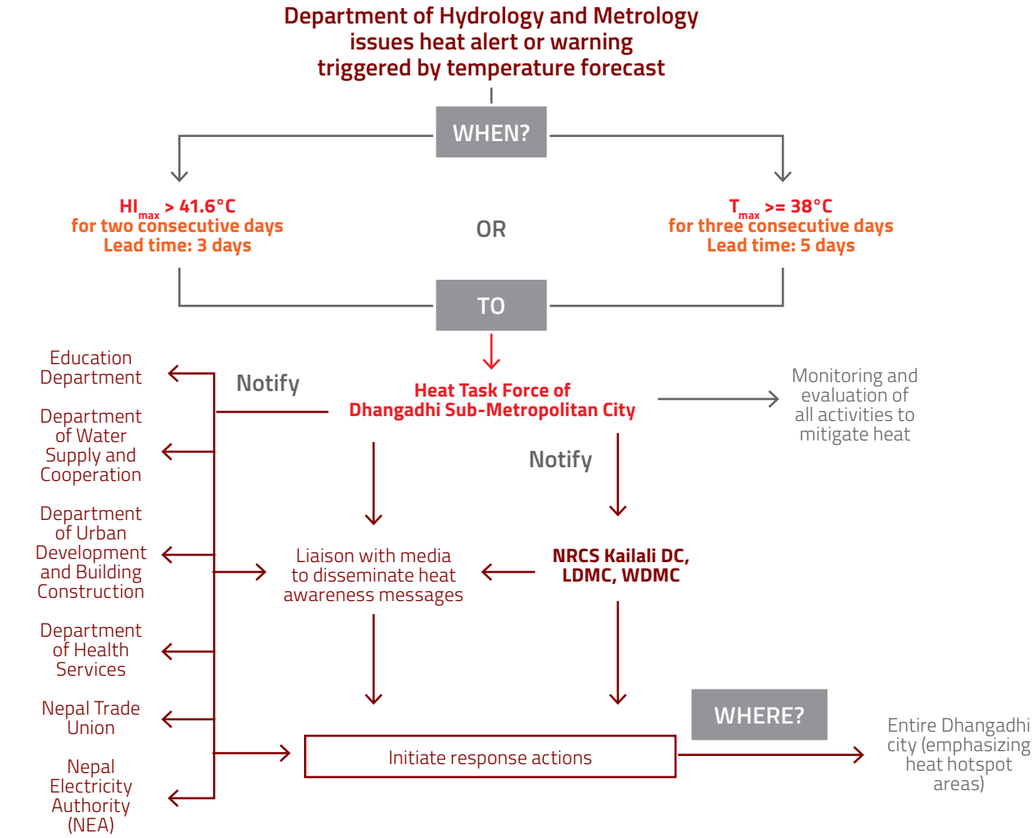
Source: NOAA–NWS

The table above (Table 1) lists the categories of associated index and possible heat disorders for people in high-risk groups, while the corresponding colour codes in the rows indicate a descending level of risk.

5.2. PROPOSED COMMUNICATION PLAN FOR ACTIVATING HEAT ALERT SYSTEM IN DHANGADHI

When the DHM issues a forecast for a heat alert or warning, the Heat Task Force of Dhangadhi Sub-Metropolitan City could implement the following communication framework to ensure that heat alert communications are managed systematically.

FIGURE 7. PROPOSED COMMUNICATION PLAN



Source: Author's illustration

The Task Force will continuously monitor heat-related activities to ensure timely and effective responses. Additionally, the Heat Task Force is responsible for coordinating and communicating actions both before and during extreme heat events, providing the necessary support for implementing the action plan. Table 6 lists the members of the Heat Task Force.

6. STAKEHOLDER COORDINATION

Stakeholder coordination is crucial for implementing the HAP, which aims to enhance preparedness, response and long-term adaptation strategies to reduce the heat risks in the city. This coordination involves the active participation of key stakeholders, including government agencies, healthcare providers, public service departments, community-based organizations and the private sector. Ongoing coordination and proactive measures are necessary to successfully implement the Heat Action Plan in Dhangadhi.

FIGURE 8. STAKEHOLDER COORDINATION

STAGE 1

- Stakeholders mapping & coordination for planning
- Strategy/identification of the response activities for heat season
- Developing the communication plans
- Update the HAP if needed
- Resource allocation (for both short-term response and long-term adaptation)
- Planning of the long-term adaptation measures

Proposed stakeholders

- DHM
- Heat Task Force
- Dhangadhi Ward Committees
- LDMC and WDMC
- Department of Urban Development and Building Construction

STAGE 2

- Activate the heat alert and protocols based on DHM alerts or seasonal forecasts (February-March for preparedness; April-June for response)
- Inform key stakeholders for the response measures
- Initiate the implementation of long-term adaptation measures (e.g, reflective roofing, housing ventilation, green spaces)

Proposed stakeholders

- DHM
- LDMC and WDMC
- Heat Task Force
- Department of Urban Development and Building Construction

STAGE 3

- Issue a media advisory to inform the public on how to stay safe during a heatwave
- Awareness campaign
- Coordinate and proceed with implementation of long-term adaptation measures)

Proposed stakeholders

- LDMC and WDMC
- Dhangadhi Ward Committees
- Media channels such as Dhangadhi Khabar, Atariya Online, Dinesh FM etc.
- Department of Urban Development and Building Construction
- Department of Health Services

STAGE 4

- Conduct the response activities planned such as activating cooling centres, distributing of drinking water
- Stakeholders' coordination for the implementation

Proposed stakeholders

- Heat Task Force
- Local Emergency Operation Centre (LEOC) and District Emergency Operation Centre (DEOC)
- LDMC and WDMC
- Department of Urban Development and Building Construction

STAGE 5

- Stakeholders' coordination for after-action review
- Documentation on lessons leamt
- Recommendations sharing
- Develop relief and recovery plan for follow-up actions
- Evaluate the effectiveness of both immediate response and long-term adaptation measures

Proposed stakeholders

- Heat Task Force
- Dhangadhi Ward Committees
- LDMC and WDMC
- Department of Urban Development and Building Construction

Overall implementation will be led by Dhangadhi Sub-Metropolitan City and Nepal Red Cross Society (NRCS), Kailali District Chapter (DC)

Source: Author's illustration

The chart above illustrates the city's overall heat action coordination. However, the coordination among stakeholders has been further expanded and tailored to address various aspects of heat risk management, including preparedness, response and long-term adaptation in the complete version of the HAP.

7. PREPAREDNESS FOR HEATWAVE

Preparing for a heatwave is essential and involves taking specific steps in advance to improve responses and coping strategies during the event. Effective preparedness can significantly reduce both recovery costs and the suffering of residents in the city. The preparedness to heatwave risks also includes educating the community on how to recognize early warning signs of an impending heatwave and understand protective measures, such as staying hydrated, using cooling methods and avoiding excessive outdoor activities during peak heat hours. The figure opposite outlines the proposed measures for heatwave preparedness in Dhangadhi.

FIGURE 9. PREPAREDNESS MEASURES

STRENGTHENING GOVERNANCE FOR HEAT RESILIENCE

1. **Identifying key stakeholders in the city**
2. **Establishing dedicated heat resilience teams or task forces within municipal government or local government**
3. Appointing a Heat Officer to lead the Heat Action Plan

EDUCATION

4. **Planning for changing school schedules in the morning during heat period / scheduling examinations before the start of the heat period**
5. Workshops for teachers regarding heat protection tips and materials that they can disseminate in classrooms

HEALTH

6. **Adding additional hospital beds and managing fans and coolers**
7. Updating existing databases regularly, including hospital admissions and emergency case records to track heat-related cases
8. **Arranging capacity-building programmes for healthcare professionals**
9. Stockpile emergency supplies such as bottled water, electrolyte drinks, first aid kits, and cooling supplies and check inventories for basic equipment and medicines required for emergency

WATER ATM/COOLING CENTRES

10. **Installing water ATMs to ensure access to clean drinking water**
11. Setting up cooling centres; creating community cooling centres in public buildings

INCENTIVES

12. **Providing incentives for low-income households such as portable handheld fans or electric fans/household level solar PV**

PLANS AND POLICIES

13. **Changing workers' schedules and shifts**
14. **Developing a ward/municipal level plan for heat response/action activities**
15. Reviewing plans for water allocation and plan to avoid power cuts during heat events
16. Updating Climate/Disaster/Heat Action Plans and policies

AWARENESS AND CAPACITY-BUILDING

17. **Developing heat awareness messages and raising awareness through distributing pamphlets; TV and radio broadcasts; and social media postings (Facebook, Twitter)**
18. Capacity-building for occupationally exposed groups and their supervisors
19. Conducting a community awareness campaign for women on heat education
20. Training to Red Cross volunteers and individuals working with disaster response to effectively identify signs of heat-related illnesses
21. Installing LED screens with rolling temperature and humidity
22. Raising awareness of the dangers of burning areas of forest and jungle as it impacts health and the environment, and increases the temperature

Source: Author's illustration

7.1. HIGHLY PRIORITIZED ACTIONS

Ten priority actions have been identified. Stakeholders and vulnerable community groups in the city have prioritized these key preparedness activities. These actions are discussed in the tables below:

TARGET AREA(S)	TARGET GROUP	SECTOR(S)	PRIMARY STAKEHOLDER	SECONDARY STAKEHOLDERS	BRIEF	CASE STUDY
1. IDENTIFYING KEY STAKEHOLDERS IN THE CITY						
Dhangadhi city	All the residents in Dhangadhi	Disaster/ Emergency Management, Planning	Dhangadhi Sub-Metropolitan City	All respective stakeholders of the Dhangadhi Sub-Metropolitan City NRCS, Kailali DC DHM, Kailali Nepal Electricity Authority Department of Water Supply and Cooperation Local Disaster Management Committee Ward Disaster Management Committee Tole Lane Organization (TLO) Department of Forestry I/NGOs such as Practical Action, United Nations Development Programme etc.	A stakeholders' committee will guide the Heat Task Force and the local government in planning and decision-making for various heat-related actions, including preparedness measures. The stakeholders' consultation process will facilitate the sharing of diverse knowledge, experiences and lessons learned, ensuring that everyone benefits from these exchanges. Therefore, it is crucial to identify key stakeholders and establish a coordination mechanism among them. All stakeholders should share a common vision and develop clear objectives for combatting heat. Additionally, the roles and responsibilities of each stakeholder must be clearly defined to avoid overlapping duties. The Dhangadhi Sub-Metropolitan City will take a lead role in identifying key st akeholders and actively involving them in activities related to heat preparedness. LDMC and NRCS teams will liaise and coordinate with WDMCs, TLOs and secondary stakeholders such as the Nepal Electricity Authority, DHM, Department of Water Supply and Cooperation, Department of Forestry. This collaborative approach will ensure the roles and responsibilities of all the stakeholders are comprehensive to address heat-related challenges within the Municipality.	During the development of the Ahmedabad Heat Action Plan, the project team developed a stakeholder network map and identified how the various municipal players fit together. This network identified key organizations and agencies likely to play important roles in the development and implementation of the Heat Action Plan. The project team had identified stakeholders at the national, state and local levels to ensure active participation and effective implementation of the plan. **Link to case study:** https://bit.ly/4gaQSnf
2. ESTABLISHING DEDICATED HEAT RESILIENCE TEAMS OR TASK FORCES WITHIN THE MUNICIPALITY OR LOCAL GOVERNMENT						
Dhangadhi Sub-Metro-politan City	Municipal government officials, local authorities and relevant stakeholders	Disaster/ Emergency Management, Governance and Policy	Dhangadhi Sub-Metropolitan City	DDMC (District Disaster Management Committee) LDMC TLO WDMC I/NGOs	To enhance heat resilience, it is essential to establish a Heat Task Force Committee – a dedicated group of stakeholders from various sectors, including municipal authorities, healthcare, disaster response and community organizations. The Task Force will drive processes related to heat action in the city. The Committee's primary role will be to lead and coordinate efforts to combat heat-related challenges and improve resilience across the Municipality. The Task Force will ensure a localized and tailored approach, addressing the specific needs of the city. This will help to create active coordination and integration to enhance heat resilience across the Municipality. Dhangadhi Sub-Metropolitan City will establish a Heat Task Force Committee in coordination with DDMC and LDMC. TLOs and WDMCs will be involved to ensure that actions are more localized and relevant to the city.	The Siddharthnagar city of Nepal has taken proactive steps by establishing a Heat Steering Committee comprising relevant stakeholders. They are responsible for all the coordination, preparedness and response activity in the city. Committee members include a coordinator, Environment and Disaster Management Committee, DHM, media, Department of Water Supply and Cooperation and the national electricity authority.

TARGET AREA(S)	TARGET GROUP	SECTOR(S)	PRIMARY STAKEHOLDER	SECONDARY STAKEHOLDERS	BRIEF	CASE STUDY
3. PLANNING FOR CHANGING SCHOOL SCHEDULES IN THE MORNING DURING HEAT PERIOD / SCHEDULING EXAMINATIONS BEFORE THE START OF THE HEAT PERIOD						
School/ colleges	School/colleges	Education	Education Department of Dhangadhi Sub-Metropolitan City	Private and Boarding Schools' Organization Nepal (PABSON); National Private and Boarding Schools' Organization Nepal (NPABSON School Management Committees Resource Centres NRCS, Kailali DC	Changing school schedules to reduce students' exposure to extreme heat is an essential measure in heat preparedness. This involves adjusting school start and end times to avoid peak heat hours, typically in the afternoon when temperatures are highest. This approach will help to minimize students' exposure to heat-related health risks such as dehydration, heatstroke and fatigue. The Education Department of Dhangadhi Sub-Metropolitan City will lead the initiative to adjust school schedules, moving classes to the morning hours during heat periods. It will also coordinate the scheduling of examinations before the onset of extreme heat. The Education Department of Dhangadhi Sub-Metropolitan City will coordinate with PABSON, NPABSON and the School Management Committee to implement these changes so that students are safe and don't have to travel to school during peak heat. Generally, classes should end by 10–10.30 a.m. so that students can return home by 11.00 a.m.	In India, the government of Jharkhand announced adjustments to school hours after the India Meteorological Department issued a heat alert. Government officials changed the school timing; for example, students from kindergarten to 8th grade attended school from 7.00–11.30 a.m., while older students in grades 9–12 had classes extended until 12.00 p.m. **Link to case study:** https://bit.ly/4feZurs
4. ADDING ADDITIONAL HOSPITAL BEDS AND MANAGING FANS AND COOLERS						
All hospitals and clinics of Dhangadhi	Patients seeking treatment at these hospitals and clinics, especially those affected by heat-related illnesses	Health	Department of Health Services	Health Division of Dhangadhi Sub-Metropolitan City NRCS, Kailali DC Hospitals of Dhangadhi	Strengthening hospital capacity in advance of heatwaves is vital to ensure that healthcare facilities can accommodate and treat an increasing number of patients suffering from heat-related illnesses. This proactive preparation would ensure that hospitals are prepared to handle any sudden rush of patients and admit them accordingly. The Health Division of Dhangadhi Sub-Metropolitan City and the Department of Health Services will jointly work to enhance hospital capacity. This could be done by adding additional beds, in addition to proper cooling facilities through the provision of fans and coolers during heatwaves. NRCS and Kailali DC can also assist by distributing fans and coolers to governmental hospitals in Dhangadhi.	In 2018, St Mary's Hospital in Newport on the Isle of Wight in the United Kingdom opened 15 additional beds on top of its usual capacity of 244 because of a surge in patients due to a heatwave. This shows a very positive adaptation against the health challenges posed by periods of heat. **Link to case study:** https://bit.ly/3D8MMxj
5. ARRANGING CAPACITY-BUILDING PROGRAMMES FOR HEALTHCARE PROFESSIONALS						
All hospitals and clinics of Dhangadhi	Medical staff at Seti Provincial Hospital and Nursing Hospital and other private clinics Nursing staff, paramedics, field staff, family physicians, paramedics and future healthcare and public health professionals	Health and Emergency Preparedness	Department of Health Services	Health Department of Dhangadhi Sub-Metropolitan City; World Health Organization (WHO); WDMC; NRCS, Kailali DC; Private Hospital Association (PHA)	Capacity-building programmes for healthcare professionals involve organizing training/workshops that enhance the knowledge and skills of healthcare workers. These programmes focus on increasing their preparedness and effectiveness in managing public health challenges, including heat-related illnesses (HRI), especially during heatwaves. This programme will ensure that healthcare professionals are ready to respond quickly and effectively during extreme heat events. Training programmes for health workers at the Seti Provincial Hospital and Nursing Hospital, along with other private clinics, will be set up by the Department of Health Services in collaboration with the Health Department Dhangadhi Sub-Metropolitan City. Guidelines from the WHO will be referred to in developing and facilitating these sessions. The WDMCs, NRCS and Kailali DC will help to run these programmes at the community level so that health workers in different places are prepared to handle the increased incidence of heat-related cases and emergencies effectively.	In 2013, in Ahmedabad, India, Mount Sinai School of Medicine led a focus group discussion with local medical professionals during a 'Health effects of heat in relation to climate change' workshop. The discussion focused on understanding the health impacts of heatwaves, the challenges of managing HRI and effective strategies to prepare healthcare professionals for heat-related health risks. **Link to case study:** https://bit.ly/3x70GNF

TARGET AREA(S)	TARGET GROUP	SECTOR(S)	PRIMARY STAKEHOLDER	SECONDARY STAKEHOLDERS	BRIEF	CASE STUDY
6. INSTALLING WATER ATMS TO ENSURE ACCESS TO CLEAN DRINKING WATER						
Ward 4 and Ward 7	Daily workers such as labourers, street vendors and auto drivers	Water and Sanitation	Disaster Management Department of Dhangadhi Sub-Metropolitan City	LDMC WDMC Department of Water Supply and Cooperation NRCS, Kailali DC I/NGOs	A water ATM is a water dispensing system that provides clean, potable water to the public. Water ATMs help ensure that vulnerable populations, such as outdoor workers, street vendors and others, have access to clean water during heatwaves, reducing the risk of dehydration and heat-related illnesses. The Disaster Management Department, jointly with the LDMC, will lead the installation of water ATMs in busy areas such as bus parks and auto stands to provide clean drinking water to daily workers/labourers, street vendors and auto drivers. The Department of Water Supply and Cooperation will ensure that clean drinking water is available in the water ATMs during the peak heat season. After the installation of the water ATMs, the WDMC will take overall responsibility for the maintenance and smooth supply of water to the water ATMs. The pre-identified locations for installing water ATMs are in the bus park road of Ward 4 and Dhangadhi chowk of Ward 7. The pre-identified locations are Bus park road- Ward 4 and Dhangadhi chowk – Ward 7.	Nepalgunj – one of the hottest cities in Nepal – records temperatures above 40°C during heatwaves. During these extreme heat events, the government, in association with the Department of Water Supply and Cooperation and WDMC, installed water ATMs at strategic locations within the city of Nepalgunj. A very simple technology like a water ATM can play an important role in building resilience during heatwaves.
7. PROVIDING INCENTIVES FOR LOW-INCOME HOUSEHOLDS SUCH AS PORTABLE HANDHELD FANS OR ELECTRIC FANS/HOUSEHOLD LEVEL SOLAR PV						
Wards 6, 10, 11, 12, 14, 16, 17, 18 and 19.	Vulnerable communities and groups	Social Protection, Energy	WDMC	Disaster Department, Dhangadhi Sub-Metropolitan City NRCS, Kailali DC LDMC Private companies I/NGOs such as BEE Group, Practical Action, etc.	Due to the vulnerability of communities to extreme heat, targeted interventions such as providing incentives are necessary to help mitigate these impacts. Offering incentives of cooling devices, such as portable handheld fans or electric fans as well as promoting solar energy solutions at the household level, can reduce the economic burden on families and ensure that vulnerable groups have the means to protect themselves from extreme heat. The WDMCs will identify and prioritize the most vulnerable communities in Wards 6, 10, 11, 12, 14, 16, 17, 18 and 19 for the distribution of incentives like portable handheld fans or electric fans (for use in temperatures below 40°C) and for installing household-level solar PV systems. These Wards have a high concentration of informal communities. In this context, the NRCS and Kailali DC will facilitate the distribution process. Partnerships with private companies can be formed to provide or subsidize the necessary equipment. The pre-identified locations for providing incentives to low-income communities are near Ward office – Ward 17, and Jugeda- Ward 10.	Australia has one of the largest solar energy systems, supported by abundant sunlight and attractive incentives offered by the Government. A very important barrier to overcome, especially for low-income families, is the high upfront installation costs of the panels and systems. To address this, the Australian Government and utility companies have developed programmes and incentives to make solar energy accessible to low-income households. **Link to case study:** https://bit.ly/41teQpf
8. CHANGING WORKERS' SCHEDULES AND SHIFTS						
Outdoor workplaces	Vulnerable groups who work outside during extreme heat, including farmers and agricultural workers, construction workers, street vendors, auto drivers, labourers and other outdoor workers	Occupational Health and Safety	Dhangadhi Sub-Metropolitan City	Nepal Trade Union; Private companies District Administration Office (DAO) Chambers of Commerce	Changing workers' schedules and shifts helps to protect their health by maintaining productivity during intense heat. This involves adjusting work hours to avoid the hottest parts of the day, typically shifting outdoor or physically demanding tasks to cooler morning or evening hours. The Dhangadhi Sub-Metropolitan City will liaise with the Nepal Trade Union and private companies to change the times and shifts of workers to cooler parts of the day during heat periods. The DAO and the Chambers of Commerce will also be involved to ensure compliance and support from businesses across the region. This will help to ensure that the new schedules are well-communicated and implemented with the contribution of these stakeholders for both workers and employers.	California is one of the largest agricultural-producing states in the US and, during summer, it can get as hot as above 40°C. Outdoor workers such as farm workers do heavy labour outdoors and, therefore, are highly vulnerable to heat-related illnesses. For this, employers within California's agricultural industry have modified work schedules and implemented heat illness prevention measures to help protect workers. **Link to case study:** https://bit.ly/4gs4oSS

TARGET AREA(S)	TARGET GROUP	SECTOR(S)	PRIMARY STAKEHOLDER	SECONDARY STAKEHOLDERS	BRIEF	CASE STUDY
9. DEVELOPING A WARD/MUNICIPAL-LEVEL PLAN FOR HEAT RESPONSE/ACTION ACTIVITIES						
Dhangadhi Sub-Metro-politan City	All the residents of Dhangadhi	Disaster/ Emergency Management, Governance and Policy	Dhangadhi Sub-Metropolitan City	NRCS, Kailai DC LDMC WDMC NGO/INGOs	Developing a ward- or municipal-level plan for heat response/action will help to address all the needs and challenges related to heat. This plan will outline specific actions and stakeholder responsibilities to mitigate the impacts of extreme heat within the community. By including the heat response plan within a broader municipal framework, it ensures that heat preparedness is integrated into existing local governance structures. It will be easier for the municipality to mobilize resources, coordinate actions and implement timely interventions. Dhangadhi Sub-Metropolitan City, in coordination with NRCS, Kailali DC, LDMC, WDMC and all departments of the metropolitan office, will coordinate the preparation of a Municipal Heat Action Plan. Dhangadhi Sub-Metropolitan City can also collaborate with local NGOs to provide technical support and resources, enabling the creation of a tailored Heat Action Plan for Dhangadhi.	The Nepalgunj Municipality has developed the first municipal heat action plan of Nepal to establish a localized framework for mitigating and adapting to heatwave impacts, protecting vulnerable populations and enhancing community resilience. **Link to case study:** https://bit.ly/4ejXj6W
10. DEVELOPING HEAT AWARENESS MESSAGES AND RAISING AWARENESS THROUGH DISTRIBUTING PAMPHLETS; TV AND RADIO BROADCASTS; AND SOCIAL MEDIA POSTINGS (FACEBOOK, TWITTER)						
Dhangadhi city	All the citizens of Dhangadhi	Communica-tion	NRCS, Kailai DC	Private sector Media LDMC WDMC Lions club, Jaycees, Lio club and Rotary clubs	The heat awareness messages help to inform the public about the risks associated with extreme heat and provide guidance on how to protect themselves. By distributing heat awareness messages through posters, pamphlets, TV and radio, communities can be educated about the signs and symptoms of heat-related illnesses, and the preventive actions they should take during extreme heat. NRCS and Kailali DC will lead the awareness campaigns on heat risks and safety precautions among members of the public. This will be done through various media, which includes using microphones, sharing pamphlets within busy areas, broadcasting through TV and radio, and posting on social media (such as NRCS and Kailali DC's Facebook and Twitter accounts as well as the Dhangadhi Sub-Metropolitan City's official website). The WDMC will ensure that the information reaches all community members, particularly those in vulnerable areas. The required materials for the awareness campaign, such as banners and posters, have already been prepared and can be accessed via this link: https://preparecenter.org/toolkit/heat/heat-action-posters/. NRCS and Kailali DC can also increase awareness of the benefits of neem leaves water, such as its cooling effects and potential to relieve heat-related discomfort. The media can also share the heat awareness videos, which can be found at this link: https://vimeo.com/showcase/9459591.	Nepalgunj City launched an integrated HAP in 2023 as an adaptation measure for heatwaves and to reduce the health risks among the general public. One of the major components of the HAP was to develop heat awareness messages and distribute them through different platforms. Multiple channels were used to share information such as TV, radio, microphones, social media and pamphlet distribution etc. Through this, a wide range of population groups received heat awareness messages. **Link to case study:** https://bit.ly/4ejXj6W

8. RESPONSE FOR HEATWAVE

Heatwave response refers to the actions taken to protect individuals and the community from the harmful effects of extreme heat. These measures are typically implemented when a heatwave is anticipated or occurring. The primary goals are to reduce health risks, safeguard vulnerable populations and minimize damage.

FIGURE 10. RESPONSE MEASURES

ALERT AND AWARENESS PROGRAMMES

1. **Providing heat alert messages to the residents for timely response and protection**
2. Raising awareness by distributing pamphlets; TV and radio broadcasts; and social media postings
3. Awareness through LED boards by sharing temperature and awareness messages
4. Operating a telephone helpline for elderly people

HEAT RELIEF DISTRIBUTION

5. **Distributing heat relief supplies such as water, electrolyte beverages, and cooling towels to affected communities**
6. Distributing reusable soft plastic ice packs
7. Drinking water distribution to the public through tankers.
8. **Door-to-door outreach in high-risk neighbourhoods to distribute heat relief supplies**

MEDICAL SUPPORT AND CARE

9. **Deploying medical units such as Rapid Response Teams (RRT) to provide on-site medical care and assistance to those affected by heat-related illnesses**
10. Increasing staffing at hospitals to attend to the influx of patients during a heat alert
11. **Record data on each patient suffering from a heat-related illness who visits a healthcare facility, and producing weekly reports on the public health impacts**

COMMUNITY SUPPORT AND OUTREACH

12. **Activating cooling centres**
13. **Water bell for students (reminders to drink water)**
14. **Installing water pots for animals**

RESOURCE MANAGEMENT

15. **Making sure water and electricity supplies are available to hospitals and other critical facilities during heat events**
16. Wetting pavements (concrete surfaces) in public spaces

WORKER PROTECTION

17. **Enforcing regulations to protect outdoor workers from excessive heat exposure**

ACTION PLAN

18. Activating heat response plans city-wide
19. Continuously monitoring the activities listed under the plan
20. Conducting post-event assessments to evaluate the effectiveness of heatwave response efforts and identify areas for improvement

Source: Author's illustration based on stakeholder workshop

8.1. HIGHLY PRIORITIZED ACTIONS

The top ten actions, prioritized by the stakeholders and community, are highlighted in Figure 10. Details on these highly prioritized actions are described in the following tables and case studies have been provided:

TARGET AREA(S)	TARGET GROUP	SECTOR(S)	PRIMARY STAKEHOLDER	SECONDARY STAKEHOLDERS	BRIEF	CASE STUDY
1. PROVIDING HEAT ALERT MESSAGES TO THE RESIDENTS FOR TIMELY RESPONSE AND PROTECTION						
Dhangadhi city	All the citizens of Dhangadhi	Early Warning Systems, Communi-cation	Disaster Department of Dhangadhi Sub-Metropolitan City	DHM; Media Information and Communication Department, Dhangadhi Sub-Metropolitan City Local Emergency Operation Centre (LEOC) District Emergency Operation Centre (DEOC)	Heat alerts are timely warnings issued to residents with information on extreme heat conditions along with ways of staying safe and minimizing health risks. These alerts are crucial for reducing heat-related illnesses and deaths. By providing heat alerts, residents can prepare and adjust their activities to avoid exposure during peak heat hours, reducing the risk of heat exhaustion, heatstroke and other health issues. During the heat season, the Disaster Department of Dhangadhi Sub-Metropolitan City will receive a heat alert from DHM, which the Disaster Department will share with residents through the Information and Communication Department and various media. The media will also play a critical role in broadcasting these messages on television, radio and online platforms such as Atariya online, Dinesh Kahabar, Today TV, etc. This message will warn residents about the impacts of heat and provide the necessary information to stay cool and hydrated. The DHM can also coordinate with telecommunication companies to send out heat alerts directly to residents' mobile phones.	The Bangladesh Meteorological Department regularly issues alerts about impending and ongoing heatwaves based on forecasts, informing people of the risk and advising them how to mitigate it. This notification typically explains how long the heatwave will last and lists all the necessary precautions. **Link to case study:** https://bit.ly/3Fgiluu
2. DISTRIBUTING HEAT RELIEF SUPPLIES SUCH AS WATER, ELECTROLYTE BEVERAGES AND COOLING TOWELS TO AFFECTED COMMUNITIES						
Construction sites, industrial areas and informal settlement of Wards 1, 2, 3, 4, 5, 8 14, 17, 18 and 19 and Seti Provincial Hospital	Vulnerable groups	Public Health, DRR	Disaster Management Department of Dhangadhi Sub-Metropolitan City	WDMC; NRCS, Kailali DC; Health Division of Dhangadhi Sub-Metropolitan City; Department of Drinking Water Supply and Cooperation; TLOs; LEOC	The distribution of heat relief supplies includes dispensing heat relief materials such as water, electrolyte beverages and cooling towels. These supplies will be given out to the community to cope with the extreme heat. This is an important action as it helps in the prevention of heat illnesses and ensures that vulnerable people have proper hydration and cooling measures. The Disaster Management Department of Dhangadhi Sub-Metropolitan City will lead the initiative to distribute heat relief supplies to communities affected by extreme heat. WDMC will identify the most affected areas and coordinate with local I/NGOs and the LEOC as well as the NRCS and Kailali DC to ensure the vulnerable population receives the necessary supplies.	The Heat Relief Network in Phoenix, Arizona, USA distributes supplies, including bottled water, electrolyte drinks and cooling towels to the homeless and other high-risk populations. **Link to case study:** https://bit.ly/3Dc1548

TARGET AREA(S)	TARGET GROUP	SECTOR(S)	PRIMARY STAKEHOLDER	SECONDARY STAKEHOLDERS	BRIEF	CASE STUDY
3. DOOR-TO-DOOR OUTREACH IN HIGH-RISK NEIGHBOURHOODS TO DISTRIBUTE HEAT RELIEF SUPPLIES						
Wards 9, 14, 16, 18 and 19	Vulnerable populations	Community Outreach	NRCS, Kailali DC	Ward Committee DDMC I/NGOs	A door-to-door outreach programme is a method of going to vulnerable people's homes to distribute the necessary heat relief items – water, electrolyte drinks and cooling towels, and to inform them about heat risks. This helps in mitigating the effects of extreme heat for vulnerable populations, such as the elderly, children and people with pre-existing medical conditions. The NRCS and Kailali DC will distribute these items door-to-door in high-risk neighbourhoods of Wards 9, 14, 16, 18 and 19. These are the wards where the largest elderly and infant populations live. The Ward Committee will help the NRCS team to identify vulnerable neighbourhoods. The team can also deliver information and education campaign (IEC) materials related to heatwave safety, symptoms of heat-induced illnesses and emergency contact numbers. The NRCS and Kailali DC can also keep records of households visited and the supplies given. The pre-identified location of door-to-door visits are Nabadurga Chowk – Ward 19 and Pulwari-Ward 14.	The Government of the Netherlands produced a National Heat Plan in 2007 following the deadly heatwave of 2006. The Netherlands Red Cross provided door-to-door outreach among the elderly to provide wellness checks and share key messages on staying safe during a heatwave. **Link to case study:** https://bit.ly/3OQrQh2
4. DEPLOYING MEDICAL UNITS SUCH AS A RAPID RESPONSE TEAM (RRT) TO PROVIDE ON-SITE MEDICAL CARE AND ASSISTANCE TO THOSE AFFECTED BY HEAT-RELATED ILLNESSES						
All the citizens of Dhangadhi	Vulnerable communities and groups suffering from heat-related illnesses, including heatstroke, dehydration and heat exhaustion	Emergency Response	Department of Health Services	Health Division, DSC Hospitals Youth clubs NRCS, Kailali DC DAO District Police, Dhangadhi Sub-Metropolitan City	A Rapid Response Team (RRT) is a specialized medical team – convened during an extreme heat event – that consists of a highly trained nurse and medical staff qualified to identify the signs of heat-related illness, including heat exhaustion, heatstroke and other heat-related health issues. The team provides immediate care and assistance to those affected. An RRT helps to ensure that the health effects from heatwaves are reduced and that people at risk have timely access to medical resources. Medical units, including RRTs, will be mobilized through the collaboration of the Department of Health Services and the Health Division of Dhangadhi Sub-Metropolitan City to provide on-site care for individuals affected by heat. The NRCS and Kailali DC can study the most heat-affected areas in order to formulate a plan on how many RRTs should be deployed in coordination with the Health Division of Dhangadhi Sub-Metropolitan City. The Red Cross Youth Clubs can help in mobilizing volunteers and community support.	After the development of a HAP for Surat – a port city in Gujarat, India – the Health Department of Surat Municipal Corporation has been deploying Mobile Medical Units in heatwave-prone areas to provide immediate medical assistance to the vulnerable communities. Link to case study https://bit.ly/3OW8M0X
5. RECORD DATA ON EACH PATIENT SUFFERING FROM A HEAT-RELATED ILLNESS WHO VISITS A HEALTHCARE FACILITY, AND PRODUCING WEEKLY REPORTS ON THE PUBLIC HEALTH IMPACTS						
All healthcare facilities in Dhangadhi, including hospitals, clinics and health centres.	Patients suffering from heat-related illnesses, including heatstroke, dehydration and heat exhaustion	Data Management, Public Health	Department of Health Services	Health Department Dhangadhi Sub-Metropolitan City Ward Health Centres NRCS, Kailali DC	Maintaining comprehensive records of heat-related illnesses in healthcare facilities involves systematically documenting all cases of heat-related conditions such as heatstroke, dehydration and heat exhaustion. This approach ensures that all cases are recorded to help authorities monitor the trend, assess the effectiveness of interventions, and enhance responses to future heat-related health crises. By keeping detailed records, healthcare facilities can provide timely and targeted responses during future heat events. The Department of Health Services, along with the Health Division of Dhangadhi Sub-Metropolitan City, will maintain full records of all cases of heat-related illness across the city's healthcare facilities. All health facilities will record the case details, treatment provided and outcome. Health facilities will regularly update their records and send this data to the Department of Health Services. This will help to analyse the public health impact of heatwaves.	Following a devastating heatwave in 2010, the Ahmedabad Municipal Corporation in India developed one of South Asia's first Heat Action Plans. A critical component of the plan is its focus on healthcare data, which was used to track heat-related illnesses and enhance hospital preparedness. Hospitals and clinics carefully record patients showing up with heat-related illnesses. These are collected on a weekly basis over the heat season for tracking trends in the public health consequences of extreme heat events. Link to case study https://bit.ly/3ORqkeB

TARGET AREA(S)	TARGET GROUP	SECTOR(S)	PRIMARY STAKEHOLDER	SECONDARY STAKEHOLDERS	BRIEF	CASE STUDY
6. ACTIVATING COOLING CENTRES						
Strategically identified locations across Dhangadhi	Vulnerable groups such as street vendors, auto drivers, outside workers etc.	Public Health	Dhangadhi Sub-Metropolitan City	LDMC WDMC NEA office Department of Drinking Water Supply and Cooperation I/NGOs and humanitarian organizations NRCS, Kailali DC	Cooling centres are places where people can cool down during hot weather. These centres are equipped with air conditioning or fans to provide a controlled, cooler environment, helping to mitigate the effects of heatwaves and extreme temperatures. The centres are an effective way to prevent or reduce the negative health impacts of severe heat as they provide a safe environment for individuals, especially the elderly, children and those with pre-existing health conditions. The Dhangadhi Sub-Metropolitan City will work with the LDMC and WDMC on activating cooling centres during heatwaves. The NEA office will ensure that the cooling centres are well serviced with an uninterrupted supply of electricity. The Department of Drinking Water Supply and Cooperation will maintain an adequate water supply at the centres. The LDMC, NRCS and Kailali DC can offer further help to manage the cooling centres. The Environment Department of Dhangadhi can also increase shaded areas or greenery around the cooling centres. The Dhangadhi Sub-Metropolitan City can also seek assistance from I/NGOs and humanitarian organizations to ensure the functioning and maintenance of these centere. During the peak heat season, i.e., from April to June, these cooling centres can be open from 11 a.m. to 4 p.m.	During the heatwave in August 2019 in Viet Nam, the Viet Nam Red Cross Society activated cooling centres based on the forecast. Four community cooling centres were opened to provide immediate heat relief to outside workers and commuters. On average, the centres were 7°C cooler than the scorching heat outside. Link to case study https://bit.ly/3BtvudF
7. WATER BELL FOR STUDENTS (REMAINDERS TO DRINK WATER)						
Schools	All school students	Education	Education Division of Dhangadhi Sub-Metropolitan City	School Management Committees PABSON and NPABSON Department of Drinking Water Supply and Cooperation	Water bells for students is a system implemented in schools where a bell or alert is rung at regular intervals to remind students and staff to drink water throughout the day. This initiative helps the school community to avoid dehydration and the associated health problems in schoolchildren and staff during in the heat season. The School Management Committees will closely collaborate with the Education Division of Dhangadhi Sub-Metropolitan City on mainstreaming water bells into schools' daily routines. The water bell will ring as a reminder to drink water twice a day at 11.30 a.m. and 2.30 p.m. Implementation and scheduling of the water bell system can be monitored by the NRCS and Kailali DC. Similarly, the Drinking Water Corporation will provide the school with an adequate supply of pure drinking water	With rising temperatures in Kerala, India, Keralan schools are ringing in a simple yet effective solution to keep students hydrated: the water bell system. This system has been reintroduced to tackle the rising heat and to ensure the well-being of students during school hours. The water bell system directly addresses heat concerns. Link to case study https://bit.ly/3GWPzvt
8. INSTALLING WATER POTS FOR ANIMALS						
All the citizens of Dhangadhi	Street animals, birds	Animal Welfare	Livestock Department	TLOs Private sector WDMC Residents of Dhangadhi	Installing water pots is an initiative to provide clean drinking water to animals during extreme heat. Through this, street animals such as dogs and cats as well as birds will be able to drink hygienic water. Locals in Dhangadhi will be asked to help by placing water pots throughout their neighbourhoods and keeping them topped up with water. This action is essential to prevent dehydration and heat-related distress in street animals and birds. The Livestock Department will initiate a citywide installation of water pots for street animals and birds. TLOs and WDMCs will collaborate in installing and maintaining the water pots in selected localities to ensure maximum coverage. This initiative can be supported by the private sector through the provision of the resources needed.	The Water for Voiceless (WFV) initiative was set up to implement water bowls across Tumakuru in India. The organization distributed around 3,500 water bowls in Bengaluru in areas like Domlur, Indiranagar, Jayanagar and Rajarajeshwari Nagar. In Tumakuru city alone, a further 3,000 water bowls have been distributed so far, demonstrating WFV's commitment to the hydration of animals and birds in heat-prone areas. Link to case study https://bit.ly/41wp3kx

TARGET AREA(S)	TARGET GROUP	SECTOR(S)	PRIMARY STAKEHOLDER	SECONDARY STAKEHOLDERS	BRIEF	CASE STUDY
9. MAKING SURE WATER AND ELECTRICITY SUPPLIES ARE AVAILABLE TO HOSPITALS AND OTHER CRITICAL FACILITIES DURING HEAT EVENTS						
All hospitals and other critical facilities in Dhangadhi, such as healthcare centres, cooling centres and emergency shelters.	Patients, healthcare workers and other individuals relying on critical facilities	Utility Management	Department of Health Services	Department of Drinking Water Supply and Cooperation NEA	Ensuring the continuous supply of water and electricity to hospitals and other critical facilities during heat events is essential for the smooth operation of healthcare and emergency services. This measure is critical because interruptions in water or electricity supplies can compromise the ability of healthcare facilities to provide adequate care, particularly for vulnerable populations. Although these actions may seem similar to the preparedness measures related to stockpiling supplies, they focus on different aspects of the heatwave response. Ensuring the availability of water and electricity for hospitals during a heatwave is something that local authorities need to prioritize while the heatwave is occurring. The Department of Health Services will ensure that hospitals and other critical facilities have a full and reliable supply of water and electricity. The Department will coordinate with the Department of Drinking Water Supply and Cooperation and the NEA to devise back-up plans to ensure uninterrupted supplies of these essential utilities.	In Victoria, Australia, public health services are well prepared to manage the risk of critical infrastructure failure, such as in the supply of electricity/air conditioning. But, while they have back-up emergency generators in situ, sometimes these might also fail. Recognizing this risk, the Department of Health provides 25 million Australian dollars annually as part of the Engineering Infrastructure Program to back-up health services' back-up plans. Link to the case study https://bit.ly/3P08eHb
10. ENFORCING REGULATIONS TO PROTECT OUTDOOR WORKERS FROM EXCESSIVE HEAT EXPOSURE						
Dhangadhi	Outdoor workers (construction workers)	Occupational Health and Safety	Dhangadhi Sub-Metropolitan City	Chamber of Commerce DAO Nepal Trade Union Private sector	Enforcing regulations that protect outdoor workers during extreme heat – such as ensuring they have appropriate working hours – is crucial for their health and well-being and reducing the incidence of heat-related illnesses. This action will help to implement guidelines for outdoor labourers that ensure maximum allowable working hours during peak heat days, scheduling regular breaks, and designating rest areas such as shaded/green areas, as well as refreshments such as water and electrolyte drinks. The DAO, in collaboration with Dhangadhi Sub-Metropolitan City and the Chamber of Commerce, will enforce regulations to protect outdoor workers from extreme heat. The Nepal Trade Union will develop and implement these guidelines.	California's 'Heat injury and illness prevention in outdoor and indoor work settings' is a set of robust regulations for outdoor workers requiring the provision of shade, drinking water and regular breaks. This regulation also includes mandatory training about heat hazards. Link to case study https://bit.ly/3VyIFRk

9. LONG-TERM URBAN ADAPTATION MEASURES

Long-term measures are essential in addition to response and preparedness efforts, as they address the root causes of heatwave impacts. These measures ensure that communities are sustainable and resilient in the face of increasing climate challenges. The goal is to reduce vulnerability and enhance adaptive capacity over time.

FIGURE 11. LONG-TERM MEASURES

URBAN GREENING INITIATIVES
1. **Roadside planting, planting in parks, maintenance of green areas**
2. **Promoting green roofing**
3. Increasing roof reflectivity
4. Increasing cool permeable pavements

WATER MANAGEMENT
5. Promoting rainwater services
6. Promote sprinkler irrigation and spray parks

HEALTH AND EMERGENCY RESPONSE
7. **Establishing dedicated heat wards in government hospitals**
8. **Quantifying heat-related data**
9. **Replacing of cool roofs and green coverage to enhance heat resilience in a healthcare facility**

AGRICULTURE AND FOOD SECURITY
10. **Promoting fish farming for heatwave resilience and food security**
11. Distributing heat-resistant seeds and drought-tolerant crops to farmers

POLICY AND GOVERNANCE
12. **Incorporating heat mitigating measures into building codes to standardize good practice**
13. **Offering incentives or rewards for residents who implement heatwave mitigation measures, such as installing reflective roofing or upgrading insulation**
14. Mainstreaming heat risk into city/municipality planning.

EDUCATION AND AWARENESS
15. **Establishing partnerships with educational institutions to incorporate heatwave preparedness into school curricula**
16. **Raising awareness of energy-efficient appliances such as the use of LED bulbs or CFL bulbs**

SUSTAINABLE INFRASTRUCTURE DEVELOPMENT
17. Replace tin roofs in schools with cooling roofs
18. Promoting sustainable transportation options, such as cycling lanes, pedestrian-friendly streets, and car-free zones

Source: Author's illustration based on stakeholder workshop

9.1. HIGHLY PRIORITIZED ACTIONS

The top eleven actions, prioritized by the stakeholders and community, are highlighted in Figure 11. Details on these highly prioritized actions are described in the following tables and case studies have been provided:

TARGET AREA(S)	TARGET GROUP	SECTOR(S)	PRIMARY STAKEHOLDER	SECONDARY STAKEHOLDERS	BRIEF	CASE STUDY
1. ROADSIDE PLANTING, PLANTING IN PARKS, MAINTENANCE OF GREEN AREAS						
Roadsides, public parks and open spaces within Dhangadhi.	All residents of Dhangadhi	Urban Planning, Climate Adaptation	Environment Department, Dhangadhi Sub-Metropolitan City	Department of Forestry Department of Urban Development and Building Construction Department of Roads WDMC Private sector Local clubs TLOs	Roadside and park planting involves strategically planting trees and greenery in urban spaces, such as along roads and within parks, to cool down the outdoor temperature and provide shade. This is an important measure to reduce urban heat and improve air quality. Trees contribute to lowering temperatures by creating shade and releasing moisture into the air. They also help in purifying the air through the absorption of pollutants and enhancing urban aesthetics, which can improve community well-being. The Environment Department, Dhangadhi Sub-Metropolitan City, in collaboration with the Department of Forestry and the Department of Urban Development and Building Construction, will identify appropriate spots along roadsides for planting trees as well as in the city's parks. The private sector, such as banks, can contribute through corporate social responsibility (CSR) initiatives, including funding and providing volunteers for planting activities. WDMC and local clubs will take responsibility for the maintenance of these green spaces.	The City of Melbourne in Australia has set a benchmark in leveraging urban green infrastructure as a strategy for heat adaptation and mitigation. By increasing the quantity and quality of green infrastructure wherever possible, the city has effectively enhanced cooling and thermal comfort in its urban environment. **Link to case study:** https://bit.ly/3ZZo0c1
2. PROMOTE GREEN ROOFING						
Urban and semi-urban areas of Dhangadhi with significant building infrastructure	Homeowners, municipal institutions	Urban Planning, Climate Adaptation	Department of Urban Development and Building Construction	LDMC; NRCS, Kailali DC; Private sector	Green roofs are vegetated surfaces installed on building rooftops. They turn unutilized spaces into green areas, contributing to urban sustainability. These roofs consist of layers of vegetation, soil and drainage systems, which help to regulate temperature. Such roofs are essential in urbanized areas as cities are usually hotter than their surroundings. Adding vegetation to rooftops helps to reduce heat absorption, improve insulation, lower overall building temperatures and improve air quality. The Department of Urban Development and Building Construction will work closely with LDMC to develop a comprehensive plan to promote green roofing across the city. NRCS and Kailali DC can conduct awareness campaigns to educate residents on the benefits of green roofing, such as providing shade, removing heat from the air and reducing surface and surrounding temperatures.	Singapore has developed green roofing as a key strategy in its ongoing efforts to mitigate urban heat. Green roofs create vegetated green spaces on building rooftops to create green spaces that provide environmental, economic and social benefits. Singapore's success with green roofing illustrates how urban areas can effectively address heat challenges and enhance urban resilience. **Link to case study:** https://bit.ly/3ZNHtMv
3. ESTABLISHING DEDICATED HEAT WARDS IN GOVERNMENT HOSPITALS						
All government hospitals in Dhangadhi.	Patients suffering from heat-related illnesses, especially vulnerable groups	Health	Health Division, Dhangadhi Sub-Metropolitan City	Seti Provincial Hospital; PHA	A heat ward is a special unit in a hospital that provides care to patients suffering from heat-related illnesses during intense heatwaves. Establishing such wards helps in managing the health effects of heatwaves, reducing the burden on general hospital services in cases of extreme heat. These wards ensure timely and focused care for patients with heatstroke, dehydration and other heat-related conditions, improving patient outcomes during peak heat periods. The Dhangadhi Health Division, in collaboration with Seti Provincial Hospital, will set up a fully functioning dedicated heat ward at the hospital. It will operate during periods of extreme heat, typically from April to June. The heat ward will have trained medical personnel who are able to identify and offer treatments for heat-related conditions.	Ahmedabad Civil Hospital in India has prepared two wards for heatstroke patients, with a total capacity of 24 beds divided into two emergency wards. One ward is for adults, and the other is for children under 12 years of age, suffering from heat-related illness. **Link to case study:** https://bit.ly/3Vwo0xW
4. QUANTIFYING HEAT-RELATED DATA						
All hospitals in Dhangadhi	Individuals affected by heat-related illnesses and the healthcare system's stakeholders	Data Management, Public Health	Department of Health Services	Health Division of Dhangadhi Sub-Metropolitan City All hospitals and clinics in Dhangadhi	The systematic collection of data on heat-related illnesses involves gathering information from hospitals and clinics to monitor health impacts during heatwaves. This process includes documenting cases of heat exhaustion, heatstroke, dehydration and other heat-related conditions, ensuring that the data is accurately recorded and consistently updated. This is crucial for the identification of trends and the enhancement of health interventions. A centralized database ensures that all collected data is organized, accessible and ready for analysis to help authorities make informed decisions in enhancing heatwave response strategies. The Department of Health Services will coordinate with the Health Division of Dhangadhi Sub-Metropolitan City and all hospitals and clinics in Dhangadhi to systematically collect data on heat-related illnesses. The Department of Health Services can create a centralized database managed by the Health Division of Dhangadhi Sub-Metropolitan City to store and analyse heat-related health data.	A Heat Smart Database has been developed in Sydney, Australia as a centralized, multi-indexed tool that allows access to data on heat and helps to enhance the region's heat management capability. A single platform consolidates diverse heat-related data, research and case studies. Learning from Sydney, the Department of Health Services of Nepal could also develop a centralized, multi-indexed resource to streamline access to heat-related data. **Link to case study:** https://bit.ly/4grVzse
5. IMPLEMENTING COOL ROOFS AND GREEN COVERAGE TO ENHANCE THE HEAT RESILIENCE OF HEALTHCARE FACILITIES						
Healthcare facilities of Dhangadhi city	Patients, healthcare staff, visitors	Hospitals, Urban Planning	Department of Health Services	Hospitals Department of Urban Planning Environment Department, Dhangadhi Sub-Metropolitan City	The implementation of cool roofs and green coverage at healthcare facilities involves using reflective roofing materials or 'cool roofs' and/or vegetative or 'green roofs' to reduce heat absorption and improve indoor temperatures. These measures help keep hospital buildings cooler, especially during heatwaves, reducing the risk of heat-related illnesses among patients and staff. The Department of Health Services can first identify hospital buildings where cool roofs and green coverage could be installed. In coordination with the Department of Urban Planning, the Department of Health Services can install insulated roofing systems or use reflective materials like white coatings, cool asphalt, or cool tiles to minimize heat absorption. The Environment Department of Dhangadhi Sub-Metropolitan City can also support these endeavours to enhance the greenery within healthcare facilities.	Karolinska University Hospital in Sweden has implemented extensive green roofs, covering over 20,000 square metres, as part of its sustainability efforts. These green roofs provide thermal insulation, reduce urban heat, help manage stormwater and create a healing environment for patients. **Link to case study:** https://bit.ly/3SeKyki

TARGET AREA(S)	TARGET GROUP	SECTOR(S)	PRIMARY STAKEHOLDER	SECONDARY STAKEHOLDERS	BRIEF	CASE STUDY
6. PROMOTING FISH FARMING FOR HEATWAVE RESILIENCE AND FOOD SECURITY						
Areas suitable for fish farming in Dhangadhi	Local farmers and community members interested in aquaculture	Aquaculture	Department of Agriculture and Livestock	WDMC TLO	Fish farming refers to the cultivation of fish in controlled bodies of water, which can also serve multiple purposes in enhancing heatwave resilience. Not only does the promotion of fish farming help to ensure food security and develop the local economy, the water bodies used for fish farming can help to reduce the urban heat island effect as they provide cooling benefits to the surrounding area. This localized cooling effect is especially important during heatwaves. The Department of Agriculture and Livestock, with the help of WDMC and TLOs, will promote fish farming in Wards 1, 3, 4, 5, 17 and 19. This initiative will help to increase food security, support the local economy and help to reduce the temperature of nearby areas.	The government of Morang, Nepal has started a massive investment programme to enhance the production of fisheries in the city. Under the ten-year Prime Minister Agricultural Programme, Morang has been declared a 'fisheries zone'. The plan aims to increase the income of farmers while controlling urban heat. Ponds and water reservoirs developed for fisheries are natural heat sinks, where the heat is absorbed during the daytime and released slowly at night. **Link to case study:** https://bit.ly/41rwBVX
7. INCORPORATING HEAT MITIGATING MEASURES INTO BUILDING CODES TO STANDARDIZE GOOD PRACTICE						
New constructions sites	All residents of Dhangadhi	Urban Planning	Department of Urban Development and Building Construction	Dhangadhi Sub-Metropolitan City	The incorporation of heat mitigating measures would involve reviewing and updating current building regulations. This is crucial for ensuring that the structural designs of new and existing buildings can effectively withstand extreme heat. Incorporating heat-resilient practices, such as thermal insulation and passive cooling, will allow buildings to remain cooler and have better comfort for the occupants, while minimizing the need for air conditioning. Department of Urban Development and Building Construction, in coordination with Dhangadhi Sub-Metropolitan City, can review and update existing building codes and identify gaps where heat-resilient measures are missing. The Department will update these building regulations by developing specific standards for heatwave mitigation measures.	The Buenos Aires Climate Action Plan includes strategies to enhance private sector resilience through updated building codes. These regulations mandate solar protection and ventilation in new constructions to improve heat adaptation. **Link to case study:** https://bit.ly/4hJaAGL

TARGET AREA(S)	TARGET GROUP	SECTOR(S)	PRIMARY STAKEHOLDER	SECONDARY STAKEHOLDERS	BRIEF	CASE STUDY
8. OFFERING INCENTIVES OR REWARDS FOR RESIDENTS WHO IMPLEMENT HEATWAVE MITIGATION MEASURES, SUCH AS INSTALLING REFLECTIVE ROOFING OR UPGRADING INSULATION						
All areas within Dhangadhi	Homeowners	Governance and Policy	Dhangadhi Sub-Metropolitan City	LDMC NRCS, Kailali DC I/NGOs	A heatwave mitigation incentive programme is a scheme designed to encourage residents to invest in heat-reduction measures at their homes or within their communities. The programme offers rewards or incentives for those who take proactive action such as installing green roofs, planting trees or other heat-mitigation strategies. These actions help to reduce indoor and outdoor temperatures and improve general resilience to heatwaves within the communities. Dhangadhi Sub-Metropolitan City can develop an incentive programme in which residents are encouraged to use heatwave mitigation measures like installing a reflective roof, upgrading insulation, planting trees or other ways to cool the house. LDMC, NRCS and Kailali DC can establish eligibility criteria for participation, the nature of incentives (e.g., tax rebates, subsidies, discounts on materials, recognition awards) and how households apply or become eligible. NRCS and Kailali DC can take the lead in mobilizing volunteers for the dissemination of information regarding the programme at the community level.	The Tokyo Metropolitan Government in Japan provides subsidies and mandates eco-friendly building practices that help mitigate heatwaves, including green roofs (since 2001), to lower building surface temperatures; awards subsidies for eco-friendly housing, including solar panels and storage batteries; and mandates solar panel installation for all new homes and buildings from April 2025. This case study demonstrates examples of financial incentives and regulatory measures that encourage residents to adopt heat-resistant infrastructure. **Link to case study:** https://bit.ly/4111K1U; https://bit.ly/4hDvk2K
9. ESTABLISHING PARTNERSHIPS WITH EDUCATIONAL INSTITUTIONS TO INCORPORATE HEATWAVE PREPAREDNESS INTO SCHOOL CURRICULA						
Schools/ colleges	Students	Education	Education Department, Dhangadhi Sub-Metropolitan City	Educational institutes (all school/colleges)	Integrating heatwave preparedness into educational curricula involves covering the knowledge of heat risks and preventive actions within school and college programmes. This is a vital step in raising awareness from a very young age, so students can protect themselves and their families and wider communities during heatwaves. Educated youth also play a future role in disseminating information to their families and communities, during imminent heatwaves to come. The Education Department of Dhangadhi Sub-Metropolitan City will establish partnerships with all academic institutions, such as schools and colleges in the city, to incorporate heatwave preparedness and preventive action-related knowledge in their educational curricula.	Greater Sydney, Australia, has developed an interdisciplinary educational programme for high school students called '50°C: Climate, heat and resilience'. This educational programme helps to address urban heat challenges, recognizing the critical role of education in fostering resilience to extreme heat. The programme is a working example of how partnerships between government, educational institutions and experts can embed heatwave preparedness into school curricula. **Link to case study:** https://bit.ly/4grVzse
10. RAISING AWARENESS OF ENERGY-EFFICIENT APPLIANCES SUCH AS THE USE OF LED (LIGHT EMITTING DIODE) BULBS OR CFL (COMPACT FLUORESCENT LIGHT) BULBS						
Residential areas, commercial establish-ments and public spaces in Dhangadhi.	All the citizens of Dhangadhi	Energy, Awareness-raising	NEA	NRCS, Kailali DC WDMC	Energy-efficiency awareness campaigns encourage people to use appliances that consume less electricity, such as LED or CFL bulbs. These campaigns are important in ensuring a reduction in energy demand, especially during heatwaves when power usage increases. By encouraging energy-efficient practices, communities can lower electricity costs, decrease pressure on the power grid and contribute to environmental sustainability. The NEA, in collaboration with NRCS, Kailali DC and WDMC can start an awareness campaign on the use of energy-efficient appliances such as LED or CFL bulls.	The Tokyo Green Building Programme in Japan has encouraged the implementation of energy-efficient systems, such as advanced insulation, energy-efficient lighting and energy-efficient appliances, to reduce energy consumption and greenhouse gas emissions. **Link to case study:** https://bit.ly/3Bf9hA5

10. WAY FORWARD

The Heat Action Plan (HAP) serves as an essential framework for initiating heat risk management in the city. It plays a crucial role in mitigating the adverse effects of extreme heat events on public health, infrastructure, the environment and the socioeconomic circumstances of the population. Moreover, it plays a critical role in the city's climate adaptation strategy, which is currently lacking in Dhangadhi. However, the city has a Disaster Management Plan (DMP), so it is essential that local authorities align the HAP with this DMP.

The next immediate step is for the local government to officially adopt the HAP and integrate it into the city's disaster management or governance processes. This should be achieved by endorsing the plan at a city board or council meeting. The HAP must be recognized as part of the city's overall disaster management and adaptation efforts rather than being considered in isolation.

Heat action requires collaboration and coordination among multiple stakeholders. Therefore, regular meetings and workshops will be essential for monitoring progress, sharing best practices, accelerating the implementation of heat action measures, evaluating lessons learned and updating the HAP. The Climate Task Force of Dhangadhi can serve as the convener of these activities. It is crucial that all members of the Climate Task Force remain committed to following and updating the HAP to build resilience and minimize the impact of heat events in the future.

Implementing all the measures outlined in the HAP at once can be resource-intensive for local governments. Therefore, the Dhangadhi Sub-Metropolitan City should identify and prioritize quick-win projects that require minimal resources for implementation. Additionally, the city can secure long-term funding by forming partnerships with government agencies, the private sector and international donors to support heat action initiatives.

Furthermore, it is crucial to periodically review and update the HAP, incorporating stakeholder feedback and adapting strategies to effectively address heat risks.

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