

Reducing Heat Impacts in Nepalgunj City, Nepal

POLICY BRIEF

Background

As climate change increases the frequency and intensity of temperature extremes in South Asia, heatwaves present a growing risk. Further global warming is expected to exacerbate this problem¹. Heat is amongst the deadliest of climate hazards, resulting in thousands of excess deaths. Past heatwaves contributed to the death of 70,000+ people in Europe in 2003, 50,000+ in Russia in 2010, and 2,500+ in India in 2010.



Water body in ward two,
Nepalgunj City/Ashma Subedi/
Climate Centre

¹ IPCC, 2021: *Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. In Press.



Cities are particularly at risk due to the urban heat island effect, in which the built environment traps heat and re-radiates it into the city, making temperatures even hotter than the surrounding areas. Risks are highest in densely populated cities where high numbers of people may be increasingly vulnerable and exposed to the heat, unless policies and plans are in place to reduce heat impacts.

This policy brief was produced to share insights on how the Nepalgunj City in Nepal could improve its preparedness for extreme heat through existing and new policies and plans. It provides a summary of existing policy frameworks that may be used to address heat; highlights potential gaps and makes recommendations for how heat can be better integrated into policies and plans on both short-term (days to months) and long-term (5+ years) timescales. It is based on desk-based research and key stakeholder interviews with city, disaster management, and health officials in Nepalgunj City.



Daily wage earners working under the scorching sun in a busy street, Nepalgunj City/
Ashma Subedi/Climate Centre

Heatwaves in Nepalgunj City

Nepalgunj City, is located in Banke District, near to Nepal's border with India. It has been subject to high temperatures of over 40°C almost every summer and in recent years its population, especially outdoor workers, has experienced widespread heat impacts^{2,3}. According to Bhatta *et al.* (2021) study, 61.2% of Nepalgunj City residents reported heat-related symptoms in the last six months. They also found that factors including gender, education, income, roof construction, cross-ventilation, working hours per day, presence of chronic disease, and medication use, had a significant association with heat-related symptoms among the participants ($p < 0.05$)⁴. Heat-related deaths are not systematically tracked in Nepal making it difficult to know the full extent of the heatwave's impacts, but given the trends in heat and anecdotal evidence, it is likely to be significant. For example, stakeholders interviewed from Nepalgunj City, mentioned that heatwave impacts have become worse in recent years and that older people, daily wage workers (e.g. auto and rickshaw drivers and street hawkers) and pedestrians, are amongst the populations most vulnerable to the heat. In addition, high density areas, industrialised areas, airports, and highways were referenced most often by interviewees as the areas where heat risk is highest.



House of a low income population family in ward 20, Nepalgunj City /Ashma Subedi/Climate Centre

- 2 MoHA. (2019). *Nepal Disaster Report 2019*. Ministry of Home Affairs, 1–54.
- 3 The Kathmandu Post. (2016). *Heat waves affect western Terai districts*. Retrieved from <https://bit.ly/3fUU49t>
- 4 Bhatta K, Pahari S. Vulnerability to Heat Stress and its Health Effects among People of Nepalgunj Sub-Metropolitan. *Journal of Nepal Health Research Council*. 2021 Jan;18(4):763-768. doi: 10.33314/jnhrc.v18i4.2734. PMID: 33510525.

A review of existing policy frameworks

Nepal has a number of policy frameworks that are relevant to addressing heat risks. In this section, we highlight five key frameworks and how they can be applied to heat, and identify where gaps exist and heat may need to be better integrated into these frameworks.

The *National Urban Policy* was developed to resolve critical issues as Nepal's cities grow rapidly and urbanise. The policy has three main objectives:

- To achieve a balanced national urban structure through proper guidance to physical infrastructure development and investment.
- To achieve a healthy, secure, and economically vibrant urban environment in order to bring about improvement in the living standards of urban residents.
- To strive towards effective urban management through legal empowerment and institutional strengthening of the local government bodies and, through effective coordination among, and capacity building of the agencies associated with urban sector development.

Each of these objectives could be applied using a heat lens. For example, objective 1 could be used to ensure new infrastructure such as roads, bridges, and buildings account for current and future temperature projections, so that they can withstand very high temperatures and provide low-energy ways to cool off, such as passive cooling.

The *National Urban Development Strategy* (NUDS) developed in 2017 includes the need for building resilience to climate change in urban areas. The NUDS explicitly mentions heat, saying “Cities should promote land use, technology and material that would contribute to low carbon emission, increase the use of alternative energy, reduce the effects of urban heat islands and lower ambient temperatures.” However, there are no specific plans or programmes currently in place to act on this and reduce the urban heat island effect. Nonetheless, this policy framework and strategy provides a strong impetus for taking heat action in urban areas.

Nepal passed a *National Climate Change Policy* in 2019 that aims to build a climate-resilient society and includes objectives around adaptation, resilience of ecosystems, mobilising green finance, promoting a green economy and mainstreaming climate into policies, strategies and plans. In this policy, heatwaves are included as one of the disasters for which monitoring, forecasting and early warning systems should be developed to improve preparedness and response. Furthermore, it includes areas such as awareness raising and capacity building, disaster risk reduction and management and health, with provisions that could be applied to the hazard of heat.

In 2016, the *Nepal Electricity Plan* was approved after the cabinet ordered the Ministry of Energy to develop a clear action plan for reducing the countries' power shortage in a year and eliminating it in two years. Electricity is critical during heatwaves and yet those are the times when power outages often tend to occur. The co-occurrence of heatwaves and power outages results in people having no way to actively cool themselves and exposes more people to potentially life-threatening temperatures. The plan does not address heat resilience, and this is a major gap that must be addressed.

Nepal also has a *National Building Code* that provides specifications for different building structures and is based on seismic analysis to address earthquake-related risks. However, the building code does not address issues related to climate change like extreme heat and how they might affect infrastructure. While all climate-related risks should be considered, within the scope of this paper it would be important to take into account how buildings and the construction materials used, may reduce or increase exposure to high temperatures.



Street vendor under the scorching sun in ward 12, Nepalgunj City Ashma Subedi/Climate Centre

Strategies for managing heat risks

There are many strategies that the Nepalgunj City could consider to reduce the risk of heatwaves. However, it's important to look across different timescales as heat requires both short and long-term strategies to strengthen climate resilience.

Short-term strategies

Actions can be taken when a heatwave is imminent or at the beginning of the “hot season” when heatwaves typically occur. These risk reduction strategies are considered “short term” and can be integrated into existing disaster management systems.

Early warning early action for heat

While heatwaves are listed as a natural hazard in the district disaster management list, interviewees shared that this hazard has received little attention thus far. However, there is a City Disaster Management Committee in Nepalgunj that acts as the planning, coordinating, and implementing body for disaster management (DM) at the city level. The committee is activated when there is a disaster and is responsible for calling stakeholders such as city officials, health officials and Red Cross officials. It may be possible to integrate heat as a hazard for which this committee is responsible.

The committee regularly conducts disaster preparedness meetings, and it is further activated when a disaster is imminent or ongoing. The committee meets in the presence of the city Mayor and involves stakeholders exchanging information, sharing plans and discussing gaps in disaster management. After the planning phase, a disaster response plan is initiated and activities such as water sanitation and hygiene (WASH) support, provision of first-aid kits and life jackets are conducted. Moreover, the committee also coordinates with the District Disaster Management Committee (DDMC) and with the help of the DDMC they coordinate with other NGOs/INGOs and government organisations for external help and relief support. The City Disaster Management Committee also encourages the involvement of NGOs and voluntary social welfare institutions working in disaster management at the grassroots level in the city.

If this mechanism is to be extended to include heatwaves, the committee could first ask the Department of Hydrology and Meteorology (DHM) to develop an impact based heatwave forecast upon which to trigger heat action. Furthermore, the committee could meet in March before the beginning of the hot season (April-June) to develop a heat action plan for the city, discuss public awareness raising and protective measures on heat risk, and prepare city services (health workers, health clinics etc.) to recognise the signs of extreme heat and anticipate a possible increase in patients. They could use any forecasts developed by the Nepal DHM to trigger heat actions immediately before the onset of a heatwave. They could also meet after the heatwave for an after-action review to discuss how the heat action plan was implemented and how improvements could be made for the future.

Heat awareness

Before the heat season, the municipal government can implement targeted awareness raising campaigns on the risks associated with heat (heat exhaustion, heat stroke, exacerbating underlying health conditions etc.) and the simple actions people can take to reduce such risks (e.g. staying out of the sun, drinking enough water, checking in on the elderly etc.) The [City Heatwave Guide](#) provides a useful list of risks and actions that can be taken. Awareness raising is critical, especially in parts of the world where people are exposed to high temperatures for extended periods of time and may not perceive themselves to be at risk. Evidence from heatwaves in neighboring India suggests that even in hot places where people are used to the heat, extreme heat does lead to heat-related illness and deaths. Consequently, it is important for individuals to take self-protective action that could safeguard them and their loved ones.

Long-term strategies for managing heat risk

There are long-term strategies that will reduce the impacts of heat and people's exposure to it over longer time periods which are linked to how our cities are structured and built. For example, there are two major ways to reduce the urban heat island effect, by increasing the reflectivity (albedo) of urban surfaces, or by increasing evapotranspiration, the process by which moisture transpires from plant leaves, evaporates and cools the air⁵. This section explains a few strategies that the Nepalgunj City may consider implementing.

Green spaces

Increasing green vegetation on roadside walkways and in parks can increase evapotranspiration and cool down a city. Increasing the number of trees that produce a lot of shade can also reduce temperatures underneath them. Green roofs are another option, where vegetation can be added to roofs to absorb heat and filter the air, thereby lowering the temperature. Increasing green spaces also provides many co-benefits including; reducing air pollution, storm water management and supporting urban wildlife and biodiversity. Public green spaces also provide a place for city residents to gather and can increase social cohesion in a community. But it is important that the tree species planted, and their locations take into consideration trees native to the region, which are easy to care for and represent the preferences of local people⁶.

5 Md. Nuruzzaman. Urban Heat Island: Causes, Effects and Mitigation Measures - A Review. International Journal of Environmental Monitoring and Analysis. Vol. 3, No. 2, 2015, pp. 67-73. [doi: 10.11648/j.ijema.20150302.15](https://doi.org/10.11648/j.ijema.20150302.15)

6 Lamichhane, D., & Thapa, H. B. (2012). Participatory urban forestry in Nepal: Gaps and ways forward. Urban Forestry & Urban Greening, 11(2), 105–111. <https://doi.org/10.1016/j.ufug.2011.07.008>

Increasing reflectivity of surfaces

A city can increase reflectivity by using more reflective materials in roofs and pavements, or by painting roofs white. Increasing roof reflectivity has many benefits including; enhancing the thermal comfort of indoor spaces without the use of air-conditioning, extending the service life of a roof by reducing roof operating temperature and reducing energy consumption⁷. The majority of the population (65.14%) in Nepalgunj have Reinforced Cement Concrete (RCC) rooftops overlaid with a tile/slate rooftop (15.53%) or thatch/straw rooftop (8.66 %) ⁸. It will be important to ensure that structural integrity is not compromised to avoid earthquake-related risks, while also increasing reflectivity. In India, this practice has been employed to cool down buildings and homes as part of the Ahmedabad Heat Action Plan under which the roofs of more than 7,000 low-income households have been painted white. This approach aligns with the [Million Cool Roofs Challenge](#), a global challenge to rapidly scale up the number of cool roofs worldwide. Importantly, cool roofs need to be regularly maintained in order to retain their effectiveness.

Urban planning for cool cities

Urbanisation is increasing around the world including in Nepalgunj. As more residents move to the city there will be an inevitable need to expand and build new infrastructure. It is critical that the urban expansion of the city is done in a way that is green and resilient with consideration for heat risks. For example, some urban planners suggest creating “ventilation corridors” of blue and green spaces to increase cool wind flow during the summer⁹. There should also be a sufficient amount of free space to channel and circulate the wind to mitigate the urban heat island effect^{10,11}.

Passive cooling

The way in which a house or building is built, including its orientation, building size, window design and orientation, can all factor into how hot it will get during the summer months. Houses that are designed with passive cooling in mind, will stay cooler and reduce energy costs. One study found that traditional houses in Nepal with earthen floors, thatched roofs, mud, and brick walls are effective at reducing indoor air temperatures.¹² Cross ventilation in homes where wind can pass through the building for the purpose of cooling residents, is an important technique and residents in Nepalgunj with cross ventilation reported fewer symptoms of heat stress¹³. Shade provided by trees and other structures can also reduce temperatures inside the home.

7 Al-Obaidi, K. M., Ismail, M., & Abdul Rahman, A. M. (2014). Passive cooling techniques through reflective and radiative roofs in tropical houses in Southeast Asia: A literature review. *Frontiers of Architectural Research*, 3(3), 283–297. <https://doi.org/10.1016/j.foar.2014.06.002>

8 Central Bureau of Statistics. (2014). National Population and Housing Census 2011. 7(2).

9 City of Stuttgart and Green and Blue Space Adaptation for Urban Areas and Eco Towns (GRaBS)

10 Md. Nuruzzaman. Urban Heat Island: Causes, Effects and Mitigation Measures - A Review. *International Journal of Environmental Monitoring and Analysis*. Vol. 3, No. 2, 2015, pp. 67-73. doi: [10.11648/j.ijema.20150302.15](https://doi.org/10.11648/j.ijema.20150302.15)

11 Hsieh, C.-M., & Huang, H.-C. (2016). Mitigating urban heat islands: A method to identify potential wind corridor for cooling and ventilation. *Computers, Environment and Urban Systems*, 57, 130–143. <https://doi.org/10.1016/j.compenvurbsys.2016.02.005>

12 Rijal, Hom. (2018). Passive Cooling of the Traditional Houses of Nepal. [10.1007/978-981-10-8465-2_38](https://doi.org/10.1007/978-981-10-8465-2_38).

13 Bhatta K, Pahari S. Vulnerability to Heat Stress and its Health Effects among People of Nepalgunj Sub-Metropolitan. *Journal of Nepal Health Research Council*. 2021 Jan;18(4):763-768. DOI: 10.33314/jnhrc.v18i4.2734. PMID: 33510525.

Long-term heat education

In addition to the short-term awareness raising that is required before the hot season, there is also a need for a long-term approach around continuous education on heat. This can be integrated into existing curricula for healthcare workers including doctors, nurses, emergency care workers, community health workers, caregivers in homes for the elderly, as well as in schools and first-aid training curricula.



Conclusion

Heat risk is one of the most certain and deadly challenges posed by climate change, but it is also a silent one. People who are affected by extreme heat often die silently in their homes and are already vulnerable (e.g. they may have pre-existing medical conditions and/or be elderly). These are preventable deaths that can be avoided with strong policies and planning. It is critical that extreme heat is given the same attention as more visually impactful hazards such as floods and droughts. Nepalgunj City can raise awareness of this deadly risk, and share ways that people can protect themselves. Simple actions such as drinking enough water and finding ways to cool down the body can save lives, especially when they are enacted systematically as part of a heat action plan. Establishing the buy-in of key institutions such as the City Disaster Management Committee, local NGOs, the Department of Health and Department of Hydrology and Meteorology, will be an important first step towards developing such a plan. Positively, many of the existing policies in Nepal can both support and underpin such a heat action plan. Long-term measures are also required to reduce the number of people exposed to high temperatures, therefore also reducing the load on healthcare services. These measures need to be integrated into urban planning and building codes for Nepalgunj City. Taking these steps to address the risk of extreme heat now, will help to avoid unnecessary suffering and economic impacts, while also providing many co-benefits for city residents.

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