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# Climate change and health: analysis of national policies and implementation challenges in Nepal

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## Abstract

# Background

Climate change is a growing global public health threat with significant consequences for health systems, particularly in climate-vulnerable countries such as Nepal. Nepal has developed policies to address climate and health risks. The understanding and preparedness of subnational stakeholders is crucial in building a climate-resilient health system. However, limited evidence exists on the understanding and capacity of local health systems and how national commitments are operationalized within Nepal's decentralized health system. Thus, this study aimed to explore the integration of climate and health in national policies and understand the capacity, priorities and operationalization of climate actions by local governments.

# Methods

We conducted a policy review and qualitative data collection, including 35 key informant interviews with stakeholders from the health, environment, disaster, and other relevant sectors across federal, provincial, and local levels. The study sites included Kapilvastu municipality, Kapilvastu District (semi-urban); Patarasi rural municipality, Jumla District (rural) and Budhanilkantha municipality, Kathmandu District(urban). We analyzed the data thematically.

# Results

Nepal has developed multiple policies to strengthen climate resilience and adaptation. At local levels, however, awareness of federal commitments was limited, and health systems faced challenges in identifying climate-related health issues and implementing adaptation strategies constrained by insufficient guidance, capacity and financing. Annual plans often prioritized disaster response over preparedness, and climate issues were often addressed through disaster management structures rather than proactively embedded into routine health governance. Urban municipalities demonstrated relatively stronger policy instruments compared to semi- urban and rural municipalities. Across all settings, climate-specific training and dedicated financing for health adaptation were minimal. The local levels relied more on reactive responses, with limited attention to surveillance, prevention, or primary healthcare adaptation.

# Conclusions

The study identified a gap between strong national climate health commitments and their translation into subnational practice. Local health systems are at an early stage of preparedness, with the need to strengthen governance, financing, and stakeholder capacity. Building climate-resilient health systems in

Nepal will require embedding climate considerations into routine health planning, enhancing communication of federal policies, and supporting local governments to shift from reactive disaster response toward proactive, locally driven adaptation strategies.

## Background

Climate change is a growing global public health threat with significant consequences for health systems worldwide. Climate change is contributing to and expected to increase health risks, mainly among low- and middle-income countries (LMICs), and affects the most vulnerable groups within each country setting [1]. The World Health Organization (WHO) identifies two pathways via which climate change contributes to health risks. First, climate change can act on health outcomes by injuries and mortality from extreme weather events, heat-related illnesses, malnutrition, non-communicable diseases and mental health issues. Second, climate change can also affect health systems directly which include the impacts on health facilities, health workforce and other health system building blocks [2]. It is estimated that between 2030 and 2050, climate change will cause an additional 250,000 deaths per year globally from malnutrition, malaria, diarrhoea and extreme heat [3]. Climate change is indicated to compound inequities in health, particularly in LMICs where the health systems are least prepared to cope with the changing health risks [2]. Extreme climate events pose additional vulnerabilities to health systems, making them more fragile and disrupting the delivery of basic health care [2, 4].

Health systems in all countries and at all levels need to respond and adapt to climate change-related health care needs [5]. As climate change threatens a system’s ability to protect and improve public health, health systems need to be resilient to be able to cope with the shocks and stressors they face from climate variability and change. Integrating climate resilience into health systems is therefore crucial for their effectiveness and sustainability [1, 6] .

In Nepal, the impact of climate change on health is visible and growing. Nepal ranks as the 6th most climate vulnerable country as per the climate risk index 2026 [7]. The Government of Nepal has recognized the public health sector as one of the most vulnerable sectors affected by the impacts of climate change [8]. Due to diverse geography and climate conditions, Nepal is exposed to varied natural- and human-induced disasters resulting from climate change. The Terai or flat areas experience floods as well as extreme heat and cold waves, the hills experience landslides and forest fires, and the mountains are prone to debris flow, landslides, avalanches, and glacial lake outburst floods [9]. Nepal has also noticed a climate-sensitive shift in the pattern of vector-borne, waterborne, airborne, cardiovascular-and nutrition-related diseases, along with injuries and mental health illnesses [10]. Moreover, floods and landslides usually damage and interrupt the water supply and sanitation system, leading to poor quality and insufficient supply of water for drinking. In addition, damage to health infrastructure is another risk posed by climate change, where many health facilities are largely situated in risk-prone areas such as close to rivers and steep slopes [11]. These impacts place a strain on Nepal's already fragile health system; thus, strengthening healthcare infrastructure and integrating climate adaptation strategies are critical to building resilience in Nepal’s health system.

At the national level in Nepal, leadership for climate change is primarily situated within the Ministry of Forests and Environment (MoFE) [12]. Within the Ministry of Health and Food Safety (MoHFS)-former Ministry of Health and Population, a focal person is assigned for the climate and health agenda. However, integrating climate change into routine health planning, its prioritization, coordination and ensuring sustained attention to it remain challenging [13]. Following the introduction of the 2015 constitution, Nepal transitioned to a federal governance system, distributing authority across federal, provincial, and local levels, with municipalities assuming primary responsibility for delivering basic health services. While roles and responsibilities were defined, this shift has also introduced persistent challenges related to role clarity, coordination, and communication across the tiers of government [14, 15]. In this context of constrained capacity and competing service delivery priorities, cross-cutting issues such as climate change face additional challenges in terms of prioritization [13]. Despite climate change's growing impact on health systems, evidence remains scarce on how to integrate climate change within health systems processes and priorities in Nepal and ensure effective actions to address prevention, adaptation and mitigation in the sector.

Nepal has developed different policies which focus on climate change and are generic, such as the National Climate Change Policy 2019, National Adaptation Plan 2021–2050, Nationally Determined Contributions (NDCs). Some policies also exist in the health sector, e.g. Health National Adaptation Plan (HNAP) 2023 and National Health Policy 2019. However, the gap is to understand how climate change has been included in health sector polices and how health has been included in climate change policies, as well as assessing the level of understanding of these issues among health sector stakeholders. The objective of this paper is therefore to review climate change-related policies in Nepal and analyze the integration of health in climate change policies and climate change in health policies. The study also examines the policy processes at decentralized subnational levels, exploring the formulation, communication and implementation of climate change and health actions, with a focus on understanding the capacity, priorities and operationalization of climate actions by local governments.

## Methods

We followed the Consolidated Criteria for Reporting Qualitative Research (COREQ) [16]. The completed checklist is available in supplementary material 1.

# Study design

The study is part of the ReBUILD for Resilience research programme that aims to strengthen the resilience capacity of health systems in fragile and shock-prone settings [17]. We conducted a cross-sectional exploratory study using qualitative methods, including review of policies and documents and primary qualitative data collection. We used policy review to meet our first objective on integration of climate change or health in polices and used qualitative methods to gather in-depth insight on implementation and operationalization of climate actions at relevant levels.

## Study sites

We selected three sites - namely Kapilvastu municipality, Kapilvastu District; Patarasi rural municipality, Jumla District, and Budhanilkantha municipality, Kathmandu District. We chose the sites purposively to represent three different geographies and sets of risks. Kapilvastu lies in the flat Terai part of the country, where the temperature goes as high as 45 degrees Celsius. It has a high occurrence of climate sensitive diseases, including vector-borne diseases such as dengue and malaria, and water-borne diseases such as diarrhoea, cholera, and respiratory diseases such as severe acute respiratory infections. The district also has a high exposure rank in terms of significant increase in extreme precipitation, increased hot night frequency, increased frequency of coolest nights and days compared to the past 30 years, and increased drought [18]. Patarasi rural municipality lies in a remote mountainous region with diverse climatic risks, which is a chronic food-insecure district due to low and insufficient production [19]. The district has experienced emerging and shifting patterns of climate sensitive diseases such as dengue and malaria. It also has a high prevalence of undernutrition [18]. Further, the district has low adaptation capacity and coping practices among communities to respond to climate change [20]. Budhanilkantha municipality is a rapidly urbanizing area in Kathmandu District with its own particular climatic vulnerabilities, including increased air pollution, changing rainfall patterns, and the effects of urban heat islands. Kathmandu is home to a mix of urban and peri-urban communities, which experience health risks from climate related challenges such as water scarcity and increased strain on essential infrastructure including water supply, sanitation and health services [21].

## Data collection

We conducted a desk- review of available policies, plans and strategies on climate change and health from 2010 since the first climate policy was introduced up to December 2025. We accessed documents using an online search and searching purposively selected government websites, mainly MoFE, MoHFS and National planning commission and municipality websites. Searches used key terms such as climate, climate change, climate crisis, policy, climate change and health, environment, adaptation, mitigation and Nepal. We extracted data from 17 documents. We developed a framework in Microsoft Excel spreadsheet to extract key information on publication dates, objectives, recommended actions, inclusion of climate or health related content, and other relevant themes such as information systems, resilience, climate-sensitive diseases, emergency preparedness and management. We developed the sheet based on our study objectives and adapted the sheet as we progressed.

We reviewed existing national and subnational policy documents to examine how health is addressed in climate change adaptation plans and strategies, and conversely how climate change is addressed in health sector policies. Particular attention was given to policy priorities, governance arrangements communication, and implementation mechanism. At the local level, we reviewed policy documents from selected municipalities to understand what policy measures were developed by local governments for responding to climate risks. This included examining whether health and climate change adaptation

strategies reference each other and the extent to which multisectoral responses are highlighted and implemented.

For qualitative data collection, we developed topic guides based on our study objectives and guided by the WHO operational framework for climate resilient health systems [22], which was further strengthened by expert consultation. The topic guide was not formally piloted but was refined by the research team in an iterative process before data collection and during the initial stage of data collection to enhance clarity, depth and address emerging themes. The topic guides were used flexibly and adaptively depending on participants' knowledge and the context to acquire breadth and depth of information from the participants. Four researchers from the study team at HERD International including the first author and coauthors conducted key informant interviews (KIIs) face-to-face with respondents at all levels. The data collection was carried out between June 2024 to May 2025.

A total of 35 key informants were included in the study (details in Table 1), selected purposively for their relevance in climate change or health. At the local levels, we included 23 participants (10 in Kapilvastu, 7 in Jumla and 6 in Kathmandu). The participants were officials representing health, environment, planning, disaster, agriculture, WASH and infrastructure sectors and district health offices. At the province level, we included representatives from the MoFE and MoHFS. We also carried out KIIs with relevant federal authorities which included representatives from the Ministries of Health, Forests and Environment, Federal Affairs and General Administration, Urban Development and development partners. None of the participants refused to participate or dropped out. Of the 35 participants, majority were office holders representing the concerned sections at all levels on climate and health and were predominantly male. Interviews were conducted in the participants' offices, without the presence of others

Each interview took around 40–60 minutes. The researchers also received training on the study design, objectives, methods of data collection, tools and techniques of conducting data collection to gather quality data, informed consent processes and confidentiality.

Table 1
Summary of key informant interviews

| Level | SN | Stakeholders/informants | Number of KIIs |
|---|---|---|---|
| **Local (n = 23)** | 1 | Chief Administrative Officer | 2 Male |
| | 2 | Health section | 2 Male, 1 Female |
| | 3 | WASH section | 1 Female |
| | 4 | Agriculture section | 2 Male, 1 Female |
| | 5 | Infrastructure section | 3 Male |
| | 6 | Environment section | 2 Male |
| | 7 | Disaster management section | 1 Male, 1 Female |
| | 8 | District Health office | 2 Male |
| | 9 | Partner Organization working in districts | 1 Male, 1 Female |
| | 10 | Local disaster management committee, Kapilvastu (1) | 1 Male |
| | 11 | Early Warning and Reporting System (EWARS) focal, District hospital | 1 Male |
| | 12 | Revenue section | 1 Male |
| **Province (n = 2)** | 1 | Ministry of Forests and Environment | 1 Male |
| | 2 | Health Directorate, Ministry of Health | 1 Male |
| **Federal (n = 10)** | 1 | Ministry of Health and Food Safety | 1 Male |
| | 2 | Epidemiology and Disease Control Division, Department of Health Services | 1 Male |
| | 3 | Climate Change Management Division, Ministry of Forests and Environment | 1 Male |
| | 4 | Ministry of Federal Affairs and General Administration (MoFAGA) | 1 Male |
| | 5 | Department of Hydrology and Meteorology (DHM), Ministry of Energy, Water Resources and Irrigation | 1 Female |
| | 6 | Ministry of Urban Development | 2 Male |
| | 7 | National Statistics Office | 1 Male |
| | 8 | Development partner | 1 Male |

| Level | SN | Stakeholders/informants | Number of KIIs |
|---|---|---|---|
| | 9 | Academica: Karnali Academy of Health Sciences (KAHS) representative | 1 Male |
| **Total KIIs** | | | **35 (6F, 29 M)** |

## Data management and analysis

All KIIs were audio recorded and transcribed in Nepali and then translated into English for analysis. Transcripts were not returned to participants for checking and they were not invited to provide feedback on the findings. We checked for saturation during data collection, when no new insights were found, and during analysis, when no new codes appeared[23]. Qualitative data were analyzed using a thematic framework analysis approach [24] and then triangulated/compared across sources. First, we extracted data from policy documents and integrated them with interview data during coding and theme development to enable comparison between policy intentions and implementation experiences. The information from KII was read and re-read, and a coding framework was developed following the emerging themes, issues and objectives. Two researchers (AR and BRB) independently coded the transcripts, meeting regularly to ensure consistency and refine themes. Reliability was checked by jointly coding the same transcripts and revisiting them when needed. Anonymized quotations were used to illustrate findings. Data were summarized and organized under defined themes and subthemes. The data were coded using qualitative software NVivo version 14 using the framework and analysis progressed iteratively with regular discussion within the research team.

## Reflexivity statement

The interview was carried out by a team of researcher including the first author and two male and two female researchers, with backgrounds in public health or environmental science, and experience in climate change and health systems and qualitative research. This expertise provided contextual understanding of the study settings. Before initiating the interview, the participants were contacted and informed about the purpose of the study and researcher's role. To enhance reflexivity, the team wrote reflective notes after each interview, joined debriefing sessions, and engaged in thematic discussions and collaborative coding to ensure diverse viewpoints were considered.

# Ethics

We received ethics approval from the Nepal Health Research Council (No. 748/2024) for the study. We obtained written consent from the participants using the consent form developed in the Nepali language. We also obtained written consent from participants to audio record the interviews and for the ease of data analysis. Interviews took place in a private place agreed by participants. Each interview was

transcribed, and anonymized and all data were assigned with an identification number, and only senior members of the research team had access to these data. The consent forms were stored by the country research team in a locked cupboard. We minimised risks to respondents by not collecting any personal information and maintaining their anonymity and confidentiality. We followed safeguarding principles and minimize potential harm. Participation was voluntary, and participants could decline any question or withdraw from the study at any time.

# Results

In this section, we first discuss the policy landscape in Nepal, followed by findings on the integration of climate change and health in policies. Subsequently we highlight governance and institutional structures, policy communication and operationalization, understanding of climate and health among stakeholders, and integration and prioritization of climate actions in local plans.

# Policy landscape in Nepal

Nepal has developed polices related to climate change since it signed the UN Framework Convention on Climate Change in 1992 [25]. However, it took nearly two decades for the country to develop its first Climate Change Policy in 2011 and National Adaptation Programmes of Actions (NAPA) in 2010. Health came into play later only during 2017, when the first Health National Adaptation Plan (HNAP) was published. The HNAP 2017–2021 was developed as part of Nepal's broader National Adaptation Plan (NAP) process, aimed at mainstreaming climate change adaptation across sectors. Its formulation was likely influenced by the global policy milestones, including the Paris Agreement and the 2010 UNFCCC conference of Parties in Cancun, which emphasized health as a priority area for climate adaptation. Likewise, the NAPA had identified public health as one of the sectors most vulnerable to the adverse impacts of climate change. Thus, HNAP was largely intended as a complementary document to strengthen the health component of NAP [26] .

Figure 1 presents the timeline of climate change and health related policies in Nepal. We identified and assessed 16 documents including national policies, strategies, plans and selected local level documents in Nepal (Table 2).

| SN | Table 2: Policy documents on climate change and health in Nepal | Source/Releasing authority |
|---|---|---|
| | **National level policy documents reviewed** | |
| 1 | National Climate Change Policy 2011 and 2019 | Ministry of Environment/MoFE |
| 2 | National Environment Policy 2019 | MoFE |
| 3 | National Health Policy 2019 | Ministry of Health and Population (MoHP) |
| 4 | Urban Health Policy, 2015 | MoHP |
| 5 | National Adaptation Programmes of Actions (NAPA) to Climate Change, 2010 | MoHP |
| 6 | National Adaption Plan (NAP) 2021–2050: Nepal | MoFE |
| 7 | National Framework on Local Adaptation Plans of Action (LAPA) 2011 and 2019 | MoFE |
| 8 | Health National Adaptation Plan (H-NAP), Nepal 2017 and 2023 | MoHP |
| 9 | The Fifteenth Plan (Fiscal Year 2019/20–2023/24) | National Planning Commission |
| 10 | Third Nationally Determined Contribution (NDC) 2025 | MoFE |
| 11 | Nepal Health Sector Strategy 2016/17-2020/21 | MoHP |
| 12 | Nepal Long-term Strategy for Net Zero Emission, 2021 | MoFE |
| | **Local level policy documents reviewed** | |
| 13 | Health Policy 2024, Kapilvastu Municipality | Kapilvastu municipality |
| 14 | Disaster Preparedness and Response Plan 2023, Kapilvastu, | Kapilvastu municipality |
| 15 | Local Disaster and Climate Resilience Framework 2024 (Draft) Budhanilkantha, 2024 | Budhanilkantha municipality |
| 16 | Waste management procedure 2018, Budhanilkantha | Budhanilkantha municipality |
| 17 | Local Adaptation Plans of Action (LAPA) Patarasi, 2022 | Patarasi rural municipality |
| *Table source: Authors' summary from policy documents* | | |

Following federalization, many policies were updated or newly introduced in 2019. The HNAP was subsequently updated in 2023. Together, these policies provide a framework for addressing climate-related health risks, though the extent of integration varies. The Climate Change Policy 2019, National Adaptation Plan (NAP) 2021, and HNAP 2023 explicitly recognize climate change as a public health concern. Other policy documents address related areas such as disaster risk management,

environmental protection, urban planning and water and sanitation that influence climate related health risks, but they do not explicitly frame these issues within a climate-health context.

# Climate change and health integration in policies

## Integration of health in core climate-related policies

The first Climate change policy in 2011 did not explicitly prioritize health, although it referenced disaster preparedness and outbreaks. In contrast, the second Climate change policy 2019 acknowledged health impacts and proposed strategies such as preparedness, forecasting and prevention mechanisms for climate-induced epidemics, particularly vector-borne and communicable diseases, and management for harmful and hazardous waste. However, it still lacked concrete implementation and monitoring and evaluation mechanisms for health adaptations, especially at the local level.

Some policies such as the National Environment Policy 2019 do not explicitly use the word climate change in their policies. Instead, the policy emphasizes reducing pollution, managing waste and promoting greenery, with implementation responsibilities assigned to local governments in alignment with federal and provincial priorities. The National Adaptation Plan (NAP) 2021–2050 identifies health, drinking water, and sanitation as a thematic component with specific adaptation programmes which focus on issues such as capacity building, WASH infrastructure improvement, climate-sensitive disease surveillance and emergency preparedness.

The third Nationally Determined Contribution (NDC) includes targets specific to health care waste, mainly non-burning technologies, multi-hazard monitoring and early warning system across provinces and integration of climate and weather data into existing surveillance systems. However, although climate sensitive disease surveillance has been envisioned by 2035 by NDC, it is still in its infancy, with piloting recently initiated in limited sentinel sites/hospitals.

The Local Adaptation Plan of Action (LAPA) 2019 is the dedicated document for the local level adaptation framework. It has suggested some possible adaptation options in health, which include informing stakeholders and community awareness, risk reduction for heat and cold waves, control of climate sensitive vector borne diseases, waste management, and reduction of indoor air pollution. However, federal KIIs suggest that not all local governments have formed LAPAs, and where LAPAs exists, health is often insufficiently addressed or absent. It was reported in Patarasi, one of the sites that LAPA was formed with the support of development partner and had been implemented focusing on development of climate adaptation action plan, primarily on physical infrastructure development for enhancing the climate adaptation, and health did not receive a priority.

## Integration of climate change in health sector policies

The health sector has produced many key policy documents such as the National Health Policy and sector-specific strategies. The 2014 Health Policy broadly recognized climate change as an emerging

health risk and emphasized multisectoral coordination, but it remained general and aspirational. The 2019 policy took a more operational approach by integrating climate considerations into disease preparedness, surveillance, and response systems. While this reflects progress toward health system readiness, both policies lack clear financing, accountability, and measurable implementation mechanisms. The Urban Health Policy 2015 prioritizes service quality, institutional strengthening, and integration of urban health within local development systems, targeting vulnerable urban populations. However, it has not addressed climate change, despite growing urban climate vulnerabilities.

A significant step taken by the MoHFS is the development of HNAP (2017–2021) and the current HNAP (2023–2030), a dedicated document on climate change and health adaptation. The previous HNAP was important in establishing a link on climate change and focused on identifying climate-sensitive diseases, and building awareness, and vulnerability assessments within the health sector. Building on this foundation, the newer HNAP expanded the scope by emphasizing climate resilient health systems and identifies key priorities such stronger surveillance of climate-sensitive diseases, climate-resilient including low carbon/environment friendly health infrastructure, and multi-stakeholder collaboration.

While Nepal's urban area is increasing, specific guidance for addressing climate change and health in urban areas is not available, highlighting the need to integrate climate risks into urban planning, infrastructure, and health systems.

At the local levels, relevant policies include the Health Policy, Disaster Preparedness and Response Plan, Waste management guidelines and LAPA. The urban site has relatively more policy instruments than the semi- urban and the rural sites, with a Local Disaster and Climate Resilience Framework currently under preparation. While all study sites possess foundational local policies, key informants indicated that climate risk assessments and adaptation measures are not systematically integrated into routine local health system planning across the settings.

Existing health sector policies increasingly establish the integration of health and climate change. Despite this, the KIIs indicate that climate risk assessments and adaption measures are not always systematically incorporated into routine planning process, particularly at province and local levels, limiting the capacity of subnational health systems to respond to climate-related health threats. Moreover, although health sector policies acknowledge climate change as a health concern, they lack clear operational frameworks or implementation guidelines to translate e adaptation priorities into practice. The health sector would benefit significantly if these plans provide structured, defined action plan for building climate resilient health systems, for example, how the individual health system building blocks will be made resilient at higher and facility levels. Further, achieving climate resilience by 2030 as envisioned would require accelerated interventions at all levels and guidance to local governments and health systems actors on their roles and how to integrate adaptation and mitigation in their work Regarding implementation, there is lack of monitoring and assurance of implementation of the policy directives. For instance, the progress status from the previous HNAP, the training of a targeted number

of health workforce is not known. Further, the health workforce, which is recognized as a critical component for climate-health actions, is insufficiently addressed across all the policies.

# Governance and institutional structures

At the federal level, climate governance in Nepal is formally structured, with clear ministerial mandates. Overall coordination on climate related matters is led by the Climate Change Management Division at MoFE, which serves as the national focal point for climate change governance. This division leads policy formulation, international negotiations (e.g., UNFCCC processes), and coordination of national adaptation and mitigation frameworks such as NDCs and NAPs. Within the health sector, responsibility for integrating climate change into health policies and programmes lies with the MoHFS. A designated focal person is assigned at the Health Coordination Division of the MoHFS for climate change and health, while operational responsibilities related to environmental health and healthcare care waste management are housed under the Management Division of the Department of Health Services. The MoHFS also has a Climate Change and Health Technical Working representing various ministries which coordinates technical work across ministries and oversees monitoring and evaluation of the H-NAP.

At provincial level, the Provincial Climate Change Coordination Councils are mandated to coordinate climate actions and align with national policies at the province level. However, the KIIs with provincial representatives from health inferred that its functionality varies across provinces and it is often less active. Further, no specific provincial technical working group or dedicated mechanism to link climate change and health coordination was found at this level.

At the local (municipality) level, the stakeholders highlighted the lack of climate change specific dedicated units or focal points for structured and focused initiatives. Across all sites, either the Environment or Disaster Management sections have some linkages with climate change. Within health, any roles relating to climate change activities are unclear or not well defined.

In Budhanilkantha (urban), the municipality has developed relatively advanced local policies addressing environment, public health, waste management, as well as a draft Local Disaster and Climate Resilience Plan under preparation. However, KII findings show that implementation lags significantly behind legislative intent. Climate change is not a routine agenda item in multisectoral municipal planning, and coordination remains limited. A key challenge unique to the urban context is cross boundary nature of environmental governance. Budhanilkantha lacks independent solid waste disposal capacity and relies on coordination with neighboring Kathmandu metropolitan city, constraining its ability to manage waste, a critical determinant of climate-related health risks. Unplanned urbanization and mixed land use further exacerbate environmental health vulnerabilities, particularly pollution and sanitation challenges.

In Kapilvastu (semi-urban), a Disaster Risk Reduction (DRR) plan has been developed in assistance of development partner., However, once the partner’s support became inactive, the local government struggled to execute the plan. Further climate change receives minimal attention in routine health governance and climate considerations are incorporated into annual work plan and budget indirectly,

majorly in the form of reactive measures to acute hazard events, example: emergency health camps or supplies.

*“There is often temptation to allocate budget for immediate relief distribution instead of planning for long-term preparedness and risk reduction. Relief work brings immediate, visible credit to the elected representatives, while risk reduction pays off only in the long term with no direct credit.” - KII_Development partner__Kapilvastu*

Similarly, in Patarasi municipality (rural), the disaster management section assumes responsibility for climate-related tasks but functions reactively and is largely inactive between acute emergency events. Inter-sectoral coordination exists to some extent, but planning processes seldom include joint discussions of climate risks. While in Budhanilkantha municipality (urban), there was a presence of disaster preparedness and response plan, where disaster management fund is allocated for reconstruction and relief materials distribution at disaster affected areas.

*“The structure within this rural municipality only becomes active in the event of a disaster; otherwise, it remains non-functional.” - KII, Rural Municipality Official, Patarasi*

Across all municipalities, Disaster Management Committees, chaired by municipal leadership and comprising ward representatives, security forces, Nepal Red Cross, and youth clubs, are formally established. Their mandate includes disaster mitigation planning and mobilization of emergency funds. However, their functioning is largely emergency-driven rather than preventive or adaptive.

Similarly, Rapid Response Teams (RRTs) exist in all sites and are trained primarily for outbreak investigation and emergency response. These teams, while operationally important during outbreaks, might have minimal integration of broader climate change or resilience perspectives.

*“Rapid response teams have received training through support from Nepal Red Cross, and has been responding to vector borne and infectious diseases such as cholera but not directly referenced to climate change, and more of reactive measures. During the outbreak, variety of awareness campaigns, including water purification initiatives, educating residents about the importance of drinking clean water, and providing cholera vaccinations.” - KII_Municipality official health section_ Kapilvastu*

# Policy communication and operationalization

A critical and consistent finding across all study sites and governance levels is the gap between policy formulation and subnational operationalization. Climate and health policies are predominantly developed through centralized, top-down processes led by federal ministries, informed by international commitments and, with limited substantive input from provincial and local governments. As a result, local ownership of these policies remains weak.

*"We can find the policy document online, but there is no direct effort from the higher authorities to orient local stakeholders." KII_Municipality official Kapilvastu*

*“I don't believe there is understanding of climate change policies, plans, and recommendations at the local level, as I myself don’t have proper reach of information about climate change while working at the local level.”- KII_Municipality official_Jumla*

Further, policy dissemination relies from sharing in websites and sometimes in some conferences and ad-hoc orientation events, reaching only selected participants and lacking systematic downward communication, clear operational guidelines, or binding implementation mechanisms. Consequently, local stakeholders often reported limited awareness and understanding of existing national climate and health policies.

Thus, this lack of policy orientation and insufficient understanding of climate and health linkages creates a major gap in awareness, understanding and implementation aligned with policy directives to the province and local governments. While federal actors generally show clarity about policy intent, information on roles, responsibilities, timelines, and operational pathways are not consistently communicated to subnational authorities. This has led to inconsistent interpretation and uneven implementation on the ground. Informants also noted that though good policy documents exist and sometimes ambitious too, the policy mandates do not necessarily imply binding implementations limiting their execution, and resource constraints further challenge the prioritization of climate change.

*“We have many good policy documents on paper, but because policies are made ambitious and also there is no strict legal or mandatory requirement to enforce them at all levels, they might not always be fully implemented when resources are tight.'- KII_Municipality Official_Kapilvastu*

# Understanding and capacities of climate and health among stakeholders

Across all sites, local level stakeholders reported that although they have awareness about climate change and its impacts, their knowledge is superficial, and their enthusiasm is mostly dependent on their personal interests. They also mentioned having limited confidence regarding understanding of the effects of climate change or potential solutions, and expressed uncertainties about educating communities on the subject due to their limited knowledge. Thus, a consistent finding across municipalities is the need for stronger technical expertise among focal persons and health workers to formulate or implement climate-health programmes.

Across all study sites, climate specific capacity building for health workers and municipal officials is limited. While the National Health Training Centre has developed climate and environmental health training packages, coverage at the local level remains limited and inconsistent. Climate change remains a relatively new agenda item at the local level, and staff often rely on external training rather than structured in-house capacity building. Most training received by local stakeholders such as health workers focuses on disaster response or disease specific issues (e.g., malaria, dengue), with climate change discussed only slightly. Formal orientations on climate-health linkages are rare, and staff often rely on personal interest or ad-hoc learning.

In Jumla, a municipality official mentioned an overall absence of climate-specific capacity building. Support from NGOs such mainly covered first aid, stretcher use, and fire extinguishers which was useful but not climate oriented. The infrastructure of Patarasi rural municipality also lacked dedicated climate trainings. Some indirect exposure existed through training including climate change topics such as; GIS training by the National Climate Change Support Program.

*“There isn’t such. We haven’t attended any capacity-building trainings... we are in a learning process’. If a problem arises, we are solving it through necessary coordination with colleagues from another municipality. I still feel that I am not completely known about the process” - KII, Rural Municipality Official, Patarasi*

# Integration and prioritization of climate actions in local plans

Across all governance levels, there is lack of dedicated budget line for climate change and environmental health in the current budget system. However, selected related activities are incorporated into the annual work plan and budget (AWPB) and implemented alongside other health priorities. But majority of activities related to climate change and environment health are conducted with development partners’ support on an ad-hoc basis based on emerging need and agreement with development partners. Within the MoHFS, climate relevant responsibilities are distributed across multiple units: environmental health programmes are managed by the Environmental Health Section, disease surveillance by the Epidemiology and Disease Control Division, and training by the National Health Training Centre. This reflects structured arrangement, yet the lack of framework limits the integration of various institutions, monitoring of the system performance and efficient use of resources and joint actions for climate resilient health systems.

Findings showed that local level stakeholders had limited understanding of the climate-health linkages and the uncertainty about what constitutes climate-health expenditure contribute to the low prioritization of climate actions in AWPBs. Although provincial and municipal stakeholders have a sense of the growing impacts of climate change in multiple sectors, what the health sector specifically can do to address these issues and what to include in their annual work plan and budget remains highly unclear to them. As a result, climate change is not well prioritized during local planning processes and municipal funding is predominantly reactive, directed toward emergency response and outbreak control rather than preparedness or long-term adaptation. Most climate and environmental health related activities are implemented on an ad-hoc basis, often dependent on development partner support, further constraining sustainability.

*“…the programs are on the health section’s annual plan. Currently, we have allocated budget for raising awareness about dengue, interaction program and for insecticide spraying. In terms of the spread of various infectious diseases, Kapilvastu municipality is now raising awareness about mosquito-borne diseases such as dengue. The budget has been allocated for such diseases, and programs are being implemented accordingly.” -KII_Municipality official heatlh section_Kapilvastu*

A promising but nascent initiative in Budhanilkantha involves the planned promotion of rainwater harvesting and groundwater recharge pits at the household level, a low-cost climate adaptation measure with direct health co-benefits. However, feasibility is constrained by land scarcity in dense urban areas, and the initiative remains at the planning stage.

# Political priorities and budget constraints

Budget limitations emerged as a significant and cross-cutting barrier, restricting municipalities' ability to invest in climate adaptation, preparedness, or preventive health measures. Participants emphasized that political representatives prioritized visible development projects, particularly road construction, over long-term climate resilience.

*“In the executive meeting, everyone lobbies for their own sector. Roads get the most priority.” -KII- municipality Official_ Budhanilkantha*

It was highlighted from the KIIs that there is insufficient budget allocation and integration of climate change programmes into municipal planning and annual budgets across different sectors.

# Multisectoral coordination

Effective climate-health action requires sustained collaboration across health, environment, agriculture, water and sanitation, urban development, and disaster management sectors. While coordination across these domains is still developing and often reactive, important foundations are being laid. At the federal level, a notable effort to strengthen coordination was the two-way agreement signed in 2022 between the Department of Health Services and the Department of Hydrology and Meteorology to integrate meteorological and hydrological data into the Early Warning and Reporting System (EWARS) for improved surveillance of climate-sensitive diseases. Although implementation is currently at a pilot stage in a few hospitals, this initiative demonstrates the potential for cross-sectoral collaboration

From the KII data, one of the systemic challenges identified by the local stakeholder was the institutional separation of climate change adaptation and disaster governance, which are managed by different line ministries at the national level such as MoFE and National Disaster Risk Management Authority. This separation results in confusion regarding roles and responsibilities and limited opportunities for integrated planning. In practice, disaster response receives more attention, while climate adaptation and preparedness remain sidelined. Confusion also exists at district and municipal levels regarding who should lead climate efforts, leading to duplication or gaps in planning.

As one development partner noted:

*“I believe the government is tackling climate change and disasters separately, even though these two can be combined and are interrelated. There is a separate sector or line agency to deal with disasters and a separate line agency to deal with environmental climate change, so there is no integration between these two sectors, and this practice has spread to the district and municipality levels, which is a source of concern.” -KII_ Development Partner_ Jumla*

Further, across study sites, such coordination remains mainly episodic, characterized by siloed institutional cultures and engagement that is largely triggered by acute disaster events rather than proactive, long-term planning. Overall, the lack of institutional integration and routine cross-sectoral engagement continues to limit coherent climate-health planning and the development of resilient, forward-looking adaptation strategies.

## Discussion

This study reviewed key climate and health related policies in Nepal to assess the integration of climate change and health and how policies are communicated and implemented in practice. The findings show policy recognition and institutional commitment, but persistent challenges in translating policy goals in routine practice. Major barriers include the lack of clear implementation and adaptation guidelines across governance level, limited understanding of climate-health linkages and unclear roles, especially at the local level. Further challenges include lack of integration of climate considerations into planning and budgeting processes; inadequate monitoring and accountability mechanisms; and resource and capacity constraints, often compounded by priorities.

# Policy progress and emerging initiatives

Nepal has made progress among LMICs in recognizing climate change as a public health concern. The development of the HNAP and inclusion of health priorities within national climate frameworks, such as the NAP and NDCs reflect growing political attention of climate related health risks. This policy trajectory aligns with global efforts to position health as a core component of climate adaptation, consistent with guidance from the World Health Organization and the UNFCCC processes [22, 27].

The H-NAP provides a vision for climate-resilient health systems, with a focus on strengthening surveillance of climate-sensitive diseases, resilient health infrastructure, preparedness and response. These priorities align with international frameworks that conceptualize climate resilience across health systems[22, 28]. Emerging initiatives in Nepal such as collaboration between health and meteorological departments to integrate climate data into disease surveillance demonstrate early steps toward operationalizing climate health linkages.

# Policy ambition and operational ambiguity

Despite these policy advances, implementation has not kept pace with strategic ambition particularly at local levels. While national policies recognize climate change as a health threat, they often do not provide practical guidance on how actions should be implemented. Roles and responsibilities are frequently unclear, funding mechanisms are uncertain, and monitoring arrangements are inconsistently applied. This gap between policy intent and practice reflects a global challenge especially in LMICs in climate-health governance, where strong commitments are not always supported by enabling institutional and financial systems needed to make them work [29, 30]

In Nepal, this challenge is particularly visible in local contexts. Local governments are expected to include climate considerations in their routine planning and budgeting, yet they receive little clarity on how national frameworks such as the HNAP should be adapted to local contexts. As a result, implementation varies across municipalities, and climate-health actions tend to be unevenly prioritized, depending on local capacity, leadership, and resources. Further, decentralization creates opportunities for context specific climate and health planning that better reflect local needs, but these benefits can only be realized when responsibilities are matched with adequate funding, technical capacity, and clear guidance[31, 32]. In Nepal, local governments carry substantial implementation responsibilities without sufficient institutional support, widening the gap between national policy commitments and local-level action[33].

# Capacity, knowledge, and the climate-health action gap

In this study, across study sites, stakeholders from health and other sectors reported low understanding of climate change and its links to health outcomes. As climate change is a relatively new agenda item, insufficient training and capacity building have contributed to uncertainty about which interventions should be prioritized. This creates confusion while making annual work plans and budgets, as what interventions the health sectors needs are not clear; more local evidence is required to guide routine planning.

These gaps affect integration of climate considerations into routine planning. Similar challenges are reported in LMICs, where low technical capacity, low risk perception, and lack of decision-support tools constrain adaptation [34, 35]. Nepal's training institutions and disease-specific programmes could provide platforms for mainstreaming climate-health competencies, but this potential remains underutilized.

# Local priorities and monitoring

Inadequate monitoring and accountability mechanisms for policies were identified as one of the prominent barriers in this study. Although some policies, for example the National Climate Change policy refer to monitoring frameworks, implementation of oversight mechanisms appears limited. The lack of defined indicators, reporting channels, and enforcement mechanisms reduces institutional incentives for compliance. Integrating climate-health indicators into existing health information systems could be one way to support monitoring [36].

# Implications for climate-resilient health systems

The findings suggest that Nepal has established a strong policy base for climate-resilient health systems, but turning this into practice requires clearer guidance, better coordination across levels of government, capacity building, and financing aligned with local responsibilities. For countries undergoing decentralization, Nepal's experience shows the need to embed climate adaptation within ongoing health system reforms [37]. Treating climate change as part of routine planning, budgeting, surveillance, and

workforce development rather than as a separate agenda may provide a more sustainable path to resilience [29, 38].

# Strengths and limitations of the study

This study contributes to the literature by providing a combined policy and implementation analysis of climate-health integration within a federalized LMIC context. By examining not only policy content but also communication, institutional arrangements, and subnational operational dynamics, it offers insight into systemic barriers beyond formal policy commitments. Addressing these systemic challenges is essential not only for Nepal but also for other LMICs seeking to build climate-resilient health systems.

Despite this, the study has some limitations. It is cross-sectional and relies on document reviews and stakeholder perspectives, which may not fully capture all provincial or municipal variations. Further, implementation dynamics are also evolving, and recent policy developments may not yet be reflected in practice. Despite these limitations, the findings offer lessons for Nepal and comparable settings.

# Conclusions

This study shows that Nepal has made important progress in recognizing and addressing the intersections between climate change and health through national policies, yet translation into practice remains limited, particularly at local levels. Weak policy communication, unclear implementation guidance, limited institutional capacity, insufficient monitoring, and resource constraints have resulted in poor understanding and low prioritization of climate actions in routine planning and budgeting. Climate-health responses therefore remain fragmented and largely reactive. Bridging this gap requires stronger implementation frameworks, improved coordination across levels of government, increased technical capacity of subnational levels, and integration of climate priorities into health systems and health priorities into climate related planning and financing. Advancing these efforts is essential for protecting public health and building climate-resilient health systems across all levels.

# Abbreviations

AWPB Annual Work Plan and Budget

HNAP Health National Adaptation Plan

KII Key Informant Interview

LAPA Local Adaptation Plan for Action

LMIC Low- and Middle-Income Country

MoFE Ministry of Forests and Environment

MoHP Ministry of Health and Population

MoHFS Ministry of Health and Food Safety

NAP National Adaptation Plan

NDC Nationally Determined Contributions

UNFCCC United Nations Framework Convention on Climate Change

WHO World Health Organization

# Declarations


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### Authors' contributions

JR, SW, SB, KD, YPJ, SR and BRB conceptualized the study and design. JR, SW, SB, SR, and KD led in grant acquisition. SR and BRB oversaw data collection with support from AR, AD, BS and SS. BRB and AR

conducted data analysis and interpretation, supported by SR. BRB prepared the manuscript with support from SR and AR. JR, SW, KD and YPJ reviewed the manuscript. All authors read and approved the final manuscript.


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### Data availability

Relevant study materials and supporting files are provided in the text. The qualitative data generated and analyzed from this study are not publicly available, as they include interviews from informants who consented to using data solely for this research and not for public storage. Data may be made available from the corresponding author upon reasonable request.

### Ethics approval and consent to participate

The study received ethics approval from the Ethical Review Board of the Nepal Health Research Council, reference 748/2024. All participants provided written informed consent for data collection. All procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki.

**Consent for publication**

Not applicable.

**Competing interests**

Th authors declare no competing interests.

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# Figures

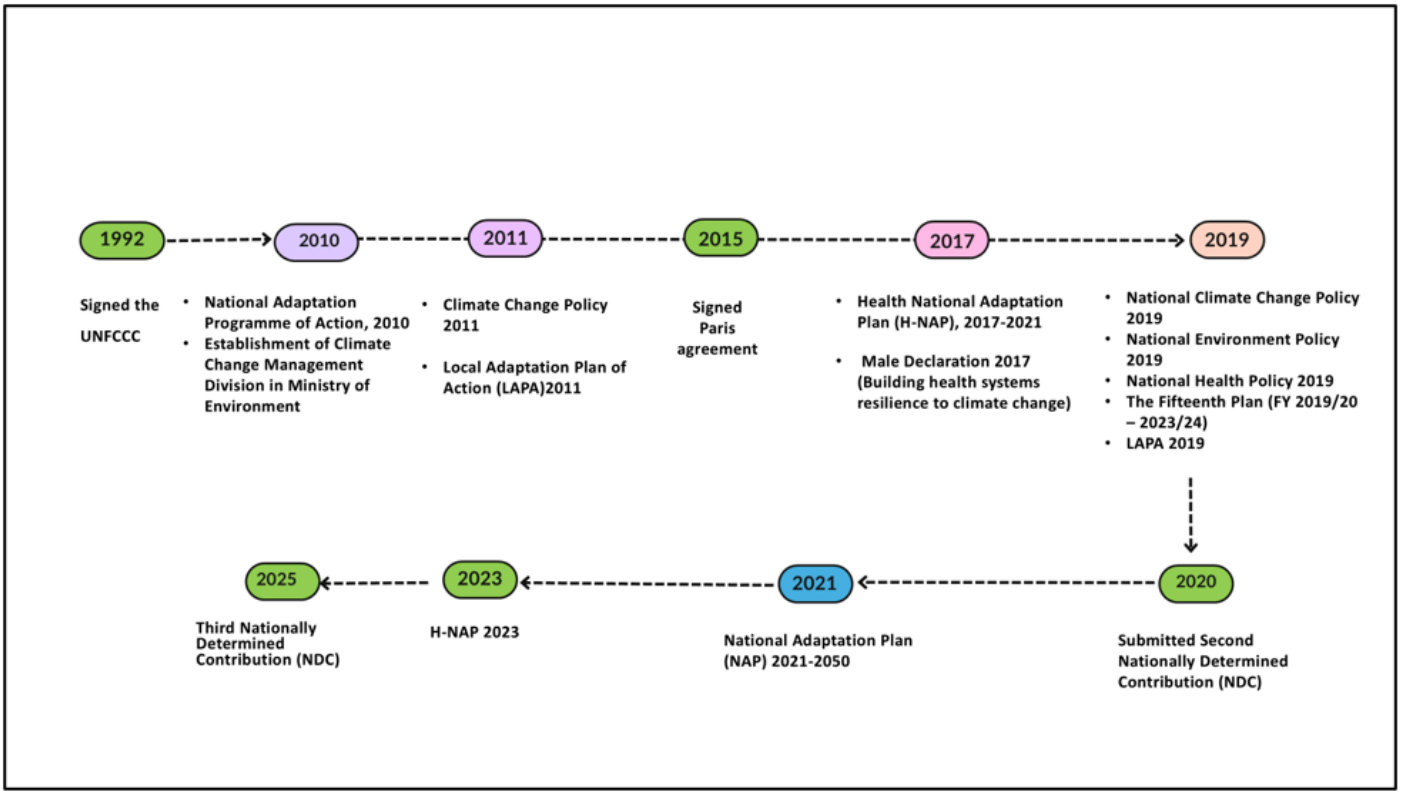



**Figure 1**

Climate change and health policy trajectory (Nepal)

# Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Supplementaryfile1COREQchecklist.docx
- Supplementaryfile2KIIguide.docx