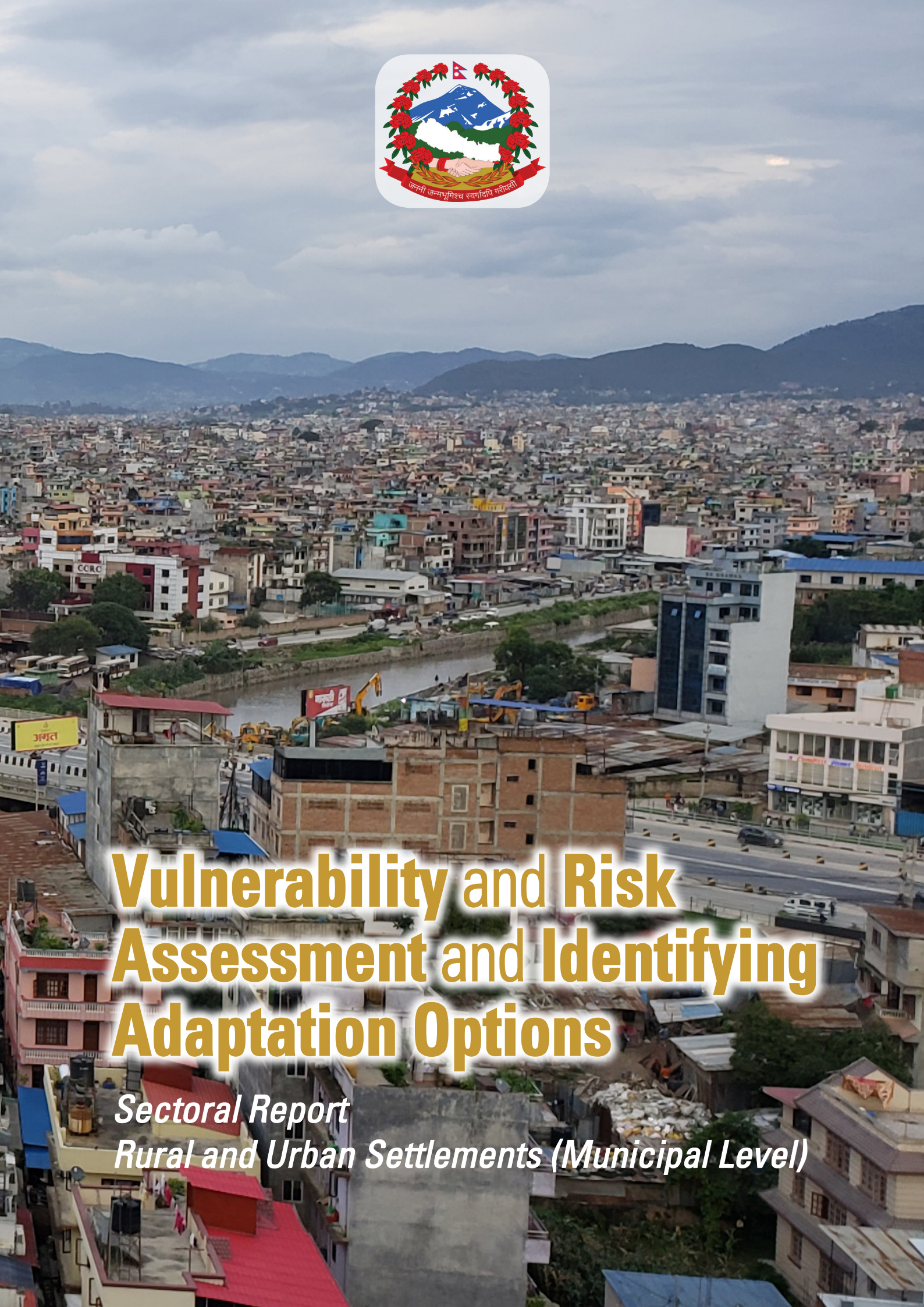

# Vulnerability and Risk Assessment and Identifying Adaptation Options

## *Sectoral Report*
## *Rural and Urban Settlements (Municipal Level)*

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**Disclaimer**
Due to unavailability of data at settlement level, the study was carried out at analyzing the available data at the municipal level. The Thematic working group led by the Ministry of Urban Development (MoUD) noted this constraint during approval of this report.

# Foreword

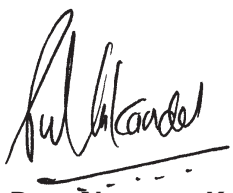
Human-induced climate change is already affecting many weather and climate extremes in every region across the globe. The latest IPCC report confirms that human activities have changed our climate and led to the more frequent heatwaves, floods, droughts, and wildfires that we have seen recently. The evidence is incontrovertible. This highly influential report provides the evidence base and impetus to develop policy strategies and practices that will help people around the world and in Nepal live with and adapt to change.

Nepal has been a pioneer in the development and implementation of effective adaptation policies and practices. Nepal has made a strong commitment to updating a mid-long term National Adaptation Plan (NAP) every ten years, as well as conducting a National level Vulnerability and Risk Assessment every five years to inform climate resource allocation policies. Vulnerability and Risk Assessment (VRA) was initiated to assess vulnerability and risk at the national, physiographic, province, municipal, and sector levels to inform the Government of Nepal's current NAP formulation process.

I am pleased to see that the VRA report on Rural and Urban Settlements (municipalities) was prepared by identifying sector-specific current vulnerability and future risk based on a solid scientific foundation and information. This report is the result of a thorough consultation process with national and provincial stakeholders and experts. This report, I believe, provides an opportunity for policymakers, decision-makers, and practitioners to make informed decisions about sector-specific vulnerability and risk to build a climate-resilient society and reduce the impacts of climate change at the local, provincial, and federal levels.

On behalf of the Ministry of Forests and Environment, I would like to thank the distinguished Chair - the Joint Secretary of the Ministry of Urban Development (MoUD)- and all the respected thematic group members who provided technical guidance to finalize this report. In addition, I gratefully acknowledge the assistance provided by the Climate Change Management Division, particularly Dr Radha Wagle and all technical committee members.

I also take this opportunity to acknowledge the funding and technical support of the British Embassy Kathmandu, and Policy and Institutions Facility (PIF) /Oxford Policy Management Limited.



**Dr Pem Narayan Kandel**
Secretary
Ministry of Forests and Environment (MoFE)

# Acknowledgment

The National Climate Change Policy (2019) identifies eight thematic areas and four cross-cutting areas which will be impacted by climate change. As such, there is a pressing need to understand how public and private investments might be impacted. Without adequate information on risks and vulnerability, it will be difficult to translate policy into action. To plan and implement a successful adaptation strategy, it is vital to understand the likely impacts of climate change on different sectors and communities, and, in particular, how these may evolve in the future.

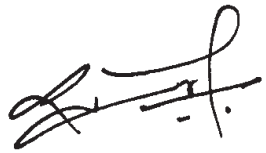
A National Adaptation Plan (NAP) needs to be developed based on a strong scientific foundation and reliable evidence. This includes data and information about how the climate has evolved in the recent past and how it may further change in the future. To realise this, the MoFE has carried out detailed Vulnerability and Risk Assessments (VRAs) of the thematic areas identified by the National Climate Change Policy at the municipal, district, and regional scales. The VRA framework and methodology presented in the report are based on the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) and the NAP technical guidelines of the UNFCCC.

This VRA report contributes to the establishment of a strong baseline for climate change impacts, risks, and vulnerabilities in Nepal. In particular, it presents relevant information on social and structural vulnerabilities and risks triggered by the interaction of climate change and socio-economic, governance, political and cultural norms and practices. The report also offers a range of adaptation options for reducing root causes of vulnerability and risk, including enhancing social inclusion and reducing gender disparity.

On behalf of the Climate Change Management Division (CCMD), I would like to extend my appreciation to the chair, vice-chair, member secretary, and all the members of the Thematic Working Groups (TWGs) on Rural and Urban Settlements (RUS) for providing guidance and input in the VRA process. Also, I acknowledge the input provided by federal, provincial, and local governments, national and international organizations, community-based organizations, and communities.

Special thanks goes to the technical committee members Raju Sapkota, Dr Arun Prakash Bhatta, Srijana Shrestha, Hari Pandey, Dr Indira Kandel, Gyanendra Karki, and Dr Bimal Raj Regmi who supported and facilitated the VRA process. We would also like to thank Gita GC, Basana Sapkota, Dr Nilhari Neupane, Dr Shiba Banskota, Apar Paudyal, Dr Ram Prasad Lamsal, Dr Pashupati Nepal, Dr Bhogendra Mishra, Regan Sapkota, Pratik Ghimire, Rojy Joshi, Bamshi Acharya, Goma Pandey, and Prashamsa Thapa, from the PIF, who provided technical insights and were involved in producing this report.

Besides, I also take this opportunity to acknowledge the funding and technical support of the British Embassy Kathmandu, and Policy and Institutions Facility (PIF)/Oxford Policy Management Limited.



**Dr Radha Wagle**
Joint Secretary
Climate Change Management Division
Ministry of Forests and Environment (MoFE)

# List of Acronyms

| | |
|---|---|
| AC | Adaptive Capacity |
| AHP | Analytical Hierarchical Process |
| CBS | Central Bureau of Statistics |
| CDD | Consecutive Dry Days |
| CGI | Corrugated Galvanised Iron |
| CO2 | Carbon Dioxide |
| CWD | Consecutive Wet Days |
| DHM | Department of Hydrology and Meteorology |
| DoS | Department of Survey |
| DoTM | Department of Transport Management |
| DUDBC | Department of Urban Development and Building Construction |
| DWSS | Department of Water Supply and Sanitation |
| DWRI | Department of Water Resources and Irrigation |
| EFLGP | Environment-Friendly Local Governance Programme |
| EIA | Environmental Impact Assessment |
| FAO | Food and Agriculture Organization |
| GDP | Gross Domestic Product |
| GESI | Gender Equity and Social Inclusion |
| GLOFs | Glacial Lake Outburst Floods |
| GoN | Government of Nepal |
| HBASE | Global Human Built-up and Settlement Extent |
| HDI | Human Development Index |
| HH | Household(s) |
| HML | High Medium Low |
| HMIS | Health Management Information System |
| HRRP | Housing Recovery and Reconstruction Platform |
| HR | Human Resource |
| HPI | Human Poverty Index |
| ICIMOD | International Centre for Integrated Mountain Development |
| IDMC | Internal Displacement Monitoring Centre |
| IEE | Initial Environment Examination |
| IOM | International Organization for Migration |
| IPCC | Intergovernmental Panel on Climate Change |
| IUDP | Integrated Urban Development Plan |
| LDC | Least Developed Countries |

| | |
|---|---|
| LEG | Least Developed Countries Expert Group |
| LGOA | Local Government Operation Act |
| LPG | Liquefied Petroleum Gas |
| MICS | Multiple Indicator Cluster Survey |
| MLD | Million Litre per Day |
| MoEST | Ministry of Education, Science, and Technology |
| MoF | Ministry of Finance |
| MoFE | Ministry of Forests and Environment |
| MoFAGA | Ministry of Federal Affairs and General Administration |
| MoFALD | Ministry of Federal Affairs and Local Development |
| MoHP | Ministry of Health and Population |
| MoHA | Ministry of Home Affairs |
| MoPE | Ministry of Population and Environment |
| MoSTE | Ministry of Science Technology and Environment |
| MoUD | Ministry of Urban Development |
| MUAN | Municipal Association of Nepal |
| NAP | National Adaptation Plan |
| NAPA | National Adaptation Programme of Action |
| NAAQS | National Ambient Air Quality Standards |
| NBC | National Building Code |
| NLFS | Nepal Labour Force Survey |
| NPC | National Planning Commission |
| NPR | Nepali Rupee(s) |
| NSET | National Society of Earthquake Technology |
| NUDS | National Urban Development Strategy |
| NUP | National Urban Policy |
| PM | Particulate Matter |
| RCC | Reinforced Concrete Cement |
| RCP | Representative Concentration Pathway |
| RUS | Rural and Urban Settlements |
| SDG | Sustainable Development Goals |
| SWM | Solid Waste Management |
| TWG | Thematic Working Group |
| UHI | Urban Heat Island |
| VRA | Vulnerability and Risk Assessment |
| VNR | Voluntary National Reporting |
| WPI | Water Poverty Index |

# Executive Summary

## Context Summary and Objectives of the Assignment

Nepal's urban and rural settlements are local drivers of economic prosperity and development. Over the past few decades, Nepal has observed the growth of urban settlements primarily driven by rural-to-urban migration, by a population in search of better opportunities, and the natural growth of urban areas. With the federal restructuring process of Nepal in 2017, urban and rural municipalities are increasingly seen as important institutions for addressing both development and environmental and climate change challenges.

However, rural and urban governments have to overcome several challenges and fully harness their potential to create an environment that enables the development of inclusive, smart, environmentally friendly, and sustainable municipalities. Over the years, Nepal has observed an increasing rate of urbanization and rapid urban growth, and this has been beyond the carrying capacity of its urban areas. Urban areas also have shortcomings, such as insufficient urban infrastructure and inadequate provisioning of services. Furthermore, climate change brings an additional threat to existing development challenges. It is an urgent task for municipal governments to ensure rural and urban settlements are inclusive, safe, resilient, and sustainable.

The government of Nepal, as a party to the United Nations Framework Convention on Climate Change (UNFCCC), has initiated the National Adaptation Plan (NAP) formulation process. In this regard, assessment of vulnerability and risk (VRA) to urban and rural settlements is an integral part of the NAP process. The overall objective of this study was to assist Nepal's NAP process in assessing climate-related risk and vulnerabilities in districts, provinces, and physiographic regions, and by identifying appropriate adaptation options relevant to the sector. It was expected that this exercise would provide key options for decision-makers to fully address adaptation concerns and integrate climate risks and vulnerabilities when planning and designing the process of urban and rural settlement.

## Methodology Summary (Framework, Approach, Methodological Process)

The Vulnerability and Risk Assessment (VRA) methodology adopted a stepwise bottom-up and top-down approach which ensured the participation of and consultation with local communities, stakeholders, and relevant experts. The methodology was guided by the overarching national VRA framework developed by the Government of Nepal. The core focus of this assessment was to characterize vulnerabilities, disasters/hazards, and exposure based on past impact, and understand potential future risks.

As a first step, possible indicators for exposure, sensitivity, and adaptive capacity concerning urban and rural settlements were identified through an extensive literature review. 95 indicators were selected for four subsectors of municipalities: (i) Socioeconomic—25; (ii) Building and settlement—36; (iii) Physical infrastructure—20; and (iv) Social infrastructure—14. Besides this,

36 indicators were identified covering the exposure, sensitivity, and adaptive capacity of rural municipalities. These selected indicators were finalized in consultation with members of the technical committee and the thematic working group (TWG). Indicator-wise data was collected from various authenticated sources—mostly from published and unpublished reports produced by the government, development organizations, civil society, and peer-reviewed articles.

Due to the limitation and availability of comparable data, only 293 municipalities were taken for broader analysis in the VRA assessment, and the remaining 460 rural municipalities were analysed with a limited number of indicators due to a lack of sufficient data and resources. Using the min-max method, the collected data was tabulated, filtered, and normalized to transform it into unitless values. Each piece of normalized data was given weightage and a priority by using the pair-wise comparison described in the Analytical Hierarchy Process (AHP) model, with 9 scales of importance ranging from equal importance (1) to extreme importance (9). The aggregated value of each indicator of exposure, sensitivity, and adaptive capacity was calculated using the weighted linear summation method.

The vulnerability—subsector-wise, and cumulative of rural and urban settlements—was determined by the aggregated value of sensitivity and adaptive capacity as defined by the IPCC-Assessment Report – Five. Once calculated, the subsector and sector-wise cumulative vulnerability and risk indexes of the district, province, and physiographic regions were ranked into five classes: (a) Very low (b) Low (c) Moderate (d) High (e) Very high. Climate extreme events, as proxy hazards and climate risk indexes, were assessed on three temporal scales—baseline period, 2030, and 2050—under two Representative Concentration Pathways (RCPs)—4.5 and 8.5—and ranked. The ranks calculated were presented in the form of both thematic maps and numerical values. This is to better aid decision-makers in setting priorities, and selecting adaptation interventions and required investments at national, provincial, and local government levels.

## Climate Change Impacts in the Sector

Based on historic climate extremes in Nepal, it was found that rural and urban settlements are impacted by climate variability and climate-induced disaster events. Rural and urban settlements are primarily impacted by floods, landslides, droughts, epidemics, heatwaves, cold waves, and fires. The consequences are massive, with loss and damage to life and property, physical and social infrastructure, cultural heritage, and disrupted socioeconomic services. Additionally, the impact includes inadequate access to basic services, issues related to health, sanitation, hygiene, air and water pollution, migration, and an increase in informal and squatter settlements. The impact is generally highest among children, women, the elderly, expectant mothers, people with chronic health problems, and disadvantaged population groups.

The key issues and challenges posed by the impact of climate change on the sectors are (i) the increasing rate of urbanization and growth beyond its carrying capacity; (ii) lack of state-of-the-art rural and urban planning and development that is resilient and sustainable; (iii) uncontrolled construction and structural design of houses and buildings in risk-prone areas; (iv) lack of affordable housing and an increase in squatter settlements and urban slums; (v) increase in impervious land surface areas, insufficient drainage, and increased surface runoff; and (vi)

increase in risk and vulnerability due to non-compliance with standard regulations and building code during infrastructure construction.

## Climate Change Exposure

The overall findings show a majority of urban municipalities (26) and rural municipalities (85) represent a 'high' to'very high' degree of exposure to climate change. Biratnagar, Lalitpur, Kathmandu, Birgunj, Bharatpur, Pokhara Lekhnath, Ghorahi, Tulsipur are the older and bigger towns developed as metropolitan and submetropolitan areas and are very highly exposed municipalities. The majority of highly exposed municipalities are those that were established or declared in 2011 or earlier and are highly populated and have high infrastructure investment and development in terms of availability of roads, irrigation, health and education infrastructure, cultural heritage sites, and market centres. The remaining 267 municipalities and 375 rural municipalities across Nepal are characterized by'moderate' to'very low' exposure to climate change, respectively. These municipalities are less populated and have inadequate infrastructure development. The least exposed municipalities include the newly declared ones with a limited population, infrastructure, and resources. Rural municipalities from the Tarai of provinces One, Lumbini, and Sudurpaschim, and the municipalities from the mid-hills of Bagmati and Gandaki provinces, are highly exposed.

## Climate Change Vulnerability: Sensitivity and Adaptive Capacity

The municipality-wise sensitivity and adaptive capacity index was analysed based on how municipalities ranked for susceptibility to climate extreme events and disasters and included the sector's capability to adjust to the impacts of climate change. The overall findings demonstrate that, in total, 121 municipalities and 167 rural municipalities show a 'high' to 'very high' degree of sensitivity to climate-related stimuli. These municipalities are scattered across all seven provinces in Nepal and are highly sensitive to climate change, given that they have sensitive features such as slope, geology, and soil character. Also, municipalities in hilly and mountainous regions, and some in the flood-prone Tarai region, are located near hazard-prone areas such as along riverbanks.

The assessment shows that, in total, 40 urban municipalities are found to have 'high' to'very high' adaptive capacity. Whereas 179 urban municipalities have 'low' to'very low' adaptive capacity. Higher adaptive capacity was found in municipalities established before 2011, as compared to newly established/declared ones. Municipalities such as Biratnagar, Birgunj, Damak, Kathmandu, Butwal, Itahari, Pokhara Lekhnath, etc. exhibit 'high' to'very high' adaptive capacity categories. 155 rural municipalities, mostly in Province 2, Karnali Province, and Sudurpaschim Province, have 'very low' and 'low' adaptive capacity; there are less than a dozen rural municipalities in other provinces which have low adaptive capacity.

With regards to vulnerability, the findings show that among 293 urban municipalities assessed, 37 fall under the 'very high' vulnerability ranking; 52 under 'high'; 42 under 'moderate'; 58 under 'low'; and 104 under 'very low'. Older, established metropolitan, sub metropolitan and municipal areas, such as Pokhara, Dharan, Kathmandu, Biratnagar, Lalitpur, Dhangadi, Dharan, Dhankuta, etc., have

both a very high adaptive capacity and a very low vulnerability to climate change. 'High' to 'very high' vulnerability category municipalities were found in all the seven provinces, i.e., 21 municipalities from Province one, 9 municipalities from Province two, 17 municipalities from Bagmati Province, 19 municipalities from Gandaki Province, 18 municipalities from Lumbini Province, 21 municipalities from Karnali Province and 21 municipalities from Sudurpaschim Province.

Additionally, a total of 85 rural municipalities has 'very high' vulnerability, and 130 others have 'high' vulnerability to climate change. These vulnerable rural municipalities are distributed across all physiographic regions of the provinces. Karnali and Sudurpaschim are the most vulnerable provinces in both rural and urban contexts.

## Climate Change Risk in Rural and Urban Settlements (RUS)

There will be an increased risk of climate change impacts in rural and urban areas. This is due to increased temperatures and extreme variability in rainfall triggering massive climate extreme events and hazards. The key climate change stressors identified in the RUS sector are changes in precipitation, extreme wet days, consecutive wet days, and temperature. An assessment of baseline risk in the sector shows a higher level of risk is observed in municipalities located in the hilly, Siwalik, Chure, and middle mountain regions. Old towns and developed cities are in the low-risk category due to their low sensitivity, which is influenced by the higher adaptive capacity of their respective municipalities. Low-risk municipalities include Dharan, Nijgadh, Parsagadhi, Bhaktapur, Changunarayan, Shankharapur, Bharatpur, Baglung, Beni, Butwal, and Lumbini Sanskritik. In all the projected scenarios, the number of municipalities at high risk will increase. There are 44 municipalities at 'very high' and 'high' risk in the baseline scenario, but this will increase to 86 in RCP 4.5 (2030), 91 in RCP 4.5 (2050), 74 in RCP 8.5 (2030), and 95 in RCP 8.5 (2050). In the case of rural municipalities, 54 are at 'very high' or 'high' risk in the baseline scenario, but this will increase to 97 in RCP 4.5 (2030), 99 in RCP 4.5 (2050), 84 in RCP 8.5 (2030), and 106 in RCP 8.5 (2050). This projected increase in risks is due to the change in precipitation-related extreme events, and the limited coping and adaptive capacity of municipalities.

## Adaptation Options in Rural and Urban Settlements

The analysis of impact, vulnerability, and risk shows that municipalities in Nepal face critical loss and damage now and are likely to continue to do so in the future, affecting all settlements and associated livelihoods. Considering this, short, medium, and long-term adaptation options were identified to address the rural and urban settlements' current and future concerns. These options emphasize the full integration of adaptation into development planning, budgeting, and monitoring and evaluation systems for municipalities. They also emphasize that the government takes a holistic approach to systemically addressing critical needs, thereby making rural and urban settlements inclusive, safe, resilient, and sustainable. The adaptation options identified are expected to ensure that they are child-friendly, disabled-friendly, old-age-friendly, and GESI-friendly to ensure rural and urban services and functions are accessible to all. Key adaptation options are described below.

Key areas of adaptation intervention in rural and urban municipalities are risk-transfer measures such as insurance schemes; equal livelihood diversification and employment; inclusive climate risk management; informal settlers and affordable housing; and improved health surveillance.

Key areas of the adaptation option in building and settlement include the provision of strict implementation of integrated urban development plans; implementation of building codes; development of policies and guidelines to incentivize green buildings and the use of clean energy; land-use plans with green areas, parks, and water management schemes; structural protection measures to prevent urban and rural municipalities from floods and landslides; capacity-building of municipalities to implement sustainable urban and rural development.

Key areas of adaptation options in physical infrastructure include climate-resilient design and timely maintenance of road infrastructure; development of municipal transportation masterplans, urban drainage master plans, and solid waste management; water retention systems; technology for irrigation and water management; pollution tax on vehicles; and awareness of climate change among citizens.

Key areas of adaptation options in social infrastructure include the development of climate-resilient design guidelines for critical infrastructure; construction of efficient public buildings and infrastructure that citizens use; retrofitted technologies for critical infrastructure where climate risks are high; ensuring the development of new social infrastructure based on projected population growth; and ensuring the protection of cultural heritage and maintenance practices for critical social infrastructure.

## Conclusion and Recommendations

The overall findings show the negative impact of climate change has aggravated existing issues within the rural and urban sectors. Particularly susceptible is the large rural, and often increasingly urban, population of infants, young children, senior citizens, expectant mothers, and people with chronic diseases or compromised immune systems. There are food and water security issues in settlements exposed to higher temperatures (especially in heat islands), and unexpected cold spells. This assessment recommends enhancing the institutional capacity of all municipalities to engage in the climate-resilient planning process to ensure inclusive, safe, resilient, and sustainable urban and rural development in Nepal. At the same time, the local government should take opportunities to localize the international commitments made under the New Urban Agenda and Sustainable Development Goals in Nepal. For future assessment, it is recommended that current data gaps be minimized with the creation of a systematic database with relevant information and indicators to represent climate change impact, vulnerability, and risk—so that all 753 municipalities can be considered broadly for climate change vulnerability and risk analysis and assessment.

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Chapter 1

# Background and Sectoral Context

## 1.1 Background

The world is witnessing a rapid demographic transition that is continuing to shape the human-built environment in new ways, as more than half of the world's population now lives in urban areas. The rapid spatial[1] and demographic transformation has led to a population shift through rural-to-urban migration (in search of better opportunities and quality of life), reclassification (conversion of rural areas into urban areas), and natural growth of urban areas (Muzzini & Aparacio, 2013). This change has brought varying socioeconomic opportunities as well as development challenges to the population living in cities, towns, and villages.

Human settlement refers to the totality of the human community with all the social, material, organizational, and cultural elements that sustain it (UN, 1976). In rural areas, the primary/dominant activities are agriculture, forestry, mining, fishing, etc. Whereas urban areas are centres for economic development and growth, such as in health, education, food processing, banking services, etc (Pradhan, 2004).

Nepal is the least urbanized country in the world. Over the years, it has adopted various criteria for defining urban and rural areas, to accompany changes in administrative boundaries resulting from political changes. In 1952/54, urban areas were defined as those with a population of over 5,000. With the federal restructuring in 2017, criteria were redefined to meet basic urban facilities (Chapagain, 2018). Municipalities in Nepal are de facto urban areas (cities and towns) designated as incorporated municipalities by the government, meeting the minimum criteria for population, infrastructure, and revenues (MoUD, 2017). The Local Government Operation Act (LGOA) 2074 of the Government of Nepal categorizes settlement areas according to the rising hierarchy of 'rural municipality', 'municipality', 'sub metropolitan', and 'metropolitan'; this is in terms of population, annual revenue, and available services[2]. However,

1 Spatial Transition: Demographic transformation due to rural to urban migration

2 Available services are categorised as available road network, electricity, drinking water, communication, solid waste management / landfill sites, open spaces and parks, bed capacity of hospital, public toilets and bus parks, financial institutions, community hall, stadium, cinema theatre, university, museum, airports, hotel and lodges, market area, slaughterhouse, cremation area, town development plans.

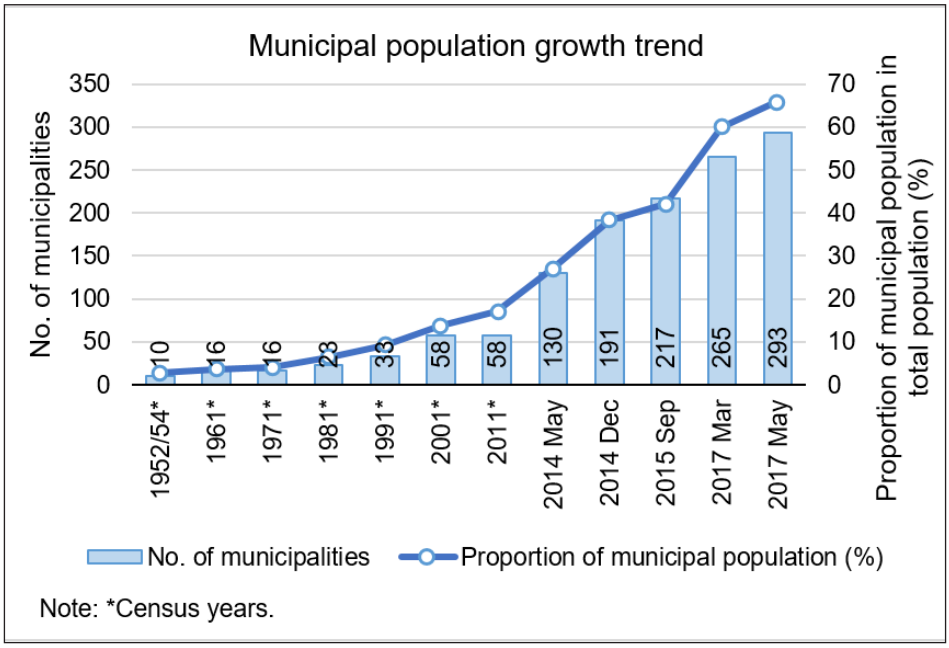



**Figure 1: Municipal Population Growth Trend**

Source: IIDS (2019)

most newly declared municipalities are rural in character when criteria such as access to and availability of physical facilities, literacy, occupational structures, and educational attainment are considered.

In 2011, there were only 58 municipalities in Nepal. After the federal restructuring, there are 753 local government units: 6 metropolitan cities; 11 sub-metropolitan cities; 276 municipalities; and 460 rural municipalities within 7 provinces. Areas designated 'urban' in Nepal total 293. More than half of the country's population (62.2%, compared to 17% in 2011 and 40% in 2017) is now estimated to be living in urban areas, as shown in Figure 1 (CBS, 2011; MoUD, 2017; MoUD, 2020), and the remainder in rural areas. Details of the province-wise distribution of municipal governments are in Table 1, below.

**Table 1: Province-wise Distribution of Municipal Governments of Nepal**

| Province | Districts | Municipal Governments | | | | | Total Wards |
|---|---|---|---|---|---|---|---|
| | | Metropolitan City | Submetro-politan City | Municipality | Rural Municipality | Total | |
| Province 1 | 14 | 1 | 2 | 46 | 88 | 137 | 1,157 |
| Province 2 | 8 | 1 | 3 | 73 | 59 | 136 | 1,271 |
| Bagmati | 13 | 3 | 1 | 41 | 74 | 119 | 1,121 |
| Gandaki | 11 | 1 | 0 | 26 | 58 | 85 | 759 |
| Lumbini | 12 | 0 | 4 | 32 | 73 | 109 | 983 |
| Karnali | 10 | 0 | 0 | 25 | 54 | 79 | 718 |
| Sudur Paschim | 9 | 0 | 1 | 33 | 54 | 88 | 734 |
| **Total** | **77** | **6** | **11** | **276** | **460** | **753** | **6,743** |

*Source: MoFAGA*[3]

3 https://www.sthaniya.gov.np/gis/

The level of urbanization in Nepal has remained low. However, the pace of urbanization has become rapid, and is likely to increase significantly in the future (MoUD, 2017). Rural-to-rural migration dropped from 62.5% in 2008 to 22.5% in 2017/18. On the other hand, rural-to-urban migration increased from 17.7% in 2008 to 65.1% in 2017/18 (NLFS Survey 2008 and 2017/18). Urban development in Nepal has been driven by this rural-to-urban migration pattern and is characterized by high population growth in urban centres such as Kathmandu, Pokhara, Biratnagar, and some emerging towns in the Tarai region. The increase in urban growth in these locations is at the expense of out-migration from many rural areas and towns in the hilly regions (MoUD, 2017). The population projection shows that by 2031 there will be 28% more people (34 million in total), compared to 2011. This projection suggests the population concentration will be higher in urban areas in the future, with a corresponding reduction in the rural population (CBS, 2014).

With the change in population dynamics, the macroeconomic scenario, including social demography, economic structure, poverty rate, and human development of the rural and urban population of the country, has also been shifting. The agriculture sector's contribution to the GDP has declined from 61% in 1981 to 31% in 2011, while the contribution of the service sector has increased from 27% to 48% during the same period. This structural transformation of the Gross Domestic Product (GDP) from agriculture to service industries has increased per capita GDP (CBS, 2014). Of the 20.7 million people of working age (people aged 15 years and older), about 13.3 million reside in urban areas and the remaining are rural dwellers (CBS, 2019). Informal employment was higher among rural dwellers (90.9%) than among urban dwellers (81.8%); and the proportion of rural dwellers in informal employment was 6.3% higher than the national average (CBS, 2019).

The rural poverty headcount ratio is much higher than in urban areas—33.2% and 7%, respectively, making evident the rural-urban divide. Only about 5% of the country's multidimensionally poor people reside in urban areas, whereas 95% of Nepal's poor people live in rural areas (NPC & OPHI, 2018). Nepal's national Human Development Index (HDI) score stood at 0.587 in 2019, which puts the country in the medium human development category. Its score in urban areas (0.647) surpasses that of rural areas (0.561) with a large urban-rural gap. Such striking disparities are explained by higher per capita income and better access to education and health services in urban areas (NPC, 2020).

The Government of Nepal has devised a vision, policy, program, and response to structurally balance urbanization; strengthen rural-urban linkages; and ensure environmental sustainability. The long-term vision articulated under the 15th National Plan expects steady growth in GDP, achieving 10.5% by 2045. Nepal commits to graduating from the status of Least Development Country (LDC) in this decade by fulfilling all the macroeconomic criteria. Its National Urban Development Strategy envisions sustainable, inclusive, resilient, green, and efficient cities. Nepal adopted the United Nations' New Urban Agenda in 2016 to work as an accelerator of the Sustainable Development Goals (SDGs) and a critical means to make cities and human settlements inclusive, safe, resilient, and sustainable (MoUD, 2016). Under SDG 11, Nepal is targeting to ensure that by 2030, 60% of people will have access to safe housing—as compared to 40% in 2019 (NPC, 2020).

The vision and goals for urban settlements will be achieved by the successful implementation of policies and strategies such as the National Urban Policy (2064), National Shelter Policy (2071), National Urban Development Strategy (2074), National Land use Policy (2072), National Building

Code (2072), National Climate Change Policy (2076), Nepal Urban Road Standard (2076), Park Development and Management Procedure (2075), Urban planning, settlement development and guilding construction guidelines (2072), Integrated Settlement Development and Relocation Guidelines (2075), Kathmandu Valley Town Development Authority (2045), Town Development Act (2045), Infrastructure Construction and Operation of Private Investment Rules (2064), and Municipal Development Fund Act (2053).

The Government of Nepal has implemented targeted urban and rural development programs all over Nepal. Some of the flagship programs are the Environment-Friendly Local Governance program (EFLGP); New Town Development Project (27 new towns, including mid-hill towns, 13 smart cities, and 5 mountain settlements); People's Housing Program and Safe Citizens Housing Program (500,000 houses); Integrated Urban Development Projects (Dharan, Janakpur, Nepalgunj, and Siddarthanagar); Secondary Town Integrated Urban Environmental Improvement Projects (Biratnagar, Birgunj, Butwal); Urban Governance and Infrastructure Improvement Project II (Itahari, Baglung, Pokhara Lekhnath, Dhankuta, Jhapa, and Tansen); and Regional Urban Development Project (Godawari, Bheemdatta, Dhangadhi, and Shuklaphanta).

## 1.2 Challenges in the Sector

Both rural and urban municipalities have to overcome several challenges to provide an enabling environment for the development of strong, effective, inclusive, and sustainable municipalities. Over the years, Nepal has observed an increasing rate of urbanization in urban centres and rapid urban growth beyond the carrying capacity of its urban municipalities. This is further aggravated by insufficient urban infrastructure and the inadequate provision of urban services. The major development challenges observed in urban and rural areas in Nepal are categorized under different themes and explained as follows:

### A. Rural and Urban Planning and Development

- *Managing the pace of urbanization:* Many existing and emerging cities in Nepal have witnessed the unavailability of affordable houses, which has resulted in urban slums, informal settlements, and unplanned and scattered urban sprawl. The issues also include conversion of agricultural land to other commercial uses; encroachment upon riversides, roadsides, and public open spaces; and degradation of cultural and heritage sites (MoPE, 2017; MoUD, 2017). The newly declared municipalities are categorized based on population size and annual revenue. However, their character is still rural, and they do not meet the desired standards of municipal services.
- *Provision for building code and land use policy is still not widely used:* Many settlements in both rural and urban areas are built on risk-prone areas, such as steep slopes prone to landslides or riverbanks, and lowlands prone to flooding. In practice, municipalities have poor compliance with building codes and are largely ignorant of many policy-related provisions.

- *Managing rural-urban linkages:* In many respects, urban and rural areas in Nepal are intertwined, interrelated and interdependent. There are no clear-cut plans and policies to strengthen the capacity of rural service centres and small, intermediate and secondary towns. This is why most municipalities have been unable to attract residents, increase investment, create jobs, or reduce their reliance on primate cities. (MoUD, 2017).

## B. Basic Infrastructure and Services

- *Urban and rural public infrastructure faces quality issues:* A significant percentage of rural/urban roads are built without adequate engineering standards for steep slopes, slope stability, or bio-engineering measures, and are located in disaster-prone areas. Regardless of their size, there is low road density in many municipalities. Less than a third of municipal roads are blacktopped, and very few municipalities have inter- and intra-city bus services. The Urban Infrastructure Condition Index, created by the Government of Nepal to assess the situation of services in the 58 (prior to restructuring) municipalities, shows that only 26 of them scored 50 or more on a scale of up to 100 (MoUD, 2017). This indicates many urban municipalities still need to meet the basic standards of systems and services for their populations.
- *Basic access to public services and utilities is often compromised:* There are many households without access to private or public toilets, sewerage systems, and waste-water treatment plants. There is an absence of faecal sludge management policy. Many households still do not have access to safe and reliable quality drinking water, piped water supply systems, and water treatment plants. In terms of water quality, the latest Nepal Multiple Indicator Cluster Survey (MICS, 2019) indicates that 75% of water sources and 85% of household drinking water showed faecal contamination, indicating additional contamination during transport and storage. Many urban areas do not have a proper plan to manage municipal solid waste, relying mostly on open spaces or dumping it into rivers or roadsides, which results in degradation of the urban environment (MoUD, 2017).
- *Quality of life and health is often compromised in urban areas:* Private and low-density vehicles are increasing day by day, resulting in the degradation of air quality and increasing traffic congestion. Urban areas and their human activities often contribute to an increasing amount of carbon dioxide and hazardous pollution (UN, 2016). There is a huge risk to health due to air and water-borne diseases. In terms of service and quality, health infrastructure and its capacities are also insufficient in both urban and rural areas.

## C. Institutional and Capacity

- *Challenges at the local level to implementation of endorsed policies, laws, and regulations:* The Initial Environment Examination (IEE), Environment Impact Assessment (EIA), and other environmental safeguards required for sustainable urban development are limited or rarely practiced. Implementing land use plans is a challenge due to the lack of strong regulation and subsidies. Most municipalities lack technically able human resources to meet technical requirements in the development of settlements and infrastructure. The implementation of building codes remains challenging. There is also a lack of clear delineation of roles and responsibilities among agencies, leading to inefficient coordination and duplication of work between line agencies and stakeholders.

## D. Additional Challenges

- *Climate change brings additional threats to existing development challenges:* In urban areas, climate change is projected to increase risks for people, assets, economies, and ecosystems, including risks from heat stress, storms, and extreme precipitation, inland flooding, landslides, air pollution, drought, water scarcity, and storm surges. These risks are amplified for those lacking essential infrastructure and services or living in exposed areas. Rural areas in Nepal are expected to experience major impacts on water availability and supply, food security, infrastructure, and agricultural incomes. Multiple stresses caused by rapid urbanization, industrialization, and economic development will be compounded by climate change and are expected to adversely affect the sustainable development capabilities of countries like Nepal by aggravating pressures on natural resources and the environment.
- Urban and rural actors and agencies do not have access to adequate information, institutional measures, technical guidance, practical tools, necessary capacity, and leadership to understand the differential impact and risks of climate change and disaster events. The existing response through the disaster risk management plan and committee, including the disaster management funds, is more focused on relief and response rather than preparedness. The concept of integrating urban and rural resilience is gradually evolving in the municipal planning and budgeting cycle. However, planned effort is required to safeguard against potential loss and damage in the face of ongoing, unpredicted changes and risks from climate change.

Chapter 2

# Objectives and Scope of the Study

## 2.1 Objectives and Rationale of the Study

The rapid and often unplanned expansion of cities is exposing a greater number of people and economic assets to the risk of disasters and effects of climate change. To respond to issues and challenges faced by rural and urban municipalities, local governments should be able to make risk-informed decision-making, and integrate response plans in development processes. This will ultimately help to enhance adaptive capacity and build the resilience of climate-vulnerable people and communities, geographical areas, physical infrastructure, and ecosystems.

The Vulnerability and Risk Assessment (VRA) is a critical step in adaptation planning and implementation. It contributes to identifying key impacts and risks in the rural and urban settlement sector and its subsectors, establishing a strong baseline for adaptation planning and decision-making. The VRAs and identification of adaptation options help guide the sector in decision-making and urban planning; designing disaster and climate risk management plans and programs strategically; and promoting the climate change adaptation agenda across Nepal.

The overall objective of this study was to assess Nepal's climate change vulnerabilities and risks, and identify adaptation options in Rural and Urban Settlements (RUS) for the ongoing National Adaptation Plan (NAP) formulation process. This study's specific objectives are as follows:

- Assess vulnerability to climate change in the rural and urban settlement sectors of municipalities—through applicable frameworks, and by ranking/categorizing associated climate change vulnerability and risks.
- Identify and categorize adaptation options for these risks, to address prioritized climate vulnerabilities and risks of municipalities within the rural and urban settlement sector.

## 2.2 Scope of the Study

The human settlement itself is an integrated human-built environment; thus, the key indicators for VRA were selected based on the identified development challenges combined with an increased risk of climate change. These have been separated into different categories and subcategories to understand the risk and vulnerability elements in the assessment for municipalities—but in the case of rural municipalities, indicators were not categorized; still, coverage of indicators within the subcategory is intact.

Based on relevant literature review, review of the national VRA framework, indicators 2017, and confirmation of data availability, four categories and their subcategories were finalized for this assessment. They cover the broad areas of human settlement and are: (i) socioeconomics, (ii) buildings and settlements, (iii) physical infrastructure, and (iv) social infrastructure (Figure 2). The indicators selected for the assessment were also discussed and validated in the Rural and Urban Settlement Thematic Working Group. dependent on the availability of data for all indicators, it was not possible to assess all 753 municipalities in Nepal with a standard set of indicators; many of the new municipalities established in 2017 do not have uniform and adequate data. For this reason, the assessment focused on a more comprehensive assessment of urban municipalities and only a general assessment of rural municipalities.

The indicator selection is based on human settlement, which covers the socioeconomic dynamics of the population, land, buildings, settlements, and physical infrastructure (Figure 2). Each indicator selected (Table 3) represents the dynamics of human settlement as far as possible within the limits of data available.

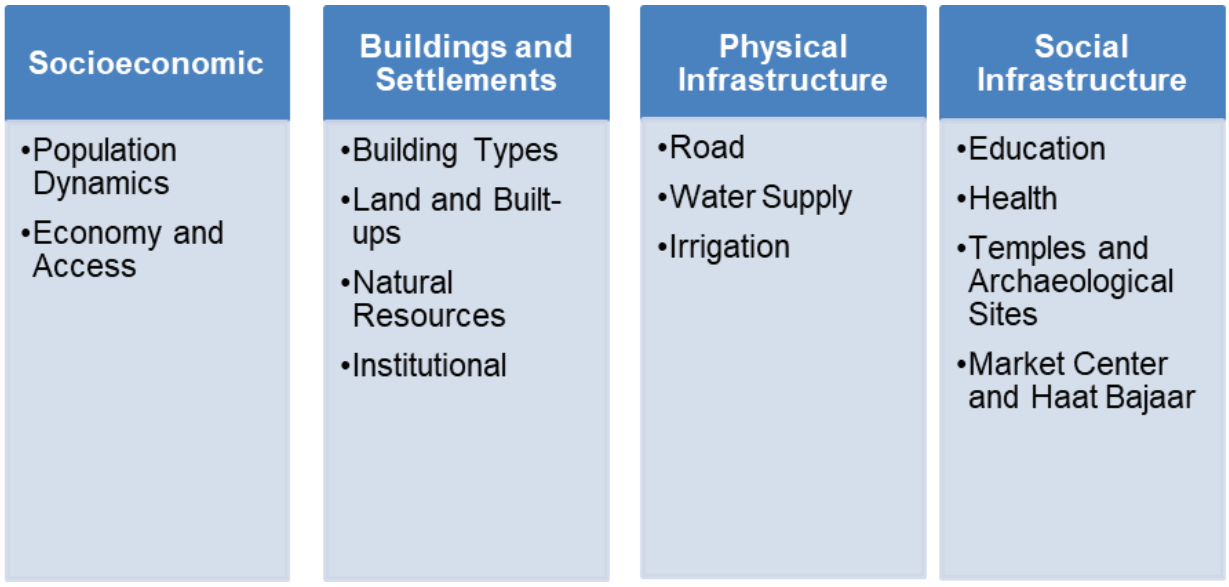



**Figure 2: Categories and Subcategories Identified Within the Sector**

Chapter 3

# Methodology

## 3.1 Framework

Nepal's NAP formulation process has developed a framework for Vulnerability and Risk Assessment (VRA) using IPCC-AR 5 as a base (Figure 3). The IPCC framework considers risk as a function of hazard, exposure, and vulnerability. According to the framework, the risk of climate-related impacts results from the interaction of climate-related hazards (including hazardous events and trends) with the exposure and vulnerability of human and natural systems. Changes in the climate system (trends and scenarios), biophysical system, and socioeconomic processes (including governance, adaptation, and mitigation actions) are drivers of hazards, exposure, and vulnerability (IPCC, 2018).

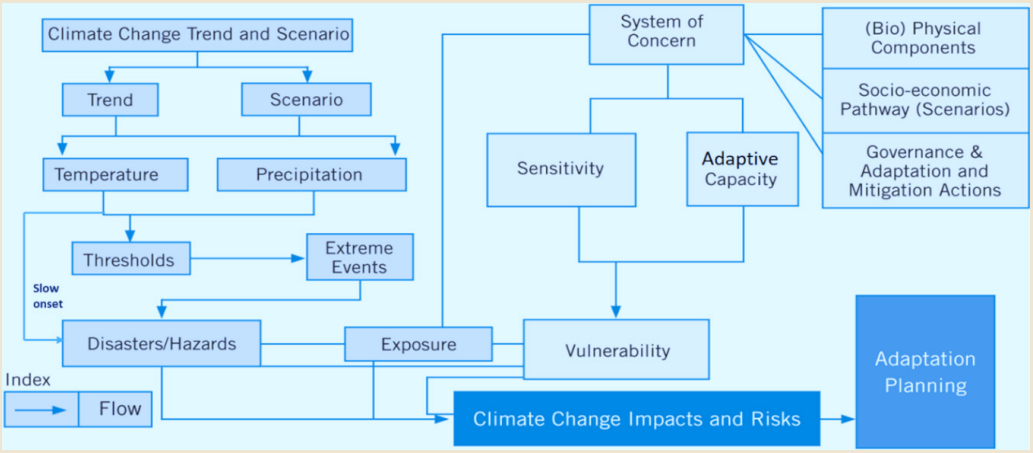



**Figure 3: Climate Change Vulnerability and Risk Assessment Framework**

Source: MoPE, 2017

## 3.2 Approach

This VRA was carried out in the RUS sector, covering all seven provinces (inclusive of 293 municipalities and 460 rural municipalities), and at the national level, using the nine steps illustrated below. The process includes both top-down and bottom-up approaches. The top-down approach was focused on a long-term adaptation plan with the integration of national plan policies and priorities. The bottom-up approach was carried out for the people on the ground, to plan adaptation and implementation by provincial and local governments, stakeholders, and the community.

## 3.3 Methodological Steps

The assessment was carried out stepwise, with the necessary reiterative, participatory, and consultative process as guided by the overarching VRA assessment framework. A simplified methodological framework was prepared for this process for the rural and urban settlement sector, as shown in figure 4.

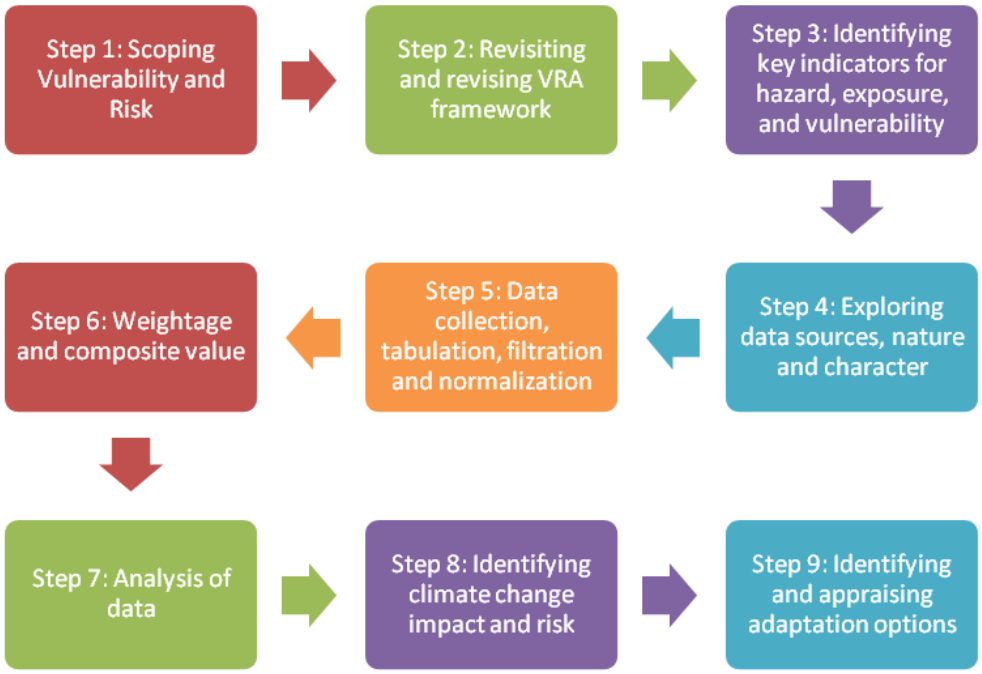



**Figure 4: Methodological Steps**

## 3.4 Indicators, Weightage, and Analysis

### 3.4.1 Process of Identifying Indicators, Prioritization, and Finalization

Indicators were finalized in four steps, as shown in Figure 5. The first step included stocktaking and relevant literature reviews were carried out in global, regional, and national contexts to identify the key risks and vulnerabilities in the sector. The second step reviewed the previous Vulnerability and Risk Assessment framework and indicators for the National Adaptation Plan (NAP) Formulation Process in Nepal. This was used to identify the potential list of indicators based

on established scientific facts and evidence. In the third step, those lists of identified indicators were further validated via technical committee meetings, thematic working group meetings, and expert consultation. Finally, feedback from the consultation was incorporated and a list of indicators was finalized. Indicators were further clustered into categories and subcategories as suggested by the thematic working group. For a list of TWG members, refer to **Annex 4**.

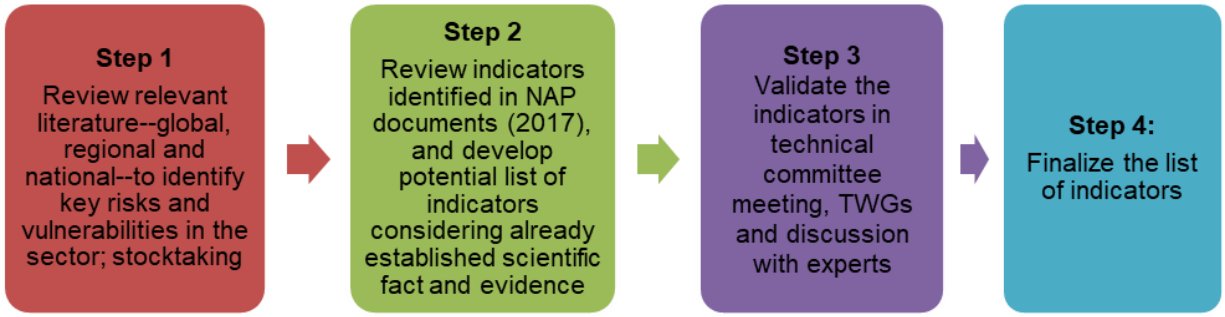



**Figure 5: Process of Identifying Indicators, Prioritization, and Finalization**

## 3.4.2 Data Collection, Tabulation, Filtering, and Normalization

The vulnerability and risk assessment relied mostly on secondary sources for data. These included data from government, regional and global centers, international and national organizations, and other national and local/community stakeholders. Most data were obtained from the government, or from organizations credited and recognized by the government. Secondary data was collected through consultations in all seven provinces, at the national level, and with local governments in selected locations. Both spatial and non-spatial datasets were used for the analysis (Table 2).

**Table 2: Different Data Types Identified, and Sources**

| Spatial Dataset | | Non-spatial Dataset | |
|---|---|---|---|
| **Data Name** | **Data Source** | **Data Name** | **Data Source** |
| Transportation (road network) | OCHA | Socioeconomic | CBS, 2011 |
| Settlements, built-up area | HBASE | Access to finance | Nepal Rastra Bank |
| Parks and open spaces | OCHA | Houses and types | CBS, 2011 |
| Health and education infrastructure | OCHA | Water supply and sanitation coverage, schemes | DWSS, 2018, CBS 2011 |
| Hydropower and irrigation infrastructure | DWRI, DoED | Sewer and drain coverage | MoUD, 2017 (NUDS) |
| Ecological zones—boundaries | DoS | Health infrastructure | MoHP, 2018, IUDP |
| Hydrography | DoS | Education infrastructure | MoEST, 2017, IUDP |
| District boundaries | DoS | Archaeological sites, market centers, ponds, and lakes | IUDP (MoUD) |
| Municipal boundaries | DoS | Municipal budgets, sectoral allocation | MoFAGA (PLGSP) |
| Land cover/land use maps | ICIMOD | Municipal plans and policies | Municipal websites |
| Hazard-prone area (flood, landslide, drought) | METEOR | Municipal technical HR capacity | Municipal websites |
| Elevation | DoS | Building code implementation status | NSET, Municipal profile, IUDP (MoUD) |
| Geology | Dpt. of Mines & Geology | Trained masons | NSET, HRRP 5W report |
| Soil | DoS | Squatter settlement | IUDP, Municipal profile |
| Early warning system coverage | MoHA | | |

After being collected, the data were tabulated, filtered, and normalized. In cases of missing data, a downscale based on proportion was used (based on population, divide the value of the Palika by the value of the district).

*Example:*
District population = X, No. of water schemes in district =109
Palika population = Y
Downscaled factor for Palika = Y/X = Z
No. of schemes at Palika = 109*Z

Standardization of data was carried out to make them compatible while comparing their importance and determining weightage. This was done differently for the quantitative indicators and categorical indicators. Data normalization was done via the min-max method, where transforming the values between 0 and 1 was carried out using the following equation:

$$x_{norm\_i} = \frac{x_i - x_{min}}{x_{max} - x_{min}} \quad \text{(I)}$$

Where;
$x_i$ is the data value to be transferred
$x_{min}$ is the lowest value of this indicator
$x_{max}$ is the highest value and
$x_{norm\_i}$ is the normalized value, which ranges between 0 and 1

### 3.4.3 Weightage Calculation Approach and Method

Experts were identified by the thematic ministry (MoUD) to determine the relative importance (weightage) of indicators. They were representatives of government officials, professors and lecturers (national and international), and researchers (national and international institutions). In total, 11 responses were obtained from these experts. Their participation and representation are illustrated in figure 6.

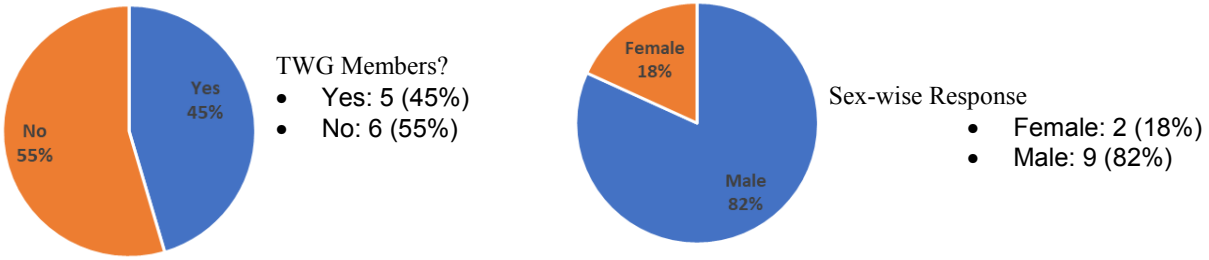



**Figure 6: Participation and Representation of Experts**

The aggregated weightage of individual indicators from multiple experts was converted into the pairwise compression metrics (similar to the AHP) and the weight was calculated based on the Saaty scale. In the pair-wise comparison method, we compare each possible pair of criteria and rate one relative to the other on a scale from "equal importance" to "extremely important". The

comparison was carried out via a Google survey form created to compare between different categories and subcategories. Composite values of each category and subcategory were obtained by adding up the weightage for individual indicators. Thus, the calculated weight was further validated through the TWG meeting in the presence of selected experts. For a detailed list of identified experts, please see **Annex 5**.

## 3.4.4 Final List of Indicators with Respective Weightage

### Table 3: List of Exposure Indicators for Municipalities and Respective Weightage

| Category | Exposure | Weight |
|---|---|---|
| Socioeconomic (0.23) | Municipal population (No) | 1 |
| Building and Settlement (0.27) | Number of HH | 0.364 |
| | Impervious area (sq. km) | 0.332 |
| | Municipal area (sq. km) | 0.304 |
| Physical Infrastructure (0.27) | Total road network (km) | 0.322 |
| | Piped water supply schemes (No) | 0.334 |
| | Irrigation schemes (No) | 0.166 |
| | Main canal length (m) | 0.178 |
| Social Infrastructure (0.23) | Education infrastructure (No) | 0.244 |
| | Health infrastructure (No) | 0.262 |
| | Archaeological and religious site (No) | 0.249 |
| | Market center and haat bajaar (No) | 0.244 |

### Table 4: List of Sensitivity Indicators for Municipalities, and Respective Weightage

| Category | Subcategory | Sensitivity | Weight |
|---|---|---|---|
| Socioeconomic (0.23) | Population Dynamics | Age groups (population of elderly; infants; children) (%) | 0.065 |
| | | Disabled population (%) | 0.065 |
| | | Poverty (HPI) | 0.071 |
| | | Health condition (people with chronic diseases) (%) | 0.064 |
| | | Deaths per 1,000 people (rate) | 0.064 |
| | | Migration rate | 0.061 |
| | | Population growth rate (%) | 0.062 |
| | Economy and Access to Resources | Gender (female-led households) (%) | 0.275 |
| | | Population dependent on agriculture (%) | 0.272 |
| Building and Settlement (0.27) | Building Types and Build-up | Built-up and types of houses (HH with CGI; thatch; jhingati) (%) | 0.078 |
| | | HH with lightweight wall (%) | 0.070 |
| | | HH with load-bearing foundation (%) | 0.070 |
| | | Population density | 0.074 |
| | | Built-up growth rate (land use change) (rate %) | 0.073 |
| | Land and Built-up Area | Flood risk-prone area (%) | 0.044 |
| | | Landslide risk-prone area (%) | 0.044 |
| | | Drought risk-prone area (%) | 0.040 |
| | | The fragility of landscape: Mean slope (degree) | 0.041 |
| | | The fragility of landscape: Geology (index) | 0.040 |
| | | The fragility of landscape: Soil (Index) | 0.040 |
| | | Settlements in flood risk-prone area (No) | 0.044 |
| | | Settlements in landslide risk-prone area (No) | 0.043 |
| | Natural Resources | Land-use change: Cultivation (%) | 0.099 |
| | | Land-use change: Forest (%) | 0.101 |
| | | Land-use change: Water body (%) | 0.099 |

| | | | |
|---|---|---|---|
| Physical Infrastructure (0.27) | Roads | Road type (length of earthen, graveled) (%) | 0.218 |
| | | Length of roads having a slope greater than 30 degrees (%) | 0.215 |
| | | Proximity: Length of roads in landslide-prone areas (%) | 0.215 |
| | | Proximity: Length of roads in flood-prone areas (%) | 0.058 |
| | Water Supply | Water schemes needing repair, maintenance, rehabilitation, and reconstruction (%) | 0.058 |
| | | Water demand (MLD) | 0.061 |
| | | Dependency ratio: HH dependent on other sources (natural water pots, springs, spouts, etc.) (%) | 0.059 |
| | | Dependency ratio: HH dependent on underground water (%) | 0.059 |
| | Irrigation | Dependency on seasonal rain for irrigation (%) | 0.057 |
| Social Infrastructure (0.23) | | Education infrastructure located in flood risk-prone area (%) | 0.232 |
| | | Education Infrastructure located in landslide risk-prone area (%) | 0.129 |
| | | Accessibility to education infrastructure (HML) | 0.116 |
| | | Health infrastructure located in flood risk-prone area (%) | 0.181 |
| | | Health infrastructure located in landslide risk-prone area (%) | 0.181 |
| | | Accessibility to health infrastructure (HML) | 0.161 |

**Table 5: List of Adaptive Capacity Indicators for Municipalities, and Respective Weightage**

| Category | Subcategory | Adaptive Capacity | Weight |
|---|---|---|---|
| Socioeconomic (0.23) | Population Dynamics | Human development index (HDI) | 0.041 |
| | | Access to financial services (%) | 0.040 |
| | | Access to drinking water—coverage (%) | 0.041 |
| | | HH with access to piped water (%) | 0.035 |
| | | HH having an alternative source of water (No) | 0.035 |
| | | HH with access to sewerage network (%) | 0.241 |
| | | HH with flush/water-seal toilets (%) | 0.205 |
| | | Total literacy (%) | 0.035 |
| | | Early warning system coverage area | 0.064 |
| | Economy and Access to resources | Total population—based on non-agro-economy (%) | 0.043 |
| | | Women's share in income (%) | 0.039 |
| | | Economically active population (%) | 0.038 |
| | | Female ownership (both house and land) (%) | 0.038 |
| | | Municipal budget allocation (female/child/poor, deprived and minorities) (NPR) | 0.040 |
| | | Per capita municipal budget (amount) | 0.065 |
| Building and Settlement (0.27) | Building Types and Buildups | Building with RCC pillar foundation type (HH %) | 0.055 |
| | | Building with RCC roof (HH %) | 0.056 |
| | | Climate-friendly building (envelope construction material) (HH %) | 0.061 |
| | | Building compliance with building code (%) | 0.059 |
| | | HH with access to electricity (%) | 0.108 |
| | | HH with alternative energy sources (solar, bioenergy, wind energy) (%) | 0.104 |
| | Natural Resources | Municipal budget for environment/climate change (NPR) | 0.061 |
| | | Ponds, lakes (No) | 0.061 |
| | | Parks | 0.030 |
| | | Community forests | 0.030 |
| | | Available open spaces for post-disaster use (%) | 0.061 |
| | | Available green areas (%) | 0.060 |

| | | | |
|---|---|---|---|
| | Institutional | Land use plan (Y/N) | 0.068 |
| | | Periodic plan/Integrated Urban Development Plan (Y/N) | 0.040 |
| | | Engineers in the municipality (No) | 0.064 |
| | | Trained masons for resilient construction (No) | 0.042 |
| | | Per capita municipal budget allocation for disaster management (%) | 0.040 |
| Physical Infrastructure (0.27) | Roads | Availability of stormwater drain line (%) | 0.080 |
| | | Metalled roads (%) | 0.234 |
| | | Road density | 0.073 |
| | | Per sq. km municipal budget for road sector (NPR) | 0.074 |
| | Water Supply | Functionally intact water schemes (%) | 0.376 |
| | Irrigation | Irrigation schemes dependent on perennial sources (%) | 0.085 |
| | | Operational schemes (%) | 0.077 |
| Social Infrastructure (0.23) | | Capacity of school buildings: Serviced population % | 0.154 |
| | | Capacity of hospitals: Serviced population (%) | 0.256 |
| | | Capacity of hospitals: Beds (No) | 0.356 |
| | | Municipal budget for health sector (NPR) | 0.233 |

**Table 6: List of Indicators (Exposure, Sensitivity, and Adaptive Capacity) for Rural Municipalities, and Respective Weightage**

| Exposure | Weightage | Sensitivity | Weightage | Adaptive Capacity | Weightage |
|---|---|---|---|---|---|
| Municipal population (No) | 0.341 | Age groups (No) | 0.05 | Capacity of school buildings—serviced population (No) | 0.065 |
| Built-up area | 0.179 | Disabled population (No) | 0.051 | HDI | 0.345 |
| Education infrastructure (No) | 0.109 | Built-up and types of houses (HH with CGI; thatch; jhingati) (No) | 0.113 | Literacy rate | 0.143 |
| Health infrastructure (No) | 0.117 | HH with lightweight walls (No) | 0.06 | Health service population | 0.053 |
| Total roads | 0.05 | HH with load-bearing foundations (No) | 0.06 | Access to drinking water—coverage (No of HH) | 0.045 |
| Total land area | 0.103 | Dependency ratio: HH dependent on other sources (natural water pots, springs, spouts etc.) (No) | 0.075 | HH access to piped water (No) | 0.144 |
| Forest area | 0.1 | Dependency ratio: HH dependent on underground water (No) | 0.075 | HH having an alternative source of water (No) | 0.052 |
| Total | 1 | HPI | 0.059 | Green-area | 0.044 |
| | | People with chronic disease (No) | 0.058 | Road density | 0.045 |
| | | Hydro in FPA (No) | 0.055 | RCC | 0.063 |
| | | Hydro LPA (no) | 0.009 | Total | 1 |
| | | Settlement in FPA (No) | 0.075 | | |
| | | Settlement in LPA (No) | 0.075 | | |
| | | Road FPA (Km) | 0.032 | | |
| | | Road LPA (Km) | 0.023 | | |
| | | Health FPA (No) | 0.008 | | |
| | | Education FPA (no) | 0.009 | | |
| | | Health LPA (No) | 0.068 | | |
| | | Education LPA (No) | 0.042 | | |
| | | Total | 1 | | |

### 3.4.5 Calculation of Vulnerability and Risk Index

The vulnerabilities of each subsector and aggregate of all subsectors—socioeconomic, building and settlement, physical infrastructure, and social infrastructure—were analysed with the aggregated values of sensitivity and adaptive capacity as shown in equation (II) and Figure 6 as defined by IPCC-AR5. According to IPCC- AR5, Vulnerability is a function of Sensitivity and Adaptive Capacity. Figure 8 illustrates a typical process and analysis of the chain of vulnerability and risk with the indicator-wise data of sensitivity, adaptive capacity, and exposure.

$$V = S - AC \qquad \text{(II)}$$

Where;
*V* is the composite vulnerability indicator
*S* is the sensitivity component of vulnerability and
*AC* is the adaptive capacity component of vulnerability.

Similarly,
Subsector-wise and cumulative risks in the rural and urban settlement sector were estimated as a function of Hazard Intensity, Exposure, and Vulnerability as shown in (III).

$$R = H_{intensity} \times V \times E \qquad \text{(III)}$$

Where;
*R* is the risk index
$H_{intensity}$ is the hazard intensity,
*V* is the vulnerability and
*E* is exposure

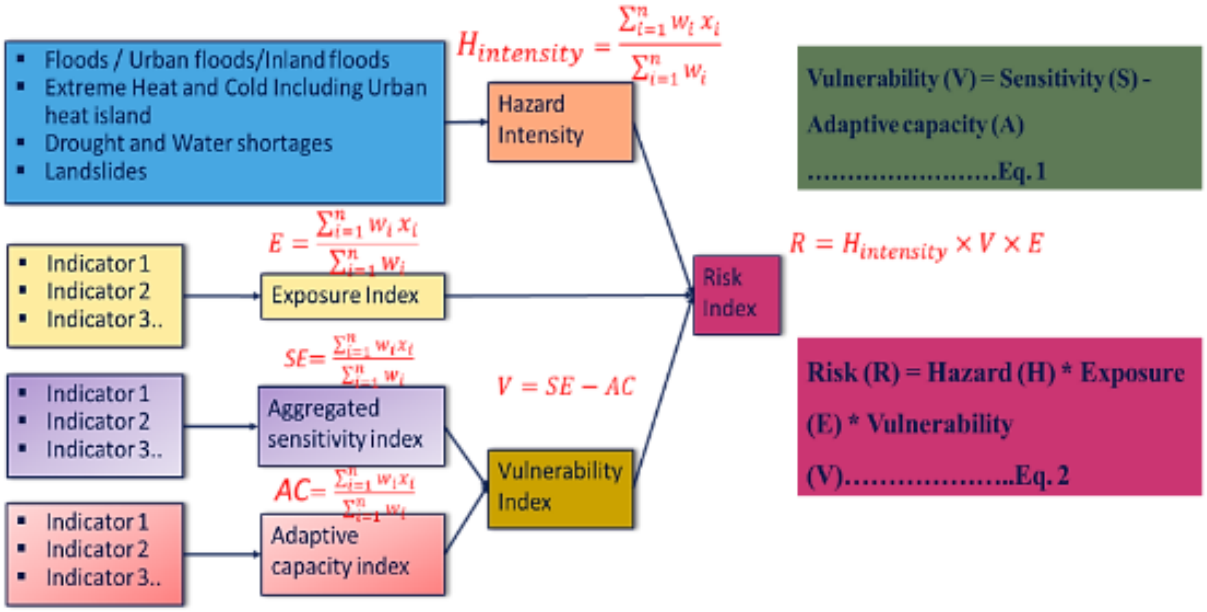



**Figure 7: Shows the typical process of calculating aggregated risk indices**

### 3.4.6 Identification of Adaptation Options

Based on information generated from the vulnerability and risk ranking, the following were identified: Adaptation options that address issues through management and operational strategies, infrastructural changes, policy adjustments, and/or capacity-building. The most appropriate or relevant adaptation strategies for consideration were identified through a set of criteria in line with national goals and targets for sustainable development, as well as national policy, sectoral policy, and national development goals. The priority longlist of adaptation options was identified based on timing/urgency for action, cost, co-benefits, efficacy, and flexibility or robustness (LEG, 2012).

The process adopted in this assessment was:

- Potential adaptation options were identified based on the impact, vulnerability, and risk maps and tables generated by the analysis of secondary data.
- The potential list of adaptation options was mapped based on literature review, particularly successful adaptation practices, effective local knowledge and practices, and efficient technologies and practices.
- Consultation with relevant experts was carried out to map effective adaptation strategies in the sector and subsectors.
- Consultation at the provincial level was carried out to identify adaptation options in the context of existing risks and vulnerabilities.
- Adaptation options were validated in Thematic Working Groups (TWGs) and a technical committee.
- The list of adaptation options was finalized.

Chapter 4

# Observed Climate Change Impacts in the Rural and Urban Settlement Sector

In recent decades, climate change (CC) impacts on human settlements have manifested worldwide. There is growing evidence that the impact of climate change on human settlements is often complex (UN-Habitat, 2019). Climate change increases the risk, frequency, and intensity of certain extreme events, such as intense heatwaves, heavy downpours, flooding from intense precipitation, and disease incidence related to temperature and precipitation changes. The IPCC (2014b) notes that most Asian cities with rapid socioeconomic growth are widely affected by climate stress, while extreme events, such as heavy floods and drought, lead to adverse impacts on human health, social security, livelihoods, and poverty.

Since the federal restructuring process in Nepal, almost two-thirds (63%) of the country's population resides in municipalities, while the remainder is in rural municipalities. Existing and emerging settlements across the mountains, hills, and Tarai of Nepal are rapidly urbanizing and, at the same time, placing the population at risk from the potential impacts of climate change (Hallegatte & Morlot, 2011; IPCC, 2014a). Rural and urban populations and livelihoods in Nepal are exposed to climate-induced events, mainly floods, landslides, cold waves, heat stress, droughts, windstorms, lightning strikes, communicable diseases, and fire.

Settlements in all physiographies are already experiencing direct and indirect impacts of climate change. It has been affected/is revealed by: water availability, use of natural resources, health concerns, energy demands for cooling/heating, urban heat islands, urban floods, dispersion of pollutants into water bodies, outbreaks of water and vector-borne diseases, and damage to roads, drainage structures, and other infrastructures that have caused great economic loss (MoFE, 2019b). The following section explains in detail the observed climate change impacts on the subsectors of rural and urban settlements in Nepal.

## 4.1 Observed Impact on Socioeconomics

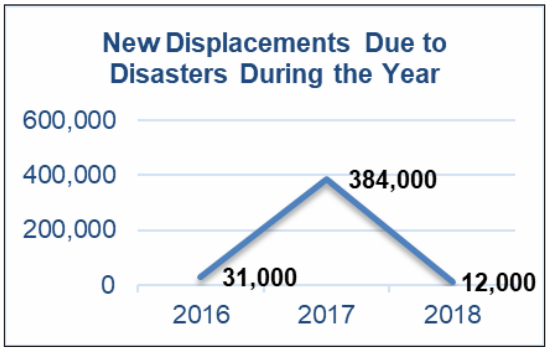
The key observed socioeconomic impacts on rural and urban lives are loss and damage to life and property; disruption in access to basic services; issues related to health, sanitation, and hygiene; air and water pollution; and elevated poverty, destitution, and desperation in the settlements. With the current climatic variability and extremes, Nepal is already bearing high economic costs with a loss of 2 to 3% of GDP per year in the agriculture and water sector—and this figure is much higher in extreme years, rising to 5% or more (MoSTE, 2014). In monetary terms, the average loss being reported nearly doubled from NPR 1.2 billion per year between 1983 and 2005, to NPR 2.2 billion between 2010 and 2016 (MoF, 2017). The National Climate Change Impact Survey 2016 carried out by CBS analysed economic loss due to climate-induced disasters in the previous five years: It revealed that a high percentage of households in the mountain region (52.3%) had lost more than NPR 60,000 in those five years, followed by those in the Tarai (35.1%) and hills (24.7%). The economic loss reported by urban settlements is higher than what is reported by rural settlements, as shown in Table 7 (CBS, 2017).

**Table 7: Economic Losses of Households Due to Climate-induced Disasters in the Last Five Years**

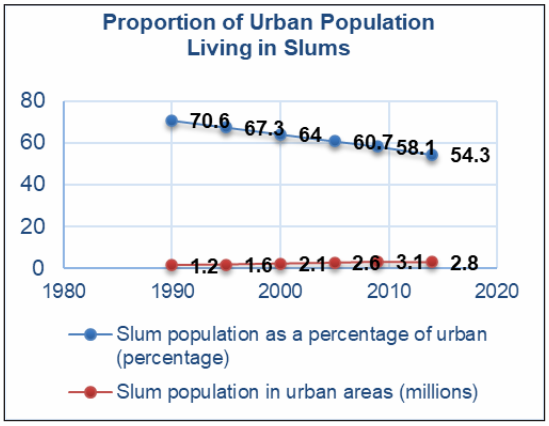
| Domain | Household (%) | | | | | |
|---|---|---|---|---|---|---|
| | No Loss | Below NPR 15,000 | NPR 15,001–30,000 | NPR 30,001–45,000 | NPR 45,001–60,000 | More than NPR 60,000 |
| Urban | 0.5 | 29.7 | 18.5 | 9.6 | 8.6 | 33.0 |
| Rural | 0.2 | 25.0 | 20.2 | 11.6 | 10.6 | 32.3 |

*Source: CBS, 2017*

Rural and urban settlements and low-income populations, marginalized and informal settlers are, largely, affected more by economic and non-economic loss during extreme events (MoFE, 2019b). It has been reported that Majhi, Raute, Chepang, and Satar are more vulnerable during floods, landslides, and fires as they keep their savings in the form of livestock and have a limited income source which gets destroyed (MoFE, 2019c). A large influx of disaster-induced migrants (Krishnamurthy, 2012) has been observed, which further increases slums and informal settlements, creating pressure on the availability of basic services and infrastructure, leading to an increase in urban poverty (MoPE, 2016). It has been reported that from 2016 to 2018, displacement due to disasters was about 427,000 households, of which 384,000 households alone in 2017, suggesting that the August 2017 floods all over the Tarai districts of Nepal resulted in such an increased figure. This is often found to be increasing the slum population (Figure 8).




*Source: IOM, 2019*
*Internal Displacement Monitoring Centre (IDMC)*




*Source: UNSD (n.d.) Millennium Development Goals Indicators Database*

**Figure 8: Displacements, and Proportion of UrbanPopulation in Slums**

It is reported that in 2000, the Kathmandu valley experienced water stress of approximately 60 million $m^3$ and water scarcity of 40 million $m^3$ (OECD, 2003), and with increasing urbanization in the valley, the present situation is even worse. There are cases reported in urban areas facing food scarcity in the aftermath of an extreme event such as drought, flood, hailstorm, inundation, and soil erosion (CBS, 2017). In the urban areas, a higher incidence of respiratory diseases is found compared to the rural areas, leading to negative health outcomes and economic burdens on the population (CBS, 2017).

The impact of climate change is generally observed to be higher on children, women, the elderly, expectant mothers, people with chronic health problems, and disadvantaged population groups (FAO, 2009; Gupte & Bogati, 2014: p. 30; Shrestha, 2013). Women's access to water resources would decrease in both rural and urban areas, leading to an increase in their workload with detrimental effects on their reproductive health (MoE, 2010).

Table 8 provides an overall perception of stakeholders of the climate impact on the socioeconomic factors of rural and urban settlements. The perceived impact of climate extreme events on socioeconomics across the provinces and physiographic regions includes migration, displacement, and increased loss and damage.

**Table 8: Observed Climate Change Impact on Urban and Rural Sector Socioeconomics Reported During Provincial Consultation**

| Region | Climate Extreme Events | Impacts and Vulnerabilities—Socioeconomic Subsectors |
|---|---|---|
| Mountain | Temperature rise; change in snowfall dates; melting of glaciers; GLOF; avalanches; soil erosion; flood-landslide; epidemics; lightning strikes; increase in fires | • Marginalized and vulnerable households are impacted<br>• Impact on agriculture production and soil<br>• Loss of lives and property<br>• Increase in the rate of migration from mountain to hills<br>• Increase in an unhygienic environment and epidemics<br>• Food insufficiency |
| Hill | Temperature rise; extreme rainfall, and variability; landslides; increase in disease (pandemic); soil erosion; fires; floods and inundation; drought | • Migration due to loss of properties and lack of access to resources such as water<br>• Climate change impact felt by women, children, senior citizens, differently abled people<br>• Resettlement in Gulmi due to impact of disasters (20–25 households); impact to livelihood assets; loss of life and properties, such as agricultural land. |
| Tarai | Temperature rise; cold waves; heatwaves; windstorms; floods; fires; increase in disease (pandemic); riverbank cutting | • Incidence of vector-borne and water-borne diseases in urban areas<br>• Agriculture sector impacted due to flooding and temperature rise: Production decline, fragmentation, and degradation<br>• Examples of disaster impact on infrastructure: Marchawar flooding; Tinau embankment breach, damage to suspension bridge in Butwal<br>• Impact on population from a heatwave, cold wave, and flooding (squatter population around Tinau)<br>• Cultural fragmentation due to migration, increase in social conflict<br>• Increase in child mortality rate |

## 4.2 Climate Change Impact on Buildings and Settlements

The structural design of houses and buildings, as well as their closeness to risk-prone areas in rural and urban areas, will impact the population's continuous access to services and functions. People living in informal settlements are found to be less prepared for the impacts of climate change due

to poor-quality housing, informal settlements, and economic issues. Most informal settlements lack piped water as well as sufficient sanitation, drainage, and public services (Satterthwaite et al., 2020).

**Table 9: Impact from Flooding on Buildings and Settlements in Nepal[4]**

| Year | Affected Families | Private Houses Fully Damaged | Private Houses Partially Damaged | Displaced Sheds | Estimated Loss (NPR) |
|---|---|---|---|---|---|
| 2011 | 400 | 723 | 448 | 0 | 512,104,500 |
| 2012 | 139 | 139 | 309 | 3 | 21,376,000 |
| 2013 | 892 | 263 | 108 | 7 | 20,327,300 |
| 2014 | 36,514 | 8,622 | 24,447 | 2 | 14,917,613,938 |
| 2015 | 23 | 14 | 4 | 8 | 16,585,000 |
| 2016 | 7,123 | 583 | 180 | 18 | 30,711,501 |
| 2017 | 15,118 | 264 | 13,886 | 9 | 26,413,500 |
| 2018 | 1,078 | 22 | 538 | 6 | 34,530,900 |
| 2019 | 3,075 | 452 | 1,907 | 241 | 1,063,495,249 |
| 2020 | 512 | 166 | 48 | 25 | 49,411,000 |
| Total | 64,874 | 11,248 | 41,875 | 319 | 16,692,568,888 |

Based on a review of the last ten years of disaster loss and damage data from the flood and landslide incidents in Nepal, it shows significant families are affected, houses are partly and fully damaged, and cattle sheds were damaged with a significant economic cost. The comparative analysis of Table 9 and Table 10 indicates that, over the last ten years, annual flood events incurred significant loss and damage to rural and urban buildings and settlements compared to landslide events in Nepal.

**Table 10: Impact from Landslides on Buildings and Settlements in Nepal[5]**

| Year | Affected Families | Govt. Houses Fully Damaged | Private Houses Fully Damaged | Private Houses Partially Damaged | Displaced Sheds | Estimated Loss (NPR) |
|---|---|---|---|---|---|---|
| 2011 | 32 | 0 | 100 | 6 | 8 | 45,726,800 |
| 2012 | 65 | 0 | 65 | 74 | 11 | 20,597,500 |
| 2013 | 174 | 0 | 135 | 60 | 14 | 169,127,458 |
| 2014 | 491 | 0 | 143 | 37 | 14 | 23,665,979 |
| 2015 | 407 | 0 | 121 | 96 | 10 | 642,400 |
| 2016 | 1,488 | 0 | 358 | 440 | 107 | 810,442,200 |
| 2017 | 334 | 0 | 140 | 40 | 19 | 61,543,000 |
| 2018 | 749 | 0 | 188 | 109 | 48 | 130,119,000 |
| 2019 | 3,054 | 0 | 1,132 | 1,590 | 77 | 405,186,000 |
| 2020 | 771 | 3 | 383 | 68 | 93 | 50,964,900 |
| Total | 7,565 | 3 | 2,765 | 2,520 | 401 | 1,718,015,237 |

There were several cases of flooding and inundation reported in the Kathmandu valley, mainly impacting buildings and settlements in various parts. Most of the informal housing and slum settlements are built with local materials and often do not meet standards (Muzzini & Aparacio, 2013: p.64). About 48% of squatter houses are temporary structures and only 2% are durable (pukka) structures with cement, brick, or concrete block walls (UN, 2013: p. 81). In 2020[6], flash floods in the Bhaktapur district inundated various areas largely because buildings and roads have encroached on the floodplains and banks of the valley's rivers. In 2018[6], the river inundated many squatter settlements and private properties in the Balkhu area. Almost 20 houses were flooded. In 2002[6], the river destroyed a garment factory on the Balkhu corridor.

4 **Source:** http://www.drrportal.gov.np/
5 **Source:** http://www.drrportal.gov.np/
6 https://tkpo.st/36Lg4wM **Accessed on 13 Feb 2021.**

It is reported that Resunga municipality in Gulmi district was declared a drought-prone area until the water lifting technology from the Maheng River provided access to water to settlements (MuAN, 2019). A comparative analysis of the Water Poverty Index (WPI) in Mahakali Municipality-4 (upstream) and Bhimdatt Municipality-13 (downstream) of the Darchula and Kanchpnpur districts of Sudurpaschim Province shows the downstream segment has a higher WPI value (65.43) compared to the upstream segment (52.60) indicating their relatively water-advantaged and -stressed situations. The upstream region exhibited more stressed situations reflecting spatial heterogeneity in terms of capacity, environmental conditions, and infrastructure development (Pathak et al., 2020).

In the rural and urban Tarai areas, it is reported that over 92% of slum houses are temporary (UN, 2013: p. 81). These provide less protection from annual monsoon rains or heat to the settlements (UN-Habitat, 2010: p. 40). The maximum rainfall of 205 mm was recorded in Nepalgunj on July 27, 2007, which caused flooding and inundation. This inundation lasted for a week in most of the city centres including New Road, Gharbari Tole, and Surkhet Road. Similarly, Biratnagar, Bhairahawa, Narayanghat, and Janakpur are also prone to inundation time and again due to drainage congestion (Adhikari, 2013).

In the urban areas of Nepal, the gradual increase in temperature has led to a rise in health concerns and put pressure on energy use for cooling purposes, causing the urban heat island effect (MoPE, 2016). Refer to the urban heat island case study in Case Study 1 and Figure 9. Waste heat, from traffic or air conditioning units, also plays an auxiliary role in contributing to the heating of the urban environment (UN-HABITAT, 2019).

### Case Study 1: Urban Heat Island Effect

Kathmandu is experiencing rapid urban growth for the last few decades. Cities are expanding across the countryside at the expense of productive land. Such urban sprawl has incurred adverse environmental consequences affecting the quality of life of urban residents in the valley. Recently, Kathmandu has been identified to be on the verge of climate change, especially in the context of urban warming.

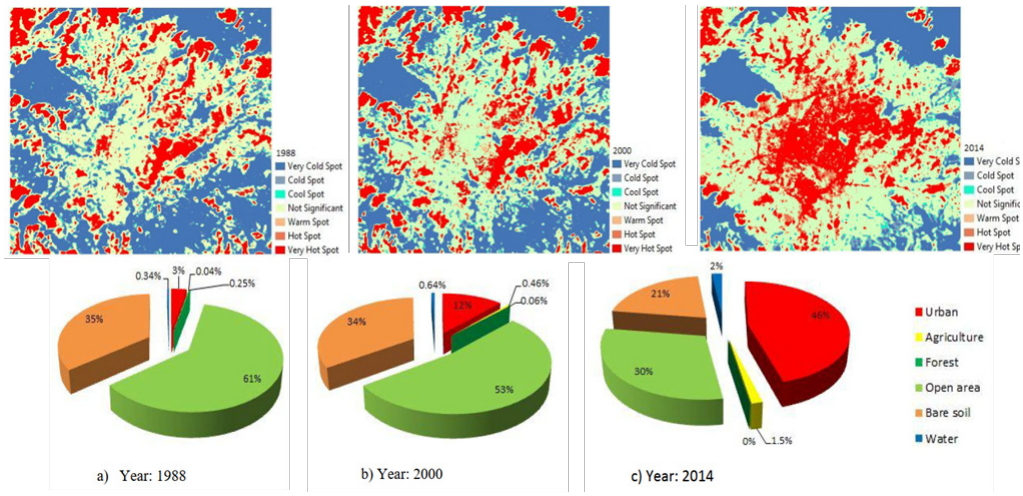



**Figure 9: Land Surface Temperature Change and Urban Growth**

The urban area of Kathmandu valley has increased considerably—by 259% during the period 1988–2014—and land surface temperature inside the urban area has also increased. There was the formation of an urban heat island in the central urban area of the valley. The study proved that the surface temperature is influenced by urban growth. Urban growth not only increases the Urban Heat Island (UHI) effect but also affects the quality of life of the people residing in the urban area. (Thapa, 2017).

Table 11 provides a summary of the discussion held during the provincial consultation about the impacts on buildings and settlements. In the building and settlement subsector, the major impacts are the displacement of settlements, damage to houses/ basecamps/ infrastructures, increase in migration and haphazard urbanization, increase in energy demand, land degradation, land/air/water pollution, river encroachment, and increase in informal settlers.

**Table 11: Summary of Provincial Consultation Input on the Impact of Climate Change on the Building and Settlement Subsector**

| Region | Climate Extreme Events | Impacts and Vulnerabilities—Building and Settlement Subsector |
|---|---|---|
| Mountain | Temperature rise; change in snowfall timing; melting of glaciers; GLOF; avalanches; soil erosion; flood-landslide; epidemics; lightning strikes; increase in fires | • Impact on settlements near rivers<br>• Increase in electricity consumption<br>• Settlement displaced; Annapurna rural municipality observed land degradation resulting in displacement<br>• River encroachment<br>• Migration of households and whole villages, due to scarcity of water |
| Hill | Temperature rise; extreme rainfall, and variability; landslides; increase in disease (pandemic); soil erosion; fires; floods and inundation; drought | • Impact on increasing energy demand<br>• Impact on settlements near disaster-prone areas<br>• Impact on infrastructure (houses, buildings, communication services, transmission lines, water pipes)<br>• Migration to urban areas due to hardship in farming and fetching water |
| Tarai | Temperature rise; cold waves; heatwaves; windstorms; floods; fires; increase in disease (pandemic); riverbank cutting | • Impact to settlements near disaster-prone areas; settlements displaced<br>• Challenge in solid waste management<br>• Flash floods, along with poor drainage facilities, increased health and sanitation issues<br>• Encroachment on riverside; growth of informal settlements and informal constructions<br>• Increase in land/air/water/noise pollution |

## 4.3 Observed Impact on the Physical Infrastructure

The observed climate change impact on physical infrastructures widely varies across geography and location. The information regarding the major impact on the physical infrastructure within human settlements is found to be scarce. However, the impact on major large infrastructure is directly associated with the service disruption to human settlements. In general, the impact of climate change was observed in rural and urban areas, mostly in houses, buildings, communication, bridges, transmission lines, water pipes, drainage congestion, damage to hydropower, traffic congestion, water pollution, drying up of water sources leading to failure of water and irrigation schemes, etc. (IPCC 2007; MoE, 2010). The types of climatic stressors and their respective impacts on urban infrastructure are explained in Table 12.

**Table 12: Climatic Stressors and their Respective Impacts on Urban Infrastructure**

| Urban Components (Assets) | Increased Temperatures and Reduced Rainfall (Drought) | Increased Rainfall (Quantity and Intensity) | Increased River Flow and Flash Flooding |
|---|---|---|---|
| Urban Roads | Concrete and bitumen roads could crack under prolonged extremely hot temperatures, resulting in potholes and more frequent maintenance. | In extreme rainfall events, roads can be eroded; form potholes; or be entirely destroyed by landslides in hilly areas. | Roads near rivers could be eroded or destroyed by flood events. |
| Solid Waste Management | Prolonged extremely high temperatures could produce offensive odours from improperly managed waste. | Increased rainfall could inundate, flood, and scatter waste that is not properly secured in landfills or collection points. | High river water or flash flooding could flood and scatter waste that is not properly secured in landfills or collection points. |
| Urban Drainage | Inferior quality drainage pipes could crack and fail under prolonged extreme temperatures. | Urban drains are either not planned systematically or non-existent. Extreme rainfall events could cause severe flooding, resulting in property and infrastructure destruction. | Drains discharging to rivers could become blocked by high river waters and sediment. High waters could enter the drainage system and create back-flow and flooding in towns. |

*Source: DUDBC & MoSTE, 2014*

Nepal is a country with varying topography, and different parts of the country are subjected to different climatic conditions. The Tarai and Churia region are prone to disasters such as floods and landslides, causing premature failures of roads. Floods pose high risks of bank-cutting and sediment deposition on roads that are lower in altitude. The roads are more vulnerable to landslides induced damage. Looking over the climate extreme events from 1971 to 2013, in the road sector, huge damage can be observed. For example, 42.48 km of roads were damaged by flood events, 380.341 km of roads by landslide events, 203.2 km of roads were damaged by extreme rain, and 72 km of roads by landslide events, 203.2 km of the road from extreme rains, and 72 km of roads by snowstorms[7]. Likewise, the massive flood of 2017 damaged roads (strategic urban roads and local municipal roads), culverts, and bridges worth NPR 2,882.8 million, which was a huge economic loss for the road sector (NPC, 2017).

Drainage congestion is one of the reasons for causing flooding and inundation in the Tarai. In September 2007, a highway bridge over the Dhanshar River in Rautahat District collapsed from flooding and traffic movement was interrupted. The waterways provided to pass the flood under the bridges of the Hulaki Sadak are significantly narrow and cause flooding and inundation in several locations (Adhikari, 2013).

Landslides and floods are the most frequently occurring hazards that pose massive damage to drinking water facilities in Nepal. For example, the flood of 2017 in 18 districts of Tarai damaged 449 water supply schemes, 142 shallow tube wells, 120 sanitation facilities, and 26 buildings worth NPR 887.7 million (NPC, 2017). The landslides and floods have washed away many drinking waters spouts. Besides, destruction of drinking water and sanitation services and contamination are caused due to localized flooding. Consultations at the provincial and local level identified the increased frequency and intensity of floods and landslides as a major threat to the water supply infrastructure. They argue that the annual cost of repair and maintenance

7 Accessed from https://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=npl&continue=y

of these infrastructures is increasing. One of the local government representatives claimed that they have to allocate more than 20% of their annual budget for repair and maintenance, which is also not sufficient.

Small-scale irrigation schemes in human settlements are affected by climatic hazard events every year. Continuous rainfall from the 19th to the 21st of July 1993, triggered an unprecedented number of landslides and floods in South-Central Nepal which inundated sixty thousand hectares of agricultural land in the Tarai and washed away 67 irrigation systems (Adhikari, 2013) with disruption to livelihood and loss of the economy. Besides, the massive flood of 2017 damaged a total of 961 government-managed irrigation schemes and river training infrastructures to various degrees (NPC, 2017).

Table 13 provides a summary of the discussion held during the provincial consultation to identify the impacts on physical infrastructure.

**Table 13: Reflection of Provincial Consultation on the Physical Infrastructure Subsector**

| Region | Climate Extreme Events | Impacts and Vulnerabilities—Physical Infrastructure Subsector |
|---|---|---|
| Mountain | Temperature rise; change in snowfall timing; melting of glaciers; GLOF; avalanches; soil erosion; flood-landslide; epidemics; lightning strikes; increase in fires | • Impact on physical infrastructure (damage to roads and bridges, water schemes)<br>• Disruption of access to goods and services<br>• Increase in electricity consumption<br>• Water pollution, depletion of groundwater |
| Hill | Temperature rise; extreme rainfall, and variability; landslides; increase in disease (pandemic); soil erosion; fires; floods and inundation; drought | • Increased energy demand<br>• Impact on infrastructure (houses, buildings, communication services, transmission lines, water pipes)<br>• Drying up of water sources leading to inaccessibility of water<br>• Traffic congestion<br>• Road blockages |
| Tarai | Temperature rise; cold waves; heatwaves; windstorms; floods; fires; increase in disease (pandemic); riverbank cutting | • Floods leading to human casualties and damaged infrastructure<br>• Marchawar flooding; Tinau embankment breach, damage to suspension bridge in Butwal<br>• Water services are disrupted: Groundwater polluted, pipes damaged and surface water polluted<br>• Damage to infrastructure, such as drinking water and latrines, causing water pollution and increasing the incidence of disease<br>• Encroachment upon sewerage and drain system |

## 4.4 Observed Impact of Climate Change on Social Infrastructure

The observed impact on social infrastructure is mainly related to disruption of services and their functions, such as decreased accessibility to the health and education infrastructure; damage to health, education, and market infrastructure due to their location; destruction of cultural heritage due to their proximity to the risk-prone area; and weathering effects on cultural heritage sites.

It was found that the lack of infrastructure construction standards regulations and mostly their compliance are leading to increased risk and vulnerability. The construction of institutions like hospitals and education centres and public places along the riverbank has increased because of comparatively low land prices. This haphazard construction of infrastructure has resulted in

increased risk due to its proximity to the river (UN-Habitat, 2015). In the Hanumante river basin, the flooding of 2018 damaged two schools, two hospitals, and one bridge in Dadhikhet (Jha, 2019). Besides, the 2017-flood hit 18 districts of the Tarai region, which resulted in the damage of 99 health facilities in Banke, Dhanusha, Jhapa, Mahottari, Morang, Parsa, Rautahat, Saptari, and Sarlahi districts, worth NPR 620 million.

Public market areas could become uninhabitable during extreme and prolonged high temperatures, severely disrupting economic activities (DUDBC & MoSTE, 2014). Market areas and cultural heritage sites without proper drainage are flooded or destroyed, severely disrupting economic activities (DUDBC & MoSTE, 2014). Unlike disaster damage to regular infrastructure, disaster damage to cultural heritage is often irreversible. The adverse impacts on heritage assets can vary by the type of underlying hazard. Flooding, for example, affects buildings through wetting and weakening.

Exposure to flooding or submersion of infrastructure causes structural instability. Floating pieces of debris cause structural damage to buildings and destroy smaller heritage objects. Flash floods are particularly dangerous for museums and archives, particularly when parts of collections are stored underground (World Bank, GFDRR, 2017). Many cultural heritage sites are located near rivers and could be destroyed or heavily damaged by rising river waters or flash floods (DUDBC & MoSTE, 2014). Table 14 provides a summary of the discussion held during the provincial consultation to identify the impacts on social infrastructure.

**Table 14: Reflection of Provincial Consultation on the Social Infrastructure Subsector**

| Region | Climate Extreme Events | Impacts and Vulnerabilities—Social Infrastructure Subsector |
|---|---|---|
| Mountain | Temperature rise; change in snowfall timing; melting of glaciers; GLOF; avalanches; soil erosion; flood-landslide; epidemics; lightning strikes; increase in fires | • Insufficient access to goods and services due to damage of infrastructure by disasters<br>• Health and education services obstructed by damaged road network |
| Hill | Temperature rise; extreme rainfall, and variability; landslides; increase in disease (pandemic); soil erosion; fires; floods and inundation; drought | • Damage to social infrastructure (health and education buildings) due to landslides<br>• Destruction of cultural heritage |
| Tarai | Temperature rise; cold waves; heatwaves; windstorms; floods; fires; increase in disease (pandemic); riverbank cutting | • Changes to the traditional rivercourse threatening riverside cultural heritage<br>• Destruction of cultural heritage |

## 4.5 Overall Observed Impacts in Cases in Rural Municipalities

The case study was carried out in selected rural municipalities in all physiographic regions to understand the climate change impacts. The cases of Gadhi Rural Municipality of Province 1; Mayadevi Rural Municipality of Lumbini Province; and Kailari Rural Municipality of Sudurpaschim Province were considered for the case study of the Tarai context. Gurans Rural Municipality, Dailekh, Karnali Province, was considered as representative of the hilly region. Besides, Waragung Rural Municipality in Gandaki Province was taken as representative of the mountain region.

The rural municipalities of the Tarai regions are the production and supply centres for major towns in Nepal. The Tarai rural municipalities have very good adaptive capacity due to the accessibility of roads and services, and economic activities due to the location of industries.

In the hilly and mountain regions, due to geographical constraints and resource limitations, the adaptive capacity of rural municipalities is low. The details of the case studies carried out in selected rural municipalities are explained in table 15 below.

**Table 15: Observed Impacts in Rural Municipalities (from Palika and Field Visits)**

| Region | Impact |
|---|---|
| Tarai | The most common climate-induced disasters observed in rural municipalities were floods, fires, cold waves, heatwaves, and groundwater depletion. These extreme events are generally found to impact mostly the poor, children, the elderly, pregnant woman, differently-abled people, and those with chronic diseases.<br>The population of Gadhi rural municipalities is mostly affected by the annual monsoon flood. Groundwater gets contaminated during the flood and this is found to have negative health outcomes for all age groups. The Musahar communities, 250 HH from the Gadhi rural municipality, are the most vulnerable group as they are landless and dependent on wage labour. These communities often live in flood risk-prone areas and are affected adversely by flooding each year.<br>Almost 90% population of the Mayadevi rural municipalities lives at risk from annual floods and inundation from the Danaw and Tinau rivers. Flooding causes huge economic losses here every year.<br>The three settlements inside the Kalari rural municipality, including Mohanpur and Rattanpur villages, are impacted by the Mohana river's annual monsoon flood and river cutting. These settlements are isolated without road access, and at high risk of an annual flood. Their communities have adopted flood mitigation measures such as bio-dykes and sugarcane plantations to reduce loss and damage to lives and properties from the Mohana river. However, the response measures adopted are not sufficient to deal with the severity and magnitude of impacts. |
| Hill | The major climate-related risks are landslides, drought, drying up of water sources, depletion of pasture land and, in the case of Gurans Municipality, an increase in invasive alien species. About 25% of the population falls within the poor and deprived group, and 15–20 houses are reported as a squatter and informal settlements. It is observed that the municipality faces heavy agricultural loss in wards 5, 6, and 7 due to river cutting and washout from its major rivers: Lahare, Sisneri, Lamatara, and Kachche. 14 households in ward no. 2 were displaced by a landslide, and later resettled in the nearest safe location. |
| Mountain | Key climate and environmental impacts observed in Waragung are an increase in rainfall, a decrease in snowfall, and a rise in temperature. This has caused the melting of snow and an increase in the volume of snow-fed rivers, causing heavy flooding. The rivers are found to be changing their course and riverbank cutting has increased, which has directly impacted the settlement in Yekle Basti (8 HH). Dry landslides and avalanches are increasing, and some settlements are at risk from them. Due to a reduced amount of snowfall and shorter winters, agricultural productivity has also decreased—for example, apple and naked barley. |

Chapter 4

# Observed and Projected Climate Change Hazards and Exposure in the Rural and Urban Settlement Sector

## 5.1 Climate Change Trend and Scenarios

The increase in temperature, extreme variability in rainfall, and increased frequency, intensity, and impact of climate extreme events and hazards are increasing in Nepal over the last 70 years. The observed trends of these two variables i.e., temperature and precipitation between 1971 and 2014 in Table 16 show a negative trend in the average amount of rainfall in all seasons. The seasonal trend of the precipitation was also decreasing with the highest decline (0.32 mm per year) during post-monsoon. However, pre-monsoon precipitation indicates a significant positive trend in the High-Himalayan region (MoFE, 2019a). On average, Nepal's annual precipitation has declined by 1.3 mm per year over the observed period (i.e., 1971-2014). In the last 40 years, the annual increment of Nepal's maximum and minimum temperature were to be 0.056°C and 0.002°C, respectively (Table 16).

**Table 16: Observed Trend of Climatic Variables in Nepal between 1971 and 2014**

| Climatic Variables | Winter | Pre-monsoon | Monsoon | Post-monsoon | Annual |
|---|---|---|---|---|---|
| Precipitation (mm/year) | -0.072 | -0.081 | -0.085 | -0.324 | -1.333 |
| Maximum temperature (°c/year) | 0.054** | 0.051** | 0.058** | 0.056** | 0.056** |
| Minimum temperature (°c/year) | 0.009 | -0.003 | 0.014* | -0.005 | 0.002 |

*Note: **significant at 99% Confidence Level and *95% of Confidence Level.*
*Source: DHM (2017, P.34)*

Physiographic region-wise, the winter temperature of the Tarai has declined annually by -0.004°C whereas the positive change in annual and seasonal temperatures in all-season is the highest in the High Himalaya region compared

to other regions of the country. The annual positive change in temperature of the Himalayan region is 0.086ºC. The highest significant positive trend (0.092ºC /year) is observed in Manang, while the lowest positive trend (0.017º C/year) is observed in the Parsa district (MoFE, 2019a).

Average annual precipitation is likely to increase in both the short-term and long-term. The average annual mean temperature will continue to rise in the future. The climate scenarios study, jointly commenced by GoN and other development agencies, raises grave concern about the accelerated changes in climate. The following are the major summary points of the report. With regards to change in precipitation and temperature in future periods:

- *Average annual precipitation is likely to increase in both the short-term and the long-term.* The average annual precipitation might increase by 2–6% in the medium-term period (2016-2045) and by 8–12% in the long-term period (2036-2065).
- *The average annual mean temperature will continue to rise in the future.* The mean temperature might increase by 0.92–1.07ºC in the medium-term period and 1.30–1.82ºC in the long-term period.
- *Both the average annual mean temperature and the average annual precipitation will continue to climb until the end of the century.* The precipitation might increase by 11–23% and the temperature might increase by 1.72–3.58ºC.
- *The temperature is projected to increase for all seasons.* The highest rates of mean temperature increase are expected for the post-monsoon season (1.3–1.4ºC in the medium-term period and 1.8–2.4ºC in the long-term period) and the winter season (1.0–1.2ºC in the medium-term period and 1.5–2.0ºC in the long-term period).
- *The precipitation is projected to decrease during the pre-monsoon season.* Seasonal precipitation will increase in all seasons except the pre-monsoon season, which is likely to see a decrease of 4–5% in the medium-term period. The post-monsoon season might have the highest increase in precipitation concerning the reference period, possibly going up by 6–19 % in the medium-term period and 19–20 % in the long-term period.

With regards to changes related to meteorological extremes in future periods:

- The intense precipitation events (P95 and P99) are likely to increase with extreme wet days (P99) expected to increase at a higher rate than very wet days (P95).
- Rainy days are likely to decrease in the future. The increase in precipitation intensity coincides with the decrease in the number of rainy days.
- The consecutive dry days (CDD) may increase in the future under RCP4.5 scenarios but may decrease in RCP8.5. For the latter scenario, an increase in consecutive wet days is in line with a decrease in CDD.
- The consecutive wet days (CWD) may decrease in the future under RCP4.5 scenarios but may increase in RCP8.5. This result matches CDD trends.
- Both warm days and warm nights are likely to increase in the future. This is in conjunction with increasing temperature trends of the future periods.
- Both cold days and cold nights are likely to decrease in the future. This, too, is in conjunction with increasing temperature trends of the future periods.
- Warm spells are likely to increase in the future as indicated by the warm spell duration index under both RCP4.5 and RCP8.5 which is in conjunction with increasing temperature trends and increasing warm days of the future periods.
- Cold spells are likely to decrease in the future as indicated by the cold spell duration index under both RCP4.5 and RCP8.5 which is in conjunction with increasing temperature trends and decreasing cold days of the future periods.

## 5.2 Climate Change Stressors/Hazards in the RUS Sector and Subsector

There have been growing concerns about climate change and urban growth, and the impacts of climate variability, and climate extreme events on human health in urban settings. The urban areas that are most susceptible to external shocks and stresses (including climate change hazards) are those that have fragile systems as well as large populations of the socially or economically marginalized.

The direct impacts of climate change are two-fold: shocks and sudden impacts such as storms and heat waves; and stressors or impacts that build gradually over time, such as average temperature increase, and long-term changes in rainfall patterns. Indirect impacts on urban areas resulting from these shocks and stresses include severe flooding (stopping bus or taxi operations, thus affecting travel to work and preventing goods from reaching the market); blackouts (as energy generation is affected by storms); increased risk of water-or vector-borne diseases (due to rainfall and changes in temperature); and heat stress (exacerbated by temperature increase). Figure 10 shows the schematic representation of Nepal's topography and hazards.

The socioeconomic impact of these hazards includes loss or damage to property/livelihoods, injuries or loss of life, damage to public services and utilities, disruption of supply chain/ communication channels, and transportation networks. The long-term impact includes the change in demography and livelihood options. (Table 17) presents direct loss and damage due to disasters in Nepal during the last 10 years. Although there is no specific database on loss and damage to rural and urban settlements, the table shows that disasters have caused a loss of NPR 792,633 million during the last decade at a rate of NPR 79,263 million per year. It accounts for a minimum of 0.01% and a maximum of 33.20% of the national GDP.

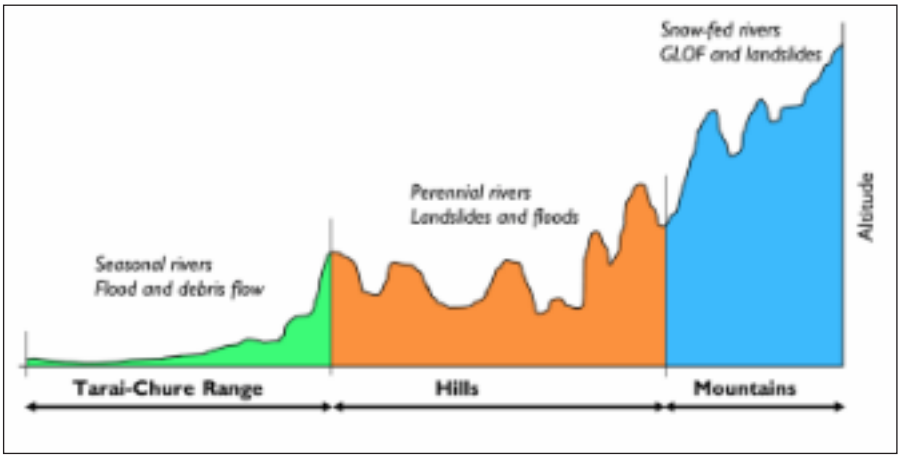



**Figure 10: Schematic Representation of Nepal's Topography and Hazards**

*Source: MoPE, 2016*

**Table 17: Monetary Value of Damage and Losses Due to Disasters in Nepal**

| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Damage and losses (NPR million) | 3,774 | 947 | 1,789 | 1,452 | 1,294 | 192 | 15,143 | 706,893 | 432 | 60,717 | 792,633 |
| Proportion of GDP (%) | 0.39 | 0.1 | 0.15 | 0.11 | 0.08 | 0.01 | 0.77 | 33.19 | 0.02 | 2.34 | |

*Source: Bhandari et al., 2020*

Huge loss and damage in terms of economic loss and human lives can be observed in rural municipalities in the last five years (2015–2020) as recorded in the DRR portal Nepal (Figure 11) due to climate extreme events. Economic losses are distributed all over Nepal except Sudurpaschim Province, and loss of human lives is more concentrated in the upper mountain regions of Province 1 and Bagmati Province, as well as in the hilly areas of Gandaki, Bagmati, and Karnali Provinces due to landslides. Loss in the Tarai belt is due to flooding events.

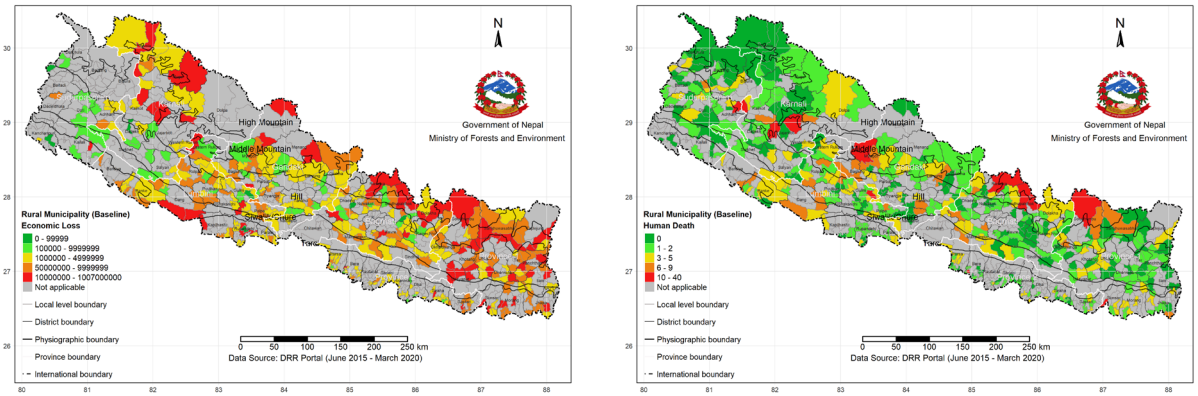



**Figure 11: Total Economic Loss and Human Death (June 2015 to March 2020) in Rural Municipalities**

## 5.2.1 Climate Change Stressors/Hazard Context

A climate change stressor is an activity or phenomenon on the climatic parameters that causes an adverse effect and therefore degrades the condition and viability of the natural system. These are the physical processes/events (hydro-meteorological) that could harm human health, livelihoods, or natural resources. In this context, human settlements are highly affected by severe storms, landslides, floods, high temperatures, and slow-onset changes such as droughts and glacial melt.

Besides poverty, inequality of resources, and income, the region is also prone to disasters and calamities. Floods, storms, landslides, arsenic poisoning, and erosion of soil are some of the common disasters Nepal regularly faces. The common hazards in the urban and rural settlements of Nepal include the following:

- Extreme temperature events cause heat waves and cold waves, which increase the risk of mortality and morbidity, particularly for aging groups and the urban and rural poor. The temperature rise also changes the monsoon patterns, which ultimately impacts the rainfall pattern and likely water scarcity issues.
- Climate extreme events and disasters (e.g., floods, landslides, fires, and droughts) cause deaths and casualties, destruction of houses and properties, displacement, disrupt food production, and affect clean and freshwater availability and quality. In certain locations or settings, climate change causes social disruption (such as following long and severe droughts), economic decline, and displacement of populations.

- Extreme events such as intense precipitation, wet days, and rainy days all lead to health, sanitation, and hygiene issues impacting women, children, the elderly, and the poor. It is projected that there will be significant increases in inter-annual and intra-seasonal variability in South Asia (Endo et al., 2012): an increase in the frequency of years with above-normal monsoon rainfall and years with extremely deficient rainfall; an increase in the seasonality of rainfall, with more rainfall during the wet season; an increase in the number of dry days; and an increase in the number of extreme precipitation events (Endo et al., 2012; Kumar et al., 2010).
- Hazards in this assessment have been selected based on historical events, literature studies, and consultations. Priority is given to those stressors or extreme events with a certain magnitude, frequency, and potential to have immediate consequences. For example, changes in extreme wet days can lead to floods and landslides that have a direct impact on buildings and settlements, including physical and social infrastructure. Weightage to the sectoral hazards indicators was given as per the expert's judgment. The experts were selected based on their competencies in the sector.

The database of all the climatic parameters and extreme events in their respective trend and scenario context is available at the district level, which is later factored in at the municipal level. Hazard at the district level includes both urban and rural municipalities and is used for municipal analysis. The major climate change hazards and stressors in the sector are illustrated in Table 18.

**Table 18: Climate Change Hazards and Stressors**

| Extreme Events | Climatic Stressors | Weights |
|---|---|---|
| Increase in warm spell duration | Change in Warm Spell Duration (%) | 0.05 |
| Increase in consecutive dry days | Change in Consecutive Dry Days (%) | 0.2 |
| Increase in heatwaves (heat island) | Change in Temperature (°C) | 0.15 |
| Increase in very wet days | Change in Precipitation (%) | 0.3 |
| Increase in heavy rainfall | Change in Extreme Wet Days (%) | 0.05 |
| Increase in floods (urban flooding, flash flooding) | Change in Number of Rainy Days (%) | 0.2 |
| Increase in landslides | Change in Warm Days (%) – 0.05 | 0.05 |
| Increase in drought | | |
| Increase in fires | | |
| Increase in windstorms | | |
| Increase in heart and respiratory disease | | |
| Increase in epidemics | | |

## 5.2.2 Climatic Hazard Trends

The trend analysis of the occurrences of 11 climatic hazards (Lightning strikes, Windstorm, Epidemic, Heavy Rainfall, Landslide, Flood, Avalanche, Hailstorm, Heatwave, Coldwave, and Snowstorm) revealed that there is a significant increasing trend of climatic hazards, especially after 1990[8]. Figure 12 below shows the trend of 11 climatic hazards in Nepal. Reported climatic hazards have increased from 79 in 1971 to 1333 in 2019. This figure doesn't include the fire, forest fire, and drought events.

8 The trends of several climatic hazards have been analysed using 49 years (1971-2019) of data from Desinventar database and the Nepal Disaster Risk Reduction Portal of the Ministry of Home Affairs.

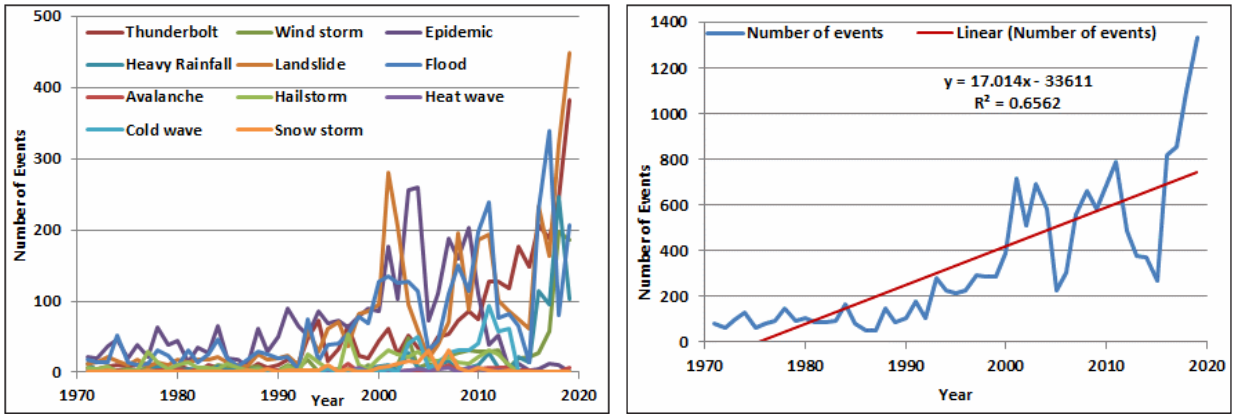



**Figure 12: All Nepal Trends of Eleven Climatic Hazards in Nepal**

The data shows that all the 753 local Palikas, 77 districts, and seven provinces experience the extent and impact of disaster events. Except for Province 2, Karnali Province, and Lumbini Province, all other four provinces extend from the Tarai to the high mountains. The high mountain region is experiencing the impact of increased temperature leading to snowstorms, avalanches, and GLOF. Middle mountains and hills experience diverse hazards such as drought, landslide, fire, lightning strikes, flash flood, and windstorm. The Siwalik disaster context is unique as it has forest fires, lightning strikes, floods, and landslides. The Tarai region is impacted by heatwaves, cold waves, epidemics, fire, windstorms, and floods (Table 19).

**Table 19: Major Hazards in Physiographic Regions**

| Physiographic Region | Major Climate-related Hazards |
|---|---|
| High Mountain | Avalanche; snowstorm; GLOF |
| Middle Mountain | Hailstorm; landslide; drought |
| Hill | Heavy rainfall; landslide; lightning strike; windstorm; fire |
| Siwalik | Forest fire, Thunderbolt; flood; landslide |
| Tarai | Flood; heatwave; cold wave; epidemic; fire; windstorm; forest fire |

The perception survey (CBS, 2017) revealed that households are observing a higher magnitude of the impact of disasters such as droughts, diseases/insects, and floods in a rural area with a mean response of 2.9 while it is 2.7 in urban areas. Similarly, more than one-fourth of households in both urban (27.23%) and rural (31.41%) areas are observing the moderate level of impact of drought with a mean response of 2.5 and 3.0 respectively.

### Change in Temperature

The maximum temperature trend is significantly positive and has increased by 0.056°C/yr in Nepal (DHM, 2017). The trend shows Manang and Taplejung districts have a higher increasing trend in annual maximum temperatures, i.e., 0.092°C/yr and 0.091°C/yr respectively. Bara and Rautahat districts are observed with the least increasing trend (Figure 13). Such a trend not only directly

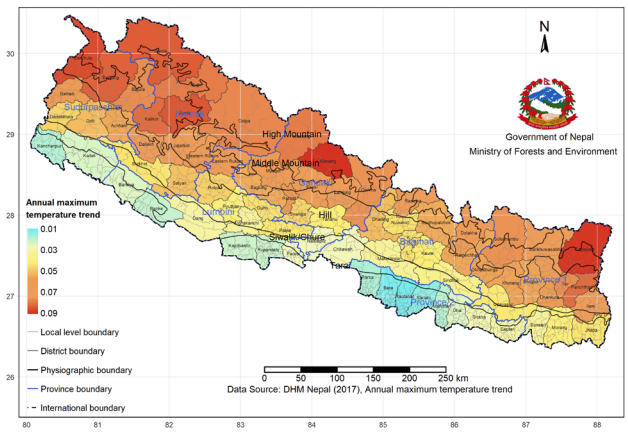



**Figure 13: Annual Maximum Temperature Trend**

impacts natural resources, deteriorates the built environment, but also affects the lifetime of infrastructure and its effective services. This kind of change in maximum temperature might directly influence the gradual increment of possible future risks in the RUS sector.

**Change in Precipitation**

Both the extreme weather variability and anthropogenic climate change have an impact on the rural and urban settlement sectors. Extreme weather events, particularly during the monsoon season in Nepal, creates problems. Normally, the summer monsoon lasts for 105 days in Nepal. In 2020, however, the monsoon lasted for 130 days, 25 days more than normal. According to the DHM (2020), the daily accumulated rainfall during the 2020 monsoon (June-September) was higher than normal (determined by the average of observed rainfall amounts between 1981 and 2010) in eastern Nepal but it was less than normal in western Nepal. Figure 14 shows the mean positive and negative annual trend for annual precipitation. The values for the annual precipitation trend by the district showed a significant downward trend at Kaski (-11.44 mm/yr) and a significant upward trend at Syangja (9.0 mm/yr).

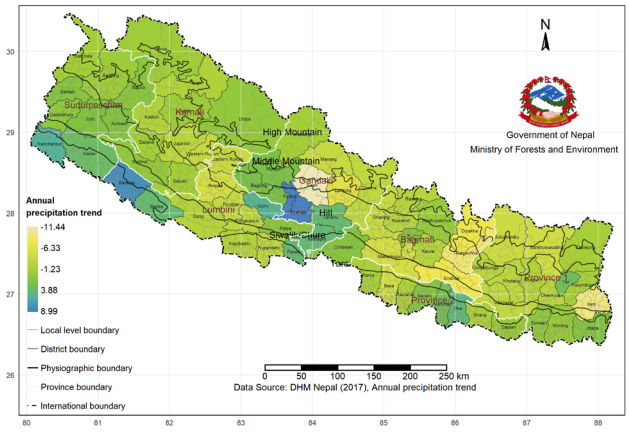



**Figure 14: Annual Precipitation Trend in Nepal**

**Floods and Landslide Hazards**

Floods and landslides are common hazards in the urban sector. The flood-prone and landslide-prone areas of Nepal are about 8% and 59% respectively. In the last 49 years (1971-2019), Nepal has suffered from 3443 flood events and 3787 landslide events. The increasing trend of floods can be attributed to mainly two factors: i) climate change and ii) land-use change. The consultation at the municipality level revealed that urban areas are getting flooded due to the combined effect of climate change and land-use change, increase in impervious areas, increase in surface runoff, and insufficient drainage capacity.

Most Tarai districts and the Palikas within them fall into moderate to high-level ranks, while a few of the districts are relatively safer from flood hazards (Figure 16). Jhapa, Morang, and Sunsari (Province 1) and Kailali district (Sudurpaschim Province) are ranked as highly vulnerable districts for flood hazards based on the number of past extreme events and their respective impacts (loss and damage). In some districts of the mid-hills and valleys, low to moderate levels of flood hazards can be observed, which is mostly due to flash floods. During the consultations with provincial and local government stakeholders, it was revealed that the majority of the Palikas of Province 2, the municipalities in the southern belts of Province 1, Bagmati Province, Lumbini Province, and Sudurpaschim Province are impacted by flooding during the monsoon season. For example, municipalities like Biratnagar, Rajbiraj, Birgunj, Parasi, Taulihawa, Nepaljung, Gulariya, Rajapur, and Tikapur experienced massive flooding and loss of properties during the rainy season.

Mostly hilly districts like Dhading, Sankhuwasabha, Baglung, Sindhupalchok, Dolpa, Taplejung, Rolpa, Makawanpur, Myagdi, Lamjung, Dolakha, Nuwakot, Gorkha, Solukhumbu, Kavrepalanchok, Dailekh, Darchula, Syangja, Palpa, Khotang, Bajura, Kalikot, Kaski, Jajarkot, Bajhang, Gulmi, and Ilam are identified as "Landslide Hazard Hotspots" (Figure 15).

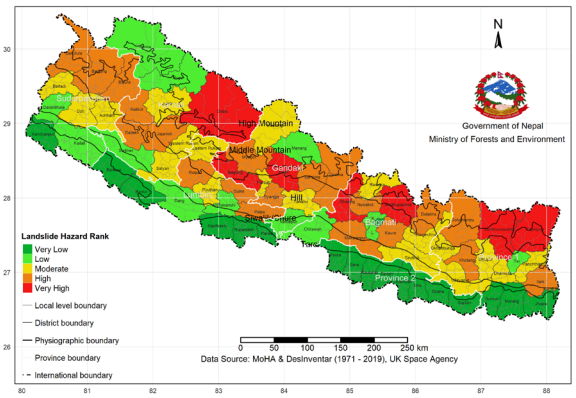



Figure 15: Landslide Hazard Hotspots

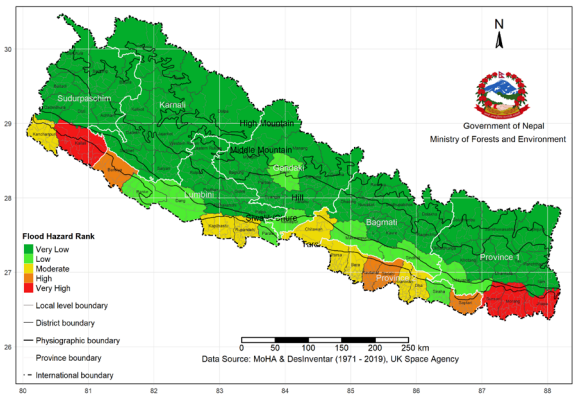



Figure 16: Flood Hazards

Dahal et al. (2008) collected about 677 landslides that occurred in Nepal from 1951 to 2006, then compared the rainfall data of 193 of those events to yield a threshold relationship between rainfall intensity, rainfall duration, and landslide initiation. The study revealed that when daily precipitation exceeds 144 mm, the risk of landslides on mountain slopes is high and that a steep landscape saturated by prototype rainfall is susceptible to landslides even with a small amount of intense rainfall. These facts suggest that the temporal and spatial character of rainfall is needed to understand the relationship between rainfall and a landslide event. The national daily thresholds currently used as a warning level for landslide initiation are as indicated in Table 20 below.

### Table 20: Rainfall Threshold for Landslide Initiation Upon Slopes

| Amount (mm) | Period (hours) |
|---|---|
| 140 | 24 |
| 120 | 12 |
| 100 | 6 |
| 80 | 3 |
| 60 | 1 |

*Source: Department of Hydrology and Meteorology*

In 2020 alone, landslides affected 58 districts (eight experienced more than 10 landslides). In Gandaki Province, 7 out of 11 districts experienced 10 or more landslides. The stakeholders consulted in the Gandaki Province also argued that in 2020, the province will suffer a massive loss of life and property due to landslides.

Gandaki Province had the highest number of landslides (113), with Lumbini Province recording the second highest with 48 incidents. Bagmati Province and Province 1 had 43 and 30 landslides respectively. On July 7, the Besisahar–Chame road, linking Manang to Lamjung, was blocked for about 12 hours due to a landslide that occurred at Khudi in Marsyangadi municipality in Lamjung. In 2020, landslides led to the deaths of 297 people (165 males and 132 females). 64 went missing and 223 were injured. Sindhupalchowk District, with 71 deaths, faced the highest number of casualties. People were killed in Baglung (12), Gulmi (11), Kalikot (37), Kaski (11), Myagdi (30), Palpa (12), Parbat (10), Syangja (15), and Tanahun (13) districts. (Table 21).

**Table 21: Landslides in 2020[9]**

| Province | District | Numbers |
|---|---|---|
| Province 1 | Panchthar | 10 |
| | Sankhuwasabha | 18 |
| | Terhathum | 10 |
| Bagmati Province | Lalitpur | 11 |
| | Makwanpur | 14 |
| | Sindhupalchowk | 18 |
| Gandak Province | Baglung | 21 |
| | Lamjung | 16 |
| | Myagdi | 11 |
| | Tanahun | 13 |
| | Syangja | 17 |
| | Parbat | 14 |
| | Kaski | 21 |
| Lumbini Province | Palpa | 31 |
| | Gulmi | 17 |
| Karnali Province | Kalikot | 19 |
| | Rukum west | 13 |
| Sudurpashchim Province | Darchula | 14 |

Notably, the provinces impacted by a landslide this year also have higher rates of urbanization and development, and clearly, there is a link between anthropogenic activities such as demographic changes and landslide events. These places will likely remain vulnerable to landslides in the future. Steep slopes, fragile geology, and intense rainfall are the causing factors of the landslides. Based on the number of historical events and total respective loss and damage analysis, these districts are categorized as landslide hotspots.

### Heatwaves and Coldwaves, Including Urban Heat Islands

For the last two decades, Nepal has been experiencing climatic extremities such as heatwaves (Pradhan et al., 2019). The study shows that heatwaves are more concentrated in the Tarai districts. The labour productivity of outdoor workers, especially agriculture laborers, wage laborers, and workers in informal sectors, is impacted by these phenomena. In Nepal, heat waves have increased in recent years in Banke, Bara, Bardiya, Kapilbastu, Parsa, Rautahat, Rupandehi, Saptari, and Sunsari districts (Figure 17). These districts have also shown an increasing trend in annual maximum temperature and warm spell duration. In Nepal, many districts of Tarai are affected by cold waves. The coldest wave-affected districts are Mahottari, Saptari, and Rautahat. However, these districts have shown an increasing trend in annual minimum temperature and a decreasing trend in cold spell duration in recent years, and hence, cold waves are expected to decrease in these districts in the future.

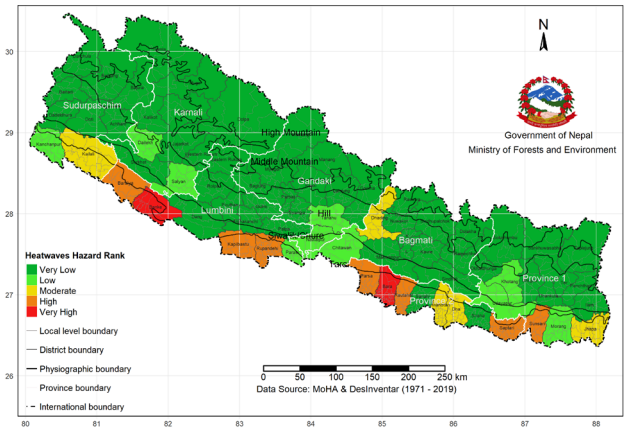



**Figure 17: Heat Wave Hazard Ranking**

9 My Republica, 7 July 2020, Landslide blocks Besisahar-Chame road - myRepublica - The New York Times Partner, Latest news of Nepal in English, Latest News Articles (nagariknetwork.com)

Urban cities are more affected by the urban heat island effect due to denser settlement, more impervious land, a decrease in green areas and water bodies, and excessive use of fuels and energy. Core cities are warmer than the surrounding suburban areas. The perception survey carried out by GoN (CBS, 2017) revealed that all the households in the central mountain region reported that 100 percent of households in the central mountain region observed an increase in cold waves, while another 100 percent reported a decrease in such incidences in the central hills. It is seen that 56.25 percent of eastern Tarai households are observing an increase in heatwaves, while none of the households are observing so in the eastern hills.

### 5.2.3 Climatic Extreme Events Scenarios

Nepal is also projected to experience an increase in the frequency and intensity of extreme events. Hazards such as heatwaves and floods may place a strain on or damage Nepal's urban and rural sector infrastructure and services, for example, the energy systems and infrastructure. An increase in potential flooding impact is also projected, which in consequence reveals that what would historically have been a 1 in 100-year flow is projected to become a 1 in 50-year or 1 in 25-year event in Nepal. The probability of heatwaves is projected to increase significantly, potentially as high as 27% by the 2090s under the highest emissions pathway (RCP 8.5). Simultaneously, the probability of cold waves is projected to decrease significantly, by less than 1% annually, over the same period.

Climate change may cause climatic hazards to become more frequent, widespread, longer-lasting, or intense under climate change. There might be multiple events at the same time across different regions, which may turn out to be catastrophic. Coupled with degrading ecosystems and biophysical processes under climate change, climatic hazards may create chronic stress and catastrophic shocks. The descriptive scenario of climatic hazards for the future climate can be expressed as in Table 22 below.

**Table 22: Descriptive Scenarios of Climatic Hazards Under Future Climate Change**

| Climate Hazard | Medium-term Scenario | Long-term Scenario |
|---|---|---|
| Increase in temperature | *Virtually certain* | *Virtually certain* |
| Increase in precipitation | *Likely* | *Very likely* |
| Increase in very wet days | *Likely* | *Very likely* |
| Increase in extreme wet days | *Very likely* | *Very likely* |
| Decrease in rainy days | *Very likely* | *Very likely* |
| Increase in consecutive dry days | *About as likely as not* | *About as likely as not* |
| Increase in consecutive wet days | *About as likely as not* | *About as likely as not* |
| Increase in warm days and nights | *Virtually certain* | *Virtually certain* |
| Decrease in cold days and nights | *Virtually certain* | *Virtually certain* |
| Increase in warm spell duration | *Virtually certain* | *Virtually certain* |
| Decrease in cold spell duration | *Virtually certain* | *Virtually certain* |
| Increase in heatwaves | *Likely* | *Very likely* |
| Decrease in cold waves | *Likely* | *Very likely* |
| Increase in heavy rainfall | *Likely* | *Very likely* |
| Decrease in snowstorms | *Likely* | *Likely* |
| Increase in thunderbolts | *Likely* | *Likely* |
| Increase in windstorms | *Likely* | *Likely* |
| Increase in hailstorms | *About as likely as not* | *About as likely as not* |
| Increase in floods | *Likely* | *Likely* |

| Climate Hazard | Medium-term Scenario | Long-term Scenario |
|---|---|---|
| Increase in landslides | *Likely* | *Likely* |
| Increase in GLOFs | *Likely* | *Likely* |
| Increase in droughts | *About as likely as not* | *About as likely as not* |
| Increase in forest fires | *Likely* | *Likely* |
| Increase in fires | *Likely* | *Likely* |
| Increase in avalanches | *Likely* | *Likely* |
| Increase in epidemics | *Likely* | *Likely* |

*Note: Virtually certain = 99–100% probability; very likely = 90–100%; likely = 66–100%; about as likely as not = 33–66%; unlikely = 0–33%; very unlikely = 0–10%; exceptionally unlikely = 0–1%.*

## A. Municipalities

The baseline composite value of identified climatic extreme events on the RUS sector (urban municipalities), based on the historical occurrence of extreme events and the weightage of respective extreme events shows that municipalities in Province 1 have a very high rank. The municipalities in Gandaki Province have a high rank (Figure 18). Municipalities in Province 2 have medium to high rank due to the higher occurrence of flooding events. Besides, municipalities in the hill and middle mountains have also medium to high rank due to the high occurrence of landslide events. Table 19 above shows the major hazard by physiographic region.

RCP 4.5 future scenario for 2030 shows a tremendous change from baseline (Figure 17), i.e., municipalities having moderate to lower extreme events have shifted towards high and very high extreme events categories. This result represents municipalities from Province 2, Bagmati Province, Gandaki Province, and Lumbini Province will likely have higher extreme events in comparison to the baseline. Extreme precipitation events are likely to increase in these Provinces and respective physiographic regions (Figure 19-A).

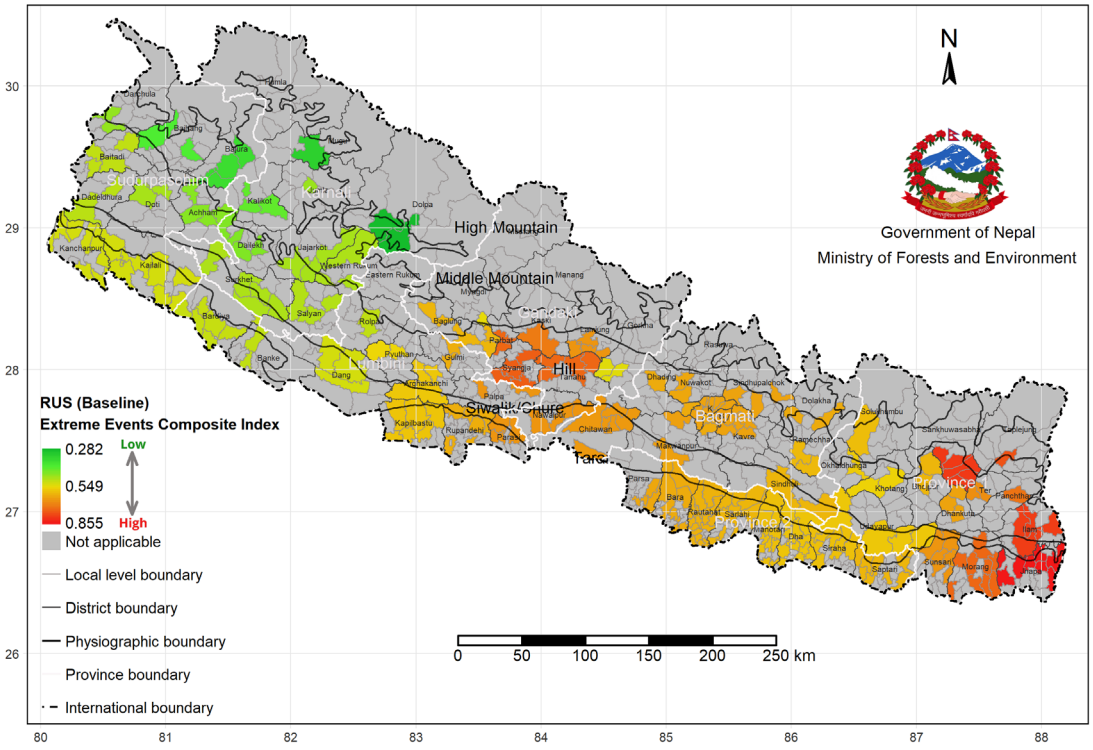
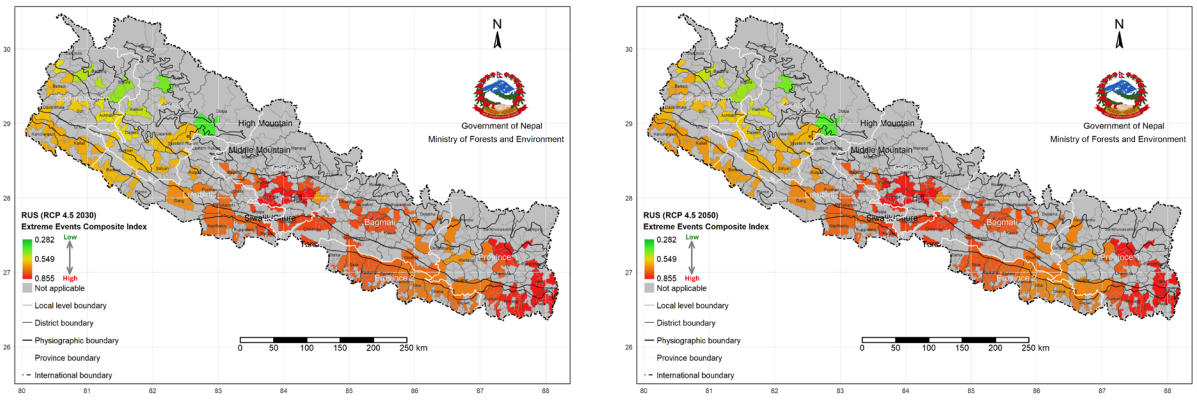



**Figure 18: Baseline Extreme EventRankingfor the Rural and Urban**



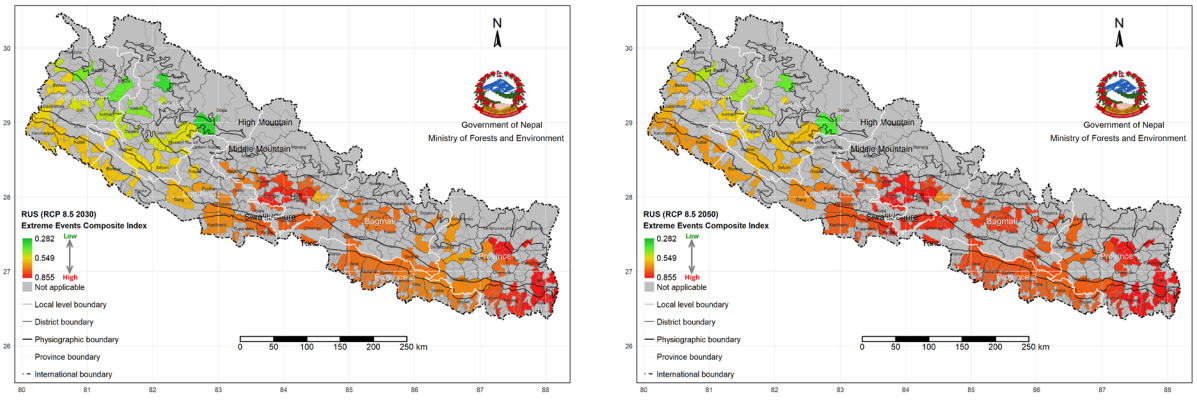

A. 2030 B. 2050

**Figure 19: Extreme Events Composite Index – RCP 4.5**

RCP 4.5 2050 (Figure 19 – B), shows that there will be a slight increment in extreme events. The overall scenario reflects that the composite value of extreme events will increase, and this is due to the increase in extreme events related to precipitation like shorter rainy days with intense rainfall as rainfall amount is going to increase.

Looking into the RCP 8.5 2030 (Figure 20 - A), the composite value of extreme events in this scenario has increased as can be seen in the increment in the number of municipalities with higher extreme events compared to the baseline. Municipalities with lower extreme events have shifted toward the moderate to high-level extreme events category.

The projected scenario of climatic extreme events on RCP 8.5 2050 (Figure 20 – B) shows that there will be a noticeable increment in index values of extreme events from baseline. This reflects all the municipalities will experience an increase in climatic stressors. Both the climatic parameters and related stressors will likely increase which will result in increased extreme events like floods and landslides, temperature rise, more heatwaves, and more uncomfortable environments in the future scenario.




A. 2030 B. 2050

**Figure 20: Extreme Events Composite Index – RCP 8.5**

## B. Rural Municipalities

In the case of rural municipalities (Figure 21) climate extreme events are more concentrated in the region of Province 1 and gradually shifted towards the western part of Nepal. Rural municipalities from Gandaki Province are also affected more by climate extreme events. Palikas in the western Mountain regions is less affected by extreme events than the eastern mountain region.

RCP 4.5 (2030) reflects the different contexts in comparison to baseline (Figure 22). There is a slight decrease in extreme events in this scenario. But in the case of RCP 4.5 (2050), a huge difference can be observed as palikas having lower extreme events have shifted toward the high and very high extreme events zone, as more extreme events are likely to increase in this scenario (Figure 22). The major role is played by the precipitation events and rise in temperature.

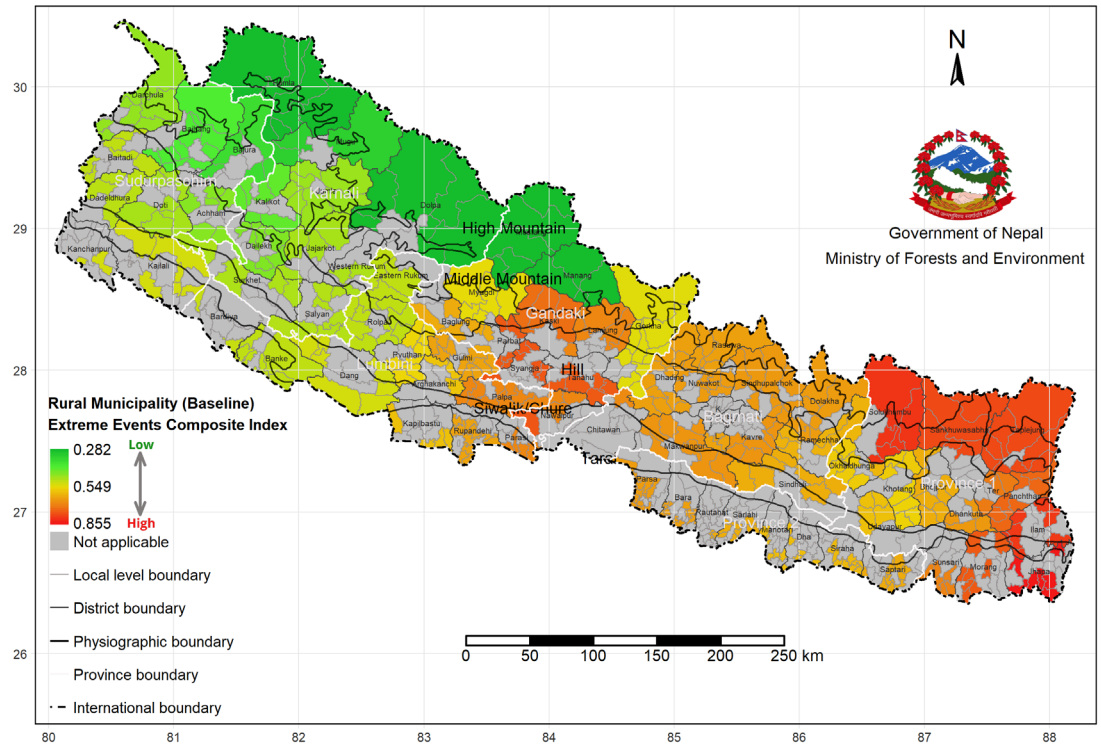



**Figure 21: Baseline Extreme Event Ranking for the Rural and Urban Settlement Sector (Rural Municipalities)**

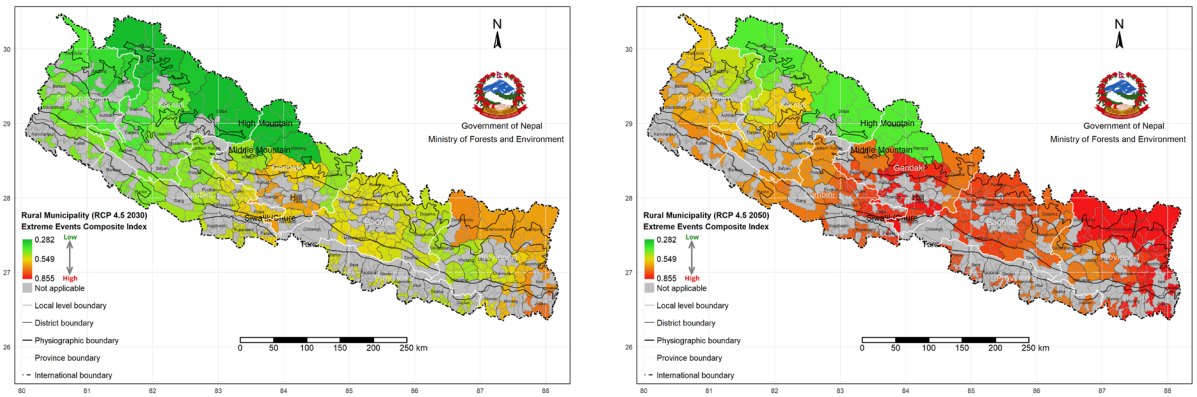



**Figure 22: Climate Extreme Events Composite Index of Rural Municipalities – RCP 4.5 (2030, 2050)**

Comparing to the baseline, there is a slight increment in the number of rural municipalities having high to very high climatic extreme events in RCP 8.5 (2030) and a huge increment in RCP 8.5 (2050). Palikas in eastern mountain regions will be facing more extreme events. Palikas in the western part of both Tarai and hilly regions of Nepal also are likely to have increased extreme events. A huge difference can be observed as Palikas having lower extreme events have shifted toward the high and very high extreme events zone, as more extreme events are likely to increase in this scenario (Figure 23).

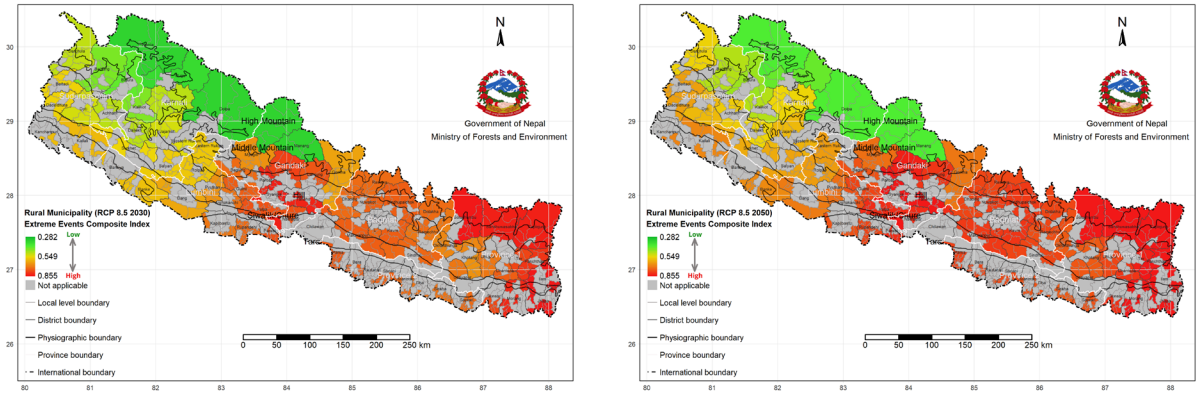



**Figure 23: Climate Extreme Events Composite Index of Rural Municipalities – RCP 8.5 (2030, 2050)**

## 5.3 Exposure in the Sector and Subsectors

The overall findings show that the majority of municipalities (33) represent a high to a very high degree of exposure to climate change (Figure 24 and Table 24). Biratnagar, Lalitpur, Kathmandu, Birgunj, Bharatpur, Pokhara Lekhnath, Ghorahi, Tulsipur are the older and bigger towns developed as metropolitan and sub-metropolitan areas and are very highly exposed municipalities. The majority of the highly exposed municipalities were established or declared in 2011 or earlier and are highly populated with high investments in roads, irrigation, health and education infrastructure, cultural heritage sites, and market centres. The rest of the other 260 municipalities across Nepal are characterized by moderate to very low exposure to climate change. These municipalities are less populated and have limited infrastructure development. Very less exposed municipalities include newly declared municipalities with low population and infrastructure and resources. The detailed numerical index value of the exposure of each municipality is presented in **Annex 10**.

### 5.3.1 Exposure in the Municipalities

The overall findings show that the majority of municipalities (26) represent a high to a very high degree of exposure to climate change (Figure 24 and Table 24). Biratnagar, Lalitpur, Kathmandu, Birgunj, Bharatpur, Pokhara Lekhnath, Ghorahi, Tulsipur are the older and bigger towns developed as metropolitan and sub-metropolitan areas and are very highly exposed municipalities. The majority of the highly exposed municipalities were established or declared in 2011 or earlier and are highly populated with high investments in roads, irrigation, health and education infrastructure, cultural heritage sites, and market centres. The rest of the other 267 municipalities across Nepal are characterized by moderate to very low exposure to climate change. These municipalities are less populated and have limited infrastructure development. Very less exposed municipalities

include newly declared municipalities with low population and infrastructure and resources. The detailed numerical index value of the exposure of each municipality is presented in **Annex 10.**

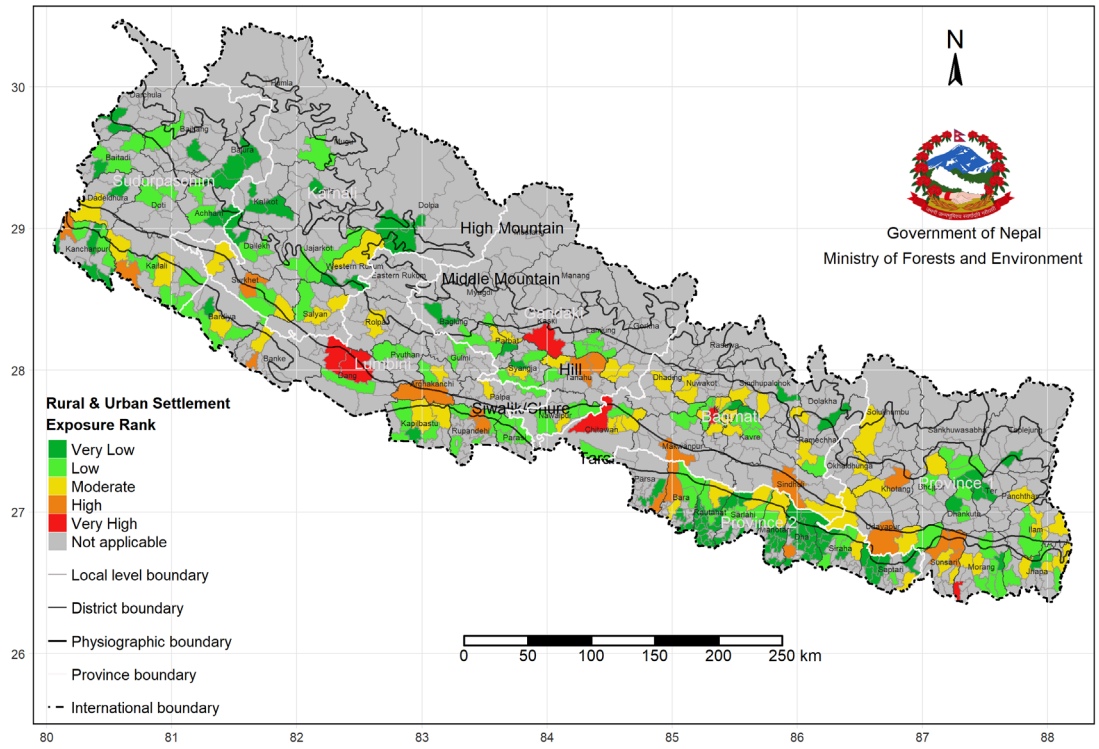



**Figure 24: Exposure Rank of the Municipalities**

**Exposure of Socioeconomic Subsector:** In the socioeconomic sub-sector, the main indicator used for assessing the exposure was the total municipal population. The findings show that the higher the population of the municipality, the higher will be the exposure to climate-related stressors and hazards. It is observed that the municipalities with a higher population where the urbanization and migration rate has increased over the year are found to have very highly exposed municipalities. The comparison of two highly exposed municipalities (Pokhara Lekhnath and Biratnagar) with the least and moderately exposed municipality (Dhorpatan and Illam) is presented in Table 23.

**Exposure of Physical Infrastructure Subsector:** In the physical infrastructure subsector, the exposure indicators used were total road length, number of water supply schemes, irrigation schemes, and main canal length. All these parameters are directly associated with the population density. Higher is the population, higher will be the development and higher will be their respective exposure value in this subsector. The comparison of two highly exposed municipality (Pokhara Lekhnath and Biratnagar) with least and moderately exposed municipality (Dhorpatan and Ilam) presented in Table 23 shows that municipality with the high level of development and infrastructure and hence relatively higher number of exposed infrastructures has added value to their respective higher exposure level to climatic stressors in this subsector.

**Exposure of Social Infrastructure Subsector:** In the social infrastructure subsector, the exposure indicators used for the assessment were the number of education infrastructure, health infrastructure, archaeological/cultural sites, and market numbers. The higher will be the value of these parameters, the higher will be the exposure rank. All these parameters are somehow

directly associated with the size of the municipality including population and development. The comparison of two highly exposed municipalities (Pokhara Lekhnath and Biratnagar) with the least and moderately exposed municipality (Dhorpatan and Ilam) presented in Table 23 shows that municipality with the higher number of social infrastructure higher exposure level to climatic stressors than the municipality with a lower number of social infrastructures.

**Table 23: Subsector-wise Comparison of a Highly-exposed Municipality with a Least-exposed Municipality**

| Municipality | Socioeconomics[10] | Buildings and Settlements | Physical Infrastructure[11] | Social Infrastructure[12] |
|---|---|---|---|---|
| Pokhara Lekhnath (Very High) | Population size (No): 401,379 | Number of households: 102,375<br>Built-up area[13]: 72.02 sq. km | Total road network (km): 2,209.233 | Education infrastructure (no): 428 |
| Dhorpatan (Very Low) | Population size (No): 26,088 | Number of households: 5,678<br>Built-up area: 0.25 sq. km | Total road network (km): 347.288 | Education infrastructure (no): 46 |
| Biratnagar (Very High) | Population size (No): 203,572 | Number of households: 45,328<br>Built-up area: 62.76 sq. km | Total road network (km): 718.329 | Health infrastructure[14] (no): 38 |
| Ilam (Moderate) | Population size (No): 49,758 | Number of households: 11,670<br>Built-up area: 3.69 sq. km | Total road network (km): 711.033 | Health infrastructure (no): 3 |

**Table 24: Exposure Ranking of Municipalities**

| Rank | Province | Municipality |
|---|---|---|
| Very High (0.626–1) | Province 1 | Biratnagar |
| | Bagmati | Lalitpur, Kathmandu, Bharatpur |
| | Gandaki | Pokhara Lekhnath |
| | Lumbini | Ghorahi, Tulsipur |
| High (0.404–0.625) | Province 1 | Barah, Dharan, Itahari, Rupakot Majhuwagadhi, Triyuga |
| | Province 2 | Janakpur, Jitpur Simara, Birgunj |
| | Bagmati | Kamalamai, Hetauda |
| | Gandaki | Bhanu, Byas |
| | Lumbini | Butwal, Tillotama, Sitganga, Nepalgunj |
| | Karnali | Birendranagar |
| | Sudurpaschim | Dhangadhi, Bhimdatta |
| Moderate (0.404–0.625) | Province 1 | Phidim, Illam, Suryodaya, Birtamod, Mechinagar, Shivasataxi, Belbari, Sundarharaicha, Duhabi, Inaruwa, Ramdhuni, Shadananda, Solududhakunda, Siddhicharan, Halesi Tuwachung, Chaudandigadhi, Katari |
| | Province 2 | Hanumannagar Kankalini, Lahan, Bardibas, Lalbandi, Brindaban, Kalaiya |
| | Bagmati | Dudhouli, Manthali, Bhimeshwor, Chautara SangachokGadhi, Melamchi, Panauti, Godawari, Changunarayan, Suryabinayak, Budhanilakantha, Chandragiri, Gokarneshwor, Belkotgadhi, Bidur, Nilakantha, Khairahani, Rapti, Ratnanagar |
| | Gandaki | Gorkha, Palungtar, Shuklagandaki, Waling, Kushma, Baglung, Kawasoti |
| | Lumbini | Tansen, Banganga, Buddhabhumi, Sandhikharka, Kohalpur, Barbardiya, Rolpa |
| | Karnali | Aathbiskot, Bagchaur, Sharada, Gurbhakot, Panchpuri |
| | Sudurpaschim | Ghodaghodi, Godawari, Parashuram |

10 CBS, 2011
11 UN-OCHA
12 MoEST, 2017
13 HBASE
14 MoH, 2018

| Rank | Province | Municipality |
|---|---|---|
| Low (0.190–0.283) | Province 1 | Deumai, Mai, Arjundhara, Bhadrapur, Damak, Gauradhaha, Letang, Patahrishanishchare, Rangeli, Ratuwamai, Sunwarshi, Dhankuta, Mahalaxmi, Chainpur, Khandbari, Panchakhapan, Bhojpur, Belaka |
| | Province 2 | Rajbiraj, Dhangadhimai, Golbazar, Siraha, Gaushala, Barahathawa, Haripur, Ishworpur, Kabilasi, Garuda, Gujara, Kolhabi, Nijgadh |
| | Bagmati | Ramechhap, Banepa, Dhulikhel, Namobuddha, Panchkhal, Mahalaxmi, Bhaktapur, Madhyapur Thimi, Dakshinkali, Kageshwori Manahora, Kirtipur, Nagarjun, Tarakeshwor, Tokha, Dhunibesi, Thaha, Kalika, Madi |
| | Gandaki | Besishahar, MadhyaNepal, Rainas, Sundarbazar, Bhimad, Chapakot, Galyang, Putalibazar, Beni, Galkot, Jaimini, Devchuli, Gaidakot, Madhyabindu |
| | Lumbini | Musikot, Resunga, Rampur, Bardaghat, Ramgram, Sunwal, Devdaha, Lumbini Sanskritik, Sainamaina, Siddharthanagar, Kapilbastu, Krishnanagar, Shivaraj, Bhumekasthan, Pyuthan, Sworgadwary, Lamahi, Bansagadhi, Gulariya, Madhuwan, Rajapur, Bheriganga |
| | Karnali | Bangad Kupinde, Bheriganga, Lekbeshi, Dullu, Narayan, Bheri, Chhedagad, Nalagad, Chhayanath Rara |
| | Sudurpaschim | Bungal, Mangalsen, Sanphebagar, Dipayal Silgadi, Shikhar, Bhajani, Gauriganga, Lamkichuha, Tikapur, Bedkot, Krishnapur, Dasharathchanda, Patan, Purchaudi |
| Very Low (0.074–0.190) | Province 1 | Phungling, Kankai, Uralabari, Pakhribas, Laligurans, Myanglung, Dharmadevi, Madi |
| | Province 2 | Bode Barsain, Dakneshwori, Kanchanrup, Khadak, Saptakoshi, Shambhunath, Surunga, Kalyanpur, Karjanha, Mirchaiya, Sukhipur, Bideha, Chhireshwornath, Dhanusadham, Ganeshman Charnath, Hansapur, Kamala, Mithila, Mithila Bihari, Nagarain, Sabaila, Sahidnagar, Aurahi, Balwa, Bhangaha, Jaleswor, Loharpatti, Manra Siswa, Matihani, Ramgopalpur, Bagmati, Balara, Godaita, Haripurwa, Hariwan, Malangawa, Baudhimai, Brindaban, Dewahhi Gonahi, Gadhimai, Gaur, Ishanath, Katahariya, Madhav Narayan, Maulapur, Paroha, Phatuwa Bijayapur, Rajdevi, Rajpur, Mahagadhimai, Pacharauta, Simraungadh, Bahudaramai, Parsagadhi, Pokhariya |
| | Bagmati | Jiri, Barhabise, Mandandeupur, Shankharapur |
| | Gandaki | Bhirkot, Phalebas, Dhorpatan |
| | Lumbini | Maharajgunj, Thakurbaba |
| | Karnali | Chaurjahari, Aathabis, Chamunda Bindrasaini, Thuli Bheri, Tripurasundari, Chandannath, Khandachakra, Raskot, Tilagufa, Musikot |
| | Sudurpaschim | Badimalika, Budhiganga, Budhinanda, Tribeni, JayaPrithivi, Kamalbazar, Panchadewal Binayak, Belauri, Mahakali, Punarbas, Shuklaphanta, Amargadhi, Melauli, Mahakali, Shailyashikhar |

### 5.3.2 Exposure in Rural Municipalities

In the case of rural municipalities, exposure is high in the Tarai and mid-hills palikas compared to the mountain palikas. The Tarai of Province 1, Lumbini, Sudurpaschim Provinces has higher exposure. Besides, the mid-hills of Bagmati and Gandaki Provinces are highly exposed (Figure 25 and Table 25). A total of 30 municipalities fall in the very high exposure category and 55 municipalities fall in the high-exposed category. Mostly the demographic and resource concentration in the palikas played a major role in increasing the exposure to climate-induced hazards. The detailed numerical index value of exposure of each municipality is presented in **Annex 11**.

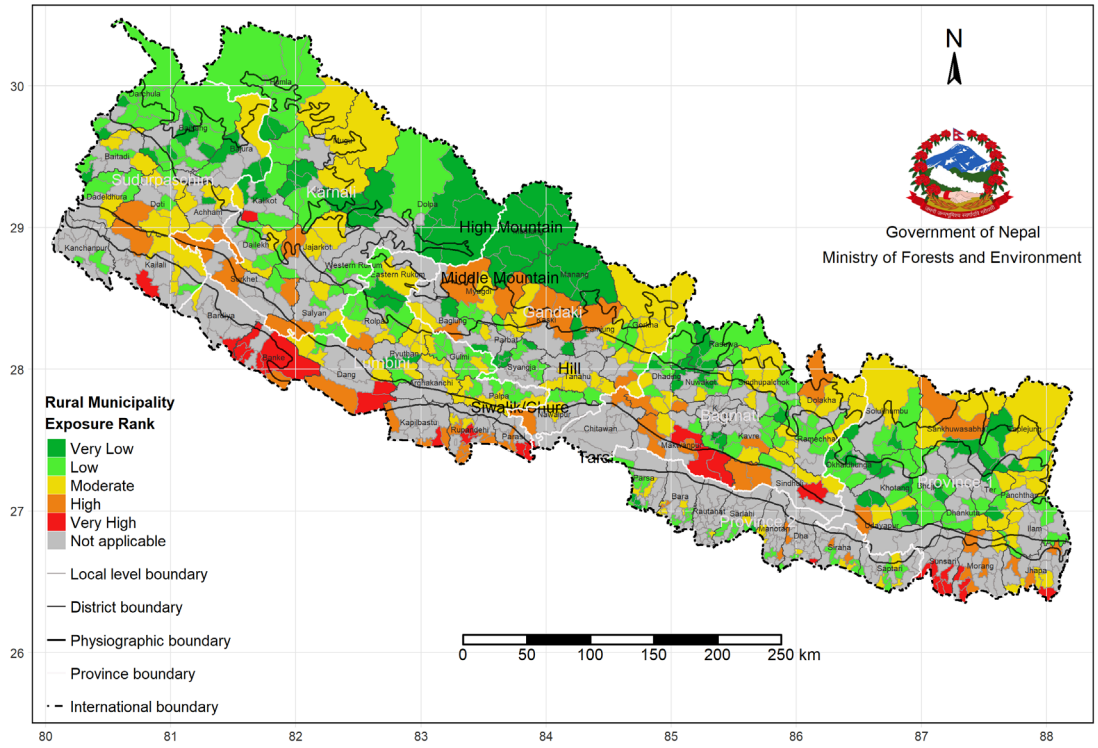



**Figure 25: Exposure Ranks of Rural Municipalities**

## Table 25: Exposure Ranking of Rural Municipalities

| Rank | Rural Municipality |
|---|---|
| Very High (0.579–1) | Kachankawal, Budhiganga, Jahada, Katahari, Barju, Bhokraha Narsingh, Dewanganj, Gadhi, Harinagar, Koshi, Janaknandani, Tinpatan, Bagmati, Bakaiya, Bhimphedi, Pratappur, Susta, Mayadevi, Siyari, Mayadevi, Gadhawa, Rapti, Baijanath, Duduwa, Janki, Khajura, Rapti Sonari, Badhaiyatal, Kalika, Kailari |
| High (0.435–0.578) | Buddhashanti, Jhapa, Kamal, Dhanpalthan, Gramthan, Kanepokhari, Kerabari, Makalu, Udayapurgadhi, Laxmipur Patari, Naraha, Bateshwor, Lakshminiya, Pipra, Hariharpurgadhi, Marin, Bigu, Roshi, Benighat Rorang, Thakre, Makawanpurgadhi, Manahari, Raksirang, Prasauni, Ichchhyakamana, Sahid Lakhan, Marsyangdi, Machhapuchchhre, Madi, Annapurna, Dhaulagiri, Badigad, Palhi Nandan, Sarawal, Gaidahawa, Kotahimai, Marchawari, Omsatiya, Rohini, Sammarimai, Bijayanagar, Suddhodhan, Yashodhara, Runtigadi, Kalimati, Rajpur, Narainapur, Barahtal, Chaukune, Simta, Junichande, Turmakhad, Jorayal, Chure, Binayee Tribeni |

Chapter 6

# Observed Climate Change Vulnerability in the Rural and Urban Sector

## 6.1 Climate Change Sensitivity in the Sector

This section provides an overview of the sensitivity index of the rural and urban municipalities and their subsectors. Based on the assessment, the analysis rank municipalities as to the degree that they are sensitive to climate change in terms of overall (combined) urban sectors and separately for four sub-sectors namely, socioeconomic, building and settlements, physical infrastructure, and social infrastructure.

### 6.1.1 Climate Change Sensitivity in the Municipalities

The overall findings show that 121 municipalities exhibit a high to very high level of sensitivity category (Figure 26 and Table 26). Among them, the majority of the municipalities scattered across all seven provinces of Nepal exhibit sensitivity to climate change given that these municipalities' geological features such as slope, geology, and soil characteristics are the factors that increase susceptibility to climate extreme events and hazards. The municipalities in the hilly region and mountain regions are more sensitive than those in the Tarai region, except in some flood-prone municipalities where they have a higher number of exposed populations and infrastructures, increasing their respective sensitivity to the annual flood events. 18 municipalities from Province 1, and 23 municipalities from Bagmati Province are categorized as very high and high sensitivity due to their fragile landscape features such as steep slopes, geology, and soil. Similarly, 9 municipalities from Lumbini Province, 22 municipalities from Gandaki Province, and 19 municipalities from Karnali Province and Sudurpaschim Province are categorized as very high and high sensitivity due to proximity to flood-prone and landslide-prone areas.

The development practices such as rampant construction of buildings, expansion of unplanned settlements, the rapid development of physical infrastructure, and social infrastructure in the respective disaster risk-prone municipal areas have also contributed to increasing the sensitivity to climatic hazards. Sensitivity to climatic hazards further increases due to lack of building code compliance, fragile and feeble road networks, maladaptive water schemes, and irrigation infrastructure. The study shows that only 42 municipalities have only implemented building codes. For detail numerical index value of sensitivity for each municipality, refer to **Annex 10**.

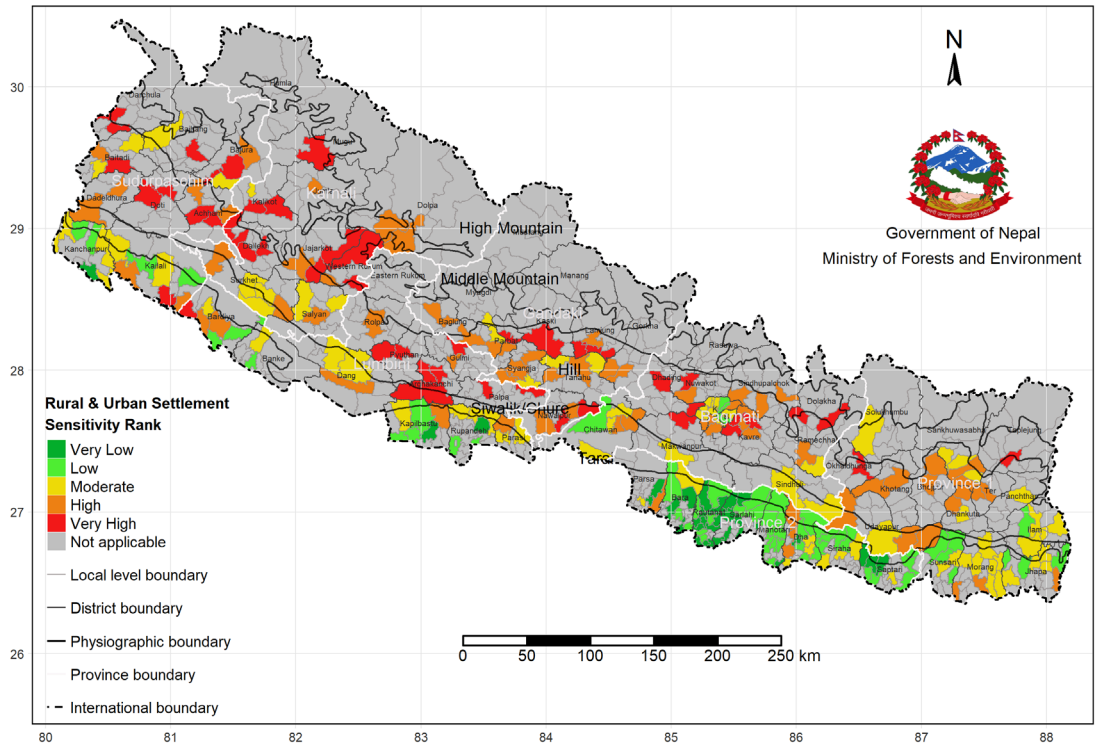



**Figure 26: Sensitivity Ranking of Municipalities**

**Sensitivity of the Socioeconomic Subsector:** The sensitivity indicators used in the assessment included population structure such as the aged group population, disabled population, female-headed households, poverty, people with chronic diseases, population dependent on agriculture, mortality rate, migration rate, and population growth rate. In highly developed and dense urbanized cities exposed to several hazards, the age group of the population, the population living with chronic disease, mortality rate, female-headed households, and poverty index influenced the sensitivity. Differential socioeconomic status and population structure such as gender, age, and health have affected the overall sensitivity of the respective municipality. For example, comparing the municipalities Siddicharan (very high sensitivity), Halesi Tuwachung (high sensitivity), and Solududhkunda (moderate sensitivity)- the findings shows that female-headed (HH%)[15] of Siddicharan was 56.21, which was much higher than that of 26.65 and 22.97 of Halesi Tuwachung and Solududhkunda respectively. The percentage of people with chronic diseases[16] was higher in Siddicharan 5.89 % than that of 2.7 % and 2.5 % of Halesi Tuwachung and Solududhkunda respectively. Similarly comparing the Bhadrapur (high sensitivity) and Mechinagar (very low sensitivity) municipalities: the percentage of the aged group population[15] of Bhadrapur (39.1%) was greater than that of Mechinagar (38.09 %). Also, the percentage of female-headed households[15] in Bhadrapur (56.21%) was greater than that of Mechinagar (26.93 %).

15 CBS, 2011
16 HMIS, 2018

**Sensitivity of the Building and Settlement Subsector:** In the building and settlement subsector, the indicators used for the assessment were risk-prone areas (flood, landslide, drought), settlements in risk-prone areas, building types (roof, wall, and foundation in terms of *kachchi* houses), the fragility of landscape (slope, geology, soil), population density, and land-use change (built up, cultivation, forest, and waterbody). The municipalities in the hilly region are more sensitive due to the proximity of settlements in a landslide-prone and fragile geology, slope, and soil types. The municipalities in the Tarai region are more sensitive due to settlements near the flood-prone areas and the severity of damage i.e., loss and damage to buildings and settlements are high. For example, comparing the municipalities Banepa (very high sensitivity) and Suryabinayek (low sensitivity) in Bagmati Province: the percentage of landslide risk-prone area of Banepa (81.9%)[17] is greater than Suryabinayek (41.6%). The number of settlements in landslide risk-prone areas in Banepa (71)[18] was higher than Suryabinayek (41)[18.] The percentage of building types with temporary *kachhi* roofs in Banepa (52 %) was greater than Suryabinayek (36%)[19]. Likewise comparing the Rajapur (very high sensitivity) municipality and Thakurbaba (moderate sensitivity) municipality of Lumbini Province; the percentage of flood risk-prone area in Rajapur (99.49%)[17] is higher than that of Thakurbaba (40.65%)[17]. The number of settlements in flood risk-prone areas[18] in Rajapur (152) is much greater than that of Thakurbaba (57). Besides, the percentage of building with temporary wall type in Rajapur (31.91%)[19] is higher than that of Thakurbaba (19.4%)[19].

A study of rainfall-induced landslides in Kathmandu reported that the municipalities in the southern hills, which are comprised of colluvium deposits, are prone to landslides (Dahal et al., 2006). These landslides occurred due to the loss of shear strength as a result of heavy rainfall, steep slopes (>60°) composed of silty gravel cover, high infiltration rates, the presence of gullies with clayey and silty gravel deposits, localized slides on upper slopes, and the encroachment of channels on lower slopes for cultivation.

**Sensitivity of the Physical Infrastructure Subsector:** In the assessment of the physical infrastructure subsector, the sensitivity indicators taken were road (*kachhi* road length, road length with a slope greater than 30-degree, road length in the risk-prone area), water schemes (schemes in need of repair, water demand, and household dependent on open water sources and underground water), and irrigation schemes dependent on seasonal rain (location to risk-prone area, accessibility). The higher the number of physical infrastructures such as roads, water supply, and irrigation systems in the municipalities prone to multiple hazards, there is the likelihood of an increase in sensitivity to climate change. For example, comparing the municipalities Bheri (high sensitivity) and Raskot (moderate sensitivity), the percentage of the length of road in landslide risk-prone area[18] in Bheri (14.97%) is greater than that of Raskot (7.22%). The percentage of the length of road[18] in flood risk-prone areas in Bheri (7.21%) was greater than that of Raskot (4.19%). Similarly, comparing Birgunj (high sensitivity) and Parsagadhi (very low sensitivity), the percentage of road length in flood risk-prone area[18] in Birgung (8.92%) whereas the value is zero in Parsagadhi. Similarly comparing Khairahani (high sensitivity) and Bharatpur (low sensitivity), the number of irrigation schemes dependent on seasonal rain[20] in Khairahani (23) is greater than that of Bharatpur (4). All these examples suggest that the development practices in risk-prone areas, and inadequate repair and maintenance of the available physical infrastructure, have increased the sensitivity of the municipality to climate change.

17 METEOR
18 METEOR, OCHA
19 CBS, 2011
20 DWRI – Department of Water Resource and Irrigation

**Sensitivity of the Social Infrastructure Subsector:** In the social infrastructure subsector assessment, the sensitivity indicators taken were the availability and accessibility of education and health service infrastructure in the municipality. The findings show that poor access to health and education services increases the sensitivity of the municipality. Similarly, the proximity of a higher number of health and education infrastructure to risk-prone areas (landslide and flood) increases the sensitivity of that respective municipality. For example, comparing the municipalities Kushma (very high sensitivity) and Baglung (moderate sensitivity), the accessibility to health and education infrastructure[21] is low in Kushma than in Baglung. Likewise, comparing the municipalities of Bhajani (very high sensitivity) and Ghodaghodi (moderate sensitivity); the percentage of education infrastructure in flood risk-prone[21] areas in Bhajani (90%) which is zero in Ghodaghodi.

**Table 26: Sensitivity Ranking of Municipalities**

| Rank | Province | Municipality |
|---|---|---|
| Very High (0.788–1) | Province 1 | Phungling, Siddhicharan |
| | Bagmati | Bhimeshwor, Jiri, Banepa, Panauti, Panchkhal, Bidur, Dhunibesi, Nilakantha, Thaha |
| | Gandaki | MadhyaNepal, Rainas, Sundarbazar, Pokhara Lekhnath, Kushma, Gaidakot, Kawasoti |
| | Lumbini | Musikot, Rampur, Tansen, Bhumekasthan, Sandhikharka, Sitganga, Pyuthan, Sworgadwary, Rajapur |
| | Karnali | Aathbiskot, Aathabis, Chamunda Bindrasaini, Dullu, Narayan, Bheri, Nalagad, Khandachakra, Tilagufa, Chhayanath Rara, Musikot |
| | Sudurpaschim | Badimalika, Budhiganga, JayaPrithivi, Kamalbazar, Mangalsen, Dipayal Silgadi, Shikhar, Bhajani, Patan, Mahakali, Shailyashikhar |
| High (0.662–0.787) | Province 1 | Bhadrapur, Biratnagar, Rangeli, Mahalaxmi, Pakhribas, Laligurans, Myanglung, Chainpur, Dharmadevi, Bhojpur, Shadananda, Halesi Tuwachung, Rupakot Majhuwagadhi, Belaka, Chaudandigadhi, Katari |
| | Province 2 | Chhireshwornath, Janakpur, Mithila, Birgunj |
| | Bagmati | Manthali, Barhabise, Chautara SangachokGadhi, Melamchi, Dhulikhel, Mandandeupur, Namobuddha, Godawari, Lalitpur, Dakshinkali, Shankharapur, Belkotgadhi, Khairahani, Rapti |
| | Gandaki | Gorkha, Palungtar, Besishahar, Bhimad, Byas, Bhirkot, Galyang, Putalibazar, Waling, Phalebas, Dhorpatan, Galkot, Jaimini, Devchuli, Madhyabindu |
| | Lumbini | Resunga, Sunwal, Banganga, Lamahi, Barbardiya, Madhuwan, Rolpa |
| | Karnali | Chaurjahari, Sharada, Gurbhakot, Panchpuri, Chhedagad, Thuli Bheri, Tripurasundari, Chandannath |
| | Sudurpaschim | Budhinanda, Panchadewal Binayak, Sanphebagar, Dhangadhi, Tikapur, Amargadhi, Parashuram, Dasharathchanda |
| Moderate (0.555–0.661) | Province 1 | Phidim, Illam, Mai, Suryodaya, Arjundhara, Birtamod, Gauradhaha, Kankai, Belbari, Letang, Patahrishanishchare, Ratuwamai, Sundarharaicha, Sunwarshi, Uralabari, Inaruwa, Itahari, Dhankuta, Khandbari, Madi, Panchakhapan, Solududhakunda, Triyuga |
| | Province 2 | Rajbiraj, Lahan, Siraha, Sukhipur, Nagarain, Sabaila, Sahidnagar, Nijgadh, Pokhariya |
| | Bagmati | Dudhouli, Kamalamai, Ramechhap, Mahalaxmi, Bhaktapur, Changunarayan, Budhanilakantha, Chandragiri, Kathmandu, Kirtipur, Nagarjun, Tarakeshwor, Tokha, Hetauda, Kalika, Madi, Ratnanagar |
| | Gandaki | Bhanu, Shuklagandaki, Chapakot, Beni, Baglung |
| | Lumbini | Bardaghat, Ramgram, Butwal, Devdaha, Sainamaina, Shivaraj, Ghorahi, Tulsipur, Kohalpur, Thakurbaba |
| | Karnali | Bagchaur, Bangad Kupinde, Bheriganga, Birendranagar, Lekbeshi, Raskot |
| | Sudurpaschim | Tribeni, Bungal, Ghodaghodi, Godawari, Bhimdatta, Krishnapur, Mahakali, Punarbas, Melauli, Purchaudi |

21 IUDP, 2020

| Rank | Province | Municipality |
|---|---|---|
| Low (0.453–0.554) | Province 1 | Deumai, Damak, Mechinagar, Shivasataxi, Barah, Dharan, Duhabi, Ramdhuni |
| | Province 2 | Bode Barsain, Dakneshwori, Hanumannagar Kankalini, Kanchanrup, Saptakoshi, Dhangadhimai, Golbazar, Kalyanpur, Karjanha, Mirchaiya, Bideha, Dhanusadham, Ganeshman Charnath, Hansapur, Kamala, Aurahi, Balwa, Bardibas, Bhangaha, Gaushala, Jaleswor, Loharpatti, Manra Siswa, Ramgopalpur, Haripur, Ishworpur, Lalbandi, Brindaban, Garuda, Paroha, Phatuwa Bijayapur, Rajpur, Jitpur Simara, Mahagadhimai, Simraungadh |
| | Bagmati | Madhyapur Thimi, Suryabinayak, Gokarneshwor, Kageshwori Manahora, Bharatpur |
| | Lumbini | Lumbini Sanskritik, Siddharthanagar, Buddhabhumi, Krishnanagar, Maharajgunj, Nepalgunj, Bansagadhi, Gulariya, Bheriganga |
| | Sudurpaschim | Gauriganga, Lamkichuha, Bedkot, Shuklaphanta |
| Very Low (0.313–0.452) | Province 2 | Khadak, Shambhunath, Surunga, Mithila Bihari, Matihani, Bagmati, Balara, Barahathawa, Godaita, Haripurwa, Hariwan, Kabilasi, Malangawa, Baudhimai, Brindaban, Dewahhi Gonahi, Gadhimai, Gaur, Gujara, Ishanath, Katahariya, Madhav Narayan, Maulapur, Rajdevi, Kalaiya, Kolhabi, Pacharauta, Bahudaramai, Parsagadhi |
| | Lumbini | Tillotama, Kapilbastu |
| | Sudurpaschim | Belauri |

## 6.1.2 Climate Change Sensitivity in Rural Municipalities

In the case of the rural municipalities (Palikas), the findings show that most of the Palikas in Tarai and mid-hill in all the provinces are highly sensitive to climate-induced extreme events and hazards. The sensitivity is high in the mid-hills of Bagmati and Gandaki Provinces. In Lumbini Province, Tarai and mid-hill Palikas have higher sensitivity. In the case of Province 1, the higher sensitivity is found in the Palikas of the Tarai region (Figure 27 and Table 27). There are 40 municipalities across the provinces that are highly sensitive to climate-induced hazards. Besides, 127 municipalities fall in the highly sensitive category. For detail numerical index value of sensitivity for each municipality, refer to **Annex 11**.

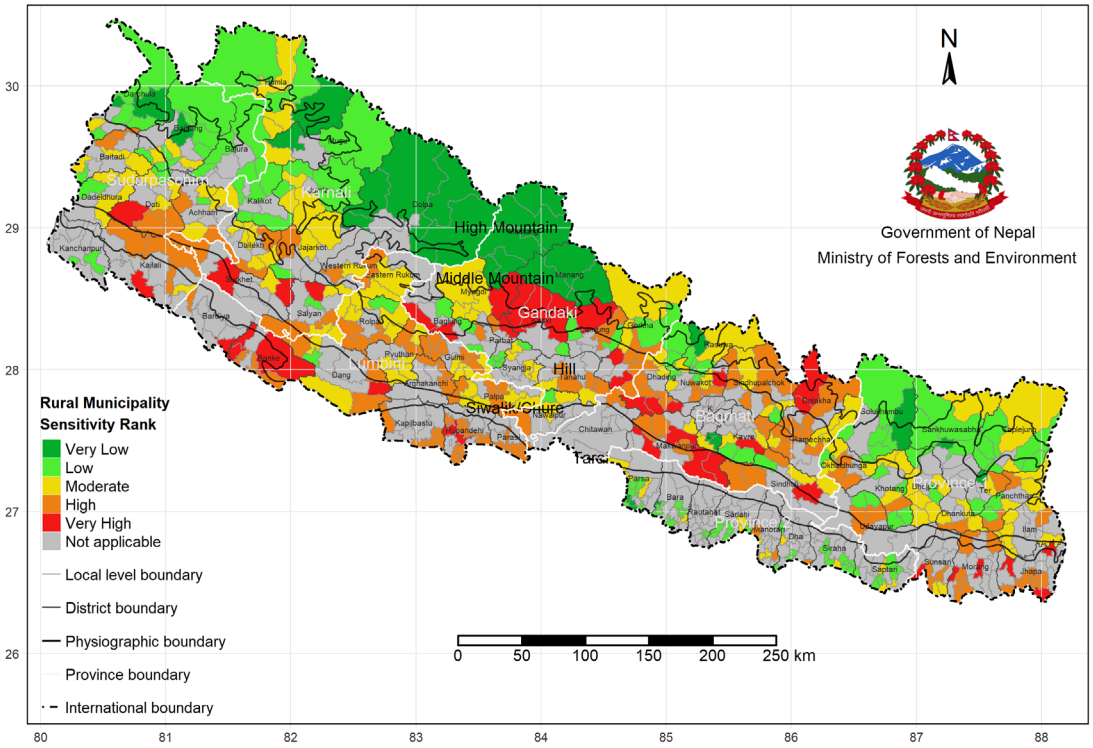



Figure 27: Sensitivity Ranks of Rural Municipalities

**Table 27: Sensitivity Ranking of Rural Municipalities**

| Rank | Rural Municipality |
|---|---|
| Very High (0.674 - 1) | Buddhashanti, Kachankawal, Kamal, Budhiganga, Kanepokhari, Koshi, Tinpatan, Bigu, Kalinchok, Roshi, Dupcheshwar, Benighat Rorang, Gajuri, Thakre, Bagmati, Bakaiya, Bhimphedi, Manahari, Sahid Lakhan, Siranchok, Marsyangdi, Annapurna, Machhapuchchhre, Madi, Annapurna, Modi, Badigad, Nisikhola, Gaidahawa, Mayadevi, Kumakha, Rapti, Baijanath, Khajura, Rapti Sonari, Badhaiyatal, Barahtal, Simta, Jorayal, Kailari |
| High (0.527 - 0.673) | Hilihang, Miklajung, Maijogmai, Barhadashi, Gauriganj, Haldibari, Jhapa, Dhanpalthan, Gramthan, Jahada, Katahari, Kerabari, Miklajung, Bhokraha Narsingh, Gadhi, Harinagar, Sangurigadhi, Aathrai, Manebhanjyang, Molung, Sunkoshi, Khotehang, Rautamai, Udayapurgadhi, Janaknandani, Pipra, Sonama, Hariharpurgadhi, Marin, Sunkoshi, Doramba, Khadadevi, Likhu Tamakoshi, Baiteshwor, Gaurishankar, Melung, Sailung, Tamakoshi, Balefi, Bhotekoshi, Helambu, Indrawati, Jugal, Bhumlu, Chaurideurali, Kakani, Likhu, Shivapuri, Galchi, Jwalamukhi, Siddhalek, Tripura Sundari, Kailash, Makawanpurgadhi, Raksirang, Ichchhyakamana, Aarughat, Bhimsen Thapa, Gandaki, Barpak Sulikot, Dordi, Anbukhaireni, Bandipur, Myagde, Rhishing, Jaljala, Kanthekhola, Chandrakot, Dhurkot, Isma, Madane, Malika, Satyawati, Bagnaskali, Mathagadhi, Rainadevi Chhahara, Rambha, Palhi Nandan, Pratappur, Sarawal, Susta, Susta, Kanchan, Kotahimai, Marchawari, Omsatiya, Rohini, Sammarimai, Siyari, Sudhdhodhan, Bijayanagar, Mayadevi, Suddhodhan, Yashodhara, Chhatradev, Malarani, Panini, Jhimruk, Naubahini, Runtigadi, Suwarnabati, Tribeni, Sani Bheri, Chhatreshwori, Kalimati, Babai, Banglachuli, Gadhawa, Duduwa, Janki, Narainapur, Geruwa, Chaukune, Gurans, Naumule, Junichande, Chaurpati, Turmakhad, Badikedar, Bogtan, Bardagoriya, Chure, Joshipur, Mohanyal, Dilasaini, Dogadakedar, Binayee Tribeni, Sisne |

## 6.2 Adaptive Capacity of the Urban Sector

The section provides an overview of the status of adaptive capacity of the rural and urban municipalities. Based on the assessment, the analysis has ranked the municipalities based on their degree of capacity to respond to climate change.

### 6.2.1 Adaptive Capacity of Municipalities

The section provides an overview of the status of adaptive capacity of the rural and urban municipalities. Based on the assessment, the analysis has ranked the municipalities based on their degree of capacity to respond to climate change.

The findings indicate that 40 municipalities are found to have high to very high adaptive capacity whereas 179 municipalities have low to very low adaptive capacity (Figure 28 and Table 28). The higher adaptive capacity was found in old municipalities which were established before 2011. These municipalities have received huge investments in urban planning and local development to newly established/declared municipalities. The municipalities such as Biratnagar, Birgunj, Damak, Kathmandu, Butwal, Itahari, Pokhara Lekhnath, etc exhibit high to very high adaptive capacity. 28 municipalities in Province 1, 51 municipalities in Province 2, 10 municipalities from Bagmati Province, 18 municipalities from Gandaki Province, 17 municipalities from Lumbini Province, 24 municipalities from Karnali Province and 31 municipalities from Sudurpaschim Province have low to very low adaptive capacity. The major cause of low adaptive capacity in these Provinces is a higher incidence of poverty, inadequate infrastructure development and access, and other prevailing local development challenges. The majority of municipalities of Province 2 have small land holding areas with few populations and infrastructures in comparison to other Provinces which reflected the relatively lower value of adaptive capacity. While comparing with Gandaki, Bagmati, and Lumbini Provinces which have a better adaptive

capacity due to high HDI, improved access to services and infrastructures, greater investment in the sector, etc.

Most of the old urban towns and cities of Nepal like Kathmandu, Pokhara, and Biratnagar have access to resources, good practices, access to information, and resilient and standard development practices. Therefore, the municipality which has developed and implemented long-term periodic and integrated plans, disaster preparedness plans; adopted building codes for infrastructure; and prioritized investments in urban planning and local development have the higher adaptive capacity. For detail numerical index value of adaptive capacity for each municipality, refer to **Annex 10**.

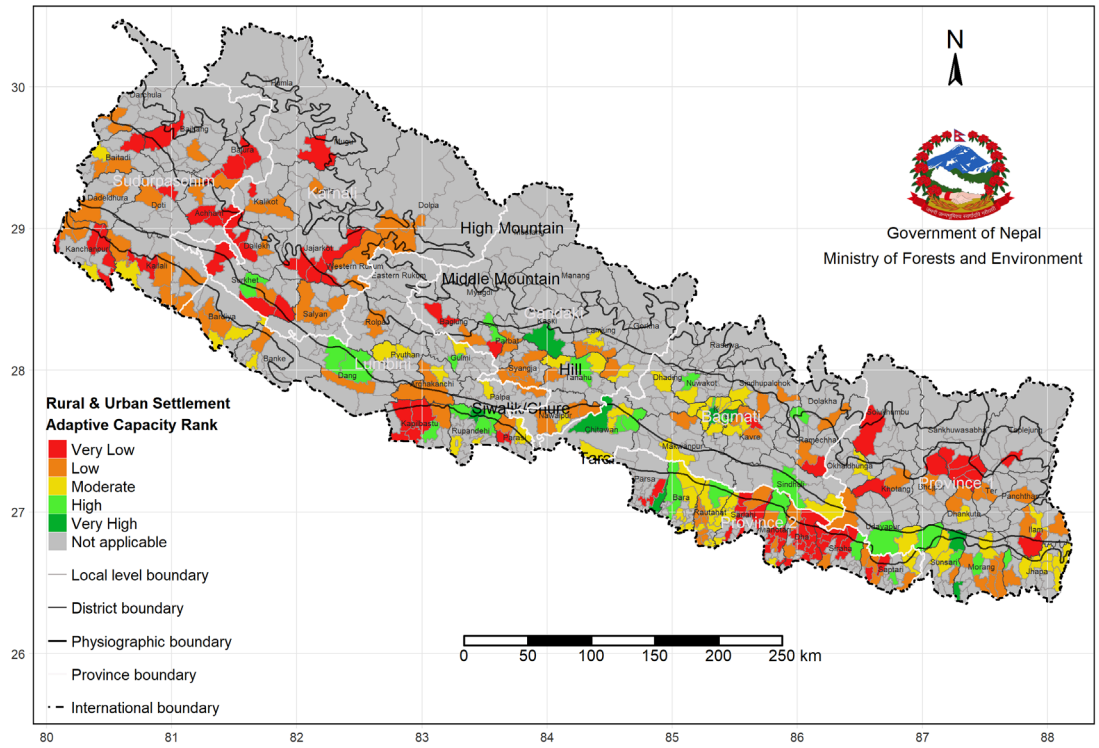



**Figure 28: Adaptive Capacity Ranking of Municipalities**

### Adaptive Capacity in the Socioeconomic Subsector

In the socioeconomic subsector, the adaptive capacity indicators taken were the HDI index, access to goods and services, literacy rate, population dependent on the non-agricultural economy, woman's share in income, economically active population, female ownership on both household and building, municipal budget allocation (Female/Children/poor deprived and minorities group), and the early warning system coverage in the municipalities. The higher the value of indicators, the higher is the adaptive capacity of the municipality.

The municipalities from Karnali Province and Sudurpaschim Province were found to have a very low adaptive capacity due to poor access to resources. Some municipalities of Province 2 also have a low adaptive capacity. For example, comparing the municipalities, Sunwarshi (low adaptive capacity) and Belbari (high adaptive capacity), the percentage of literacy in Sunwarshi (56.66 %) was less than in Belbari (72.58 %)[22]. The amount of budget allocation targeting the

22 CBS, 2011

marginalized women and deprived groups in Sunwarshi (NPR 39,08,186) was less than Belbari (NPR 76,08,586) [23]. Besides, the area of early warning system coverage (sq. km) of Sunwarshi (35.54 sq. km) was less than Belbari 66.82 (sq. km)[24]. Similarly comparing the municipalities Ramgram (very low adaptive capacity) and Tilottama (high adaptive capacity), the percentage of access to drinking water coverage in Ramgram (88%) was less than Tilottama (99%)[25]. The percentage of access to the piped water network[25] in Ramgram (15%) was less than in Tilottama (40%). Besides, the percentage of literacy in Ramgram (66.71%) was very less than in Tilottama (80.75%)[26]. Also, the percentage of the non-agro-based economy of Ramgram (5.94%) was less than that of Tilottama (14.24%)[26].

**Adaptive Capacity in the Building and Settlement Subsector**

In the assessment of the building and settlement subsector, the adaptive capacity indicator taken were building types, natural resources, and institutional provisions. The findings showed that those municipalities that have the higher compliance to building-code construction and having climate-friendly buildings have higher adaptive capacity. The higher adaptive capacity is also enhanced by the increased access to electricity and alternative energy, availability to open and green spaces, adequate technical human resources in the municipality, availability of trained masons, and availability of integrated multi-year plans.

The higher adaptive capacity in the municipalities reflects that the municipalities have adopted sound development practices during urban and settlement planning, possess the capacity to implement different policies and regulations, and had a long-term vision for urban development. For example, comparing the municipalities Gaushala (low adaptive capacity), Bardibas (high adaptive capacity): the percentage of building with RCC roof[26] in Bardibas (7.7%) is higher than in the Gaushala (5.38%). Similarly, comparing the municipalities, Ratnanagar (moderate adaptive capacity) and Rapti (high adaptive capacity), the percentage of climate-friendly building wall envelope[26] in Rapti (22.6%) is higher than that of Ratnanagar (5.97%). The percentage of available green areas[27] in Rapti Ratanagar is nearly equal to 100%. Also, comparing the municipalities of Maharajgunj (very low adaptive capacity) and Kapilbastu (high adaptive capacity), the percentage of building with RCC roofs in Kapilbastu[26] (61%) is higher than that of Maharajgunj (58 %). Besides, the percentage of building compliance[28] in Kaplibastu (22%) is higher. On the contrary building code does not exist in Maharjgung.

**Adaptive Capacity in the Physical Infrastructure Subsector**

In the assessment of the physical infrastructure subsector, the adaptive capacity indicators taken were road (availability of stormwater drain line, metallic roads, road density, municipal budget in road sector), functionally intact water schemes, and irrigation schemes (dependent on perennial sources and operational schemes). The adaptive capacity of the municipalities in this subsector is influenced by the higher value of road density, metallic road percentage, investment in the road sector, roads with a storm drain, operational water, and irrigation schemes. The investment capacity of the municipality to maintain the infrastructure is also one of the influencing factors in enhancing the adaptive capacity of the municipalities. For example, comparing the municipalities Krishnapur (very low adaptive capacity) and Dhangadhi

23 MoFAGA, 2020
24 MoHA
25 DWSS, 2018
26 CBS, 2011
27 https://www.openstreetmap.org
28 NSET, 2018; IUDP, 2020

(high adaptive capacity), the percentage of the metallic road[29] in Krishnapur was none whereas it is 15% in Dhangadhi. Also, the road density[30] of Dhangadi (3.5), was higher compared to Krishanpur (1.7). Besides, the amount of municipal budget in the road sector[31] in Dhangadi (NPR 12,77,94,440) was higher compared to Krishnapur (NPR 4,75,00,000).

Similarly comparing the municipalities Bheriganga, Dullu, Raskot (very low adaptive capacity), and Birendranagar (high adaptive capacity), the road density was 2, 2.24, and 1.25 for Bheriganga, Dullu, and Raskot respectively which was very less than that of Birendranagar which was 8.08[30]. The percentage of functionally intact water schemes[32] of Bheriganga, Dullu, and Raskot was 27, 25, and 29 respectively, which was nearly equal and less compared to 28 in Birendranagar. Besides, the number of operational irrigation schemes[33] in Bheriganga, Dullu, and Raskot was 7, 1, and 2 respectively which was less compared to 13 schemes in Birendranagar.

**Adaptive Capacity in the Social Infrastructure Subsector**

In the assessment of the social infrastructure subsector, the adaptive capacity indicators take was s schools and health infrastructure (capacity service population, capacity hospital beds). The adaptive capacity of the municipalities is influenced by the higher value of capacity of the health and education infrastructure. Old 58 municipalities have the higher adaptive capacity in this subsector. On the contrary, the newly declared municipalities have lower adaptive capacity than the old towns. For example, comparing the municipalities Sunwarshi (low adaptive capacity) and Belbari (high adaptive capacity), the number of available hospital beds[34] in Sunwarshi (5) is less than that of Belbari (10). The amount of Health sector budget[31] of Sunwarshi (NPR 1,00,00,000) was very less than that of Belbari (NPR 4,42,88,788) 2020). Similarly, comparing the municipalities Mithila (very low adaptive capacity) and Bardibas (very high adaptive capacity), the percentage of the capacity of education institutes giving services to its population[35] in Mithila (23%) is less than that of Bardibas (28%). Besides, the capacity of the hospital bed[34] in Mithila is zero, whereas the value is 200 for Bardibas. Also, the amount of municipal budget in the health sector[31] in Mithila (NPR 1,64,55,671) is very less than that of Bardibas (NPR 3,90,00,000).

**Table 28: Adaptive Capacity Ranking of Municipalities**

| Rank | Province | Municipality |
|---|---|---|
| Very High (0.741–1) | Province 1 | Biratnagar, Dharan |
| | Province 2 | Birgunj |
| | Bagmati | Lalitpur, Changunarayan, Kathmandu, Bharatpur |
| | Gandaki | Pokhara Lekhnath |
| | Lumbini | Butwal |
| High (0.571–0.740) | Province 1 | Damak, Belbari, Itahari, Belaka, Triyuga |
| | Province 2 | Rajbiraj, Bardibas, Brindaban, Jitpur Simara |
| | Bagmati | Bhaktapur, Madhyapur Thimi, Suryabinayak, Bidur, Rapti |
| | Gandaki | Byas, Beni |
| | Lumbini | Resunga, Sainamaina, Tillotama, Kapilbastu, Ghorahi, Tulsipur |
| | Karnali | Birendranagar |

29 IUDP, 2020
30 UN-OCHA, https://cbs.gov.np/district-profile/
31 MoFAGA, 2020
32 DWSS, 2018
33 DWRI
34 MoH, 2018
35 MoEST, 2017

| | | |
|---|---|---|
| Moderate (0.465–0.570) | Province 1 | Arjundhara, Bhadrapur, Birtamod, Kankai, Mechinagar, Shivasataxi, Letang, Barah, Ramdhuni, Dhankuta, Chaudandigadhi |
| | Province 2 | Saptakoshi, Lahan, Jaleswor, Bagmati, Balara, Baudhimai, Brindaban, Garuda, Gaur, Gujara, Rajdevi, Kalaiya, Kolhabi, Mahagadhimai, Nijgadh, Pacharauta, Simraungadh |
| | Bagmati | Dudhouli, Kamalamai, Bhimeshwor, Melamchi, Dhulikhel, Panauti, Godawari, Mahalaxmi, Budhanilakantha, Chandragiri, Dakshinkali, Gokarneshwor, Kageshwori Manahora, Kirtipur, Nagarjun, Shankharapur, Tarakeshwor, Tokha, Belkotgadhi, Dhunibesi, Nilakantha, Hetauda, Kalika, Khairahani, Madi |
| | Gandaki | Gorkha, Besishahar, Shuklagandaki, Baglung |
| | Lumbini | Musikot, Tansen, Bardaghat, Devdaha, Lumbini Sanskritik, Siddharthanagar, Sandhikharka, Pyuthan, Nepalgunj |
| | Sudurpaschim | Dhangadhi, Dasharathchanda |
| Low (0.382–0.464) | Province 1 | Phidim, Deumai, Illam, Suryodaya, Gauradhaha, Patahrishanishchare, Rangeli, Ratuwamai, Sundarharaicha, Uralabari, Duhabi, Inaruwa, Mahalaxmi, Pakhribas, Laligurans, Myanglung, Bhojpur, Siddhicharan, Rupakot Majhuwagadhi, Katari |
| | Province 2 | Dakneshwori, Hanumannagar Kankalini, Kanchanrup, Khadak, Surunga, Janakpur, Balwa, Gaushala, Barahathawa, Lalbandi, Dewahhi Gonahi, Gadhimai, Ishanath, Katahariya, Madhav Narayan, Maulapur, Paroha, Phatuwa Bijayapur, Rajpur |
| | Bagmati | Manthali, Jiri, Barhabise, Chautara SangachokGadhi, Banepa, Mandandeupur, Namobuddha, Thaha, Ratnanagar |
| | Gandaki | Palungtar, MadhyaNepal, Rainas, Sundarbazar, Bhanu, Bhimad, Bhirkot, Chapakot, Galyang, Putalibazar, Waling, Kushma, Phalebas, Galkot, Devchuli, Gaidakot, Kawasoti, Madhyabindu |
| | Lumbini | Rampur, Sunwal, Banganga, Bhumekasthan, Sitganga, Sworgadwary, Kohalpur, Bansagadhi, Barbardiya, Gulariya, Madhuwan, Thakurbaba, Bheriganga, Rolpa |
| | Karnali | Aathbiskot, Bagchaur, Bangad Kupinde, Sharada, Lekbeshi, Narayan, Thuli Bheri, Tripurasundari, Khandachakra, Tilagufa, Musikot |
| | Sudurpaschim | JayaPrithivi, Sanphebagar, Dipayal Silgadi, Shikhar, Bhajani, Ghodaghodi, Godawari, Lamkichuha, Tikapur, Bedkot, Belauri, Bhimdatta, Amargadhi, Melauli, Patan, Mahakali, Shailyashikhar |
| Very Low (0.244–0.381) | Province 1 | Phungling, Mai, Sunwarshi, Chainpur, Dharmadevi, Khandbari, Madi, Panchakhapan, Shadananda, Solududhakunda, Halesi Tuwachung |
| | Province 2 | Bode Barsain, Shambhunath, Dhangadhimai, Golbazar, Kalyanpur, Karjanha, Mirchaiya, Siraha, Sukhipur, Bideha, Chhireshwornath, Dhanusadham, Ganeshman Charnath, Hansapur, Kamala, Mithila, Mithila Bihari, Nagarain, Sabaila, Sahidnagar, Aurahi, Bhangaha, Loharpatti, Manra Siswa, Matihani, Ramgopalpur, Godaita, Haripur, Haripurwa, Hariwan, Ishworpur, Kabilasi, Malangawa, Bahudaramai, Parsagadhi, Pokhariya |
| | Bagmati | Ramechhap, Panchkhal |
| | Gandaki | Dhorpatan, Jaimini |
| | Lumbini | Ramgram, Buddhabhumi, Krishnanagar, Maharajgunj, Shivaraj, Lamahi, Rajapur |
| | Karnali | Chaurjahari, Bheriganga, Gurbhakot, Panchpuri, Aathabis, Chamunda Bindrasaini, Dullu, Bheri, Chhedagad, Nalagad, Chandannath, Raskot, Chhayanath Rara |
| | Sudurpaschim | Badimalika, Budhiganga, Budhinanda, Tribeni, Bungal, Kamalbazar, Mangalsen, Panchadewal Binayak, Gauriganga, Krishnapur, Mahakali, Punarbas, Shuklaphanta, Parashuram, Purchaudi |

## 6.2.1 Adaptive Capacity of Rural Municipalities

The findings show that most of the rural palikas in Province 2, Karnali, and Sudurpaschim Provinces have a lower adaptive capacity (Figure 29, Table 29). A total of 71 municipalities with very low and 84 municipalities with low adaptive capacity, mostly in Province 2, Karnali, and Sudurpaschim Provinces have very low adaptive capacity. There are less than a dozen of rural municipalities in other Provinces which have low adaptive capacity. The low adaptive capacity is mostly triggered by a lack of access to resources and services, including lower HDI and a higher incidence of poverty in the provinces and respective palikas. For detail numerical index value of sensitivity for each municipality, refer to **Annex 11**.

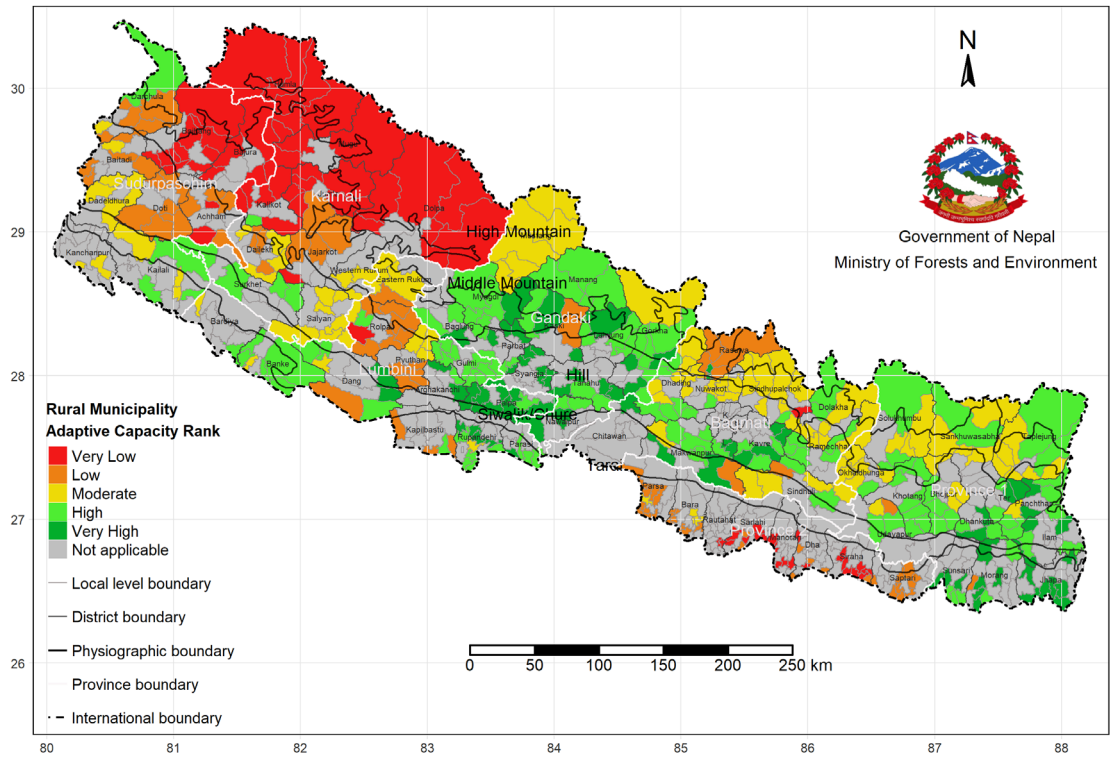



**Figure 29: Adaptive Capacity Ranks of Rural Municipalities**

**Table 29: Adaptive Capacity Ranking of Rural Municipalities**

| Rank | Rural Municipality |
|---|---|
| Very Low (0.101–0.310) | Arnama, Aurahi, Bariyarpatti, Bishnupur, Laxmipur Patari, Naraha, Nawarajpur, Sakhuwanankarkatti, Bateshwor, Dhanauji, Ekdanra, Mahottari, Pipra, Samsi, Sonama, Basbariya, Bramhapuri, Chandranagar, Dhankaul, Kaudena, Parsa, Ramnagar, Tripurasundari, Durga Bhagwati, Yemunamai, Tribeni, Shiwalaya, Chharka Tangsong, Dolpo Buddha, Jagadulla, Kaike, Mudkechula, Shey Phoksundo, Guthichaur, Hima, Kanakasundari, Patrasi, Sinja, Tila, Mahawai, Naraharinath, Pachaljharana, Palata, Sanni Tribeni, Khatyad, Mugu mkarmarong, Soru, Adanchuli, Chankheli, Kharpunath, Namkha, Sarkegad, Simkot, Tanjakot, Chhededaha, Gaumul, Himali, Jagannath, Swami Kartik, Bithadchir, Chabispathivera, Durgathali, Saa Paal, Kedarseu, Khaptadchhanna, Masta, Surma, Talkot, Thalara, Bannigadhi Jayagadh, Dhakari |

## 6.3 Vulnerability in the Rural and Urban Settlement Sector

The section presents the municipality-wise vulnerability by analysing the difference between the sensitivity and adaptive capacity of urban sectors and their subsector as well as rural municipalities.

### 6.3.1 Vulnerability in the Municipalities

The finding shows that among 293 municipalities assessed, 37 municipalities fall under the very high, 52 high, 42 moderate, 58 low, and 104 in a very low vulnerable category (Figure 30 and Table 30). The old-established metropolitan, sub-metropolitan, and municipalities such as Pokhara, Dharan, Kathmandu, Biratnagar, Lalitpur, Dhangadi, Dhankuta, etc, have a very high adaptive capacity and have a very low vulnerability to climate change. These municipalities exhibit human high development index, improved access to adequate livelihood assets, improved access to urban services and function, economically sound systems, resilient physical and social infrastructure, and high institutional capacity to plan and act to prepare and respond effectively to climate-induced shocks and stress. For this reason, old established municipalities have adequate capacity for climate-induced shocks and stresses. Also, the municipalities with low vulnerability ranking are comparatively better positioned to protect and enhance people's lives, secure development gains, and foster an investible environment.

The high to very high vulnerability category municipalities were found in all seven Provinces i.e., 21 municipalities from Province 1, 9 municipalities from Province 2, 17 municipalities from Bagmati Province, 19 municipalities from Gandaki Province, 18 municipalities from Lumbini Province, 21 municipalities from Karnali Province and 21 municipalities from Sudurpaschim Province. The main reason for the high vulnerability found in the above-mentioned municipalities in all the provinces is due to their respective very high sensitivity and low adaptive capacity. Many of the municipalities have their unique climate and development challenges including proximity to risk-prone areas and inadequate administrative and technical measures to deal with climate risk management. This means that the major challenges within the highly vulnerable municipalities are poverty reduction, natural hazards, environmental sustainability, social inclusion, and institutional readiness to deal with shocks and stress. The municipalities with higher population density and lower institutional capacity are particularly vulnerable both to the impacts of disasters and the slow, creeping effects of the changing climate.

At the same time, unplanned and haphazard urbanization has been associated with a considerable increase in urban sprawl and informal settlements which critically making the population exposed to climate change impacts. The municipalities from the Tarai areas are vulnerable due to low-lying flood plains with rapid urbanization and unplanned development and construction. The municipalities from the hilly region have high to very high vulnerability due to fragile geology and landscape, development of infrastructure in those risk-prone terrains, and respective development challenges such as resource mobilization. The newly declared municipalities are more rural, lack basic expected services and functions, and lack sufficient human resources for proper planning and development to implement systematic policies and codes. For this reason, newly established municipalities in Nepal have a very low adaptive capacity. However, these municipalities have prospects as these towns are in the developing stage, fewer human interventions have occurred so far which is an opportunity to make towns,

cities, and human settlements inclusive, safe, resilient, and sustainable in near future. For detail numerical index value of vulnerability for each municipality, refer to **Annex 10**.

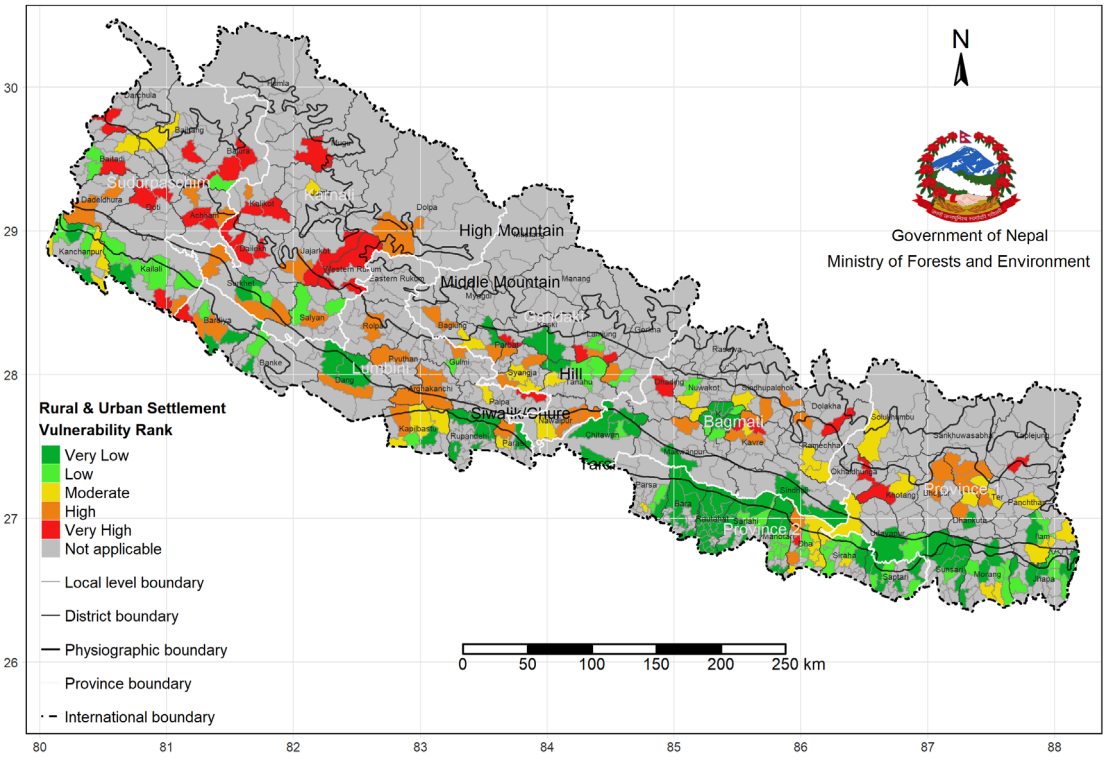



**Figure 30: Vulnerability Ranking of Municipalities**

## Table 30: Vulnerability Ranking of Municipalities

| Rank | Province | Municipality |
|---|---|---|
| Very High (0.686–1) | Province 1 | Phungling, Dharmadevi, Siddhicharan, Halesi Tuwachung |
| | Province 2 | Chhireshwornath |
| | Bagmati | Jiri, Banepa, Panauti, Panchkhal, Nilakantha |
| | Gandaki | MadhyaNepal, Rainas, Kushma, Dhorpatan |
| | Lumbini | Rampur, Sandhikharka, Rajapur |
| | Karnali | Aathbiskot, Chaurjahari, Aathabis, Chamunda Bindrasaini, Dullu, Narayan, Bheri, Nalagad, Khandachakra, Tilagufa, Chhayanath Rara, Musikot |
| | Sudurpaschim | Badimalika, Budhiganga, Budhinanda, JayaPrithivi, Kamalbazar, Mangalsen, Dipayal Silgadi, Shikhar, Bhajani, Patan, Mahakali, Shailyashikhar |
| High (0.488–0.685) | Province 1 | Phidim, Mai, Suryodaya, Rangeli, Sunwarshi, Mahalaxmi, Pakhribas, Laligurans, Myanglung, Chainpur, Khandbari, Panchakhapan, Bhojpur, Shadananda, Solududhakunda, Rupakot Majhuwagadhi, Katari |
| | Province 2 | Karjanha, Sukhipur, Janakpur, Kamala, Mithila, Nagarain, Sabaila, Sahidnagar |
| | Bagmati | Manthali, Ramechhap, Bhimeshwor, Barhabise, Chautara SangachokGadhi, Melamchi, Dhulikhel, Mandandeupur, Namobuddha, Belkotgadhi, Dhunibesi, Thaha |
| | Gandaki | Palungtar, Sundarbazar, Bhimad, Bhirkot, Chapakot, Galyang, Putalibazar, Waling, Phalebas, Galkot, Jaimini, Devchuli, Gaidakot, Kawasoti, Madhyabindu |
| | Lumbini | Musikot, Tansen, Ramgram, Sunwal, Banganga, Krishnanagar, Shivaraj, Bhumekasthan, Sitganga, Pyuthan, Sworgadwary, Lamahi, Barbardiya, Madhuwan, Rolpa |
| | Karnali | Sharada, Bheriganga, Gurbhakot, Panchpuri, Chhedagad, Thuli Bheri, Tripurasundari, Chandannath, Raskot |
| | Sudurpaschim | Bungal, Panchadewal Binayak, Sanphebagar, Tikapur, Krishnapur, Mahakali, Amargadhi, Parashuram, Purchaudi |

| Rank | Province | Municipality |
|---|---|---|
| Moderate (0.314–0.487) | Province 1 | Deumai, Illam, Arjundhara, Bhadrapur, Birtamod, Gauradhaha, Letang, Patahrishanishchare, Ratuwamai, Sundarharaicha, Uralabari, Duhabi, Inaruwa, Madi, Chaudandigadhi |
| | Province 2 | Bode Barsain, Dakneshwori, Hanumannagar Kankalini, Shambhunath, Dhangadhimai, Golbazar, Kalyanpur, Mirchaiya, Siraha, Bideha, Dhanusadham, Ganeshman Charnath, Hansapur, Mithila Bihari, Aurahi, Balwa, Bhangaha, Gaushala, Loharpatti, Manra Siswa, Matihani, Ramgopalpur, Godaita, Haripur, Haripurwa, Ishworpur, Kabilasi, Lalbandi, Bahudaramai, Parsagadhi, Pokhariya |
| | Bagmati | Dudhouli, Godawari, Mahalaxmi, Budhanilakantha, Chandragiri, Dakshinkali, Nagarjun, Shankharapur, Tarakeshwor, Bidur, Kalika, Khairahani, Ratnanagar |
| | Gandaki | Gorkha, Besishahar, Bhanu, Byas, Shuklagandaki |
| | Lumbini | Resunga, Buddhabhumi, Maharajgunj, Kohalpur, Thakurbaba |
| | Karnali | Bagchaur, Bangad Kupinde, Lekbeshi |
| | Sudurpaschim | Tribeni, Dhangadhi, Gauriganga, Ghodaghodi, Godawari, Lamkichuha, Bhimdatta, Punarbas, Shuklaphanta, Dasharathchanda, Melauli |
| Low (0.120–0.313) | Province 1 | Kankai, Mechinagar, Shivasataxi, Belbari, Barah, Itahari, Ramdhuni, Dhankuta, Belaka, Triyuga |
| | Province 2 | Kanchanrup, Khadak, Rajbiraj, Saptakoshi, Surunga, Lahan, Bardibas, Jaleswor, Barahathawa, Hariwan, Malangawa, Brindaban, Dewahhi Gonahi, Gadhimai, Garuda, Gaur, Ishanath, Katahariya, Madhav Narayan, Maulapur, Paroha, Phatuwa Bijayapur, Rajdevi, Rajpur, Jitpur Simara, Mahagadhimai, Nijgadh, Pacharauta, Simraungadh |
| | Bagmati | Kamalamai, Madhyapur Thimi, Gokarneshwor, Kageshwori Manahora, Kirtipur, Tokha, Hetauda, Madi, Rapti |
| | Gandaki | Pokhara Lekhnath, Beni, Baglung |
| | Lumbini | Bardaghat, Devdaha, Lumbini Sanskritik, Sainamaina, Siddharthanagar, Ghorahi, Nepalgunj, Bansagadhi, Gulariya, Bheriganga |
| | Karnali | Birendranagar |
| | Sudurpaschim | Bedkot, Belauri |
| Very Low (0–0.119) | Province 1 | Damak, Biratnagar, Dharan |
| | Province 2 | Bagmati, Balara, Baudhimai, Brindaban, Gujara, Kalaiya, Kolhabi, Birgunj |
| | Bagmati | Lalitpur, Bhaktapur, Changunarayan, Suryabinayak, Kathmandu, Bharatpur |
| | Lumbini | Butwal, Tillotama, Kapilbastu, Tulsipur |

## 6.3.1.1 Subsector-wise Vulnerability

### 1. Socioeconomic Subsector

The results show that 16 municipalities from Province 1, 17 municipalities from Sudurpaschim, 16 municipalities and from Karnali Province have very high and high vulnerability rank (Figure 31). The individual rank of the municipality is referred to in **Annex 7**. The highly vulnerable municipalities are mostly located in Karnali Province, Sudurpaschim, and Province 1. The high vulnerability in the municipalities is triggered by the high level of poverty, the higher number of female-headed households, the higher number of people with chronic diseases, low literacy rate, low level of access to resources and budgets. Table 31 illustrate a comparison of adaptive capacity within Kamalbajar

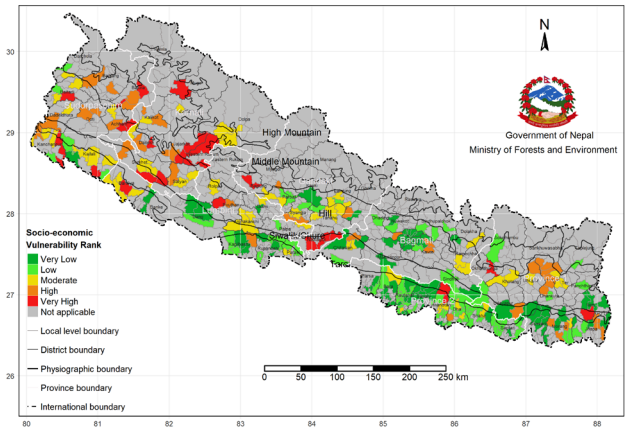



**Figure 31: Socioeconomic Vulnerability Ranking of Municipalities**

and Dhangadi municipalities by looking at the percentage of various age group, percentage dependent on agriculture, and human poverty index. Similarly, the percentage of total literacy and percentage of female ownership in both house and land were other factors considered in the comparison.

**Table 31: Comparison Example: Municipalities with lower Vulnerability and higher Vulnerability in the Socioeconomic Subsector[36]**

| Municipality | Rank | Sensitivity | Adaptive Capacity |
|---|---|---|---|
| Kamalbajar | Very High | • Age group (elderly, infants, children): 50.82 %<br>• Population dependent on agriculture: 32.78 %<br>• Poverty: HPI 46.7 | • Total literacy (%) 55.12<br>• Female ownership (both house and land) 1.28 % |
| Dhangadhi | Very Low | • Age group (elderly, infants, children): 34.57 %<br>• Population dependent on agriculture: 23.85 %<br>• Poverty: HPI 29.5 | • Total literacy (%) 75.24<br>• Female ownership (both house and land) 7.31 % |

## 2. Building and Settlement Subsector

In the vulnerability assessment of the building and settlement subsector, it is found that in total 76 municipalities reflects very high to high vulnerability within the sector in which 7 municipalities from Province 1, 17 municipalities from Province 2, 4 municipalities from Bagmati Province, 11 municipalities from Gandaki Province, 12 municipalities from Lumbini Province, 15 municipalities from Karnali Province and 10 municipalities from Sudurpaschim, have very high and high vulnerability (Figure 32). For the vulnerability rank of each municipality refer to **Annex 7**. This reason for this high vulnerability was due to the construction of settlements in risk-prone areas specially landslide and flood risk-prone areas, construction of non-code compliance buildings, and lack of technical human resources in the municipality. A comparison was done between Sitganga (very highly vulnerable) and Shivraj (very low vulnerable) to further understand the differences in municipalities' sensitivity and adaptive capacity to climate change in the building and settlement subsector. Table 32 illustrates that the percentage of landslide risk-prone areas, the number of settlements in landslide-prone areas, and the percentage of households with the loadbearing foundation are major factors influencing the sensitivity to climate change in Sitganga and Shivraj municipalities. Similarly, the percentage of building with RCC roof type households, and the percentage of household's access to electricity was taken as a measure to compare adaptive capacity between the Sitganga and Shivraj municipalities.

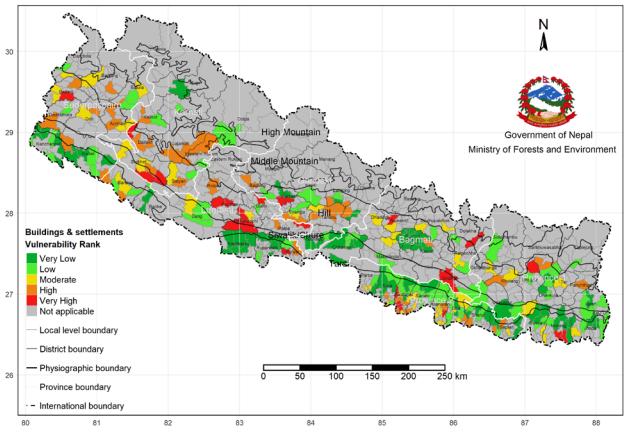



**Figure 32: Building and Settlement Vulnerability Ranking of Municipalities**

36 CBS, 2011

**Table 32: Comparison Example: Municipalities with lower Vulnerability and higher Vulnerability in the Building and Settlement Subsector[37]**

| Municipality | Rank | Sensitivity | Adaptive capacity |
|---|---|---|---|
| Sitganga | Very High | • Landslide risk-prone area: 64.41%<br>• 160 settlements in landslide-prone area<br>• HH with loadbearing foundation: 71.25% | • Building with RCC roof type (HH): 2%<br>• HH with access to electricity: 28.94% |
| Shivraj | Very Low | • Landslide risk-prone area: 21.54%<br>• 7 settlements in landslide-prone area<br>• HH with loadbearing foundation: 58.94% | • Building with RCC roof type (HH): 47.67%<br>• HH with access to electricity: 58.35% |

### 3. Physical Infrastructure Subsector

The study found that a total of 86 municipalities show very high and high vulnerability which includes 11 municipalities from Province 1, 15 municipalities from Province 2, 12 municipalities from Bagmati Province, 12 municipalities from Gandaki Province, 11 municipalities from Lumbini Province, 17 municipalities from Karnali Province and 13 municipalities from Sudurpaschim, have very high and high vulnerability (Figure 33). For the rank of each municipality refer to **Annex 7**.

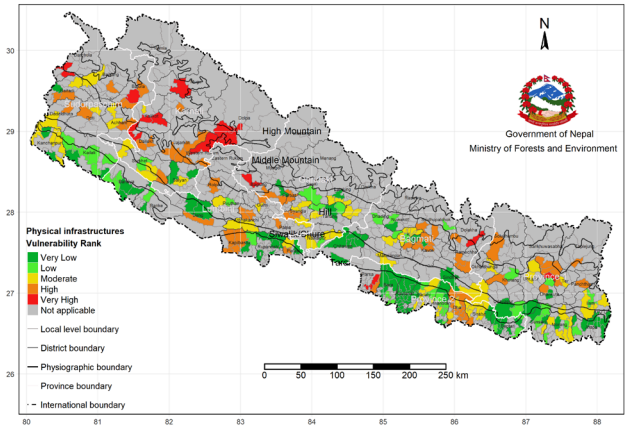



**Figure 33: Physical Infrastructure Vulnerability Ranking of Municipalities**

The findings reflect that most of the municipalities in the hilly, as well as the Tarai region, are more vulnerable to climate change. The physical infrastructure constructed especially roads, water, and irrigation were found in risk-prone areas and these infrastructures lack sufficient drainage structures and further need repair and maintenance.

The comparison was carried out between two municipalities' vulnerability ranking i.e., Jiri (very highly vulnerable) and Kamalamai (very low vulnerable) to understand the factors responsible for high or low vulnerability. Table 33 illustrates the percentage of road type, percentage of road length in landslide-prone areas, and percentage of dilapidated water schemes which have increased sensitivity to climate change in Jiri and Kamalamai municipalities, respectively. Besides, the percentage of stormwater drain line availability, percentage of metalled road, and percentage of functionally intact water are taken as a measure to compare adaptive capacity between the Jiri and Kamalamai municipalities.

37 CBS, 2011, METEOR, UN-OCHA

**Table 33: Comparison Example: Municipalities with lower Vulnerability and higher Vulnerability in the Physical Infrastructure Subsector[38]**

| Municipality | Rank | Sensitivity | Adaptive Capacity |
|---|---|---|---|
| Jiri | Very High | • Road type (length of earthen, graveled): 100%<br>• Length of roads in landslide-prone areas: 13.22%<br>• Dilapidated water schemes: 84% | • Availability of stormwater drain line: 0%<br>• Metalled road: 0%<br>• Functionally intact water schemes: 16% |
| Kamalamai | Very Low | • Road type (length of earthen, graveled): 52.77%<br>• Length of roads in landslide-prone areas: 6.81%<br>• Dilapidated water schemes: 70% | • Availability of stormwater drain line: 7%<br>• Metalled road: 47.22%<br>• Functionally intact water schemes: 29.9% |

### 4. Social Infrastructure Subsector

The result shows that 3 municipalities from Province 2, 5 municipalities from Bagmati Province, 1 municipality from Gandaki Province, 1 municipality from Lumbini Province, 2 municipalities from Karnali Province and 3 municipalities from Sudurpaschim Province have shown very high and high vulnerability (Figure 34). For the rank of each municipality refer to **Annex 7**.

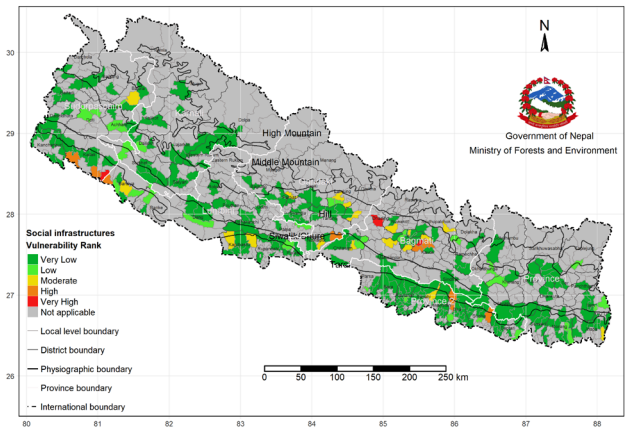



**Figure 34: Social Infrastructure Vulnerability Ranking of Municipalities**

The comparison between the vulnerability ranking of two municipalities i.e., Tikapur (very highly vulnerable) and Lamkichuha (very low vulnerable) is presented inTable 34. The findings illustrate that the percentage of health infrastructure located in flood risk-prone areas, and the percentage of infrastructure located to flood risk-prone areas has largely increased the sensitivity to climate change in Tikapur and Lamkichuha municipalities. Besides, the percentage of the population accessing services from school and the amount of municipal budget allocated in the health sector was taken as a measure to compare adaptive capacity between the Tikapur and Lamkichuha municipalities.

**Table 34: Municipalities with lower Vulnerability and higher Vulnerability in the Social Infrastructure Subsector[39]**

| Municipality | Rank | Sensitivity | Adaptive Capacity |
|---|---|---|---|
| Tikapur | Very High | • Health infrastructure located in flood risk-prone area: 100%<br>• Education infrastructure located in flood risk-prone area: 7.35% | • Municipal budget in health sector: NPR 21,130,244 |
| Lamkichuha | Very Low | • Health infrastructure located in flood risk-prone area: 0%<br>• Education infrastructure located in flood risk-prone area: 0% | • Municipal budget in health sector: NPR 27,625,247 |

Note: For provincial vulnerability maps and illustration within the municipalities, refer to **Annex 8**

## 6.3.2 Vulnerability in Rural Municipalities

Many municipalities face unique climate and development challenges, such as proximity to risk-prone areas where administrative and technical solutions are lacking. A total of 85 rural municipalities have very high and 130 rural municipalities have high vulnerability to climate

38 DWSS, 2018, METEOR, NUDS, 2017(c), UN-OCHA
39 MoFAGA, 2020, METEOR, UN-OCHA

change (Figure 35, Table 35). The vulnerability in rural municipalities is concentrated in Province 2, Bagmati Province, Lumbini Province, Karnali Province, and Sudurpaschim Province. Few Palikas in the Gandaki Province are also extremely vulnerable. Except for Province 1 and Gandaki Province, the vulnerability is distributed across all physiographic regions of the remaining Provinces. Karnali and Sudurpaschim Provinces are the most vulnerable of the provinces. Furthermore, the Provinces' vulnerability is influenced by higher sensitivity of population and resources, as well as a lower capacity to respond to the effects of climate change.

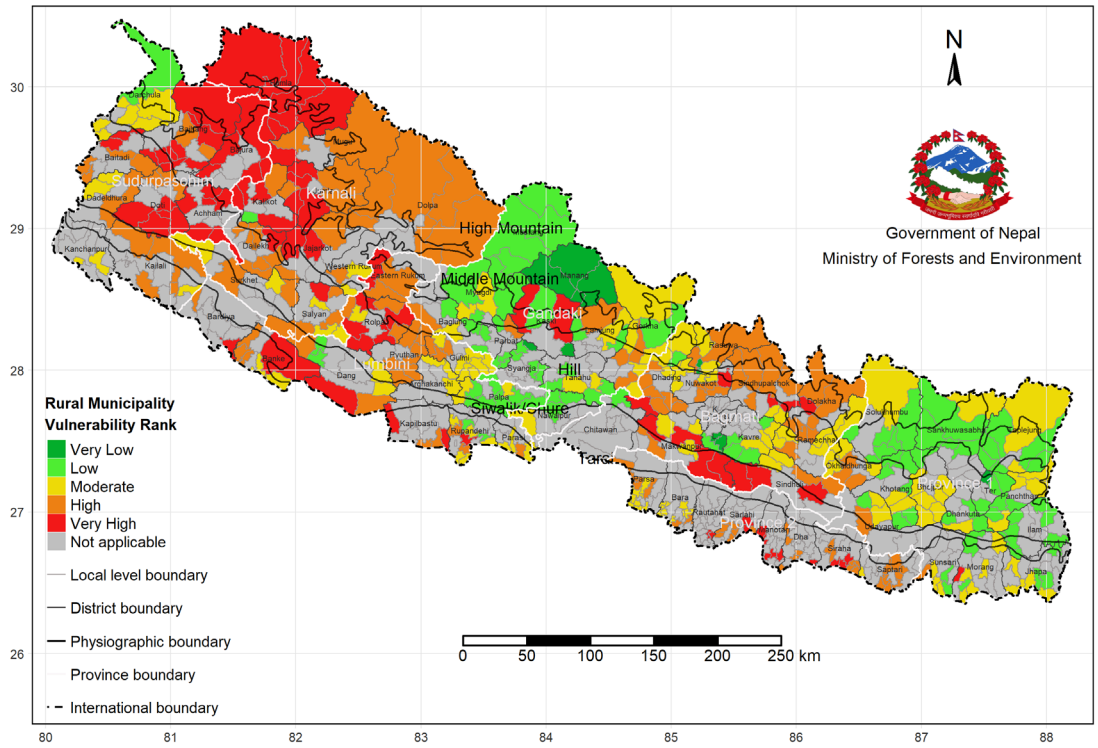



**Figure 35: Vulnerability rank of the rural municipality**

## Table 35: Vulnerability Ranking of Rural Municipalities

| Rank | Rural Municipality |
|---|---|
| Very High (0.743–1) | Budhiganga, Aurahi, Bariyarpatti, Laxmipur Patari, Janaknandani, Ekdanra, Mahottari, Pipra, Samsi, Sonama, Bramhapuri, Chandranagar, Hariharpurgadhi, Marin, Tinpatan, Kalinchok, Balefi, Tripurasundari, Dupcheshwar, Benighat Rorang, Bagmati, Bakaiya, Bhimphedi, Raksirang, Durga Bhagwati, Yemunamai, Annapurna, Madi, Mayadevi, Bijayanagar, Suddhodhan, Pariwartan, Runtigadi, Sunchhahari, Suwarnabati, Tribeni, Kumakha, Rajpur, Rapti Sonari, Badhaiyatal, Naumule, Junichande, Kuse, Kanakasundari, Sinja, Tatopani, Tila, Mahawai, Naraharinath, Pachaljharana, Sanni Tribeni, Khatyad, Adanchuli, Chankheli, Kharpunath, Namkha, Sarkegad, Simkot, Tanjakot, Chhededaha, Gaumul, Himali, Jagannath, Swami Kartik, Bithadchir, Chabispathivera, Durgathali, Saa Paal, Kedarseu, Khaptadchhanna, Talkot, Thalara, Bannigadhi Jayagadh, Chaurpati, Dhakari, Mellekh, Ramaroshan, Turmakhad, Badikedar, Bogtan, Jorayal, K I Sin, Dilasaini, Dogadakedar, Sisne |

Chapter 7

# Projected Climate Change Risks and Adaptation Options in the Rural and Urban Municipalities

## 7.1 Future Climate Change Risks in the RUS Sector and Subsectors

There will be an increased risk of climate change impacts in the rural and urban areas due to increased temperature and extreme variability in the rainfall triggering massive climate hazards. The IPCC report (2017) has shown medium confidence in arguing that many global risks of climate change are concentrated in urban areas. However, there is a very high level of scientific confidence arguing that heat stress, extreme precipitation, inland, and coastal flooding, landslides, air pollution, drought, and water scarcity pose risks in urban areas for people, assets, economies, and ecosystems.

Risks are amplified for those lacking essential infrastructure and services or living in poor-quality housing and exposed areas. Besides, water availability and supply, food security, and agricultural incomes, including shifts in production areas of food and non-food crops are some of the risks in the rural context across the world (high confidence). These impacts are expected to disproportionately affect the welfare of the poor in rural areas, such as female-headed households and those with limited access to land, modern agricultural inputs, infrastructure, and education.

Table 36 presents the outcome of the literature review, consultation at the federal, provincial, and local level, and with subject matter experts. Stakeholders perceived that in the future, the impact of climate change will increase posing threat to socio-economic development in both rural and urban areas of Nepal. For example, the consultations in Gandaki Province revealed that more landslides will be triggered due to intense rainfall in a short duration time and other factors such as haphazard road construction, fragile geological context, unplanned

settlements, and inadequate preparatory measures. Stakeholders consulted in Province 1 & Province 2 argue that unsustainable and rapid population boom in the urban areas coupled with climate change will increase more frequency of flood events and increased the risk of physical damages and loss of life. Table 36 below illustrates the key climatic stressors in the sector and their respective risk within the sector.

**Table 36: Types of Climatic Stressors and Related Risks in the Rural and Urban Settlement Sector**

| Climatic Hazards/Stressors | Key Risks in Urban and Rural Areas |
|---|---|
| Flooding | Deaths and injuries. Disruptions to livelihoods/incomes, food supplies, and drinking water. |
| Heat and cold (including urban heat island effect) | Increase in mortality and morbidity, including shifts in seasonal patterns and concentrations (due to hot days with higher/more prolonged high temperatures or unexpected cold spells). Avoiding risks often most difficult for low-income groups. |
| Water shortages and drought in urban regions | Constraints on urban water provision services to people and industry with human and economic impacts. Damage and loss to urban ecology and its services, including urban and peri-urban agriculture. |
| Geo-hydrological hazards (mud/ landslides) | Damage to networked infrastructure. Loss of human life and property |
| Windstorms with higher intensity | Damage to dwellings, businesses, and public infrastructure; loss of function and services. Challenges to recovery, especially without insurance. |
| Compound slow-onset hazards, including rising temperatures and variability in temperature and water | Damage to or degradation of soils, water catchment capacity, fuelwood production, urban and peri-urban agriculture, and other productive or protective ecosystem services. Knock-on impacts for urban and peri-urban livelihoods and urban health, |
| Water shortages and drought in rural areas | Reduced agricultural productivity of rural people, including those dependent on rainfed or irrigated agriculture, or high-yield varieties, forestry, and inland fisheries. Food insecurity and decrease in incomes; decrease in household nutritional status. |

### 7.1.1 Future Climate Change Risks in the Municipalities

The baseline risk context of the municipalities (Figure 36, Table 37), assessed in this study, shows 46 number of municipalities are under high and very high risk in baseline which reflects the higher level of risk of climate change impact in municipalities located in the hilly, Siwalik/ Chure, and middle mountain regions. This is due to the compounding impact of climate-induced hazards such as landslides, floods, drought, fire, extreme variability in temperature and precipitation, among others. The regions also had a higher degree of sensitivity to hazards such as fragile geology (slope, soil) with limited capacity to cope and respond to the climate-induced disasters and other impacts associated with climate change. Some municipalities of the Tarai region have also shown high risk due to higher exposure to flood-related extreme events, high sensitivity, and limited capacity to cope and adapt. The old towns along with developed cities are in the low-risk category due to their low sensitivity influenced by the higher adaptive capacity. These include municipalities like Dharan from Province 1; Nijgadh, Parsagadhi from Province 2; Bhaktapur, Madhyapur Thimi, Shankharapur, Bharatpur from Bagmati; Beni from Gandaki, Lumbini Sanskritik, Butwal from Lumbini Province and Amargadhi from Sudurpaschim. The combined effect of exposure, the composite value of extreme events, and relative vulnerability associated with sensitivity and adaptive capacity determined the risks of climate change impacts in the case of municipalities.

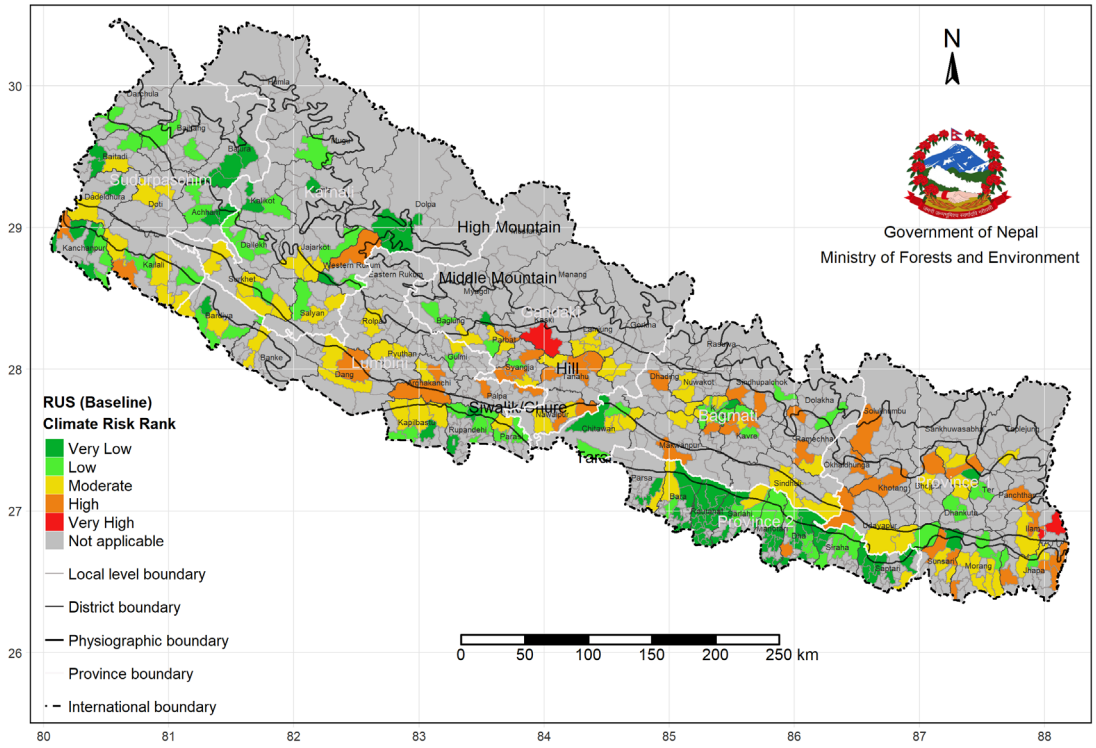



**Figure 36: Baseline Climatic Risk Ranking of Municipalities**

## Table 37: Baseline Risk Ranking of Municipalities

| Rank | Province | Municipality |
|---|---|---|
| Very High (0.486–0.826 | Province 1 | Suryodaya |
| | Gandaki | Pokhara Lekhnath |
| High (0.310–0.485) | Province 1 | Phidim, Illam, Bhadrapur, Birtamod, Gauradhaha, Mechinagar, Biratnagar, Barah, Itahari, Chainpur, Shadananda, Solududhakunda, Siddhicharan, Halesi Tuwachung, Rupakot Majhuwagadhi, Katari |
| | Province 2 | Janakpur |
| | Bagmati | Manthali, Bhimeshwor, Chautara SangachokGadhi, Melamchi, Banepa, Panauti, Panchkhal, Godawari, Nilakantha, Hetauda |
| | Gandaki | Bhanu, Bhimad, Byas, Galyang, Putalibazar, Waling, Kushma, Gaidakot, Kawasoti |
| | Lumbini | Rampur, Tansen, Sandhikharka, Sitganga, Ghorahi |
| | Karnali | Aathbiskot |
| | Sudurpaschim | Dhangadhi, Bhimdatta |
| Moderate (0.215–0.309) | Province 1 | Phungling, Deumai, Mai, Arjundhara, Shivasataxi, Belbari, Patahrishanishchare, Rangeli, Ratuwamai, Sundarharaicha, Sunwarshi, Duhabi, Inaruwa, Ramdhuni, Mahalaxmi, Dharmadevi, Khandbari, Panchakhapan, Bhojpur, Chaudandigadhi, Triyuga |
| | Province 2 | Hanumannagar Kankalini, Lalbandi, Jitpur Simara, Birgunj |
| | Bagmati | Dudhouli, Kamalamai, Ramechhap, Dhulikhel, Lalitpur, Budhanilakantha, Chandragiri, Gokarneshwor, Tarakeshwor, Belkotgadhi, Bidur, Dhunibesi, Thaha, Khairahani, Rapti, Ratnanagar |
| | Gandaki | Gorkha, Palungtar, Besishahar, MadhyaNepal, Rainas, Sundarbazar, Shuklagandaki, Chapakot, Phalebas, Baglung, Galkot, Devchuli, Madhyabindu |
| | Lumbini | Musikot, Sunwal, Banganga, Buddhabhumi, Shivaraj, Bhumekasthan, Pyuthan, Sworgadwary, Lamahi, Tulsipur, Kohalpur, Nepalgunj, Barbardiya, Rajapur, Rolpa |
| | Karnali | Bagchaur, Sharada, Bheriganga, Birendranagar, Gurbhakot, Panchpuri, Bheri, Chhedagad |
| | Sudurpaschim | Dipayal Silgadi, Shikhar, Bhajani, Ghodaghodi, Godawari, Tikapur, Parashuram, Patan |

| Rank | Province | Municipality |
|---|---|---|
| Low (0.138–0.214) | Province 1 | Damak, Kankai, Letang, Uralabari, Dhankuta, Pakhribas, Laligurans, Myanglung, Belaka |
| | Province 2 | Dhangadhimai, Golbazar, Lahan, Siraha, Sukhipur, Chhireshwornath, Kamala, Mithila, Sabaila, Sahidnagar, Bardibas, Gaushala, Haripur, Ishworpur, Kabilasi, Kalaiya |
| | Bagmati | Jiri, Barhabise, Mandandeupur, Namobuddha, Mahalaxmi, Changunarayan, Suryabinayak, Dakshinkali, Kageshwori Manahora, Kathmandu, Kirtipur, Nagarjun, Tokha, Kalika, Madi |
| | Gandaki | Bhirkot, Dhorpatan, Jaimuni |
| | Lumbini | Resunga, Bardaghat, Ramgram, Devdaha, Sainamaina, Siddharthanagar, Tillotama, Krishnanagar, Maharajgunj, Bansagadhi, Gulariya, Madhuwan, Bansagadhi_a |
| | Karnali | Bangad Kupinde, Lekbeshi, Aathabis, Chamunda Bindrasaini, Dullu, Narayan, Tribeni Nalagad, Tilagufa, Chhayanath Rara, Musikot |
| | Sudurpaschim | Bungal, JayaPrithivi, Mangalsen, Sanphebagar, Gauriganga, Lamkichuha, Krishnapur, Punarbas, Purchaudi, Mahakali, Shailyashikhar |
| Very Low (0.026–0.137) | Province 1 | Dharan, Madi |
| | Province 2 | Bode Barsain, Dakneshwori, Kanchanrup, Khadak, Rajbiraj, Saptakoshi, Shambhunath, Surunga, Kalyanpur, Karjanha, Mirchaiya, Bideha, Dhanusadham, Ganeshman Charnath, Hansapur, Mithila Bihari, Nagarain, Aurahi, Balwa, Bhangaha, Jaleswor, Loharpatti, Manra Siswa, Matihani, Ramgopalpur, Bagmati, Balara, Barahathawa, Godaita, Haripurwa, Hariwan, Malangawa, Baudhimai, Brindaban, Chandrapur, Dewahhi Gonahi, Gadhimai, Garuda, Gaur, Gujara, Ishanath, Katahariya, Madhav Narayan, Maulapur, Paroha, Phatuwa Bijayapur, Rajdevi, Rajpur, Kolhabi, Mahagadhimai, Nijgadh, Pacharauta, Simraungadh, Bahudaramai, Parsagadhi, Pokhariya |
| | Bagmati | Bhaktapur, Madhyapur Thimi, Shankharapur, Bharatpur |
| | Gandaki | Beni |
| | Lumbini | Butwal, Lumbini Sanskritik, Kapilbastu, Thakurbaba |
| | Karnali | Chaurjahari, Thuli Bheri, Tripurasundari, Chandannath, Khandachakra, Raskot |
| | Sudurpaschim | Badimalika, Budhiganga, Budhinanda, Tribeni, Kamalbazar, Panchadewal Binayak, Bedkot, Belauri, Mahakali, Shuklaphanta, Amargadhi, Dasharathchanda, Melauli |

The finding shows that in RCP 4.5 (2030), Figure 37, Bhanu, Byas and Kushma from Gandaki Province, and Sitganga from Lumbini Province; the risk level increased from high to very high compared to the baseline scenario (Figure 36). For the risk rank of each municipality, refer to **Annex 12**. Overall, the number of very high-risk municipalities has increased up to 6 from 2 in baseline whereas the high-risk category increased to 80 from 44 in baseline (Table 38) in this scenario. The main reason for this is the likely increase in climate extreme events such as an increase in temperature and precipitation, increase in warm days and nights, increase in very wet days, decrease in rainy days, and increase in heavy rainfall. Besides, the climate extreme scenarios, the other socio-economic factors also government the likelihood of risk as it will influence the sensitivity, and vulnerability of those municipalities.

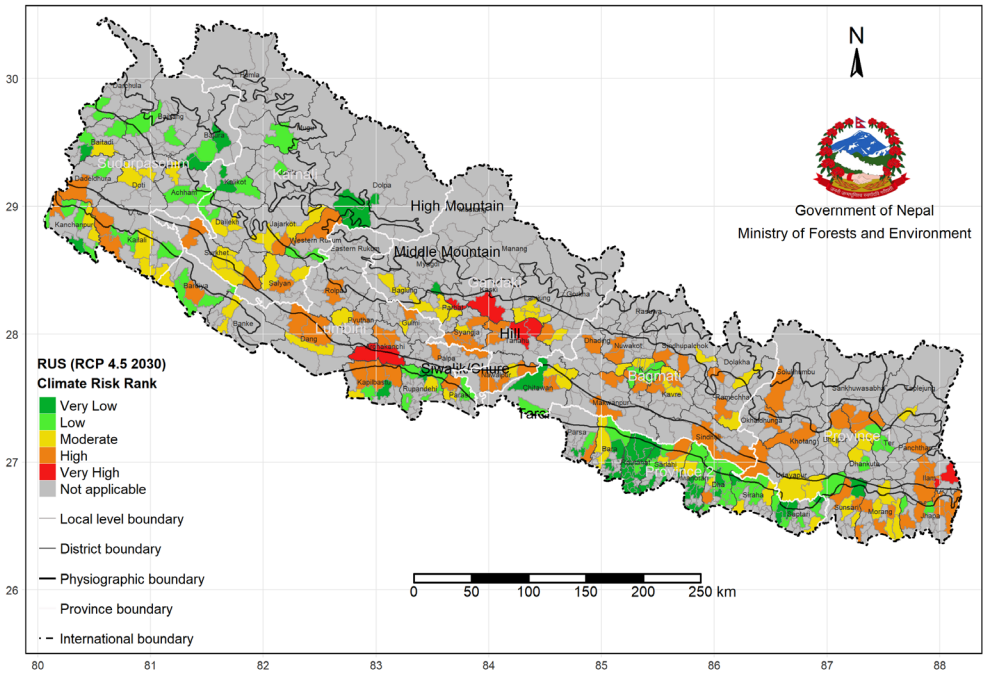



**Figure 37: Climate Risk Ranking of Municipalities Under RCP 4.5 (2030)**

Similarly looking into the future scenario 2050 (RCP 4.5), Nilkantha from Bagmati Province have shifted from high to very high risk rank and Jitpur Simara from Province 2, Sworgadwari and Rajapur of Lumbini Province and Patan of Sudurpaschim Province shifted from moderate to high risk compared to 2030 (RCP 4.5) as there will be a slight increment in annual precipitation trend in Gulmi district which can results in the hazardous events like floods and landslide in the Palikas of Gulmi, thus this can be the major cause of the shift (Figure 38). For the risk rank of each municipality, refer to **Annex 12**.

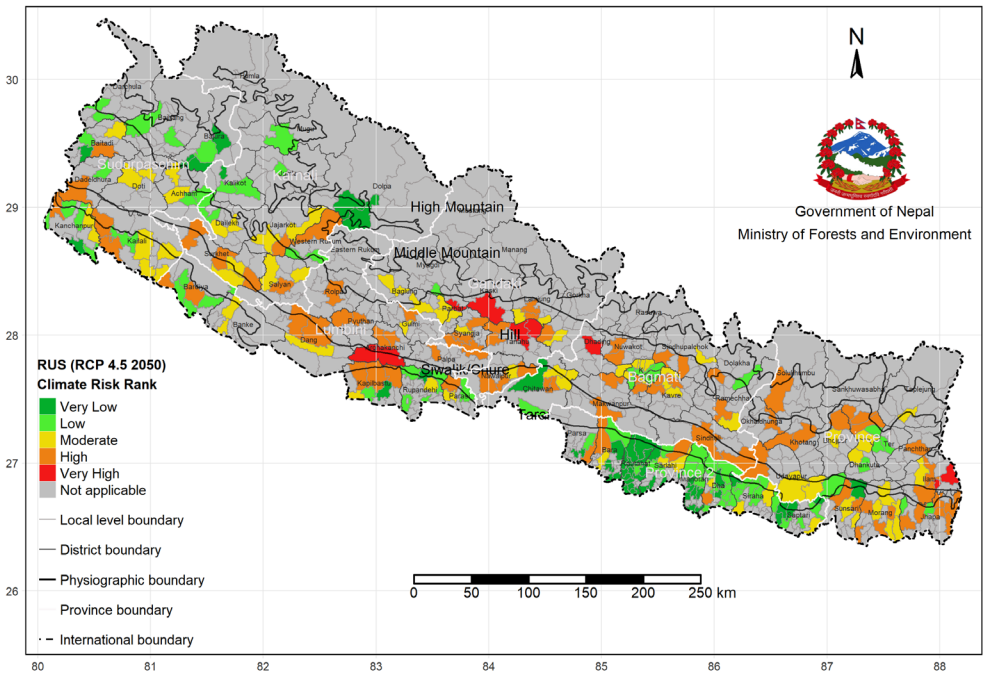



**Figure 38: Climate Risk Ranking of Municipalities Under RCP 4.5 (2050)**

In 2030 under RCP 8.5 (Figure 40), Bhanu and Byas from Gandaki Province, and Sitganga from Lumbini Province will experience the increased risks from high to very high compared to the baseline scenario. Overall, the number of very high-risk municipalities has increased up to 5 from 2 in baseline and up to 69 from 44 in baseline (Table 38) in this scenario. For the risk rank of each municipality, refer to **Annex 12**. The potential reason for this is the compounding likely impact of climate extreme events particularly the potential of flooding due to intense and heavy rainfall, the potential increase in the heatwave and cold waves, etc.

In 2050 under RCP 8.5 (Figure 39), Rupakot Majhuwagadhi from Province 1, Janakpur from Province 2, Nilkantha from Bagmati Province and Kushma fro Gandaki Province shifted from high to very high rank in compared to 2030 scenarios under RCP 8.5. Similarly, Sunwarshi, Bhojpur and Chaudandigadhi from Province 1; Jitpur Simara from Province 2; Chandragiri, Ramechhap, Rapti and Ratnanagar from Bagmati; Sundarbajar, Shuklagandaki, and Madhyabindu from Gandaki Province; Buddhavumi, Bhumekasthan, Pyuthan and Rajapur from Lumbini Province, Sharada and Gurbhakot from Karnali Province and Parashuram and Patan from Sudurpaschim Province shifted from moderate risk to high risk compared to 2030 scenarios under RCP 8.5. For the risk rank of each municipality, refer to **Annex 12**. There are compounding and contextual influence of climate extreme events in these municipalities based on their geographic locations and nature of influence by extreme events, geological fragility, and existing vulnerability. For example, the potential of an increase in temperature and precipitation is likely to trigger landslides in the hilly municipalities, whereas flooding and heat and cold waves in municipalities of the Tarai region. Also, there is a high likelihood of an increase in fire, epidemics in both hilly and Tarai municipalities.

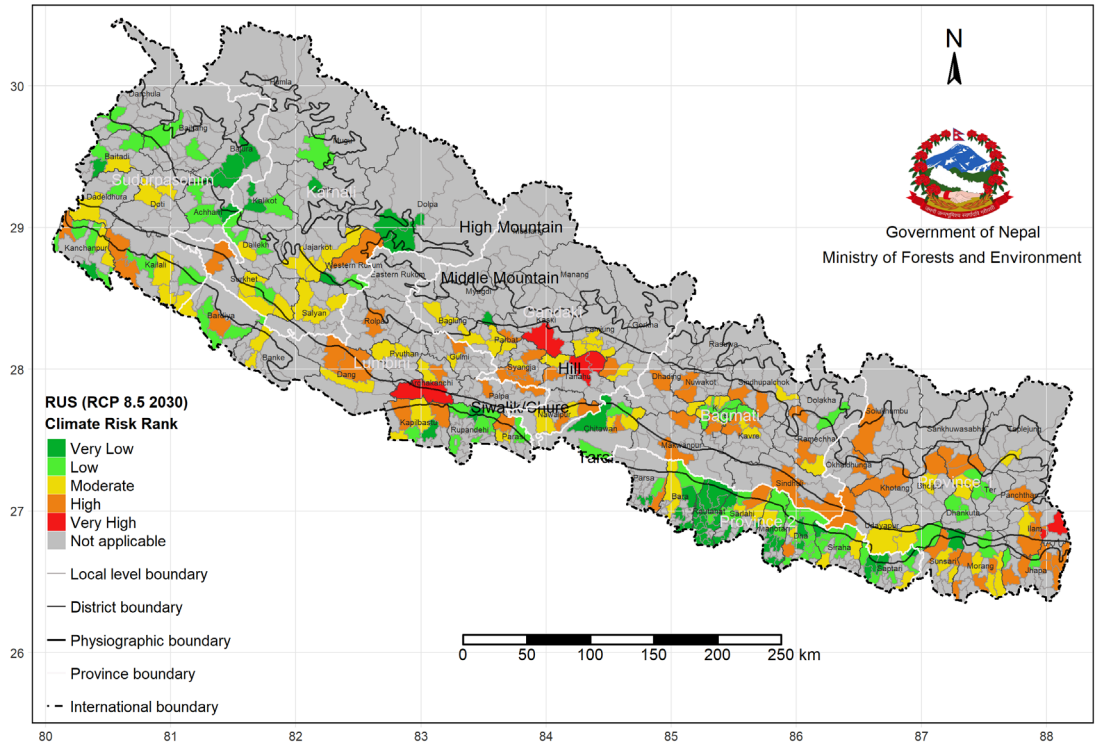



**Figure 39: Climate Risk Ranking of Municipalities Under RCP 8.5 (2030)**

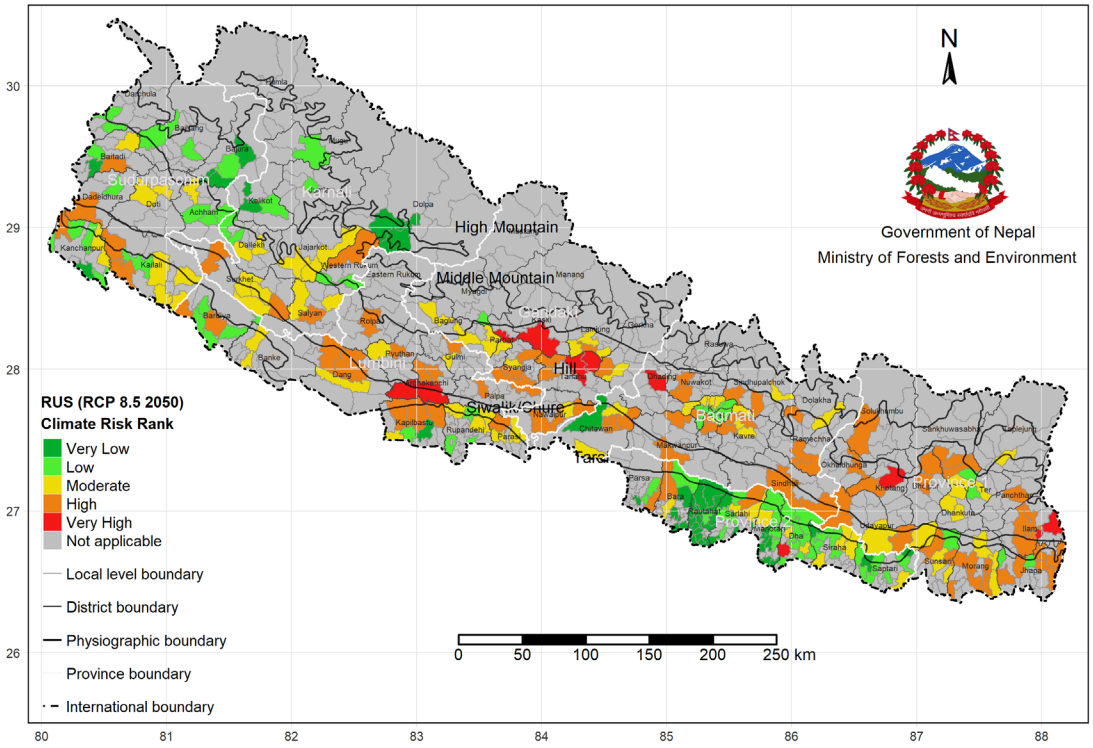



**Figure 40: Climate Risk Ranking of Municipalities Under RCP 8.5 (2050)**

While comparing the physiographic regions of municipalities, compared to the middle mountain and hilly region, the Siwalik/ Chure seems to be more at risk. The municipalities with a higher probability of landslide events, and the fragile landscape in terms of geology, slope, and soil will be at more risk. Some municipalities from Tarai will be also in the high-risk category in the projected scenario due to low-lying flood plains and extreme precipitation events inducing the flood.

In all the projected scenarios, the number of municipalities at high risk has increased. Overall changes in the number of municipalities from different risk rank from baseline to different scenario is presented in Table 38. Precipitation parameter carries the highest weight in this sector and hence related extreme events like landslides and floods will also increase. In this context, the municipalities with more flood-prone areas will have a more increased risk in the future scenario.

**Table 38: Summary of Risk Ranking of Municipalities in a Projected Scenario**

| Risk Rank | Baseline (Current) | RCP 4.5 2030 | RCP 4.5 2050 | RCP 8.5 2030 | RCP 8.5 2050 |
|---|---|---|---|---|---|
| Very High | 2 | 6 | 7 | 5 | 9 |
| High | 44 | 80 | 84 | 69 | 86 |
| Moderate | 85 | 76 | 72 | 78 | 78 |
| Low | 76 | 76 | 77 | 82 | 75 |
| Very Low | 86 | 55 | 53 | 59 | 45 |
| Total | 293 | 293 | 293 | 293 | 293 |

In summary, looking at the future scenarios of climate extreme indices backed by stakeholders' perception, and literature review, the likelihood of risk to the urban sector in Nepal will increase

significantly in the future due to the high degree of sensitivity of the sector to the extreme events and limited adative capacity to respond to the loss and damages including impacts. Most of the municipalities will have to face the challenges of managing risk and ensuring the resilience of inhabitants and resources. The population concentration in urban areas will also trigger a high risk of climate change impacts in the future.

There are studies carried out in the Urban sector in Nepal which also project a risky future with Vulnerability extending into urban areas with risks such as flooding and extreme heat in particular. Research has established a reasonably well-constrained relationship between heat and cold stress. and labour productivity, household consumption patterns, and (by proxy) household living standards. According to studies, the probability of heatwave is projected to increase significantly, potentially as high as 27% by the 2090s under the highest emissions pathway (RCP 8.5) (World Bank, 2021).

*Note: For risk maps of the municipalities in baseline and projected scenario RCP 4.5 (2030, 2050) and RCP 8.5 (2030, 2050) at the province level, refer to* ***Annex 14.***

### Case Study 2: Urban Flooding Risk and Drainage Infrastructure Capacity

Urban drainage systems are increasingly overburdened during extreme precipitation events and are stretched to their limits by increasing populations. The study of Kathmandu Metropolitan City explores the relationship between the increasing urban runoff and flooding due to increased imperviousness and extreme rainfall events due to climate change. The findings of the research show that future climate change conditions with present urbanization will increase pluvial flooding. The intensity of extreme climate events in the study area showed an increasing trend. The study showed that there would be an average increase of 12.73%, ranging from 15.58 % to 9.89 %, in extreme rainfall when the rainfall intensity of the baseline for 1968-2013 and time series RCP 4.5, 2040-2070 was compared. The comparison of the four parameters in different time series showed similar results, where the percentage of flood volume, conduit surcharge, and nodes flooded and surcharged increased under the future climate scenario. There will be a 40-percentage increase in the flooding amount considering the current and future climate for a 25-year return period. Furthermore, the urban drainage management infrastructure designed based on current climate conditions will not be able to cope with future climate conditions (Pradhan Salike & Pokhrel, 2017).

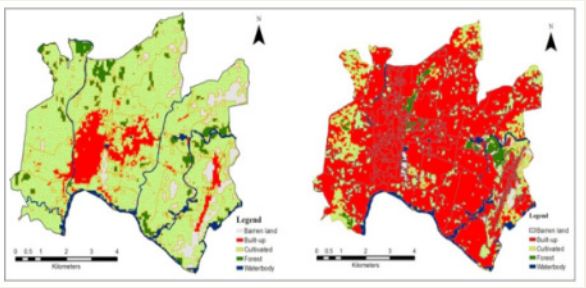


**Figure 41: Land Cover Changes, Kathmandu Metropolitan City (1980–2010)**

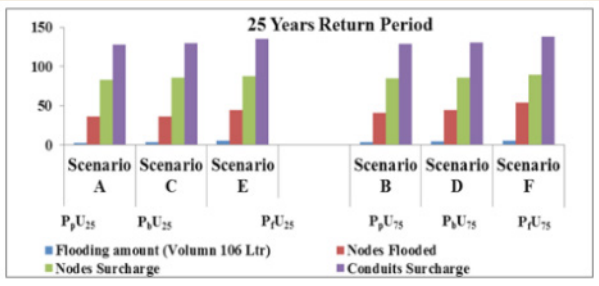



**Figure 42: Impact of Present and Future Rainfall on Urban Drainage**

Another study a case of Bharatpur says that cities are experiencing stormwater drainage problems due to a combination of urban sprawl, structural, hydrological, socioeconomic, and climatic factors. Given the limited capacity of drainage systems in cities, urban flooding and waterlogging are expected to intensify. The problem gets worse when low-lying areas are filled up for infrastructure development due to unplanned urban growth, reducing permeable areas. Additionally, solid waste, when dumped in canals and open spaces, blocks urban drainage systems and worsens urban flooding and waterlogging. The analysis was performed using a hydraulic model in Bharatpur Nepal, which identifies 12.7% of the area is under flood risk under baseline, flood risk can be minimized up to 5.5% with structural interventions in a drainage system. However, the area under flood risk could increase to 7.6% in Bharatpur in five years if the cities' solid waste is not managed properly, suggesting that the structural solution alone, without proper solid waste management, is almost ineffective in reducing the long-term flooding risk in these cities (Ismat et al. 2019)

## 7.1.2 Future Climate Change Risks in Rural Municipalities

The findings show that 10 municipalities in total fall under very high-risk rank and 45 under high-risk rank (Figure 43, Table 39). The baseline risk posed by climate extreme events shows that Budhiganga, Koshi, Janaknandani, Bagmati, Bakaiya, Bhimphedi, Madi, Pratappur, Mayadevi, and Rapti Sonari rural municipalities have very high risk. These municipalities are spread across the provinces. The analysis also shows that the municipalities which have high risk in the baseline scenarios are distributed in Province 1, Province 2, Bagmati Province, Gandaki Province, and Lumbini Province. On contrary, the municipalities of Karnali Province have moderate to low risk.

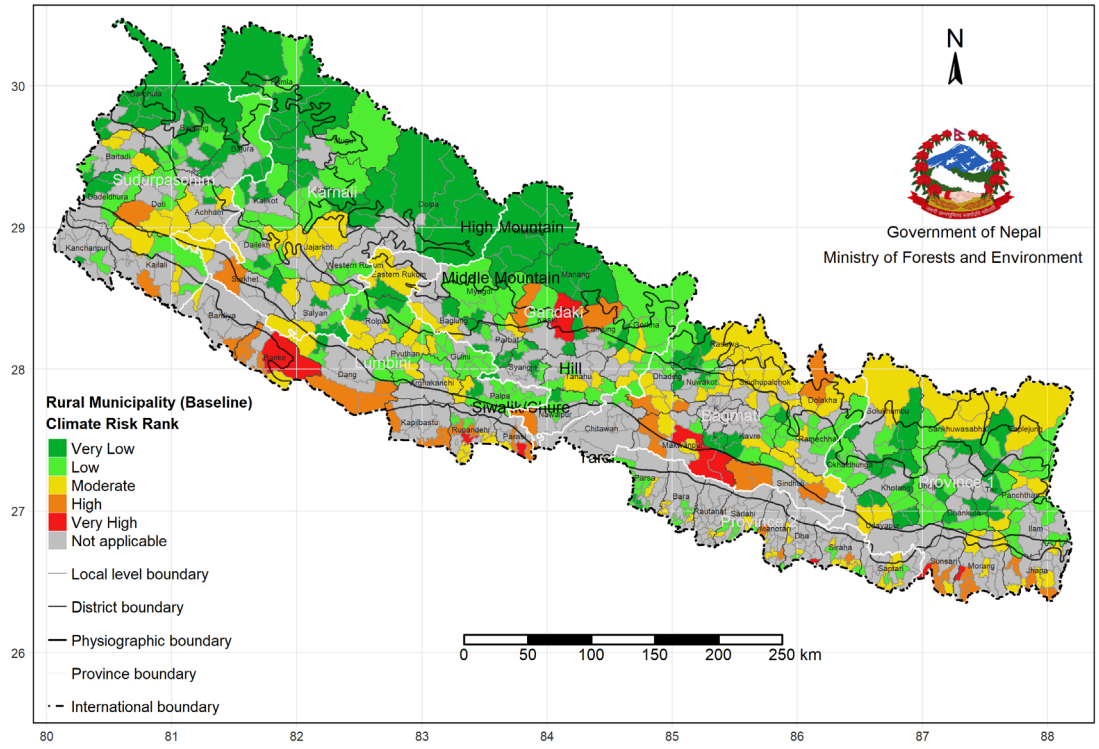



**Figure 43: Baseline Risk Ranks of Rural Municipalities**

The palikas lying in low land and mid-hill chure area are more prone to risk. The overall risk is directly associated with the vulnerability concerning the respective adaptive capacity of those palikas. Town-centric developed Palikas have reflected higher adaptive capacity which has decreased the risk level of those palikas. Palikas exposed to higher extreme events are also found to be in high-risk rank.

**Table 39: Baseline Risk Ranking of Rural Municipalities (Palika)**

| Baseline Climate Risk Rank | Palika |
|---|---|
| Very High (more than 0.520) | Budhiganga, Koshi, Janaknandani, Bagmati, Bakaiya, Bhimphedi, Madi, Pratappur, Mayadevi, Rapti Sonari |
| High (0.336–0.520) | Jhapa, Kachankawal, Kamal, Dhanpalthan, Gramthan, Jahada, Katahari, Bhokraha Narsingh, Dewanganj, Gadhi, Harinagar, Laxmipur Patari, Pipra, Sonama, Hariharpurgadhi, Marin, Tinpatan, Bigu, Benighat Rorang, Thakre, Manahari, Raksirang, Marsyangdi, Annapurna, Sarawal, Susta, Susta, Gaidahawa, Siyari, Bijayanagar, Mayadevi, Suddhodhan, Yashodhara, Gadhawa, Rajpur, Rapti, Baijanath, Duduwa, Janki, Khajura, Badhaiyatal, Barahtal, Jorayal, Kailari, Binayee Tribeni |

The assessment of risks in the rural palikas shows that climate change risk in 2030 is higher in palikas or mid-hills and Tarai. However, some of the mountain palikas in Bagmati and Province 1 have a high risk of climate extreme events in 2030 under both scenarios. Besides, it is interesting to note that in 2050, under both the RCP scenarios, the risks from climate extreme events are increasing and also evident in the mountain palikas of Province 1, and Bagmati Province (Figure 44, 45, Table 40).

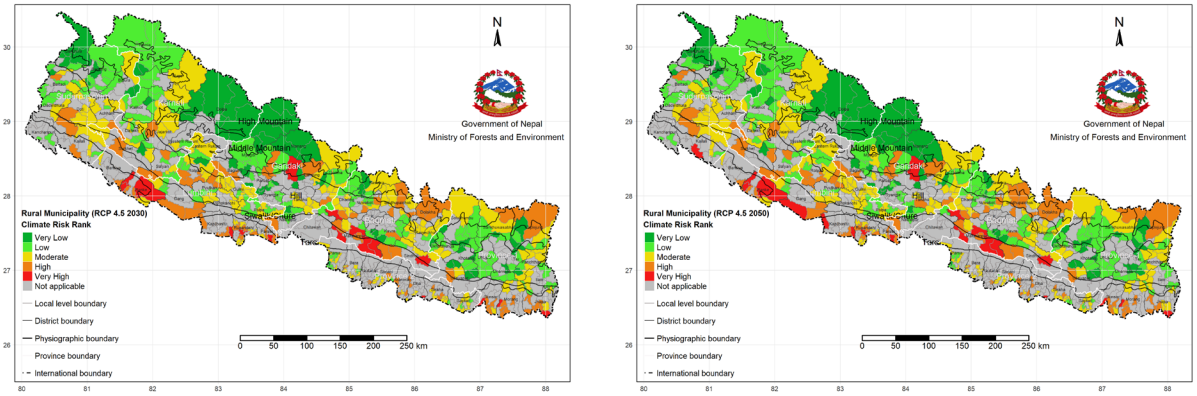



**Figure 44: Climate Risk Ranks of Rural Municipalities under RCP 4.5 (2030, 2050)**

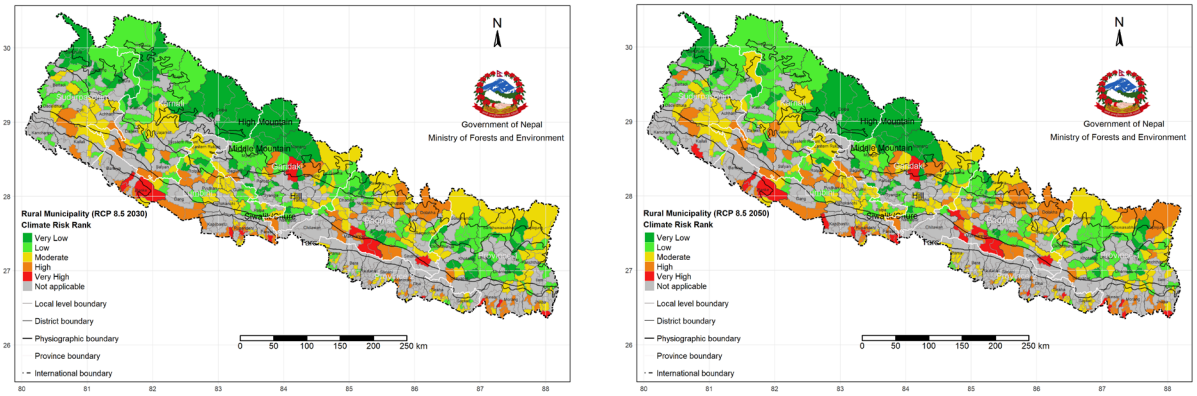



**Figure 45: Climate Risk Ranks of Rural Municipalities under RCP 8.5 (2030, 2050)**

Based on the geographic positions of municipalities, the existence of hazards, and haphazard infrastructure development, there are compounding and contextual impacts of climate severe events. Increases in temperature and precipitation, for example, could cause landslides in hilly municipalities, while flooding and heat and cold waves are more likely in Tarai municipalities. In addition, both hilly and Tarai municipalities are likely to see a rise in fires and epidemics. The intensity and magnitude of impact from climate extreme events and climate-induced disasters will increase in the future due to maldevelopment practices.

*Note: For the detailed risk rank of each municipality in the different projected scenarios, refer to* ***Annex 13****.*

**Table 40: Summary of Risk Ranks of Rural Municipalities in a Projected Scenario**

| Risk Rank | Baseline (Current) | RCP 4.5 2030 | RCP 4.5 2050 | RCP 8.5 2030 | RCP 8.5 2050 |
|---|---|---|---|---|---|
| Very High | 10 | 17 | 20 | 15 | 24 |
| High | 44 | 80 | 79 | 69 | 82 |
| Moderate | 117 | 149 | 153 | 140 | 154 |
| Low | 170 | 148 | 145 | 154 | 144 |
| Very Low | 119 | 66 | 63 | 82 | 56 |
| Total | 460 | 460 | 460 | 460 | 460 |

Note: For risk maps of the rural municipalities in baseline and projected scenario RCP 4.5 (2030, 2050) and RCP 8.5 (2030, 2050) at the province level, refer to **Annex 15.**

## 7.2 Opportunities for Adaptation in this Sector

The NAP technical guidelines define adaptation options as management and operational strategies, infrastructural changes, policy adjustments, or capacity-building. The action involves adjusting with current development activities (climate-proofing or building resilience), while others are new, or require major transformations in operations. Other considerations include the spatial scale of the action (local to regional), and an indication of its timing and urgency, based on the expected level and severity of the impacts.

Based on the analysis of climate change impact, vulnerability, and risk in the rural and urban municipalities, it is found that municipalities in Nepal are already impacted and will likely face critical loss and damage now and in the future. Considering this, the short, medium and long-term adaptation options were identified to address the rural and urban settlements' vulnerabilities and risks. The adaptation options emphasize the significance of the whole of the Government approach engaging all relevant stakeholders in the process to systemically address the critical needs to ensure the rural and urban settlement is inclusive, safe, resilient, and sustainable. The identified adaptation options are gender-responsive which due considers child, differently abled, old age, indigenous community, and GESI friendly technology and practices to ensure rural and urban services and functions are accessible to all.

The adaptation options were identified based on literature study, review of national commitment and plan of action included in the relevant sector policy, strategy, program as well as the international commitment made under SDGs and New Urban Agenda, consultation with stakeholders representing provincial officials, municipal officers, and community and review of best practices case study in the sector. The identified adaptation options have been categorized into its rural and urban settlements subsectors (i) socioeconomic; ii) building and settlements; iii) physical infrastructure and iv) social infrastructure where systematic interventions are required.

The recommendations for adaptation options, from this study, at the local level are impractical. According to the LAPA framework 2019, all rural municipalities (palikas) will prepare and implement LAPAs based on their climate change vulnerability and risk context, as well as their respective capabilities. To improve the adaptive capacity of vulnerable households, communities, ecosystems, livelihood assets and resources, and critical areas, more contextual, practical, and

effective adaptation options must be identified and promoted. Local adaptation options should also consider the possibility of making development investments more climate-resilient, as well as mainstreaming climate change into policies and plans (Regmi et al., 2016). To sustain adaption initiatives, local government and communities have to be supported with finance, capacity building, and human resource development. The list of adaptation options applicable for the local palikas is included in the Annex of LAPA framework 2019.

### 1. Area of Intervention: Socioeconomic

Intervention within the socioeconomic subsector requires uplifting the socioeconomic status, poverty reduction, increase livelihood opportunities and enhance resilience via access to good health and sanitation services of the people inside the municipality. The key areas of socio-economic intervention in rural and urban settlement sectors are risk-spreading measures such as the implementation of insurance schemes; promote equal livelihood diversification and employment; inclusive climate risk management; identifying the informal settlers and provide alternatives such as affordable housing, and improve health surveillance. The detailed adaptation options are given below.

| Key Risks and Vulnerabilities | Adaptation Options | Short-term | Medium-term | Long-term |
|---|---|---|---|---|
| Large numbers of people exposed in urban areas to climate extreme events and disasters. For example, food and landslides are common. Particularly susceptible are people in low-income informal settlements with inadequate infrastructure (and often on flood plains or along riverbanks). These has posed serious environmental health consequences.<br><br>Inland flooding increases risks of deaths and injuries and disruptions to livelihoods/ incomes, food supplies, and drinking water<br><br>Due to increase in temperature and heat island effect and cold waves in urban centres and Tarai region there will be risk of mortality and morbidity increasing, including shifts in seasonal patterns and concentrations due to hot days with higher or more prolonged high temperatures or unexpected cold spells. Avoiding risks often most difficult for low-income | • Ensure provision of insurance system covering physical properties and livelihood recovery mechanism against climate hazards for the population and livelihood assets at risk | ✓ | | |
| | • Promote livelihood diversification/employment generation options including access to credit, land title, and financing resources, green jobs related to infrastructure, renewable energy, etc to minimize the climate change-induced migration and support marginalized groups and women in civic participation and local government | | ✓ | |
| | • Promote a multi-hazard approach in dealing with disasters including climate change, establish a mechanism at all levels for disaster preparedness, rescue response, and rehabilitation to disaster and epidemic with a specific GESI focus. Also, prepare emergency plans for supply disruption of water, electricity, and essential goods | | ✓ | |
| | • Deploy a rapid response team, empower the community, and allocate resources for emergency service at the municipal level | ✓ | | |
| | • Increase access of urban and rural vulnerable households and population (including people with disabilities, senior citizens, single women), to disaster preparedness and response such as early warning system, lifesaving technique, knowledge, and skills | | ✓ | |
| | • Develop a system at the municipal level to identify and regularly update the demographic database on low-income, marginalized and informal settlers, to plan and regulate the squatting of the area and rehabilitate and relocate the displaced migrants as well as providing accessible infrastructure and services to the population at the municipal level | | ✓ | |

| Key Risks and Vulnerabilities | Adaptation Options | Short-term | Medium-term | Long-term |
|---|---|---|---|---|
| | • Improve health surveillance system at the municipal level via the use of information technology to reduce infection rates, protects public health, and spur economic activity (to prepare for infectious diseases such as COVID-19 and other pandemics) | ✓ | | |
| | • Increase access to resources of people covered by the allowance, grants-senior citizen, single women, widows, people/children with disabilities, the population covered by endangered people's allowance reservations, and special privilege during/after a disaster | | | ✓ |
| Water shortages in rural and urban municipalities, mostly in the mid hills and mountains, will increase risks from constraints on urban water provision services to people and industry with human and economic impacts. Risk of damage and loss to urban ecology and its services including urban and peri-urban agriculture.<br><br>Mostly in the Chure, Siwalik and mid hills, there is risk of damage to or degradation of soils, water catchment capacity, fuel wood production, urban and peri-urban agriculture, and other productive or protective ecosystem services which ulitimately lead to the risk of knock-on impacts for urban and peri-urban livelihoods and urban health.<br><br>Likely risks of migration, displacement which might lead to crowding in some urban and rural settlements. | • Ensure provision of affordable housing, access to land and finance, employment opportunities, a facilitating environment for entrepreneurship, and basic infrastructure at the municipal level to all age groups | | | ✓ |
| | • Integrate data and ICT networks and ensure digital connectivity for each individual and the community to ensure universally accessible, affordable, safe, and reliable information and communication | | | ✓ |
| | • Enhance participation, ownership and create awareness on climate change risk to all the population at the municipal level | ✓ | | |
| | • Ensure access to basic urban and rural services and functions to the population (including access to communication, financial institutions, health services, transportation, water, clean air, waste management, etc) at the municipal level | ✓ | | |
| | • Design smart regulations in providing government services and ensure infrastructure development and risk-informed land use planning right for all the population at the municipality level | | ✓ | |
| | • Create a database of households at both urban and rural municipalities based on their risks and vulnerabilities. Also, develop mechanisms of regularly monitoring the risk and vulnerability level | | ✓ | |
| | • Design specific adaptation options that reduced women's stress, workload and pressure. For example, efficient technologies and practices in agriculture, easy access to water resources, etc. | | ✓ | |
| | • Identify and promote social protection measures and alternatives for people living in slum and squatter areas, along the banks of the river | | ✓ | |
| | • Support municipalities to develop strategies to manage population influx and crowding. Ensure basic services and smart measures | | | ✓ |

## 2. Area of Intervention: Buildings and Settlements

The adaptation options in the building and settlement area incorporate all the basic things required for access to safe housing within a green-built environment. The key areas of building and settlements adaptation options include: ensure the provision of strict implementation of integrated urban development plans, implementation of building codes, develop policy and guidelines to incentivize green buildings and use of clean energy, ensure land-use plan to ensure green areas, park, and water management scheme; construct structural protection measures to prevent from floods and landslides, build the capacity of municipalities to implement sustainable urban and rural development.

| Key Risks and Vulnerabilities | Adaptation Options | Short-term | Medium-term | Long-term |
|---|---|---|---|---|
| The increase in disaster events and loss and damages will likely trigger risk of damage to networked infrastructure. Risk of loss of property<br><br>Substandard buildings and physical infrastructure and the services and functions they support particularly susceptible. Old and difficult to retrofit buildings and infrastructure in cities Local government unable or unwilling to give attention to disaster risk reduction (limited coping and adaptive capacities) | • Prepare Integrated Urban Development Plans (IUDPs) emphasizing low carbon and climate-resilient urban settlements in all municipalities. Implement climate-resilient Physical Development Plans using GIS and hazards mapping techniques | | ✓ | |
| | • Ensure strict Implementation of building code: Provide capacity building training to municipal level masons and engineers to ensure construction is carried out as per the code at the municipal level | ✓ | | |
| | • Develop policy and guidelines to Provide Incentives for green (energy efficient/ eco-friendly/indigenous technology) buildings | ✓ | | |
| | • Introduce natural elements into plans for the built environment and peri-urban areas- preserve green areas and parks as a natural water management scheme and also as a climate change adaptation measure, greening cities by introducing urban forest parks, biodiversity and ecosystem preservation, rooftop gardens, kitchen gardens, wetland parks, and roadside planting | ✓ | | |
| | • Promote Urban planning with the consideration of specific needs of children, women, differently able people, and old age people for better contribution to urban development at all municipality level | | ✓ | |
| | • Consider Indigenous and Local Knowledge and Practices in settlement planning and shelter development when looking at shelter building in the areas that are at risk of recurrent disasters | | ✓ | |
| | • Increase the existing river embankment wall height in line with climate change projections and strengthen wall structures to withstand flood events | ✓ | | |
| | • Construct proper river-training works complying with international standards through a combination of gabion protection, concrete retaining wall, soil stabilization, and bioengineering technique | ✓ | | |
| | • Discourage low-density housing construction at the periphery by adopting a development tax or impact fees that internalize the real cost of sprawl for property developers | | | ✓ |

| Key Risks and Vulnerabilities | Adaptation Options | Short-term | Medium-term | Long-term |
|---|---|---|---|---|
| | • Reassess development controls, such as floor-area ratios, plot coverage, and height limits, other among other restrictions to address the exponential growth of the city for future scenario | ✓ | | |
| | • Conduct training programs on climate-resilient buildings for industry stakeholders to promote climate-resilient building designs, green building concepts, and alternative materials | ✓ | | |
| | • Increase the human resources capacity of the local government by compulsory designated post of urban planners, architects, and engineers | ✓ | | |
| | • Build capacity of human resources of local government in terms of climate change, impact, and sustainable resilient town planning | ✓ | | |
| | • Revise building codes with the integration of climate risk factor, more climate-friendly robust design, and materials | ✓ | | |
| | • Ensure provision of affordable rental housing regularize the maintaining living standard to minimize the slumming of the area | | ✓ | |
| | • Increase the access to Housing and Land Tenure by providing affordable and adequate housing and secure land tenure for each family to upgrade the squatter and marginalized informal settlers by providing subsidy on land, construction materials, interest-free home loans, promoting low-cost housing technology in code compliance with alternative construction materials and indigenous construction materials | | ✓ | |
| | • Enforce land-use planning and bylaws etc provision of subsidy to effective implementation of land use plan, to control the construction on the risk-prone area | | | ✓ |
| | • Relocate the most at-risk structures and where needed, the most at-risk communities; Demolish and replace unsafe structures or abandon high-risk locations | | ✓ | |
| | • Implement Slope stabilization programs and construction of retaining walls, drainage systems, trapping dams, other protective structures targeting the road, drainage, and other infrastructures | ✓ | | |
| | • Promote integrated urban and territorial planning and design for sustainable urban expansion to optimize the spatial dimension of urban forms and deliver positive outcomes of urbanization such as promoting economic growth. Mainstream disaster risk reduction factor into it | | | ✓ |
| | • Plan for different satellite town approach to foster planned urban expansion in a sustainable and climate-resilient manner and for balanced rural and urban linkage | | | ✓ |
| | • Adopt the Bottom-up Smart City concept: Urban Labs, Open Data, and the Open-Source Movement; Open data and open-source software contribute to increased economic development, efficient urban mobility as well as resilience in planning and service provision | | | ✓ |
| | • Establish database system to record and monitor the exposures of buildings and their sensitivity to climate extreme events and disasters | ✓ | | |

### 3. Area of Intervention: Physical Infrastructure

The adaptation options of physical infrastructure include: design and maintain road infrastructure; prepare municipal transportation masterplan, prepare urban drainage master plan, implement solid waster management and adopt circular economy; promote water retention system; adopt new technology for irrigation and water management; reinforce pollution tax to the vehicles, and build awareness of climate change to citizens.

| Key Risks and Vulnerabilities | Adaptation Options | Short-term | Medium-term | Long-term |
|---|---|---|---|---|
| Due to increased impact of climate induced disasters such as windstorm, landslide, flood, fire there will be increased risk of damage to dwellings, businesses, and public infrastructure. Risk of loss of function and services. Challenges to recovery, especially where insurance is absent<br><br>The risk and vulnerability are increased due to mal-development practices in the hills of Nepal mostly due to haphazard road construction, extraction of natural resources beyond the carrying capacity, and unplanned infrastructure development<br><br>The fragile Chure, Siwalik, mid hills and mountain region is prone to landslides and other disasters due to its geological structure such as soil, slope.<br><br>Every year the roads, bridges, culverts and other infrastructure are damaged by the flood and landslide. The physical infrastructure in rural and urban areas cannot withstand the extreme events and magnitude of damages. | • Design and maintain road infrastructure with the side drainage giving due consideration to the runoff system and flooding | | ✓ | |
| | • Prepare municipal transportation masterplan, plan new roads away from flood-prone or hazardous areas. And upgrade existing roads with improved drainage facilities | | ✓ | |
| | • Increase O&M with a condition assessment approach via road maintenance Users' Committee and drainage clean-up Users' Committee. And develop and implement the provision of grants for repair and maintenance of infrastructures | ✓ | | |
| | • Protect the roads via bioengineering and retaining practices- make it compulsory for all the roads in the hilly areas | ✓ | | |
| | • Promote alternative road construction material as per designed load, adopt pedestrianized way pavement with percolated finishing, and promote non-motorized cycleway as a green infrastructure approach | | | ✓ |
| | • Update Nepal road construction standard for planning, designing, and maintenance, integrate climatic safety factor and special consideration for differently able people | | | ✓ |
| | • Construct urban drainage systems in an integrated manner considering both surface drainage and wastewater drainage; prepare an Urban Drainage Master Plan, with coordination between DUDBC, DoR, and DWSS | | ✓ | |
| | • Strengthen actions for Sustainable Urban Drainage targeted at reducing flooding, through works and services including containment basins, heavy-runoff control structures, seepage-drainage systems, riverside parks | | | ✓ |
| | • Adapt gutters by ensuring that new infrastructures are no longer designed to be used for wastewater or solid waste and can no longer act as bottlenecks during periods of heavy rainfall, raise user awareness of the need to maintain the structures, place covers on structures to avoid them being used for solid waste during periods of rain | | ✓ | |

| | | | | |
|---|---|---|---|---|
| | • Implement a solid waste reduction and recycling program to reduce the amount of waste generated and transported to the landfill. Promote treatment of waste to generate energy in the form of electricity, heat, or transport fuels. Promotion of achieving zero waste activity, reducing waste generation, moving away from landfill and incineration practices towards transforming waste to energy, and adopting zero-plastic policies | ✓ | | |
| | • Protect the dumping site through a bund construction which would prevent the floodwaters from entering into the dumping site | ✓ | | |
| | • Promote renewable energy for the co-benefits of less fire risk and reduced deforestation | | ✓ | |
| | • Promote Water retention system – expanded rainwater harvesting, water storage, and conservation techniques, water reuse, water use, and irrigation efficiency | | ✓ | |
| | • Develop regulatory mechanism on groundwater extraction, the inclusion of recharge pit and pond concept before extraction | | | ✓ |
| | • Raise awareness among the public and community relays of best practices for the use and maintenance of stormwater and wastewater structures | ✓ | | |
| | • Publicize new irrigation techniques (drip irrigation, reducing water losses in drinking water supply and irrigation pipes, reducing the effects of evaporation, protecting the collection, storage, and distribution structures | ✓ | | |
| | • Develop safely managed water and sanitation services ensuring the special needs of female and children and ensure an integrated urban water management system for each resident and the community, to ensure adequate and equitable access to safe and affordable water, sanitation and hygiene; attain a balance between demand and supply of potable water in the context of water conservation | | ✓ | |
| | • Prepare a strategic plan for reviving the natural springs, spring-shed and wetland protection, and source protection. Also promote, gravity and water lifting technique in target areas | | | ✓ |
| | • Reinforce Pollution tax to the vehicles and use the tax money for adaptation and resilience activities in the urban areas | | ✓ | |
| | • Build awareness of climate change and its impacts on mobility, encouraging the population to prepare and contribute toward mitigation and adaptation measures | ✓ | | |
| | • Promote climate-smart public transportation. Promotion of Electric vehicles, reduce the dependency on fossils in the transport sector through effective mass public transport means, development of electrical (hydro-powered) rail network to support mass transportation | | | ✓ |

## 4. Area of Intervention: Social Infrastructure

The adaptation options of social infrastructure include the development of climate-resilient design guidelines for critical infrastructure; construction of efficient public building and infrastructure that citizens use; introduce retrofit technologies for critical infrastructure where climate risk is high; plan new social infrastructure based on projected population growth; ensure protection in cultural heritage and ensure maintenance practices for critical social infrastructure.

| Key Risks and Vulnerabilities | Adaptation Options | Short-term | Medium-term | Long-term |
|---|---|---|---|---|
| Lack of piped water to homes of hundreds of millions of urban dwellers. Many urban areas subject to water shortages and irregular supplies, with constraints on increasing supplies.<br><br>The current disasters and extreme events have posed serious environmental health consequences from overwhelmed, aging, poorly maintained, and inadequate urban drainage infrastructure and widespread impermeable surfaces.<br><br>Lack of capacity and resilience in water management regimes including rural–urban linkages. Dependence on water resources in energy production systems<br><br>Disasters very likely. Local structures and networked infrastructure (piped water, sanitation, drainage, communications, transport, electricity, gas) particularly susceptible. Inability of many low-income households to move to housing on safer sites. | • Develop climate-resilient design guidelines for critical infrastructure such as roads, bridges, dams, and public buildings such as schools and hospitals; Also, enhance safety and resilience of new infrastructure for higher risk regions and infrastructure types; Review existing engineering practices in light of the changing climate | | ✓ | |
| | • Increase Operation and Maintenance for condition assessment of public properties and social infrastructure | ✓ | | |
| | • Design a guideline to incorporate child friendly, disable friendly, old age, and GESI friendly factor to upgrade existing infrastructure as well as in new construction | | ✓ | |
| | • Construction of efficient and green public building and infrastructure | | | ✓ |
| | • Prioritize and develop adaptation solutions such as retrofit technologies for the most critical regions and most critical of existing infrastructure types | ✓ | | |
| | • Discourage haphazard construction of roads and infrastructure. Ensure strict compliance measures discouraging such detrimental practices | ✓ | | |
| | • Align urban planning and development of infrastructure to avoid ecological imbalances, increased risk of exposure to new pathogens, and the emergence of new diseases | | | ✓ |
| | • Construct protective bunds or walls around sensitive cultural heritage and religious sites | ✓ | | |
| | • Consider standards for maintenance practices (repair and maintenance fund) to increase the reliability of heritage structures over time | ✓ | | |
| | • Prioritize and maintain the aesthetic value of cultural heritages and cityscape while planning and developing the urban form, horizontally and vertically (public squares, open plaza, heritage site, skyline, elevation treatment) | | ✓ | |
| | • Reinforce compulsory provision to place sandbag barriers around sensitive cultural heritage sites. Also, Organize maintenance Users' Committee for both market areas and cultural heritage sites | ✓ | | |

## 5. Others

| Adaptation Options | Short- term | Medium-term | Long-term |
|---|---|---|---|
| • Support all 753 palikas in developing vulnerability and risk profiles and identifying adaptation options (LAPA). And help to integrate adaptation options in regular development plan and budget | ✓ | | |
| • Help Palikas to develop and implement climate-resilient or climate proofing development infrastructure guidelines to safeguard development investments and avoid the mal-development practices | ✓ | | |
| • Support palikas on developing and implementing green growth strategies and plans which aims at promoting green jobs and employment | | ✓ | |
| • Help municipalities to develop strategies for mobilizing private sector investments in the green sector (tourism, energy, agriculture, and forestry) | | | ✓ |
| • Strengthen the institutional capacity for coordination, planning, monitoring, and reporting of the concerned agency responsible for managing climate change | ✓ | | |
| • Integrate climate change in educational curriculum within the schools and colleges of municipalities | | | ✓ |
| • Support Palikas to organize innovation fair to promote climate-resilient technologies and practices | ✓ | | ✓ |
| • Support the most vulnerable palikas to develop integrated water resource management plan and implement it with support from communities. Also, promote community-based initiatives to recharge ponds, water harvesting tanks and other measures to ensure efficient management of water | ✓ | | ✓ |

Chapter 8

# Conclusion and Recommendations

## 8.1 Conclusion

The pace of urbanization is very fast in Nepal, where currently about 63% of the total population lives in an urban area and this is expected to grow further by 2030. Measuring urbanization in terms of municipal population alone, and rural municipalities as the rural area, has its limitations. Most of the newly declared municipalities after the federal restructuring process in 2017 are predominantly rural, and still at an early phase of urbanization. The analysis of existing and new municipalities paints a grey picture of the state of rural and urban economic growth and development, affected by critical issues and deep-rooted development challenges. Imbalanced rural-urban growth; environmental concerns; a deficit of basic infrastructure; unplanned physical growth; increasing urban and rural poverty; and weak financial and institutional capacities are some common challenges facing this sector.

Climate change brings additional threats to these existing development challenges in the sector, and will undermine the attempts to ensure inclusive, safe, resilient, and sustainable development. The vulnerability and risk assessment carried out in 293 municipalities and 460 rural municipalities located in different physiographies of Nepal suggests that current human settlements have already experienced the impact of climate change. Findings show that it is likely municipalities will be at risk in the future due to increased temperature and extreme variability in rainfall triggering massive climate hazards. Populations and livelihoods in these municipalities are exposed to climate-induced events, mainly floods, landslides, cold waves, heat stress, droughts, windstorms, lightning strikes, communicable diseases, and fires. The municipalities of Nepal are found to have varied sensitivity and adaptive capacities that may incur loss and damage differently to subsectors such as socioeconomy and infrastructure. The poor and marginalized, female-led households, dependent populations, and low-income informal settlements are most affected by the impact of climate change.

Among 293 municipalities, 37 municipalities and 85 rural municipalities fall under the 'very high' vulnerable category. Old cities such as Pokhara, Dharan, Kathmandu, Biratnagar, Lalitpur, Dhangadi, Dharan, Dhankuta have a very high level of adaptive capacity with low vulnerability to climate change. Rural municipalities in the Tarai belt with good accessibility that are more urbanised and have higher adaptive capacity have portrayed low vulnerability. Some towns and rural municipalities from the Tarai belt have also shown high vulnerability due to low-lying flood plains and development activities in risk-prone areas. Vulnerability of municipalities is also triggered by a highly sensitive population in terms of female-led households, elderly age groups, impoverishment, and people with chronic diseases. Municipalities from the hilly region have high to very high vulnerability due to fragile geology and landscape, the location of infrastructure in risk-prone terrain, and other development challenges.

There will be an increased risk of climate change impacts in rural and urban areas. The baseline risk context of the Rural and Urban Settlement sector reflects the higher level of risk in municipalities located in the hilly, Siwalik, Chure, and middle mountain regions. Old cities along with developed ones are in the low-risk category, due to their low sensitivity and higher adaptive capacity. In total, 46 municipalities and 55 rural municipalities fall under high to very high risk in the baseline context. Projected risk by 2030 and 2050 has shown a significant increase in risk in the number of both rural and urban municipalities. Municipalities with high and moderate ranking in the baseline assessment have shifted toward very high and high ranking in projected scenarios. In this context, the more vulnerable municipalities with more flood and risk-prone areas, will have a much-increased risk in future scenarios due to the increased risks of extreme events.

The planned adaptation measures in the sector are found to be inevitable. They require an increased focus on planning with integrated concepts of urban and rural resilience and the adoption of low-carbon pathways. According to the LAPA framework 2019, all municipalities (rural and urban palikas) will and should prepare and implement LAPAs based on their climate change vulnerability and risk context, as well as their respective capabilities. The institutional capacity of municipalities needs to be enhanced in clarifying the roles and responsibilities; fulfilling policy gaps; and developing climate-resilient planning so that local governments can establish links between sustainable urbanization, livelihood opportunities, and inclusive and improved quality of life. At the same time, local governments should take initiative to localize those international commitments made under the New Urban Agenda and Sustainable Development Goals to ensure inclusive, safe, resilient, and sustainable communities in Nepal.

## 8.2 Recommendations

Urban municipalities do not have a complete dataset set up as an appropriate indicator for assessment. It is therefore urgent to establish a baseline for both urban and rural municipalities so that future vulnerability and risk assessment can be made and relied upon. It is particularly important to maintain local-level spatial time series data with high resolution on (i) land use (ii) database on roads, drainage, sewerage, water supply networks and schemes, electricity, and communication (iii) database of cultural heritages and religious sites in spatial scale.

It is observed that there is a need to integrate infrastructure and land-use dimensions in a regular survey of CBS so that consolidated information can be retrieved from a single source.

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# Annexes

## Annex 1: Key Terminology

(Source: IPCC AR5 WGII Glossary 2014)

| | |
|---|---|
| Adaptation | The process of adjustment to actual or expected climate change and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit bene□cial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate change and its effects. |
| Adaptive Capacity (AC): | The ability of systems, institutions, humans, and other organisms to adjust to potential damage; to take advantage of opportunities; or to respond to consequences. |
| Climate Trends | Patterns in climate variables such as temperature and precipitation are observed in historic datasets. |
| Climate Projections | A projection of the response of the climate system to emissions or concentration scenarios of greenhouse gases and aerosols, or radiative forcing scenarios, often based upon simulations by climate models. Projections are distinguished from climate predictions: Projections are subject to substantial uncertainty as they are based on assumptions concerning future socio-economic and technological developments that may or may not be realized. |
| Climate Extreme Events | The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) end of the observed values of the variable, such as high temperatures (e.g., heatwave) or extremely heavy rainfall. |
| Disasters | Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require an immediate emergency response to satisfy critical human needs, and that may require external support for recovery. |
| Exposure (E): | The presence of people, livelihoods, species or ecosystems, environmental functions, services and resources, infrastructures, or economic, social, or cultural assets in places and settings that could be adversely affected. |
| Hazards (H): | The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources. In this report, the term hazard usually refers to climate-related physical events such as droughts, floods, hurricanes, etc. |
| Impacts (I) | Effects on natural and human systems. It generally refers to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate change or hazardous climate events occurring within a specific time period, and the vulnerability of an exposed society or system. They are also referred to as consequences and outcomes. |
| Resilience | The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance; responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation. |
| Risk (R) | The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as a probability of the occurrence of hazardous events or trends multiplied by the impacts of these events or trends. Risk results from the interaction of vulnerability, exposure, and hazard. |
| Sensitivity (S) | The degree to which a system or species is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea-level rise). |
| Thresholds | A critical limit within the climate system induces a non-linear response to a given force. |
| Transformation | A change in the fundamental attributes of natural and human systems. |
| Vulnerability (V) | The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. |
| Vulnerability Index (VI) | A metric characterizing the vulnerability of a system. A climate vulnerability index is typically derived by combining, with or without weightage, several indicators assumed to represent a vulnerability. |

# Annex 2: Case Analysis of Rural Municipality – Brief Overview

## Mayadevi Rural Municipality, Lumbini Province

**Introduction**

Mayadevi rural municipality (RM) is located in the Tarai plains—northwest part of Rupandehi district of the Lumbini Province. The municipality has natural and cultural significance as it lies near the birthplace of Gautam Buddha, and Mayadevi is Lord Buddha's mother's name. With a total population of 47,196 (6,810 HH) in an area of 72.44 sq km, Mayadevi RM has fertile agricultural land, industry, business, and tourism to ensure prosperity for its citizens. Yadav, Tharu, Brahim, Chhtteri, etc are major caste groups residing in this municipality. Maydevi RM is connected with the Bhairahawa–Lumbini–Taulihawa road network, and Danaw, Tinau and Ghaghara are three major rivers that pass from north to south through the municipality.

**Climate and Environment Issues**

Mayadevi RM has been implementing development policies and programs to address its social, economic, and environmental problems. The key climate and environmental-related problems observed are groundwater depletion, drought, flood, air pollution, water pollution, and solid waste management. Groundwater resources are the primary sources of water supply in the municipality and have been extracted much faster than they can be replenished. Groundwater is primarily used for drinking water, agriculture, irrigation, industry, and tourism. It has been observed that over the last few years, the level for extraction of groundwater through deep boring increased from 30 feet to 400 feet. It is observed that water availability is declining every dry season.

Even though communities are less aware of the direct impact of climate change, the municipality is facing too much water during monsoon and too little water in dry periods causing a severe economic loss in the municipality. Almost 90 % population of the Mayadevi RM are living at risk of floods and inundation every year from the Danaw and Tinau rivers. Dhamauli, Bangai, and Gonaha village are the most drought-prone hit area of the municipality. The community has perceived that extreme event of intense rain have frequently been observed and the number of rainy days declines resulting in loss of agriculture productivity by about 30 %. The major industrial activities in the municipalities are cement factories, steel factories, pharmaceuticals, distilleries, and bottlers. Industrial activity is a major cause of concern for unrestricted groundwater extraction, air pollution, surface water pollution, and solid waste generation. The extraction of river sand from the river has been regulated recently. The proper environmental assessment and capacity to develop and implement a sound management plan within the municipality are currently lacking.

**Resilience to climate change**

The municipality has prioritized a balanced budget allocation in most of the prevailing development challenges of the municipality such as health, agriculture, education, physical infrastructure, road, environment and disaster management, target group, etc. The women are represented in the development planning process of the municipality. The Mayadevi municipality has well-connected road infrastructure in all its wards. The municipality is up to speed with its information and technology and catering its services to its citizen online. It has prepared its building permit

guideline for its implementation to ensure risks are mitigated in the design of new buildings and infrastructure. Adequate open spaces in public lands have been identified.

The communities are provided with livelihood opportunities such as fish farming business in an intention to recharge the groundwater, smoke-free stoves to ensure positive health outcomes, access to health facilities from its institutions, access to education within 15 mins radius, disaster response, and preparedness measure with the engagement of locals through awareness, an early warning system for floods, and disaster response equipment with ambulance and fire brigade facilities.

Further efforts should be made to ensure municipality response to the environment and climate change are systematic in protecting from flood, regular monitoring of overexploitation of groundwater, and prepare a long-term plan and schemes for efficient utilization of surface and rainwater resources.

## Gurase rural municipality, Karnali Province

**Introduction**

Gurans Rural Municipality, a tourist destination of Dailekh district, is located at a distance of 25 km from Surkhet. It is located at a distance of 544 meters from sea level and in the hilly region of western Nepal. With an area of 164.79 square kilometers, Gurase Rural Municipality has an average annual temperature of 25 degrees Celsius to 35 degrees Celsius. The total population of the municipality is 22033 with a total household of 4096 (CBS, 2011). The municipality is popular for commercial vegetable production and tourism and has a huge potential opportunity for agriculture, forest, animal and bird biodiversity, and herbs. 92.33% of the total population is dependent on agriculture.

**Climate and Environment Issue and risk**

Major climate-related risks are landslides, drought, drying up of water sources, depletion of pastureland, the increment of unusable grazing vegetation in pastureland. 25% of the population falls under the poor and deprived group. 15/20 houses are reported as a squatter. Lahare, Sisneri, Lamatara, and Kachche rivers are the major landslide and flash flood triggering mediums. Landslide risk-prone areas are identified in ward numbers 2, 7, and 8. Wards 5, 6, and 7 are in heavy agricultural loss due to river cutting and washout. The municipality is unable to monitor the informal construction regarding the code compliance of the new building construction. 97.7% of the HH are still dependent on firewood for cooking purposes.

**Resilience to climate change**

14 houses in ward no 2 were at very risk due to landslides which were later resettled in the nearest safer location without affecting their livelihood. 95% of the settlements have access to the vehicular road. The municipal transport master plan is prepared by the municipality and larger road projects are constructed with the proper DPR formulation with environmental impact assessment. Side drains and retaining walls are in practice for the sustainability of the road infrastructure. Each ward has a proper health facility with access to a minimum primary health facility. the municipality has 1 hospital, 9 birthing centers, and 6 health posts. The municipality is operating two ambulances providing a 50% subsidy to the people residing there to get the service for an emergency health condition. 15-bed hospital plans are in pipeline. The municipality has

total 55 numbers of educational institutions. 95% of the household have the access to drinking water. The municipality is in a process toward the conservation of water sources in people's participation. Recharge pond concept and reserve tank (underground collection tank by 150 HH) is used for the rainwater collection and recharge, there are 8 ponds within the municipality. Twelve water schemes are in operation covering the entire municipality. Eight water lifting schemes by gravity and solar are in pipeline for the people residing in higher altitudes. 97% of the HH have access to toilets and since the municipality is more in rural character, they are managing the solid waste by each household by themselves. 83.6% of HH use solar energy for lighting purposes. 762 HH have access to financial services with the purpose of savings and for their livelihood support. Open spaces are identified by the municipality as a part of a disaster preparedness plan and school institutions are used for emergency purposes. The municipal disaster management committee is working actively. The municipality has prepared the guideline for land and resources preservation. The municipality has started allocating the budget in the climate change sector in terms of awareness campaigns. NGO, INGO, and other private sectors are the very important stakeholders for the municipality to focus on the sector-specific issues and their solutions. Active and meaningful participation of the woman and the deprived group is ensured by the municipality during the planning and implementation phase and budget allocation is practiced as per the prior need.

Municipal involvement is very positive in the climate resilience part but due to geographical constraints and less financial capacity, it is unable to take any action on diversified issues of climate change. The major focus of the municipality should be on the financial management and identifying the stakeholders for the proper climate-resilient village development. Some long-term visionary plans should be developed in an integrated way for solid waste management, physical infrastructure development, natural resource utilization, and conservation.

## Kailari rural municipality, Sudurpaschim Province

### Introduction

Kailari rural municipality, located 27 KM east of Dhangadhi sub-metropolitan city, lies above 135 M above sea level and Tarai belt of Nepal. The area of the municipality is 233.27 Sq. Km and the total population is 47987 (CBS, 2011) with a total household of 7802. The population growth rate is 2.29% with 109 settlements. The municipality has a greater opportunity for agriculture, tourism, and industries due to available flatlands and accessibility.

### Climate and Environment Issue and risk

The municipality has got 38.17 Sq. Km as a residential area, 32.4 Sq. Km as other impervious area and 156.93 Sq. Km as green area (Agriculture, water, and forest cover). Major rivers inside the municipality are Mohana, Dhuraha, and Likma Kataini which are also the major contributors to flood-related hazards. 1654 HH inside the municipality are ranked as poor households by the municipality. Flood, river cutting, and windstorms are the major hazards affecting the area. Relocation of the settlement residing nearby risk-prone areas is always an issue. Landless Kamaiya is the major rising issue of the municipality, about almost all wards, have one camp and each camp has 50 to 60 households. Environment impact assessment is not in practice inside the municipality for the construction of the infrastructures. Some education infrastructure is also located in the flood risk-prone area.

88 HH in the Mohana community and people here are from Tharu ethnicity. Large flood impacted the area during 65/66 in which several households were damaged, residents were transferred to the safer highland after rescue and resettled nearby in highland. The community becomes isolated without access during flooding events and rescue and response operation becomes very hard at that time. Flooding happens every year, but the community has started some adaptation and mitigation measures. They have planted sugarcane farming all around the community which not only deaccelerates the motion of flow but also collects the sedimentation and fertile soils and also supports their livelihood. They have also practiced the bioengineering and embankment method. The people have identified bioengineering should be supported by physical dikes to reduce the damages due to flooding. They get the early warning information on the flood about 7 to 8 hours prior. The community uses shelter house and the school during the flood as they are in highland. From year 64/65 the river is changing its path and cutting the side of the school also keeping the school itself at risk. People have started the construction of double-story houses as flood adaptation options.

**Resilience to climate change**

The municipality has identified the risk-prone area and prepared the master plan for those areas. Three settlements inside the municipality are isolated without road access and are also at high risk of flooding. The municipality has also prepared the transportation master plan for the development of the road sector. The municipality has started to implement the national building code in coordination with NSET and also has started to provide mason training. The municipality has the coverage of an early warning system. The municipality has a disaster management committee and also prepared a disaster management plan, and the budget is allocated for disaster management funds. One ambulance and a municipal police van are used for the emergency service. The municipality has identified 5 places as open spaces and has constructed some shelter houses for the affected community for a post-disaster purpose. The municipality is allocating a budget for climate change.

## Waragung rural municipality, Gandaki Province

**Introduction**

Located in Mustang district in a middle mountain region with a population of 2330 (725 Households) and an area of 885.78 Sq. Km. The municipality has several opportunities from tourism, religious and natural perspectives. Kagkhola and Kaligandaki are the major rivers that pass through this municipality. Lack of knowledge and awareness level, the scattered settlement with tough geology are the major challenge for development and resource mobilization within the municipality.

**Climate and Environment Issue**

The key climate and environmental impacts observed in Waragung are an increase in rainfall but a decrease in snowfall, a rise in temperature due to which available snows are melting and the increase in the water volume of the snow-fed rivers, flooding events are also increasing trend. The rivers are found to be changing their path and riverbank cutting has increased which has directly impacted the settlement in Yekle Basti (8 HH). The dry landslides and avalanches are increasing in trend and some settlements are at risk due to landslides and flooding in sandy hills and rivers. Due to less amount of snowfall and shorter winter periods, agricultural productivity has also decreased, for example, apple and Naked Barley. The population in the

rural municipality is dependent on a tourism-based economy and people are more concerned about doing tourism business, and it is found that the traditional nature and agriculture-based income-generating activities are gradually diminishing. It is observed that apple farming and its production are shifting towards the north. The municipality has not implemented any codes and regulations for the new construction of the buildings. During the winter season, 7 settlements do not have access to the road due to snowfall.

**Resilience to climate change**

The primary focused area of the municipality for investment and development is increasing the accessibility of settlements, protecting the settlements that lie near riverbanks via riverbanks protection, river training, irrigation schemes, construction of community building. The municipality has not identified climate change as a prior investment sector.

# Annex 3: Summary Findings of Provincial Consultation on Rural and Urban Settlement Sector

## Province 1

**Mountain**: The participants during consultations and the communities during field visits identified that temperature rise, snowfall, melting of glaciers, GLOF, avalanches, soil erosion, and too much and too little water are the most common climatic extreme events in this Province and region. Marginalized women, children, marginalized and vulnerable households, basecamps, and settlements near the rivers were impacted the most. The impact can be observed on agriculture production and soil also. Electricity energy consumption has also increased.

**Suggested Adaptation Options:**

- Develop an early warning system
- Implement disaster preparedness activity
- Promote alternative energy practice
- Develop and implement climate-resilient plans

**Hill:** Temperature is in increasing trend and extreme rainfall and variability with an increased flood, landslide, and fire events are the most common stressors in the regions. The impact can be seen as increasing energy demand, drying of water sources, impact to the settlements near disaster-prone areas, migration due to loss of properties and lack of access to resources such as water, impact on infrastructure (house, buildings, communication services, transmission lines, water pipes), impact on agriculture and forest land and its productivity. Marginalized people, squatter and slum dwellers, women, children, and elderly, minority groups are the most affected people by the extreme events.

**Suggested Adaptation Options:**

- Promote climate and environment-friendly rural and urban settlement through the master plan
- Develop early warning systems
- Promote alternative and clean energy technology and practices for regulating pollution and wastes
- Promote water conservation in rural and urban areas
- Develop policy and regulations to regulate the haphazard construction and making it climate resilient
- Promote urban ecosystem-based adaptation
- Promote smart city and settlement concept
- Promote maintenance and improvement of drainage and water sewerage system

**Tarai:** Temperature rise, increasing hazards like flood, cold wave, heat wave, and variation in rainfall have been observed throughout the year. The major impacts can be seen in the form of water services are disrupted: groundwater polluted, the pipes damaged and surface water pollution, a new type of diseases in the urban sector both vector-borne and water bone, a flood is taking life and damaging infrastructure, agriculture is worse impacted due to flooding and temperature rise: production decline, fragmentation, and degradation. Urban and rural

households mostly poor, ethnic minorities and those who do not have land and proper houses are mostly affected by the climatic impacts.

**Suggested Adaptation Options:**

- Develop and implement adaptation and climate-resilient urban and rural settlement improvement plans
- Provide necessary training to the local government to be cautious in haphazard infrastructure construction
- Help local government to design codes for buildings and standards that will protect houses from floods
- Promote green belt
- Identify open spaces for rescue and rehabilitation
- Promote elevated pumps, elevated buildings, elevated roads, elevated water schemes, and latrines.
- Develop and implement climate-resilient building codes in urban and rural areas
- Develop and implement urban resilient and smart cities master plan
- Implement water-saving technology and practices

## Province 2

Extreme heat (temperature increase), Drought, Heatwave and cold wave, Flooding, and inundation all are in increasing trend. The temperature in Tarai has increased rapidly, the summer is hotter and winter is also warming and more frequent and massive flood with an incidence of new diseases are in increasing trend. Disruption of road and transport services due to flood, fog, cold waves. Loss and damage are huge due to economic losses, floods and landslides are rampant damaging infrastructure and properties, an outbreak of diseases and sanitation issues are rising. Households of the poor and deprived group, mostly marginalized, Dalit and ethnic groups example Mushar settlement are impacted more due to climate extreme events. Damage to the road, bridges, culverts, and drainage, settlements displaced, and induced migration is observed in past days.

**Suggested Adaptation Options:**

- Promote early warning systems
- Implement shelter programs for the homeless and those having poor houses
- Ensure proper drainage system
- Promote riverbank protection and bioengineering to reduce the impact of flooding
- Develop standards and guidelines for climate and environment-friendly physical infrastructure development
- Implement building codes promote safe shelter and settlements
- Promote the protection and conservation of water sources (surface, underground)
- Increase awareness of communities on disaster risk reduction
- Develop water conservation ponds

## Bagmati Province

Increasing temperature and changes in rainfall, increasing extreme events and their impact, increase in flood and landslide are observed during past years. Impact to populations: lack of transportation, disruption of services, communication disruptions, school closure, etc., impact

on water resources and irrigation infrastructure, displaced settlement, households damaged induced migration due to climate change are the major impacts observed over the years.

**Suggested Adaptation Options:**

- Promote early warning systems and increase access of communities on the potential risk
- Promote effective rescue and relief at the local provincial and federal level
- Aware and sensitize private sectors about the need to develop climate-resilient systems
- Ensure infrastructure development follow climate resilience standards and codes
- Implement strict guidelines to stop haphazard road construction
- Ensure use of bioengineering practices while constructing roads
- Promote urban and terrace farming

## Gandaki Province

**Mountain:** Snow avalanches and GLOF, temperature rise, change in time of snowfall are the most common change in events observed over the years. Settlement displacement, loss of lives and property, the decline in the rate of migration from mountain to Hills, Annapurna Rural municipality observed land degradation resulting in settlement displacement, impact to physical infrastructure are the major common climatic impacts.

**Suggested Adaptation Options:**

- Early warning system
- Risk mapping and zonation
- Climate-resilient design
- The planned relocation of settlement to a non-risk zone
- Stringent compliance to EIA and IEE

**Hill:** Rainfall variability: heavy rain, no rain, and sporadic rain, Hailstones, Drought, Temperature rise, flood, landslide are the most common change in events observed over the years. drying up water source leading toward inaccessibility of water, loss, and damage to physical infrastructure, traffic congestion, loss of lives and property, settlement displaced, unplanned migration of settlement, unplanned urbanization, the major common climatic impacts. The most vulnerable group women, children, senior citizens, differently abled people are mostly affected by the extreme events.

**Suggested Adaptation Options:**

- Early warning system
- Risk/hazard mapping
- Climate-resilient design
- Bioengineering
- Relocation plan
- Child-friendly, disabled friendly, senior citizen friendly physical infrastructure development
- Building code implementation
- Integration of rainwater harvesting in building permit
- Integration of concept of recharge pit and recharge pond in building permit system from household to large scale
- Integration of land use plan in building permit system

- Assurance of equitable access to physical infrastructure and services to all.

## Lumbini Province

**Hills**: Landslide and floods are in increasing trend. Landslide: Siddha baba, Tansen Road, and Flood: Banganga is a recent event. Road blockage, damages to irrigation facilities, damage to hydropower infrastructures, damage to water sources, damages to settlements are observed over the years. In Gulmi (20-25 households) were displaced and resettled later. Impact on livelihood assets, loss of life, and properties such as agricultural land and livestock, loss of life due to damages, loss of life due to the spread of diseases are happening frequently during extreme events.

**Suggested Adaptation Options:**

- Invest in capacity building
- Promote bioengineering (plantation of Amrisso and Bamboo)
- Protect water sources and arrange alternative drinking water
- Invest in research and development particularly understanding water demand and other issues impacted by climate change
- Implement a health surveillance system
- Implement fire control measures particularly protecting water pipes
- Develop reallocation and resettlement plans
- Implement river protection works
- Promote rainwater harvesting and other water conservation technologies
- Implement water-efficient technologies and irrigation systems
- Conserve and manage water resources and other critical infrastructures
- Implement guidelines for making water resources and energy production infrastructure more climate-resilient
- Implement early warning systems

**Tarai:** Identified extreme events are increasing in temperature, rainfall variability, other extreme events – heat wave, cold wave. The frequency, intensity, and magnitude of flood, inundation, heatwave, and cold wave are increasing. Flood: Marchwar flooding, Embankment of Tinau: damage to the suspension bridge is the recent example of impacts. Other common observed impacts are impacted to the population by a heatwave, cold wave and flooding (squatter population around Tinau), health hazards due to extreme temperature and rainfall- poor health and sanitation conditions of poor households, damage to infrastructure such as drinking water, latrines are causing the water pollution and increasing the incidence of diseases, damage to other infrastructures such as transmission lines, irrigation canals, roads, suspension bridge, water catchment areas, ponds.

**Suggested Adaptation Options:**

- Promote early warning systems including disease surveillance
- Build capacity of local governments
- Help local and provincial government develop standard codes for building climate-resilient infrastructure
- Implement resettlement plans
- Develop DRM and CCA guidelines

- Invest in water conservation and management technologies
- Implement guidelines to control health hazards particularly heat wave and cold waves
- Promote insurance for people and their resources

## Karnali Province

Increased avalanche, GLOF, flood-landslide, epidemics, cold waves, thunderbolts are the common extreme events happening over the years in this Province. Relocation and immigration, increase unhygienic environment, increase epidemics, river encroachment, spring drying up, spring relocation, food insufficiency, increased temperature, water pollution, depletion of groundwater level are the commonly observed impacts due to climate change.

**Suggested Adaptation Options:**

- Bioengineering
- Tree-plantation and increase greenery and park area nearby settlement
- Spring protection (Taar -Baar and tree plantation)
- Rainwater harvesting (common – pond and private in HH)
- Mainstream the climate change in every development
- Green road
- Access to the health, (vaccines, health center, moveable health centers, blood banks)
- Squatter settlement management
- Integrated settlement plan
- Based on physiography – develop the building codes to ensure climate-sensitive building construction
- Increase the health centers based on the physical distance and population proportion.
- Policy to use the underground water resources
- Develop the high dam and reservoirs at the basin level
- Consider the increased climate change especially precipitation intensity while constructing the culverts and drainage

## Sudurpaschim Province

People have identified an increase in river flow due to melting of snow, GLOF, increase in temperature, landslide, fire, increase in diseases (Pandemic), soil erosion, flood and inundation, drought, cold wave, heatwave, and windstorm as most common extreme events in this Province. Life and economic loss; migration, cultural transformation, a decrease in tourism activities, haphazard urbanization, increase in land/air/water/noise pollution, challenges in solid waste management, loss and damage in physical infrastructure, increase in the rate of child mortality, increase in gender inequality and negative impact on female health, a decrease in entrepreneurship and income generation, the negative impact in school and education sector, overloading in urban infrastructure, depletion of agricultural land, change in a traditional river system, the encroachment of sewerage and drain system, depletion of the groundwater table, increase in vector-borne and water-borne diseases, increase in social conflict, impact on good governance are the major climatic impacts observed over the years in this sector.

**Suggested Adaptation Options:**

- Prepare and implement a land-use plan
- Proper implementation of environmental impact assessment (EIA) during the construction of development and physical infrastructure
- Initiate and foster awareness campaign in society and school about health and sanitation
- Implement the integrated solid waste management system and site
- Ensure effective coordination between government, private sector, non-government organization, and relevant stakeholders
- Initiate and foster afforestation in risk-prone areas
- Ensure relocation of the settlement located in risk-prone areas
- Increase the accessibility of health services in remote areas
- Proper management of fecal sludge
- Identify and conserve tourism spots
- Conservation of water resources (lake, ponds, wetland, watersheds)
- Revision of national building code with the integration of climatic factor
- Construction of environment-friendly infrastructure
- Implement an integrated managed settlement plan
- Balance development of infrastructure as per prior need
- Minimize the increased exploitation of natural resources
- Implement the concept of groundwater recharge via recharge pit and recharge pond
- Preparation of integrated masterplan and policy for infrastructure development

# Annex 4: List of Thematic Working Group Members

| SN | Name | Organization | Designation | Gender |
|---|---|---|---|---|
| 1 | Padam Mainali | Ministry of Urban Development | Joint Secretary | M |
| 2 | Suresh Kumar Wagle | Ministry of Urban Development | Senior Divisional Engineer | M |
| 3 | Suman Salike | Ministry of Urban Development | Senior Divisional Engineer | M |
| 4 | Om Sodari | Ministry of Urban Development | Under Secretary, Legal Section MOUD | M |
| 5 | Kishor Shrestha | Ministry of Urban Development | SDE, Housing Section | M |
| 6 | Sangita Singh | Ministry of Urban Development | Senior Sociologist | F |
| 7 | Padma Sundar Joshi | UNHABITAT | | M |
| 8 | Dr Sanjay Upreti | IoE-Pulchowk Campus | Professor | M |
| 9 | Kishor Jha | RUPSON | | M |
| 10 | Rajendra P. Pyakurel | National Association of Rural Municipalities | | M |
| 11 | Sarita Sapkota | Municipal Association of Nepal | | F |
| 12 | Jaya K Gurung | Nepal Development Research Institute | | M |
| 13 | Kamal Sigdel | UNDP | | M |

# Annex 5: List of National Expert for Weightage

| SN | Name | Institutions | TWG - Member (Y/N) | Gender |
|---|---|---|---|---|
| 1 | Mr. Surendra Mohan Shrestha (Joint Sec.) | MOUD | Y | M |
| 2 | Mr. Nava Raj Pyakurel (Joint Sec) | MOUD/Bagmati Dev. Project | N | M |
| 3 | Mr. Chakrawoti Kantha (DDG) | DUDBC | N | M |
| 4 | Mr. Kishor Shrestha (SDE) | MOUD | N | M |
| 5 | Mrs. Mira Gyawali (SDE) | DUDBC | N | F |
| 6 | Mr. Om Dharananda Rajopadhyaya | Freelancer Expert | N | M |
| 7 | Prf. Dr Sanjaya Uprety | IOE | Y | M |
| 8 | Dr PS Joshi | UN Habitat | Y | M |
| 9 | Mr. Kishor Jha | RUPSON | Y | M |
| 10 | Mrs. Monika Maharjan (Er.) | MOUD | N | F |

# Annex 6: Comparative analysis of municipalities on sensitivity and adaptive capacity in indicator basis representing Province and physiography

The municipality with higher sensitivity and its comparison with an adjoining municipality.

| Name of Municipality | Context | Reason |
|---|---|---|
| Siddicharan, Solududhkunda, Halesi Tuwachung, Bhadrapur, Mechinagar (Province 1) | Very high: Siddicharan<br>High: Halesi Tuwachung, Bhadrapur<br>Moderate: Solududhkunda<br>Low: Mechinagar | Siddicharan: Halesi Tuwachung : Solududhkunda<br>Socioeconomic: Female headed HH% 56.21>26.65>22.87; People with chronic diseases % 5.89>2.7>2.5<br>Building and settlements: Landslide risk-prone area% 96.95>95.8>76.6;<br>Physical infrastructure: Dependent on open drinking water sources HH% 87>76>61; irrigation schemes dependent on seasonal rain (No) 8>1<2<br>Social infrastructure: %of health infrastructure in landslide risk-prone area 8.33>0>0; % of education infrastructure in landslide risk-prone area 35.59>0<2.17<br>Bhadrapur: Mechinagar<br>Socioeconomic: Aged group population % 39>38; Female headed HH% 56.21>26.93;<br>Building and settlements: Flood risk-prone are % 33<34.4<br>Physical infrastructure: % of road in flood risk-prone area 4.5>1.7;<br>Social infrastructure: % of education infrastructure in flood risk-prone area 3.33>2.24 |
| Mithila, Birgunj Parsagadhi, Dhanushadham (Province 2) | High: Mithila, Birgunj<br>Low: Dhanushadham<br>Very Low: Parsagadhi | Mithila: Dhanushadham<br>Building and settlements: no of settlement on flood risk-prone area 28>14; no of settlement in landslide risk-prone area 4>0;<br>Physical infrastructure: % of road length in flood-prone area 5.25>3.48<br>Social infrastructure: Health infrastructure in flood risk-prone area (%) 15.38>0<br>Birgunj: Parsagadhi<br>Socioeconomic: Female-headed HH% 56.21>5.66;<br>Building and settlements: Flood risk-prone area (%) 73.23>22.29; settlement in flood risk-prone area (No) 78>31; HH with load bearing wall foundation (%) 58.5>8.72<br>Physical infrastructure: Road length in flood risk-prone area (%) 8.92>0;<br>Social infrastructure: Health infrastructure in flood risk-prone area (%) 33.33>0; Education infrastructure in flood risk-prone area (%) 14.85>0 |
| Banepa, Khairahani, Ratnanagar, Suryabinayek (Bagmati Province) | Very high: Banepa<br>High: Khairahani<br>Moderate: Ratnanagar<br>Low: Suryabinayek | Khairahani: Ratnanagar<br>Building and settlements: Landslide risk-prone area (%) 4.59>0; Temporary houses (%) 16.19>5.97;<br>Physical infrastructure: Irrigation schemes dependent on seasonal rain (No) 23>6;<br>Social infrastructure: Health infrastructure located to flood risk-prone area (%) 66.66>33.33; Education infrastructure located to flood risk-prone area (%) 21.5>3.5<br>Banepa: Suryabinayek<br>Socioeconomic: population dependent on agriculture (%) 32.01>13.24; Poverty index 27.3>19.4<br>Building and settlements: Landslide risk-prone area (%) 81.9>41.6; a settlement in landslide risk-prone area (No) 71>41; building type with temporary kachhi roofs (%) 52>36<br>Physical infrastructure: water schemes need repair and maintenance (%) 82>50<br>Social infrastructure: Education infrastructure in landslide risk-prone area (%)38>1 |

| Name of Municipality | Context | Reason |
|---|---|---|
| Kushma, Pokhara Lekhnath, Shuklagandaki, Baglung (Gandaki Province) | Very High: Kushma, Pokhara Lekhnath<br>Moderate: Baglung, Shuklagandaki<br>Low: Baglung | Kushma: Baglung<br>Socioeconomic: Aged group population (%) 44.89>42.24; Population dependent on agriculture (%) 29.57>28.57; People with chronic diseases (%) 7.01>3.21;<br>Building and settlements: HH with temporary roof type (%) 85.16>77.95; HH with load-bearing foundation type (%) 93.89>83.80<br>Pokhara Lekhnath: Shuklagandaki<br>Socioeconomic: People with chronic diseases (%) 22.18>2.79; migration rate 11.9>-4.7; Population growth rate 2.57>0.25<br>Building and settlements: Settlement in flood risk-prone area (No) 164>50; Settlement in landslide risk-prone area (No) 806>245;<br>Physical infrastructure: Road length in landslide risk-prone area (%) 5.09>2.02<br>Social infrastructure: Education infrastructure in landslide risk-prone area (%) 13.55>3.52 |
| Rajapur, Sunwal, Thakurbaba, Bardaghat (Lumbini Province) | Very High: Rajapur<br>High:Sunwal<br>Moderate: Thakurbaba, Bardaghat | Rajapur: Thakurbaba<br>Building and settlements: Flood risk-prone area (%) 99.49>40.65; settlement in flood risk prone area (No) 152>57; building with temporary wall type (%) 31.19>19.4<br>Social infrastructure: Education infrastructure in flood risk-prone area (%) 17.39>2.17<br>Sunwal: Bardaghat<br>Building and settlements: Settlements in flood risk-prone area (No) 34>21; a settlement in landslide risk-prone area (No) 11>8; Building with loadbearing foundation type (%) 61.1>52.35 |
| Bheri, Panchpuri, Chhedgadh, Lekbesi (Karnali Province) | Very High: Bheri<br>High: Panchpuri, Chhedgadh<br>Moderate: Lekbesi | Bheri: Chhedgadh<br>Socioeconomic: Female-headed household (%) 56.21>12.69<br>Building and settlements: settlement in flood risk-prone area (No) 47>21; a settlement in landslide risk-prone area (No) 227>207;<br>Physical infrastructure: Length of road in landslide risk-prone area (%) 14.9>9.5; Length of road in flood risk-prone area (%) 7.21>1.35<br>Accessibility to Education infrastructure high in Chhedgadh and low in Bheri<br>Panchpuri: Lekbesi<br>Socioeconomic: Aged group population (%) 49.25>44.91; Building and settlements: Building with temporary roof type (%) 87.17>84.30; Building with temporary wall type (%) 57.41>23.38 |
| Bhajani, Badimalika, Ghodaghodi, Tribeni Sudurpaschim Province | Very high: Bhajani, Badimalika<br>Modeate: Ghodaghodi, Tribeni | Bhajani: Ghodaghodi<br>Socioeconomic: Female-headed household (%) 56.21>26.66<br>Building and settlements: Flood risk-prone area (%) 0.55>0.14; a settlement in flood risk-prone area (No) 77>65<br>Physical infrastructure: length of road in a flood-prone area (%) 7.6>1.77;<br>Social infrastructure: education infrastructure in flood risk-prone area (%) 90.32>0<br>Badimalika: Tribeni<br>Socioeconomic: Aged group population (%) 45.5>41.4; people with chronic diseases (%) 5.26>2.59<br>Building and settlements: Landslide risk-prone area (%) 0.94>0.62; a settlement in landslide risk-prone area (No) 71>51; a settlement in flood risk-prone area (No) 20>6<br>Physical infrastructure: the road in landslide-prone area (%) 15.76>0; the road in flood risk-prone area (%) 9.29>0 |

*Sources: CBS, 2011; DWRI; DWSS, 2018; HMIS, 2018; NSET, 2018; ICIMOD; IUDP 2020; MoHP, 2018; NUDS, 2017; UN-OCHA, METEOR*

The municipality with lower adaptive capacity and its comparison with an adjoining municipality.

| Name of Municipality | Context | Reason |
|---|---|---|
| Sunwarshi, Belbari, Dharmadevi, Dhankuta Province 1 | Very low: Dharmadevi<br>Low: Sunwarshi<br>Moderate: Dhankuta<br>High: Belbari | Sunwarshi: Belbari<br>Socioeconomic: Literacy (%) 56.66<72.58; Budget allocation for woman marginalized and deprived group (NPR) 3908186< 7608586; early warning system coverage (sq. Km) 35.54<66.82<br>Building and settlements: RCC pillar buildings (%) 4.14<12.58; RCC roof type building (%) 1.3<10.65, Parks (No) 1<5;<br>Physical infrastructure: Storm drain line on road (%) 0<5; Metallic road (%) 0<13.3; HH access to sewer network (%) 0<58;<br>Social infrastructure: Available hospital bed (No) 5<10; Health sector budget (NPR) 10000000< 44288788;<br>Dharmadevi: Dhankuta<br>Socioeconomic: Literacy (%) 71.19<81.73; economically active population (%) 52.19<62.43; Budget allocation for woman marginalised and deprived group (NRs) 1685746< 278654000; Early warning system coverage (Sq.Km) 0.56<92.58<br>Building and settlements: RCC roof type building (%) 15.3<0.3<br>Physical infrastructure: Metallic road (%) 0<26; Municipal budget in road sector (NPR) 13586616< 147321000; Functionally intact water schemes (%) 19.62<25.99;<br>Social infrastructure: Capacity of hospital serviced population (%) 47.30<79.82; municipal budget in health sector (NPR) 10437000< 24372894 |
| Mithila, Birgunj Parsagadhi, Bardibas Province 2 | Very low: Parsagadhi, Mithila<br>High: Bardibas<br>Very High: Birgunj | Parsagadhi: Birgunj<br>Socioeconomic: Access to financial services (No) 40046< 289658; Access to piped water (%) 8.07<17.46; Literacy (%) 48.24< 66.52; Early warning system coverage (Sq. Km) 99.69<128.36<br>Building and settlements: Building with RCC pillar (%) 2.72<11.5; Building with RCC roof (%) 5.8<58.28;<br>Physical infrastructure: Road with stormwater drain (%) 0<17; Municipal budget in the road sector (NPR) 103732050<645486785<br>Social infrastructure: Capacity of the hospital bed (No) 0<500; Municipal budget on health sector (NPR) 33045180<205628125<br>Mithila: Bardibas<br>Non-agro economy (%) 9.2<10.6; Per capita municipal budget (NPR) 6848<24641; early warning system coverage area (sq.Km) 109<149<br>Building and settlements: available green area (Sq.km) 188.17<314.87;<br>Physical infrastructure: Metallic road (%) 0<13; Municipal budget on-road sector (NPR) 51655960<206000000<br>Social infrastructure: Capacity of school building service population (%) 23.72<28.92; capacity of the hospital bed (No) 0<200; Municipal budget in the health sector (NPR) 16455671<39000000 |

| Name of Municipality | Context | Reason |
|---|---|---|
| Panchkhal, Changunarayan, Ratnanagar, Rapti Bagmati Province | Very low: Panchkhal<br>Moderate: Ratnanagar<br>High: Rapti<br>Very high: Changunarayan | Panchkhal: Changunarayan<br>Socioeconomic: HDI index 0.38<0.6; literacy (%) 70.4<77.3; Non-agro based economy (%) 12.2<28.19;<br>Building and settlements: Building with RCC roof type (%) 6.5<30; climate-friendly building wall envelope (%) 0.4<63.66;<br>Physical infrastructure: Road density 4.3<6.2; Municipal budget in the road sector (NPR) 40000000< 280000000; HH with sewer network (%) 0<79;<br>Social infrastructure: Capacity of school building service population (%) 20.2<55.4;<br>Ratnanagar: Rapti<br>Socioeconomic: Access to piped water (%) 30<40.5; Budget allocation for woman marginalized and deprived group (NPR) 2765481< 335844396; Per capita municipal budget (NPR) 10700<1562096; early warning system coverage area (sq.Km) 24<88<br>Building and settlements: climate-friendly building wall envelope (%) 5.9<22.6;<br>Available green area (Sq.km) 69.18<211.51;<br>Municipal budget for road sector (NPR) 80871638< 260811000; operational irrigation schemes (No) 6<18;<br>Social infrastructure: Capacity of school building service population (%) 19.77<35.54;<br>Capacity of hospital building service population (%) 36.26<44.35; |
| Madhyanepal, Byas, Jaimuni, Beni Gandaki Province | Very low:, Jaimuni<br>Low: Madhyanepal<br>High: Byas, Beni | Madhyanepal: Byas<br>Socioeconomic: Access to drinking water coverage (%) 82.5<88.5; Literacy (%) 75.5<79.5; Budget allocation for woman marginalized and deprived group (NPR) 5668932< 11991731, per capita municipal budget (NPR) 26521<139970, early warning system coverage area (sq.Km) 2.62<89.7<br>Building and settlements: Building with RCC pillar foundation (%) 7<21.2; Building with RCC roof type (%) 11.4<34.9;<br>Physical infrastructure: Road with storm drain line (%) 0<15; functionally intact water schemes (%) 24>31; operational irrigation schemes (No) 8<26<br>Social infrastructure: Capacity of the hospital bed (No) 5<205; Municipal budget in the health sector (NPR) 25126788< 53151755<br>Jaimuni: Beni<br>Socioeconomic: Access to piped water network (%) 91.4>96.6; Literacy (%) 73.37<77.24; non-agro based economy (%) 8.68<10.36; economically active population (%) 48<57; early warning system coverage (Sq. Km) 34.4<42.09<br>Building and settlements: Building with RCC footing (%) 0.26<17.14; Building with RCC roof type (%) 0.69<20.78;<br>Physical infrastructure: Road with storm drain (%) 0<4; Municipal budget in road sector (NPR) 8280000< 28358251; functionally intact water schemes (%) 25.97<28.93;<br>Social infrastructure: Capacity of the hospital bed (No) 3<99; Municipal budget in the health sector (NPR) 2200000< 22873578 |

| Name of Municipality | Context | Reason |
|---|---|---|
| Maharajgunj, Ramgram, Kapilbastu, Tilottama Lumbini Province | Very low: Maharajgunj, Ramgram High: Kapilbastu, Tilottama | Maharajgunj: Kapilbastu<br>Socioeconomic: Access to pipe water (%) 1.13<16.87; literacy (%) 47.66<57.44; Budget allocation for woman marginalized and deprived group (NPR) 2778708> 17350220; early warning system coverage (sq.Km) 46.3<70.8<br>Building and settlements: Building with RCC roof (%) 58<61; Building in compliance to code (%) 0<22.31<br>Physical infrastructure: Metallic road (%) 0<27.62; HH with sewer network (%) 0<40; HH with electricity access (%) 39.9<59.6<br>Social infrastructure: Capacity of school building service population (%)15.5<21.24; Municipal budget in the health sector (NPR) 71804551< 93246398<br><br>Ramgram: Tilottama<br>Socioeconomic: Access to drinking water coverage (%) 88<99; Access to piped water15<40; Literacy (%) 66.71<80.75; non-agro based economy (%) 5.94<14.24<br>Building and settlements: Building with RCC pillar footing (%) 5<20; Building with RCC roof (%) 49<71;<br>Physical infrastructure: Road density 1.8<9.18; Municipal budget in the road sector (NPR) 142097087< 368665528;<br>Social infrastructure: Capacity of hospital building service population (%) 17.6<57.9; |
| Bheriganga,Dullu, Raskot, Birendranagar Karnali Province | Very low: Bheriganga,Dullu, Raskot High: Birendranagar | Bheriganga,Dullu, Raskot : Birendranagar<br>Socioeconomic: Access to drinking water coverage (%) 74,64,71 <96; Literacy (%) 70.9,63.84,57.02<79.65<br>Building and settlements: Building with RCC pillar footing (%) 2,0.1,0<10; Building with RCC roofing (%) 7,0.4,0.1<36.2;<br>Physical infrastructure: Road density 2, 2.24, 1.5<3.68; Operational irrigation schemes (No) 7,1,2<13;<br>Social infrastructure: Capacity of the hospital bed (No) 5,0,0<500 |
| Krishnapur, Purchaudi, Dhangadhi, Dasharathchanda Sudurpaschim Province | Very low: Krishnapur, Purchaudi Moderate: Dhangadhi, Dasharathchanda | Krishnapur: Dhangadhi<br>Socioeconomic: HDI index 0.47<0.52; Access to pipe water (%) 3.79<20.04; Literacy (%) 66.44<75.24<br>Building and settlements: Building with RCC roof type (%) 8.2<31.4;<br>Physical infrastructure: Metallic road (%) 0<15.14; road density 1.7<3.5; Municipal budget in road sector (NPR) 47500000< 127794440<br>Social infrastructure: Municipal budget in the health sector (NPR) 10000000< 48535740<br>Purchaudi: Dasharathchanda<br>Socioeconomic: Access to piped water (%) 74<85; Literacy (%) 55.27<72.16;<br>Building and settlements: Building with RCC roof (%) 0.4<8.7;<br>Physical infrastructure: Metallic road (%) 0<26.76; HH with access to electricity (%) 6.3<73.6<br>Social infrastructure: Capacity of the hospital bed (No) 0<25 |

*CBS, 2011; DWRI; DWSS, 2018; HBASE; HMIS, 2018; NSET, 2018; ICIMOD; IUDP 2020; MoEST, 2018; MoFAGA, 2020; MoHA; MoHP, 2018; NUDS, 2017*

# Annex 7: Subsector Wise Vulnerability Rank of municipalities

## 1. Socioeconomic Vulnerability

| Rank | Province | Municipality |
|---|---|---|
| Very High (0.593 -1) | Province 1 | Mai, Siddhicharan |
| | Province 2 | Bardibas |
| | Gandaki | Dhorpatan, Devchuli, Gaidakot, Kawasoti, Madhyabindu |
| | Lumbini | Sworgadwary, Barbardiya |
| | Karnali | Aathbiskot, Chaurjahari, Bheriganga, Gurbhakot, Narayan, Bheri, Nalagad, Chhayanath Rara, Musikot |
| | Sudurpaschim Province | Budhiganga, Budhinanda, Kamalbazar, Panchadewal Binayak, Bhajani, Krishnapur, Punarbas, Patan |
| High (0.409 – 0.592) | Province 1 | Arjundhara, Bhadrapur, Birtamod, Patahrishanishchare, Rangeli, Sundarharaicha, Mahalaxmi, Pakhribas, Chainpur, Dharmadevi, Khandbari, Panchakhapan, Shadananda, Chaudandigadhi |
| | Province 2 | Janakpur |
| | Bagmati | Namobuddha, Panchkhal, Dhunibesi, Kalika |
| | Gandaki | Palungtar, Chapakot, Galyang, Beni |
| | Lumbini | Banganga, Pyuthan |
| | Karnali | Bangad Kupinde, Panchpuri, Chamunda Bindrasaini, Dullu, Chhedagad, Raskot, Tilagufa |
| | Sudurpaschim Province | Badimalika, Tribeni, Bungal, JayaPrithivi, Mangalsen, Dipayal Silgadi, Shikhar, Bhimdatta, Parashuram |
| Moderate (0.267 – 0.408) | Province 1 | Uralabari, Laligurans, Myanglung, Madi, Bhojpur, Halesi Tuwachung, Rupakot Majhuwagadhi |
| | Province 2 | Dhangadhimai, Dhanusadham, Sahidnagar, Aurahi, Bhangaha, Ramgopalpur, Rajpur, Nijgadh |
| | Bagmati | Manthali, Ramechhap, Jiri, Khairahani, Ratnanagar |
| | Gandaki | Besishahar, MadhyaNepal, Rainas, Bhanu, Bhimad, Byas, Bhirkot, Waling, Galkot, Jaimini |
| | Lumbini | Musikot, Rampur, Ramgram, Bhumekasthan, Sandhikharka, Sitganga, Bansagadhi, Gulariya, Madhuwan, Rajapur, Thakurbaba, Bheriganga, Rolpa |
| | Karnali | Bagchaur, Sharada, Birendranagar, Lekbeshi, Aathabis, Thuli Bheri, Tripurasundari, Chandannath, Khandachakra |
| | Sudurpaschim Province | Sanphebagar, Gauriganga, Ghodaghodi, Lamkichuha, Bedkot, Mahakali, Shuklaphanta, Amargadhi, Melauli, Purchaudi, Shailyashikhar |
| Low (0.113 – 0.266) | Province 1 | Phungling, Phidim, Gauradhaha, Shivasataxi, Ratuwamai, Sunwarshi, Dhankuta, Solududhakunda, Katari |
| | Province 2 | Bode Barsain, Dakneshwori, Hanumannagar Kankalini, Kanchanrup, Khadak, Shambhunath, Surunga, Golbazar, Kalyanpur, Karjanha, Mirchaiya, Siraha, Sukhipur, Bideha, Chhireshwornath, Ganeshman Charnath, Hansapur, Kamala, Mithila, Mithila Bihari, Nagarain, Sabaila, Balwa, Gaushala, Loharpatti, Manra Siswa, Matihani, Balara, Godaita, Haripurwa, Brindaban, Dewahhi Gonahi, Gujara, Ishanath, Katahariya, Madhav Narayan, Maulapur, Paroha, Phatuwa Bijayapur, Jitpur Simara, Birgunj |
| | Bagmati | Kamalamai, Barhabise, Chautara SangachokGadhi, Melamchi, Panauti, Belkotgadhi, Nilakantha, Madi |
| | Gandaki | Sundarbazar, Shuklagandaki, Putalibazar, Kushma, Phalebas, Baglung |
| | Lumbini | Tansen, Bardaghat, Sunwal, Butwal, Devdaha, Lumbini Sanskritik, Krishnanagar, Maharajgunj, Shivaraj, Lamahi |
| | Sudurpaschim Province | Godawari, Tikapur, Belauri, Dasharathchanda, Mahakali |

| Rank | Province | Municipality |
|---|---|---|
| Very low (0 – 0.112) | Province 1 | Deumai, Illam, Suryodaya, Damak, Kankai, Mechinagar, Belbari, Biratnagar, Letang, Barah, Dharan, Duhabi, Inaruwa, Itahari, Ramdhuni, Belaka, Triyuga |
| | Province 2 | Rajbiraj, Saptakoshi, Lahan, Jaleswor, Bagmati, Barahathawa, Haripur, Hariwan, Ishworpur, Kabilasi, Lalbandi, Malangawa, Baudhimai, Brindaban, Gadhimai, Garuda, Gaur, Rajdevi, Kalaiya, Kolhabi, Mahagadhimai, Pacharauta, Simraungadh, Bahudaramai, Parsagadhi, Pokhariya |
| | Bagmati | Dudhouli, Bhimeshwor, Banepa, Dhulikhel, Mandandeupur, Godawari, Lalitpur, Mahalaxmi, Bhaktapur, Changunarayan, Madhyapur Thimi, Suryabinayak, Budhanilakantha, Chandragiri, Dakshinkali, Gokarneshwor, Kageshwori Manahora, Kathmandu, Kirtipur, Nagarjun, Shankharapur, Tarakeshwor, Tokha, Bidur, Hetauda, Thaha, Bharatpur, Rapti |
| | Gandaki | Gorkha, Pokhara Lekhnath |
| | Lumbini | Resunga, Sainamaina, Siddharthanagar, Tillotama, Buddhabhumi, Kapilbastu, Ghorahi, Tulsipur, Kohalpur, Nepalgunj |
| | Karnali | Dhangadhi |

## 2. The vulnerability of Building and Settlement Subsector

| Rank | Province | Municipality |
|---|---|---|
| Very High (0.634 - 1) | Province 1 | Rangeli, Sunwarshi, Shadananda |
| | Province 2 | Loharpatti, Baudhimai, Paroha, Phatuwa Bijayapur, Rajpur |
| | Bagmati | Kamalamai, Jiri, Bidur |
| | Gandaki | Phalebas, Jaimini |
| | Lumbini | Musikot, Rampur, Ramgram, Bhumekasthan, Sitganga, Pyuthan, Sworgadwary |
| | Karnali | Bheriganga, Gurbhakot, Aathabis |
| | Sudurpaschim Province | Patan |
| High (0.445 – 0.633) | Province 1 | Phidim, Khandbari, Panchakhapan, Halesi Tuwachung |
| | Province 2 | Bode Barsain, Shambhunath, Siraha, Kamala, Bhangaha, Balara, Dewahhi Gonahi, Ishanath, Madhav Narayan, Maulapur, Rajdevi, Mahagadhimai |
| | Bagmati | Panchkhal |
| | Gandaki | Palungtar, MadhyaNepal, Rainas, Bhanu, Bhimad, Byas, Chapakot, Galyang, Dhorpatan |
| | Lumbini | Tansen, Bardaghat, Gulariya, Rajapur, Rolpa |
| | Karnali | Aathbiskot, Chaurjahari, Sharada, Lekbeshi, Chamunda Bindrasaini, Dullu, Narayan, Bheri, Chhedagad, Nalagad, Khandachakra, Raskot |
| | Sudurpaschim Province | Budhiganga, JayaPrithivi, Mangalsen, Sanphebagar, Dipayal Silgadi, Godawari, Tikapur, Parashuram, Purchaudi |
| Moderate (0.272 – 0.444) | Province 1 | Gauradhaha, Biratnagar, Duhabi, Laligurans, Myanglung, Siddhicharan, Rupakot Majhuwagadhi, Belaka |
| | Province 2 | Rajbiraj, Karjanha, Bideha, Ganeshman Charnath, Mithila Bihari, Aurahi, Balwa, Jaleswor, Manra Siswa, Matihani, Ramgopalpur, Barahathawa, Godaita, Gadhimai, Gaur, Katahariya, Pacharauta, Bahudaramai, Pokhariya |
| | Bagmati | Manthali, Barhabise, Melamchi, Belkotgadhi, Dhunibesi, Nilakantha, Thaha |
| | Gandaki | Shuklagandaki, Waling |
| | Lumbini | Sandhikharka, Tulsipur, Barbardiya, Thakurbaba |
| | Karnali | Bangad Kupinde, Birendranagar, Panchpuri |
| | Sudurpaschim Province | Budhinanda, Bungal, Kamalbazar, Panchadewal Binayak, Shikhar, Dasharathchanda, Melauli, Shailyashikhar |

| Rank | Province | Municipality |
|---|---|---|
| Low (0.1 – 0.271) | Province 1 | Phungling, Deumai, Mai, Suryodaya, Bhadrapur, Mechinagar, Shivasataxi, Sundarharaicha, Inaruwa, Itahari, Dhankuta, Mahalaxmi, Chainpur, Madi, Bhojpur, Solududhakunda, Chaudandigadhi, Katari |
| | Province 2 | Dakneshwori, Dhangadhimai, Mirchaiya, Sukhipur, Chhireshwornath, Janakpur, Mithila, Nagarain, Sabaila, Sahidnagar, Bardibas, Gaushala, Bagmati, Haripur, Ishworpur, Kabilasi, Malangawa, Brindaban, Gujara, Nijgadh, Simraungadh, Parsagadhi |
| | Bagmati | Dudhouli, Ramechhap, Bhimeshwor, Chautara SangachokGadhi, Hetauda, Kalika, Ratnanagar |
| | Gandaki | Besishahar, Bhirkot, Putalibazar, Pokhara Lekhnath, Galkot, Devchuli |
| | Lumbini | Resunga, Sunwal, Lumbini Sanskritik, Ghorahi, Lamahi, Bansagadhi, Madhuwan, Bheriganga |
| | Karnali | Bagchaur, Thuli Bheri, Tripurasundari, Chandannath, Tilagufa, Musikot |
| | Sudurpaschim Province | Badimalika, Tribeni, Bhajani, Ghodaghodi, Belauri, Mahakali, Shuklaphanta, Amargadhi, Mahakali |
| Very low (0 – 0.099) | Province 1 | Illam, Arjundhara, Birtamod, Damak, Kankai, Belbari, Letang, Patahrishanishchare, Ratuwamai, Uralabari, Barah, Dharan, Ramdhuni, Pakhribas, Dharmadevi, Triyuga |
| | Province 2 | Hanumannagar Kankalini, Kanchanrup, Khadak, Saptakoshi, Surunga, Golbazar, Kalyanpur, Lahan, Dhanusadham, Hansapur, Haripurwa, Hariwan, Lalbandi, Brindaban, Garuda, Jitpur Simara, Kalaiya, Kolhabi, Birgunj |
| | Bagmati | Banepa, Dhulikhel, Mandandeupur, Namobuddha, Panauti, Godawari, Lalitpur, Mahalaxmi, Bhaktapur, Changunarayan, Madhyapur Thimi, Suryabinayak, Budhanilakantha, Chandragiri, Dakshinkali, Gokarneshwor, Kageshwori Manahora, Kathmandu, Kirtipur, Nagarjun, Shankharapur, Tarakeshwor, Tokha, Bharatpur, Khairahani, Madi, Rapti |
| | Gandaki | Gorkha, Sundarbazar, Beni, Kushma, Baglung, Gaidakot, Kawasoti, Madhyabindu |
| | Lumbini | Butwal, Devdaha, Sainamaina, Siddharthanagar, Tillotama, Banganga, Buddhabhumi, Kapilbastu, Krishnanagar, Maharajgunj, Shivaraj, Kohalpur, Nepalgunj |
| | Karnali | Chhayanath Rara |
| | Sudurpaschim Province | Dhangadhi, Gauriganga, Lamkichuha, Bedkot, Bhimdatta, Krishnapur, Punarbas |

### 3. The vulnerability of Physical Infrastructure Subsector

| Rank | Province | Municipality |
|---|---|---|
| Very High (0.663 - 1) | Province 1 | Dharmadevi |
| | Province 2 | Bahudaramai, Parsagadhi, Pokhariya |
| | Bagmati | Jiri |
| | Gandaki | Dhorpatan |
| | Karnali | Aathbiskot, Aathabis, Chamunda Bindrasaini, Thuli Bheri, Tripurasundari, Khandachakra, Tilagufa, Chhayanath Rara |
| | Sudurpaschim Province | Badimalika, Mahakali, Shailyashikhar |
| High (0.458 – 0.662) | Province 1 | Phungling, Phidim, Pakhribas, Laligurans, Chainpur, Khandbari, Madi, Panchakhapan, Solududhakunda, Halesi Tuwachung |
| | Province 2 | Siraha, Bideha, Chhireshwornath, Ganeshman Charnath, Hansapur, Kamala, Mithila, Mithila Bihari, Nagarain, Sabaila, Sahidnagar, Birgunj |
| | Bagmati | Manthali, Ramechhap, Bhimeshwor, Chautara SangachokGadhi, Melamchi, Banepa, Mandandeupur, Namobuddha, Panauti, Panchkhal, Godawari |
| | Gandaki | Galyang, Waling, Kushma, Phalebas, Galkot, Jaimini |
| | Lumbini | Musikot, Tansen, Ramgram, Buddhabhumi, Krishnanagar, Maharajgunj, Shivaraj, Bhumekasthan, Sandhikharka, Lamahi, Rolpa |
| | Karnali | Chaurjahari, Gurbhakot, Dullu, Narayan, Bheri, Chhedagad, Nalagad, Chandannath, Musikot |
| | Sudurpaschim Province | Budhiganga, Budhinanda, Tribeni, JayaPrithivi, Kamalbazar, Panchadewal Binayak, Shikhar, Amargadhi, Melauli, Patan |

| Rank | Province | Municipality |
|---|---|---|
| Moderate (0.303 – 0.457) | Province 1 | Deumai, Mai, Suryodaya, Letang, Rangeli, Ratuwamai, Sundarharaicha, Sunwarshi, Uralabari, Duhabi, Myanglung, Bhojpur, Shadananda, Siddhicharan, Katari |
| | Province 2 | Dhangadhimai, Golbazar, Kalyanpur, Karjanha, Mirchaiya, Sukhipur, Dhanusadham, Janakpur, Manra Siswa, Ramgopalpur, Godaita, Haripur, Haripurwa, Kabilasi, Lalbandi, Malangawa |
| | Bagmati | Dudhouli, Mahalaxmi, Budhanilakantha, Chandragiri, Dakshinkali, Gokarneshwor, Kageshwori Manahora, Kirtipur, Nagarjun, Shankharapur, Tarakeshwor, Tokha, Hetauda, Thaha |
| | Gandaki | Gorkha, Palungtar, MadhyaNepal, Rainas, Sundarbazar, Bhimad, Bhirkot, Chapakot, Putalibazar, Devchuli, Gaidakot, Madhyabindu |
| | Lumbini | Resunga, Rampur, Sunwal, Sitganga, Sworgadwary |
| | Karnali | Sharada, Bheriganga, Lekbeshi, Panchpuri, Raskot |
| | Sudurpaschim Province | Bungal, Mangalsen, Sanphebagar, Dipayal Silgadi, Bhimdatta, Krishnapur, Mahakali, Punarbas, Shuklaphanta, Parashuram, Purchaudi |
| Low (0.119 – 0.302) | Province 1 | Illam, Gauradhaha, Biratnagar, Patahrishanishchare, Dharan, Inaruwa, Ramdhuni, Mahalaxmi, Rupakot Majhuwagadhi, Chaudandigadhi |
| | Province 2 | Bode Barsain, Hanumannagar Kankalini, Saptakoshi, Aurahi, Balwa, Bhangaha, Gaushala, Loharpatti, Matihani, Hariwan, Ishworpur, Mahagadhimai, Pacharauta, Simraungadh |
| | Bagmati | Barhabise, Lalitpur, Kathmandu, Bidur, Dhunibesi, Nilakantha |
| | Gandaki | Bhanu, Shuklagandaki, Pokhara Lekhnath, Kawasoti |
| | Lumbini | Banganga, Pyuthan, Kohalpur, Madhuwan, Rajapur, Thakurbaba |
| | Karnali | Birendranagar |
| | Sudurpaschim Province | Bhajani, Gauriganga, Ghodaghodi, Godawari, Lamkichuha |
| Very low (0 – 0.118) | Province 1 | Arjundhara, Bhadrapur, Birtamod, Damak, Kankai, Mechinagar, Shivasataxi, Belbari, Barah, Itahari, Dhankuta, Belaka, Triyuga |
| | Province 2 | Dakneshwori, Kanchanrup, Khadak, Rajbiraj, Shambhunath, Surunga, Lahan, Bardibas, Jaleswor, Bagmati, Balara, Barahathawa, Baudhimai, Brindaban, Brindaban, Dewahhi Gonahi, Gadhimai, Garuda, Gaur, Gujara, Ishanath, Katahariya, Madhav Narayan, Maulapur, Paroha, Phatuwa Bijayapur, Rajdevi, Rajpur, Jitpur Simara, Kalaiya, Kolhabi, Nijgadh |
| | Bagmati | Kamalamai, Dhulikhel, Bhaktapur, Changunarayan, Madhyapur Thimi, Suryabinayak, Belkotgadhi, Bharatpur, Kalika, Khairahani, Madi, Rapti, Ratnanagar |
| | Gandaki | Besishahar, Byas, Beni, Baglung |
| | Lumbini | Bardaghat, Butwal, Devdaha, Lumbini Sanskritik, Sainamaina, Siddharthanagar, Tillotama, Kapilbastu, Ghorahi, Tulsipur, Nepalgunj, Bansagadhi, Barbardiya, Gulariya, Bheriganga |
| | Karnali | Bagchaur, Bangad Kupinde |
| | Sudurpaschim Province | Dhangadhi, Tikapur, Bedkot, Belauri, Dasharathchanda |

## 4. The vulnerability of Social Infrastructure Subsector

| Rank | Province | Municipality |
|---|---|---|
| Very high (0.759 - 1) | Bagmati | Banepa, Nilakantha |
| | Sudurpaschim Province | Tikapur |
| High (0.472 – 0.758) | Province 2 | Lahan, Chhireshwornath, Mithila |
| | Bagmati | Dhulikhel, Panauti, Panchkhal |
| | Gandaki | Gaidakot |
| | Lumbini | Rajapur |
| | Karnali | Bhajani, Dhangadhi |
| | Sudurpaschim Province | Lahan, Chhireshwornath, Mithila |
| Moderate (0.269 – 0.471) | Province 1 | Bhadrapur |
| | Province 2 | Ishworpur |
| | Bagmati | Bhadrapur |
| | Gandaki | Ishworpur |
| | Lumbini | Barhabise, Mandandeupur, Godawari, Budhanilakantha, Belkotgadhi, Thaha, Khairahani |
| | Sudurpaschim Province | Gorkha, Besishahar, Rainas, Kushma, Kawasoti |
| Low (0.093 – 0.268) | Province 1 | Phungling, Suryodaya, Patahrishanishchare, Ratuwamai, Siddhicharan, Halesi Tuwachung |
| | Province 2 | Hanumannagar Kankalini, Sukhipur, Janakpur, Garuda, Pokhariya |
| | Bagmati | Bhimeshwor, Mahalaxmi, Madhyapur Thimi, Chandragiri, Kirtipur, Nagarjun, Tarakeshwor, Rapti |
| | Gandaki | MadhyaNepal, Sundarbazar |
| | Lumbini | Rampur, Sunwal, Lamahi, Kohalpur, Bansagadhi, Madhuwan, Bheriganga |
| | Karnali | Panchpuri, Dullu |
| | Sudurpaschim Province | Budhiganga, Kamalbazar, Mangalsen, Dipayal Silgadi, Shikhar |
| Very low (0 – 0.092) | Province 1 | Phidim, Deumai, Illam, Mai, Arjundhara, Birtamod, Damak, Gauradhaha, Kankai, Mechinagar, Shivasataxi, Belbari, Biratnagar, Letang, Rangeli, Sundarharaicha, Sunwarshi, Uralabari, Barah, Dharan, Duhabi, Inaruwa, Itahari, Ramdhuni, Dhankuta, Mahalaxmi, Pakhribas, Laligurans, Myanglung, Chainpur, Dharmadevi, Khandbari, Madi, Panchakhapan, Bhojpur, Shadananda, Solududhakunda, Rupakot Majhuwagadhi, Belaka, Chaudandigadhi, Katari, Triyuga |
| | Province 2 | Bode Barsain, Dakneshwori, Kanchanrup, Khadak, Rajbiraj, Saptakoshi, Shambhunath, Surunga, Dhangadhimai, Golbazar, Kalyanpur, Karjanha, Mirchaiya, Siraha, Bideha, Dhanusadham, Ganeshman Charnath, Hansapur, Kamala, Mithila Bihari, Nagarain, Sabaila, Sahidnagar, Aurahi, Balwa, Bardibas, Bhangaha, Gaushala, Jaleswor, Loharpatti, Manra Siswa, Matihani, Ramgopalpur, Bagmati, Balara, Barahathawa, Godaita, Haripur, Haripurwa, Hariwan, Kabilasi, Lalbandi, Malangawa, Baudhimai, Brindaban, Brindaban, Dewahhi Gonahi, Gadhimai, Gaur, Gujara, Ishanath, Katahariya, Madhav Narayan, Maulapur, Paroha, Phatuwa Bijayapur, Rajdevi, Rajpur, Jitpur Simara, Kalaiya, Kolhabi, Mahagadhimai, Nijgadh, Pacharauta, Simraungadh, Bahudaramai, Birgunj, Parsagadhi |
| | Bagmati | Dudhouli, Kamalamai, Manthali, Ramechhap, Jiri, Chautara SangachokGadhi, Melamchi, Namobuddha, Lalitpur, Bhaktapur, Changunarayan, Suryabinayak, Dakshinkali, Gokarneshwor, Kageshwori Manahora, Kathmandu, Shankharapur, Tokha, Bidur, Dhunibesi, Hetauda, Bharatpur, Kalika, Madi, Ratnanagar |
| | Gandaki | Palungtar, Bhanu, Bhimad, Byas, Shuklagandaki, Bhirkot, Chapakot, Galyang, Putalibazar, Waling, Pokhara Lekhnath, Beni, Phalebas, Baglung, Dhorpatan, Galkot, Jaimini, Devchuli, Madhyabindu |

| Rank | Province | Municipality |
|---|---|---|
| Very low (0 – 0.092) | Lumbini | Musikot, Resunga, Tansen, Bardaghat, Ramgram, Butwal, Devdaha, Lumbini Sanskritik, Sainamaina, Siddharthanagar, Tillotama, Buddhabhumi, Kapilbastu, Krishnanagar, Maharajgunj, Bhumekasthan, Sandhikharka, Sitganga, Pyuthan, Sworgadwary, Ghorahi, Tulsipur, Nepalgunj, Gulariya, Thakurbaba, Rolpa |
| | Karnali | Aathbiskot, Chaurjahari, Bagchaur, Bangad Kupinde, Sharada, Bheriganga, Birendranagar, Gurbhakot, Lekbeshi, Aathabis, Chamunda Bindrasaini, Narayan, Bheri, Chhedagad, Nalagad, Thuli Bheri, Tripurasundari, Chandannath, Khandachakra, Raskot, Tilagufa, Chhayanath Rara, Musikot |
| | Sudurpaschim Province | Budhinanda, Tribeni, Bungal, JayaPrithivi, Panchadewal Binayak, Sanphebagar, Gauriganga, Ghodaghodi, Godawari, Lamkichuha, Bedkot, Belauri, Bhimdatta, Krishnapur, Mahakali, Punarbas, Shuklaphanta, Amargadhi, Parashuram, Dasharathchanda, Melauli, Patan, Purchaudi, Mahakali, Shailyashikhar |

# Annex 8: Province wise vulnerability of municipalities

## Province 1

In Province 1, six municipalities (Phungling, Chainpur, Dharmadevi, Khandbari, Siddhicharan, Halesi Tuwachung) are found to have a very high vulnerability ranking (Figure I). All these municipalities are in the hill and middle mountain region. The fragile geology and landscape, settlements, and development are occurring comparatively in risk-prone areas indicating a higher level of sensitivity. The inefficient resource mobilization and institutional preparedness to planning and act better are lowering the adaptive capacity of these municipalities. Some municipalities in the Tarai belt are also in a highly vulnerable rank due to their inherent exposure to annual flood events and settlements are in flood plains. The Tarai areas also have higher accessibility toward roads and services, resources, and respective development opportunities, it is found that most of the municipalities are less vulnerable ranking. To demonstrate municipalities sensitivity and adaptive capacity to climate change, the comparison between two municipalities vulnerability ranking i.e., Phungling (very high vulnerable) and Dharan (very low vulnerable) as an example from Province 1 was carried out to illustrate the influence of development indicators to represent the respective vulnerability of these municipalities. The table below illustrates that the percentage of population dependent on agriculture, percentage of households with temporary roof types, and percentage of road length in landslide-prone areas are comparative measures leading toward sensitivity to climate change in Phungling and Dharan municipalities, respectively. Similarly, the percentage of literacy rate, percentage of building with RCC roof type by households, and capacity of the hospital were taken as a measure to compare adaptive capacity between Phungling and Dharan municipalities.

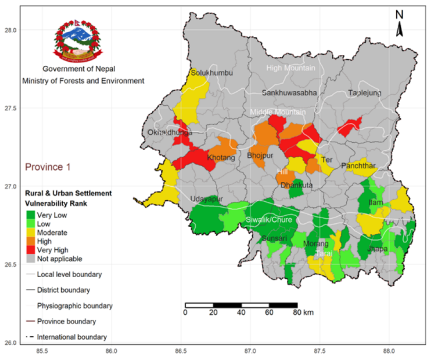



**Figure I: Vulnerability Ranks of Province One**

**Comparison of the municipality of lower vulnerability with higher vulnerability in Province 1**

| Municipality | Rank | Sensitivity | Adaptive capacity |
|---|---|---|---|
| Phungling | Very high | • The population dependent on agriculture 29.38 %<br>• A household with temporary roof types 95.28 %<br>• 13 % of road length in landslide risk-prone area | • Total Literacy 78.22 %<br>• Building with RCC roof type HH 5.6 %<br>• Availability of stormwater drain line 0 %<br>• The capacity of the hospital (Bed) (No) 25 |
| Dharan | Very low | • The population dependent on agriculture 16.48 %<br>• A household with temporary roof types 59.03 %<br>• 2.15 % of road length in landslide risk-prone area | • Total Literacy 82.84 %<br>• Building with RCC roof type HH 44 %<br>• Availability of stormwater drain line 21%<br>• The capacity of the hospital (Bed) (No) 500 |

*Sources: CBS, 2011; MoH, 2018; NUDS, 2017; UN-OCHA*

## Province 2

In Province 2, two municipalities (Chhireshwornath, Janakpur) are found to have very high vulnerability rank (Figure II). All these municipalities are in the Tarai belt with the exposed risk of settlements and built environments into flood risk as well as slow-onset drought events. The construction practice of maximum households in those areas is temporary structures. To demonstrate municipalities sensitivity and adaptive capacity to climate change, the comparison between two municipalities vulnerability ranking i.e., Janakpur (very high vulnerable) and Jaleshwor (very low vulnerable) as an example from Province 2 was carried out to illustrate the influence of development indicators to represent the respective vulnerability of these municipalities. The table below illustrates the percentage of female-headed households, the number of settlements in flood risk-prone areas, the percentage of dilapidated water schemes, and the percentage of education infrastructure located to flood risk-prone areas as a comparative measure leading toward sensitivity to climate change in Janakpur and Jaleshwor municipalities, respectively. Similarly, the human development index, percentage of climate-friendly building, percentage of availability of stormwater drain line, and percentage of the population having access to hospital services was taken as a measure to compare adaptive capacity between the Jankapur and Jaleshwor municipalities.

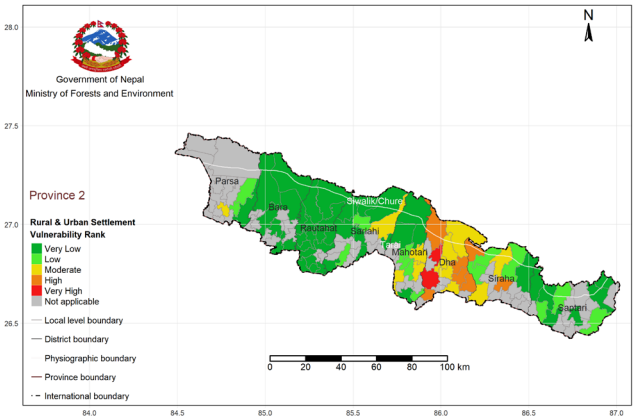



**Figure II: Vulnerability rank of Province 2**

### Comparison of the municipality of lower vulnerability with higher vulnerability in Province 2

| Municipality | Rank | Sensitivity | Adaptive capacity |
|---|---|---|---|
| Janakpur | Very high | • Female-headed households 19.42 %<br>• 40 Settlements in flood risk-prone area<br>• Dilapidated water schemes 75 %<br>• Education Infrastructure located to flood risk-prone area 26.31 % | • HDI value 0.459<br>• Climate-friendly building (envelope construction material type) HH% 24.65<br>• Availability of stormwater drain line 11 %<br>• The capacity of the hospital (service population no) 17.6 % |
| Jaleswor | Very low | • Female-headed households 56.21 %<br>• 26 Settlements in flood risk-prone area<br>• Dilapidated water schemes 60 %<br>• Education Infrastructure located to flood risk-prone area 1.96 % | • HDI value 0.526<br>• Climate-friendly building (envelope construction material type) HH% 49.53<br>• Availability of stormwater drain line 19 %<br>• The capacity of the hospital (service population no) 18 % |

*Sources: CBS, 2011; DWSS, 2018; MoH, 2018; NUDS, 2017; UN-OCHA, METEOR*

## Bagmati Province

In this Province, 4 municipalities (Jiri, Banepa, Panchkhal, Nilakantha) are found to have very high vulnerability rank (Figure III). Some municipalities like Jiri, Nilkantha and Banepa from the middle mountains are in high vulnerability rank. The reason for this very high and high vulnerability is its fragile geology and terrain and the proximity of settlements and infrastructures in disaster risk-prone areas and the prevailing development challenges of these municipalities.

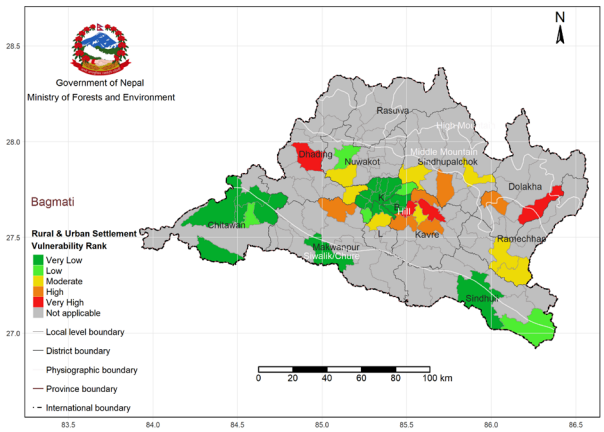



**Figure III: Vulnerability rank of Bagmati Province**

Besides these old, developed municipalities and towns also come under this Province which has a very high level of adaptive capacity and hence is found to be low vulnerability to climate change. To demonstrate municipalities sensitivity and adaptive capacity to climate change, the comparison between two municipalities vulnerability ranking i.e., Nilkantha (very high vulnerable) and Rapti (very low vulnerable) as an example from Bagmati Province was carried out to illustrate the influence of development indicators to represent the respective vulnerability of these municipalities. The table below illustrates the percentage of population dependent on agriculture, percentage of households with load-bearing foundation type, and percentage of dilapidated water schemes as a comparative measure leading toward sensitivity to climate change in Nilkantha and Rapti municipalities, respectively. Similarly, the percentage of the non-agro-based economy, percentage of climate-friendly building, percentage of functionally intact water scheme, and amount of per capacity municipal was taken as a measure to compare adaptive capacity between the Nilkantha and Rapti municipalities.

### Comparison of the municipality of lower vulnerability with higher vulnerability in Bagmati Province

| Municipality | Rank | Sensitivity | Adaptive capacity |
|---|---|---|---|
| Nilkantha | Very high | • The population dependent on agriculture 34.92 %<br>• HH with load-bearing foundation type 84.05 %<br>• Dilapidated water schemes (%) 60 | • Non-agro based economy 9.68 %<br>• Climate-friendly building (envelope construction material type) HH 0.6 %<br>• Functionally intact water schemes 40 %<br>• Per capita Municipal budget (Amount): NPR 17,622 |
| Rapti | Very low | • The population dependent on agriculture 21.87%<br>• HH with load-bearing foundation type 41.25 %<br>• Dilapidated water schemes 50 % | • Non-agro based economy 17.13%<br>• Climate-friendly building (envelope construction material type) HH22.6%<br>• Functionally intact water schemes 50 %<br>• Per capita Municipal budget (Amount): NPR 15,62,096 |

*Sources: CBS, 2011; DWSS, 2018; MoFAGA, 2020*

## Gandaki Province

In Gandaki Province, Madhya Nepal, Rainas, Sundarbazar, Kushma, Dhorpatan and Gaidakotare the 6 municipalities found in very high vulnerability rank (Figure IV). The flood and landslide-prone areas, the proximity of settlements, roads, and social infrastructure to those areas, and many water schemes requiring repair are the major cause of high vulnerability. The maximum towns are in the hill region with higher landslide risk areas. The older towns like Pokhara, Baglung, Beni, Kushma are found to have a high level of adaptive capacity making these municipalities less vulnerable to climate change. To demonstrate municipalities sensitivity and adaptive capacity to climate change, the comparison between two municipalities vulnerability ranking i.e., Rainas (very high vulnerable) and Shuklagandaki (very low vulnerable) as an example from Gandaki Province was carried out to illustrate the influence of development indicators to represent the respective vulnerability of these municipalities. The table below illustrates the percentage of population dependent on agriculture, percentage of households with temporary roof type, and percentage of road length in landslide-prone areas as a comparative measure leading toward sensitivity to climate change in Rainas and Shuklagandaki municipalities, respectively. Similarly, the percentage of total literacy, percentage building with RCC roof type, percentage of availability of stormwater drain line, and the number of trained masons for resilient house construction was taken as a measure to compare adaptive capacity between the Rainas and Shuklagandaki municipalities.

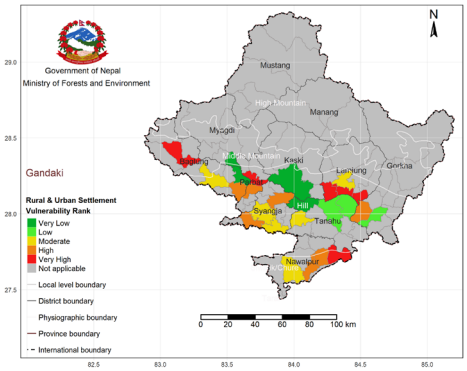



**Figure IV: Vulnerability rank of Gandaki Province**

### Comparison of the municipality of lower vulnerability with higher vulnerability in Gandaki Province

| Municipality | Rank | Sensitivity | Adaptive capacity |
|---|---|---|---|
| Rainas | Very high | • The population dependent on agriculture 32.19 %<br>• HH with temporary roof type 94.56 %<br>• Length of roads in landslide-prone areas 4.78% | • Total Literacy 69.22 %<br>• Building with RCC roof type (HH) 2.1 %<br>• Availability of stormwater drain line 0 %<br>• 27 trained masons for resilient construction. |
| Shuklagandaki | Very low | • The population dependent on agriculture 28.75%<br>• HH with temporary roof type 66.65 %<br>• Length of roads in landslide-prone areas 2.02% | • Total Literacy (%) 78.75<br>• Building with RCC roof type (HH%) 32.57<br>• Availability of stormwater drain line 6%<br>• 68 trained masons for resilient construction. |

*Sources: CBS, 2011; DWSS 2075; NSET, 2018; MoH, 2018; NUDS, 2017; UN-OCHA, METEOR*

## Lumbini Province

In Lumbini Province, Rampur, Shivaraj, Sandhikharka, Rajapur are the 4 municipalities found to have a very high vulnerability ranking (Figure V). The Rajapur, Lamahi, and Shivaraj are highly exposed to flood risk whereas Rampur and Pyuthan are exposed to landslide risk. These municipalities have a high number of settlements and infrastructure in risk-prone areas. The building construction practice is more loadbearing foundation types, and temporary wall and roof types are increasing the risk from climate change. Other older towns such as Butwal, Nepalgunj, Tulsipur, Ghorahi, Siddarthanagar are found to be less vulnerable to climate change. To demonstrate municipalities sensitivity and adaptive capacity to climate change, the comparison between two municipalities vulnerability ranking i.e., Pyuthan (very high vulnerable) and Tulsipur (very low vulnerable) as an example from Lumbini Province was carried out to illustrate the influence of development indicators to represent the respective vulnerability of these municipalities. The table below illustrates that the percentage of female-headed households, the percentage of temporary roof type, the percentage of road length having slope grader than 30 degrees, and percentage of health infrastructure located in landslide risk-prone area as a comparative measure leading toward sensitivity to climate change in Pyuthan and Tulsipur municipalities, respectively. Similarly, the human development index, percentage of building with RCC roof type, percentage of metallic road, the capacity of the hospital, and the number of trained masons for resilient construction are taken as a measure to compare adaptive capacity between the Pyuthan and Tulsipur municipalities.

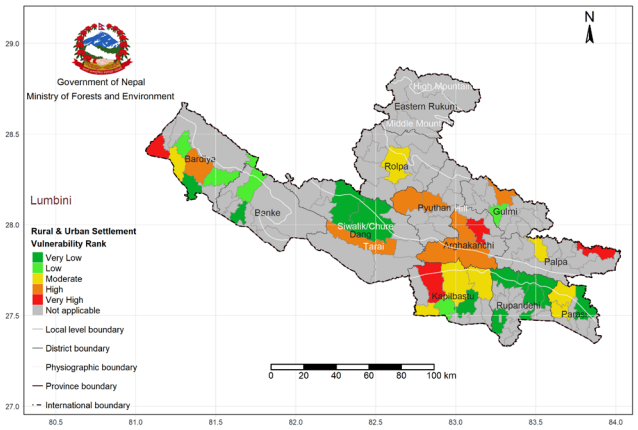



**Figure V: Vulnerability rank of Lumbini Province**

### Comparison of the municipality of lower vulnerability with higher vulnerability in Lumbini Province

| Municipality | Rank | Sensitivity | Adaptive capacity |
|---|---|---|---|
| Shivaraj | Very high | • HPI 38.3<br>• HH with light weight wall type (%) 19.3<br>Length of the road in landslide risk prone area 5.96% | • Access to financial services 90%<br>• Building with RCC pillar foundation type (HH) 2.55 %<br>• Metallic roads 0%<br>• The capacity of the hospital (Bed) (No) 0<br>• Trained masons for resilient construction (No) 0 |
| Tulsipur | Very low | • HPI 34.9<br>• HH with light weight wall type (%) 1.16<br>Length of the road in landslide risk prone area 1.3% | • Access to financial services 100%Building with RCC pillar foundation type (HH) 11.49 %<br>• Metallic roads 8.2 %<br>• The capacity of the hospital (Bed) (No) 235<br>• 266 trained masons for resilient construction. |

*Sources: CBS, 2011; NSET, 2018; IUDP, 2020; 2018; MoH, 2018; UN-OCHA, METEOR*

## Karnali Province

The municipalities of Karnali Province are found to be the most highly vulnerable Province of all (Figure VI). In overall 6 municipalities (Aathabis, Chamunda Bindrasaini, Dullu, Khandachakra, Tilagufa, Chhayanath Rara) have reflected very high vulnerability in this province. The Karnali Province development is challenged by geography and inaccessibility of adequate basic services which is leading towards low adaptive capacity and high sensitivity to effectively manage and respond to the climate-induced risk. It is found that only 3 municipalities Bangad Kupinde, Lekbesi and Birendranagar are a low and very low vulnerability rank in this Province and remaining all the municipalities are found to be moderate to a high level of vulnerability ranking to climate change. To demonstrate municipalities sensitivity and adaptive capacity to climate change, the comparison between two municipalities vulnerability ranking i.e., Dullu (very high vulnerable) and Birendranagar (very low vulnerable) as an example from Karnali Province was carried out to illustrate the influence of development indicators to represent the respective vulnerability of these municipalities. The table below illustrates that human poverty index, percentage of households with temporary roof type, and percentage of road length in landslide-prone areas s as a comparative measure leading toward sensitivity to climate change in Dullu and Birendranagar municipalities, respectively. Similarly, the percentage of literacy, percentage of building with RCC roof type, percentage of metallic roads, and capacity of the hospital to provide services was taken as a measure to compare adaptive capacity between the Dullu and Birendranagar municipalities.

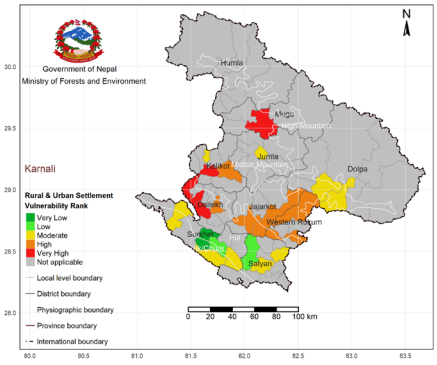



**Figure VI: Vulnerability rank of Karnali Province**

## Comparison of the municipality of lower vulnerability with higher vulnerability in Lumbini Province

| Municipality | Rank | Sensitivity | Adaptive capacity |
|---|---|---|---|
| Dullu | Very high | • Poverty (HPI) 41.4<br>• HH with temporary roof type 90.93%<br>• Length of roads in landslide-prone areas 15 % | • Total Literacy 63.84 %<br>• Building with RCC roof type (HH) 0.4 %<br>• Metallic roads 0 %<br>• The capacity of the hospital (Bed) (No) 0 |
| Birendranagar | Very low | • Poverty (HPI) 36.4<br>• HH with temporary roof type 50.76 %<br>• Length of roads in landslide-prone areas 4.3 % | • Total Literacy 79.65 %<br>• Building with RCC roof type (HH) 36.2 %<br>• Metallic roads 8.2 %<br>• The capacity of the hospital (Bed) (No) 500 |

*Sources: CBS, 2011; NSET, 2018; IUDP, 2020; 2018; MoH, 2018; UN-OCHA, METEOR*

## Sudurpaschim Province

In Sudurpaschim Province, 3 municipalities (Badimalika, Budhiganga, Jaya Prithivi) are found to be very high vulnerability ranking (Figure VII). Most of the municipalities are in the hilly region which is prone to landslide risk and those located in the Tarai region are prone to flood risk putting municipalities in a high vulnerability ranking. The higher number of settlements and infrastructures in the risk-prone areas, the higher is the vulnerability. Additionally, the construction practice of buildings is found to be temporary types and non-compliance to codes. To demonstrate municipalities sensitivity and adaptive capacity to climate change, the comparison between two municipalities vulnerability ranking i.e., Tikapur (very high vulnerable) and Dhangadi (very low vulnerable) as an example from Sudurpaschim Province was carried out to illustrate the influence of development indicators to represent the respective vulnerability of these municipalities.

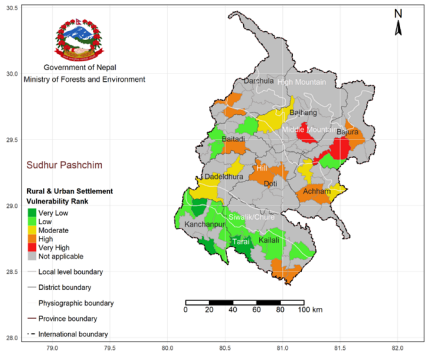



**Figure VII: Vulnerability rank of Sudurpaschim Province**

The table below illustrates the percentage by various age groups, percentage of household temporary roof type, and percentage of road length in the flood-prone area as a comparative measure leading toward sensitivity to climate change in Tikapur and Dhangadi municipalities, respectively. Similarly, the human development index, percentage of building with RCC roof type, percentage of metallic roads, and the number of engineers in the municipal was taken as a measure to compare adaptive capacity between the Tikapur and Dhangadi municipalities.

**Comparison of the municipality of lower vulnerability with higher vulnerability in Lumbini Province**

| Municipality | Rank | Sensitivity | Adaptive capacity |
|---|---|---|---|
| Tikapur | High | • Age group (Old age population, Infant population, Children Population) 36.73 %<br>• HH with temporary roof type 66.21 %<br>• Length of roads in flood-prone areas 7.72 % | • HDI value 0.49<br>• Building with RCC roof type (HH) 18.3 %<br>• Metallic roads 7.1 %<br>• Engineers in the Municipality (No) 3 |
| Dhangadhi | Very low | • Age group (Old age population, Infant population, Children Population) 34.57 %<br>• HH with temporary roof type 53.45 %<br>• Length of roads in flood-prone areas 2.89% | • HDI value 0.52<br>• Building with RCC roof type (HH) 31.45 %<br>• Metallic roads 15.1 %<br>• Engineers in the Municipality (No) 6 |

*Sources: CBS, 2011; IUDP, 2020; 2018; MoH, 2018; Municipal website; UN-OCHA, METEOR*

# Annex 9: Vulnerability rank of rural municipalities

| Vulnerability rank | Palika |
|---|---|
| Very High (0.743 - 1) | Budhiganga, Aurahi, Bariyarpatti, Laxmipur Patari, Janaknandani, Ekdanra, Mahottari, Pipra, Samsi, Sonama, Bramhapuri, Chandranagar, Hariharpurgadhi, Marin, Tinpatan, Kalinchok, Balefi, Tripurasundari, Dupcheshwar, Benighat Rorang, Bagmati, Bakaiya, Bhimphedi, Raksirang, Durga Bhagwati, Yemunamai, Annapurna, Madi, Mayadevi, Bijayanagar, Suddhodhan, Pariwartan, Runtigadi, Sunchhahari, Suwarnabati, Tribeni, Kumakha, Rajpur, Rapti Sonari, Badhaiyatal, Naumule, Junichande, Kuse, Kanakasundari, Sinja, Tatopani, Tila, Mahawai, Naraharinath, Pachaljharana, Sanni Tribeni, Khatyad, Adanchuli, Chankheli, Kharpunath, Namkha, Sarkegad, Simkot, Tanjakot, Chhededaha, Gaumul, Himali, Jagannath, Swami Kartik, Bithadchir, Chabispathivera, Durgathali, Saa Paal, Kedarseu, Khaptadchhanna, Talkot, Thalara, Bannigadhi Jayagadh, Chaurpati, Dhakari, Mellekh, Ramaroshan, Turmakhad, Badikedar, Bogtan, Jorayal, K I Sin, Dilasaini, Dogadakedar, Sisne |
| High (0.602 - 0.742) | Koshi, Manebhanjyang, Molung, Sunkoshi, Udayapurgadhi, Agnisair Krishna Savaran, Belhi Chapena, Bishnupur, Chhinnamasta, Mahadeva, Rupani, Tilathi Koiladi, Tirahut, Arnama, Bhagawanpur, Bishnupur, Naraha, Nawarajpur, Sakhuwanankarkatti, Aaurahi, Bateshwor, Dhanauji, Lakshminiya, Mukhiyapatti Musarmiya, Basbariya, Bishnu, Chakraghatta, Dhankaul, Kaudena, Parsa, Ramnagar, Golanjor, Phikkal, Khadadevi, Baiteshwor, Bigu, Gaurishankar, Melung, Sailung, Tamakoshi, Bhotekoshi, Helambu, Indrawati, Jugal, Panchpokhari Thangpal, Kakani, Likhu, Panchakanya, Shivapuri, Gosaikunda, Uttargaya, Gajuri, Galchi, Jwalamukhi, Siddhalek, Thakre, Tripura Sundari, Manahari, Adarshkotwal, Suwarna, Jirabhawani, SakhuwaPrasauni, Thori, Sahid Lakhan, Siranchok, Barpak Sulikot, Marsyangdi, Modi, Nisikhola, Dhurkot, Isma, Madane, Pratappur, Gaidahawa, Kotahimai, Mayadevi, Yashodhara, Ayirabati, Gaumukhi, Jhimruk, Mallarani, Mandavi, Naubahini, Sarumarani, Lungri, Sukidaha, Thawang, Sani Bheri, Chhatreshwori, Darma, Kalimati, Babai, Gadhawa, Baijanath, Janki, Khajura, Geruwa, Barahtal, Simta, Bhagawatimai, Bhairabi, Dungeshwor, Gurans, Mahabu, Thantikandh, Barekot, Shiwalaya, Chharka Tangsong, Dolpo Buddha, Jagadulla, Kaike, Mudkechula, Shey Phoksundo, Guthichaur, Hima, Patrasi, Palata, Mugu mkarmarong, Soru, Masta, Surma, Adharsha, Purbichauki, Sayal, Bardagoriya, Chure, Joshipur, Kailari, Mohanyal, Alital, Ganayapdhura, Nawadurga, Pancheshwar, Shivanath, Sigas, Surnaya, Bhume, Putha Uttarganga |
| Moderate (0.468 - 0.601) | Phaktanglung, Pathibhara Yangwarak, Falelung, Hilihang, Miklajung, Yangwarak, Gauriganj, Jhapa, Kachankawal, Kamal, Dhanpalthan, Gramthan, Jahada, Kanepokhari, Miklajung, Bhokraha Narsingh, Dewanganj, Harinagar, Sangurigadhi, Bhotkhola, Aamchowk, Arun, Hatuwagadhi, Pauwadungma, Ramprasad Rai, Tyamkemaiyung, Khumbupasanglahmu, Champadevi, Chisankhugadhi, Khijidemba, Likhu, Diprung, Khotehang, Rautamai, Sunkoshi, Balan Bihul, Ghanglekh, Sunkoshi, Doramba, Gokulganga, Likhu Tamakoshi, Sunapati, Umakunda, Lisangkhu Pakhar, Sunkoshi, Chaurideurali, Roshi, Temal, Kispang, Myagang, Suryagadhi, Tadi, Tarkeshwar, Naukunda, Aamachodingmo, Gangajamuna, Netrawati Dabjong, Rubi Valley, Indrasarowar, Kailash, Makawanpurgadhi, Baragadhi, Bishrampur, Devtal, Karaiyamai, Parwanipur, Pheta, Prasauni, Bindabasini, Chhipaharmai, Dhobini, Jagarnathpur, Kalikamai, Pakahamainpur, Paterwasugauli, Aarughat, Ajirkot, Bhimsen Thapa, Chum Nubri, Gandaki, Dordi, Bandipur, Rhishing, Malika, Raghuganga, Badigad, Chandrakot, Chatrakot, Gulmidarbar, Kaligandaki, Malika, Ruru, Satyawati, Rainadevi Chhahara, Rambha, Palhi Nandan, Sarawal, Susta, Susta, Kanchan, Marchawari, Rohini, Sammarimai, Siyari, Chhatradev, Malarani, Panini, Madi, Banfikot, Tribeni, Siddha Kumakha, Kapurkot, Tribeni, Banglachuli, Rapti, Duduwa, Narainapur, Chaukune, Chingad, Janaki, Beldandi, Laljhadi, Ajaymeru, Bhageshwar, Apihimal, Dunhu, Lekam, Malikaarjun, Marma, Naugad, Binayee Tribeni |
| Low (0.287 - 0.467) | Aathrai Tribeni, Maiwakhola, Meringden, Mikwakhola, Sidingba, Sirijangha, Falgunanda, Kummayak, Tumbewa, Chulachuli, Fakphokthum, Maijogmai, Mangsebung, Rong, Sandakpur, Barhadashi, Buddhashanti, Haldibari, Katahari, Kerabari, Barju, Gadhi, Chaubise, Chhathar Jorpati, Shahidbhumi, Aathrai, Chhathar, Phedap, Chichila, Makalu, Sabhapokhari, Silichong, Salpasilichho, Thulung Dudhkoshi, Dudhkoshi, Likhupike, Mahakulung, Nechasalyan, Sotang, Ainselukhark, Barahapokhari, Jantedhunga, Kepilasagadhi, Rawa Besi, Sakela, Tapli, Bethanchowk, Bhumlu, Khanikhola, Mahabharat, Bagmati, Khaniyabash, Ichchhyakamana, Dharche, Dudhpokhari, Kwholasothar, Anbukhaireni, Devghat, Ghiring, Myagde, Aandhikhola, Arjunchaupari, Biruwa, Harinas, Kaligandagi, Machhapuchchhre, Waragun Muktikshetra, Lo-Ghekar Damodarkunda, Gharapjhong, Lomanthang, Thasang, Annapurna, Dhaulagiri, Mangala, Bihadi, Jaljala, Mahashila, Painyu, Bareng, Kanthekhola, Taman Khola, Tara Khola, Bagnaskali, Mathagadhi, Nisdi, Purbakhola, Ribdikot, Tinau, Omsatiya, Sudhdhodhan, Dangisharan, Shantinagar, Kalika, Byas, Bulingtar, Bungdikali, Hupsekot |
| Very Low (0.013 - 0.286) | Menchayam, Konjyosom, Mahankal, Kalika, Phedikhola, Rupa, Chame, Narpa Bhumi, Nasho, Manang Nshiang |

# Annex 10: Numerical Index Value of Vulnerability, Hazard and Risk for all 293 Municipalities

| District | Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | RIsk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Taplejung | Phungling | 0.154 | 0.812 | 0.377 | 0.752 | 0.757 | 0.871 | 0.889 | 0.836 | 0.904 | 0.224 | 0.258 | 0.263 | 0.248 | 0.268 |
| Sankhuwasabha | Khandbari | 0.218 | 0.652 | 0.321 | 0.566 | 0.798 | 0.907 | 0.92 | 0.883 | 0.961 | 0.302 | 0.344 | 0.348 | 0.335 | 0.364 |
| Sankhuwasabha | Panchakhapan | 0.213 | 0.63 | 0.323 | 0.521 | 0.798 | 0.907 | 0.92 | 0.883 | 0.961 | 0.288 | 0.328 | 0.332 | 0.319 | 0.347 |
| Sankhuwasabha | Chainpur | 0.26 | 0.682 | 0.315 | 0.636 | 0.798 | 0.907 | 0.92 | 0.883 | 0.961 | 0.375 | 0.427 | 0.433 | 0.416 | 0.452 |
| Sankhuwasabha | Madi | 0.109 | 0.561 | 0.361 | 0.314 | 0.798 | 0.907 | 0.92 | 0.883 | 0.961 | 0.129 | 0.147 | 0.149 | 0.143 | 0.156 |
| Sankhuwasabha | Dharmadevi | 0.164 | 0.706 | 0.327 | 0.653 | 0.798 | 0.907 | 0.92 | 0.883 | 0.961 | 0.239 | 0.272 | 0.276 | 0.265 | 0.288 |
| Solukhumbu | Solududhakunda | 0.331 | 0.624 | 0.371 | 0.413 | 0.594 | 0.68 | 0.683 | 0.656 | 0.732 | 0.312 | 0.357 | 0.358 | 0.344 | 0.384 |
| Okhaldhunga | Siddhicharan | 0.288 | 0.919 | 0.476 | 0.752 | 0.567 | 0.667 | 0.657 | 0.652 | 0.728 | 0.314 | 0.37 | 0.364 | 0.361 | 0.403 |
| Khotang | Halesi Tuwachung | 0.324 | 0.777 | 0.351 | 0.74 | 0.558 | 0.659 | 0.65 | 0.639 | 0.725 | 0.345 | 0.408 | 0.403 | 0.396 | 0.449 |
| Khotang | Rupakot Majhuwagadhi | 0.422 | 0.739 | 0.458 | 0.45 | 0.558 | 0.659 | 0.65 | 0.639 | 0.725 | 0.382 | 0.451 | 0.445 | 0.438 | 0.496 |
| Bhojpur | Shadananda | 0.324 | 0.676 | 0.349 | 0.554 | 0.6 | 0.708 | 0.701 | 0.677 | 0.765 | 0.336 | 0.396 | 0.392 | 0.379 | 0.428 |
| Bhojpur | Bhojpur | 0.245 | 0.733 | 0.424 | 0.508 | 0.6 | 0.708 | 0.701 | 0.677 | 0.765 | 0.247 | 0.292 | 0.289 | 0.279 | 0.315 |
| Dhankuta | Mahalaxmi | 0.235 | 0.716 | 0.458 | 0.405 | 0.631 | 0.739 | 0.746 | 0.721 | 0.801 | 0.234 | 0.274 | 0.276 | 0.267 | 0.297 |
| Dhankuta | Pakhribas | 0.171 | 0.729 | 0.407 | 0.537 | 0.631 | 0.739 | 0.746 | 0.721 | 0.801 | 0.184 | 0.216 | 0.218 | 0.211 | 0.234 |
| Dhankuta | Dhankuta | 0.232 | 0.582 | 0.528 | 0.012 | 0.631 | 0.739 | 0.746 | 0.721 | 0.801 | 0.173 | 0.203 | 0.205 | 0.198 | 0.22 |
| Terhathum | Myanglung | 0.167 | 0.699 | 0.441 | 0.409 | 0.663 | 0.789 | 0.785 | 0.763 | 0.836 | 0.175 | 0.208 | 0.207 | 0.201 | 0.221 |
| Terhathum | Laligurans | 0.151 | 0.734 | 0.427 | 0.504 | 0.663 | 0.789 | 0.785 | 0.763 | 0.836 | 0.168 | 0.2 | 0.199 | 0.193 | 0.212 |
| Panchthar | Phidim | 0.304 | 0.645 | 0.394 | 0.405 | 0.706 | 0.831 | 0.827 | 0.796 | 0.868 | 0.339 | 0.399 | 0.397 | 0.382 | 0.416 |
| Ilam | Illam | 0.302 | 0.599 | 0.472 | 0.157 | 0.791 | 0.902 | 0.899 | 0.875 | 0.945 | 0.317 | 0.362 | 0.361 | 0.351 | 0.379 |
| Ilam | Deumai | 0.275 | 0.531 | 0.449 | 0.079 | 0.791 | 0.902 | 0.899 | 0.875 | 0.945 | 0.272 | 0.31 | 0.309 | 0.301 | 0.325 |
| Ilam | Mai | 0.229 | 0.585 | 0.323 | 0.438 | 0.791 | 0.902 | 0.899 | 0.875 | 0.945 | 0.291 | 0.332 | 0.331 | 0.322 | 0.348 |
| Ilam | Suryodaya | 0.399 | 0.646 | 0.413 | 0.368 | 0.791 | 0.902 | 0.899 | 0.875 | 0.945 | 0.486 | 0.554 | 0.552 | 0.538 | 0.581 |
| Jhapa | Mechinagar | 0.398 | 0.475 | 0.497 | 0 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.357 | 0.404 | 0.402 | 0.396 | 0.418 |
| Jhapa | Arjundhara | 0.259 | 0.65 | 0.509 | 0.178 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.299 | 0.339 | 0.337 | 0.332 | 0.35 |
| Jhapa | Kankai | 0.172 | 0.58 | 0.516 | 0.029 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.177 | 0.201 | 0.2 | 0.197 | 0.207 |
| Jhapa | Shivasataxi | 0.308 | 0.532 | 0.502 | 0 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.302 | 0.341 | 0.34 | 0.334 | 0.353 |
| Jhapa | Damak | 0.274 | 0.485 | 0.656 | 0 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.174 | 0.197 | 0.196 | 0.193 | 0.204 |
| Jhapa | Gauradhaha | 0.268 | 0.609 | 0.458 | 0.207 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.316 | 0.358 | 0.356 | 0.35 | 0.37 |
| Jhapa | Birtamod | 0.296 | 0.606 | 0.498 | 0.12 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.327 | 0.37 | 0.369 | 0.363 | 0.383 |
| Jhapa | Bhadrapur | 0.269 | 0.701 | 0.55 | 0.19 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.313 | 0.354 | 0.353 | 0.347 | 0.366 |
| Morang | Letang | 0.209 | 0.576 | 0.492 | 0.074 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.189 | 0.217 | 0.217 | 0.213 | 0.227 |
| Morang | Sundarharaicha | 0.294 | 0.589 | 0.413 | 0.26 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.305 | 0.352 | 0.35 | 0.344 | 0.366 |
| Morang | Belbari | 0.373 | 0.578 | 0.621 | 0 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.267 | 0.307 | 0.306 | 0.301 | 0.32 |
| Morang | Patahrishanishchare | 0.279 | 0.621 | 0.442 | 0.26 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.29 | 0.334 | 0.333 | 0.327 | 0.348 |
| Morang | Uralabari | 0.185 | 0.609 | 0.421 | 0.281 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.195 | 0.224 | 0.223 | 0.22 | 0.234 |
| Morang | Ratuwamai | 0.251 | 0.581 | 0.417 | 0.236 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.256 | 0.295 | 0.294 | 0.289 | 0.307 |
| Morang | Sunwarshi | 0.229 | 0.623 | 0.382 | 0.388 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.259 | 0.298 | 0.297 | 0.292 | 0.311 |
| Morang | Rangeli | 0.259 | 0.665 | 0.408 | 0.413 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.298 | 0.343 | 0.341 | 0.336 | 0.357 |
| Morang | Biratnagar | 0.693 | 0.674 | 0.802 | 0 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.398 | 0.458 | 0.457 | 0.449 | 0.478 |
| Sunsari | Dharan | 0.454 | 0.543 | 0.887 | 0 | 0.654 | 0.767 | 0.753 | 0.757 | 0.808 | 0.112 | 0.131 | 0.128 | 0.129 | 0.138 |

| District | Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | Risk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sunsari | Barah | 0.478 | 0.519 | 0.564 | 0 | 0.654 | 0.767 | 0.753 | 0.757 | 0.808 | 0.31 | 0.363 | 0.356 | 0.358 | 0.382 |
| Sunsari | Ramdhuni | 0.332 | 0.524 | 0.521 | 0 | 0.654 | 0.767 | 0.753 | 0.757 | 0.808 | 0.237 | 0.278 | 0.272 | 0.274 | 0.292 |
| Sunsari | Itahari | 0.519 | 0.607 | 0.61 | 0 | 0.654 | 0.767 | 0.753 | 0.757 | 0.808 | 0.361 | 0.423 | 0.415 | 0.417 | 0.445 |
| Sunsari | Duhabi | 0.3 | 0.542 | 0.452 | 0.091 | 0.654 | 0.767 | 0.753 | 0.757 | 0.808 | 0.248 | 0.291 | 0.285 | 0.287 | 0.306 |
| Sunsari | Inaruwa | 0.287 | 0.596 | 0.475 | 0.145 | 0.654 | 0.767 | 0.753 | 0.757 | 0.808 | 0.247 | 0.29 | 0.284 | 0.286 | 0.305 |
| Udayapur | Belaka | 0.268 | 0.71 | 0.662 | 0 | 0.577 | 0.692 | 0.677 | 0.676 | 0.739 | 0.178 | 0.213 | 0.208 | 0.208 | 0.227 |
| Udayapur | Chaudandigadhi | 0.31 | 0.696 | 0.52 | 0.24 | 0.577 | 0.692 | 0.677 | 0.676 | 0.739 | 0.253 | 0.303 | 0.296 | 0.296 | 0.323 |
| Udayapur | Triyuga | 0.416 | 0.566 | 0.642 | 0 | 0.577 | 0.692 | 0.677 | 0.676 | 0.739 | 0.221 | 0.265 | 0.259 | 0.259 | 0.283 |
| Udayapur | Katari | 0.36 | 0.717 | 0.454 | 0.417 | 0.577 | 0.692 | 0.677 | 0.676 | 0.739 | 0.33 | 0.396 | 0.387 | 0.387 | 0.423 |
| Saptari | Saptakoshi | 0.112 | 0.524 | 0.49 | 0 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.078 | 0.092 | 0.089 | 0.09 | 0.096 |
| Saptari | Kanchanrup | 0.18 | 0.476 | 0.472 | 0 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.12 | 0.141 | 0.138 | 0.139 | 0.148 |
| Saptari | Shambhunath | 0.146 | 0.445 | 0.339 | 0.145 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.116 | 0.137 | 0.133 | 0.135 | 0.143 |
| Saptari | Khadak | 0.143 | 0.448 | 0.396 | 0.029 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.104 | 0.122 | 0.119 | 0.12 | 0.128 |
| Saptari | Surunga | 0.171 | 0.441 | 0.408 | 0 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.12 | 0.141 | 0.138 | 0.14 | 0.148 |
| Saptari | Bode Barsain | 0.14 | 0.479 | 0.341 | 0.202 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.116 | 0.137 | 0.133 | 0.135 | 0.144 |
| Saptari | Dakneshwori | 0.165 | 0.468 | 0.394 | 0.07 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.124 | 0.146 | 0.142 | 0.144 | 0.153 |
| Saptari | Rajbiraj | 0.204 | 0.64 | 0.623 | 0 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.135 | 0.159 | 0.155 | 0.157 | 0.167 |
| Saptari | Hanumannagar Kankalini | 0.309 | 0.549 | 0.43 | 0.149 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.246 | 0.29 | 0.283 | 0.286 | 0.304 |
| Siraha | Lahan | 0.345 | 0.559 | 0.581 | 0 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.208 | 0.244 | 0.236 | 0.242 | 0.258 |
| Siraha | Dhangadhimai | 0.217 | 0.506 | 0.363 | 0.207 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.175 | 0.206 | 0.199 | 0.204 | 0.218 |
| Siraha | Golbazar | 0.205 | 0.486 | 0.333 | 0.231 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.168 | 0.198 | 0.191 | 0.196 | 0.209 |
| Siraha | Mirchaiya | 0.175 | 0.461 | 0.352 | 0.145 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.135 | 0.159 | 0.153 | 0.157 | 0.168 |
| Siraha | Karjanha | 0.096 | 0.5 | 0.292 | 0.343 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.085 | 0.1 | 0.097 | 0.099 | 0.106 |
| Siraha | Kalyanpur | 0.169 | 0.477 | 0.334 | 0.215 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.137 | 0.161 | 0.156 | 0.16 | 0.17 |
| Siraha | Sukhipur | 0.184 | 0.585 | 0.346 | 0.388 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.168 | 0.198 | 0.191 | 0.196 | 0.209 |
| Siraha | Siraha | 0.254 | 0.56 | 0.384 | 0.264 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.214 | 0.252 | 0.243 | 0.25 | 0.266 |
| Dhanusha | Ganeshman Charnath | 0.143 | 0.533 | 0.33 | 0.326 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.124 | 0.148 | 0.144 | 0.146 | 0.158 |
| Dhanusha | Dhanusadham | 0.14 | 0.471 | 0.317 | 0.236 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.115 | 0.136 | 0.133 | 0.135 | 0.146 |
| Dhanusha | Mithila | 0.149 | 0.689 | 0.389 | 0.496 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.145 | 0.172 | 0.168 | 0.17 | 0.184 |
| Dhanusha | Chhireshwornath | 0.179 | 0.763 | 0.319 | 0.781 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.203 | 0.242 | 0.236 | 0.24 | 0.259 |
| Dhanusha | Mithila Bihari | 0.158 | 0.417 | 0.245 | 0.281 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.134 | 0.159 | 0.156 | 0.158 | 0.17 |
| Dhanusha | Hansapur | 0.133 | 0.53 | 0.361 | 0.256 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.111 | 0.131 | 0.128 | 0.13 | 0.141 |
| Dhanusha | Sabaila | 0.162 | 0.621 | 0.354 | 0.442 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.152 | 0.181 | 0.177 | 0.179 | 0.193 |
| Dhanusha | Sahidnagar | 0.189 | 0.581 | 0.334 | 0.405 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.173 | 0.206 | 0.201 | 0.204 | 0.221 |
| Dhanusha | Kamala | 0.155 | 0.543 | 0.305 | 0.393 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.141 | 0.168 | 0.164 | 0.166 | 0.18 |
| Dhanusha | Bideha | 0.154 | 0.501 | 0.313 | 0.298 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.132 | 0.157 | 0.153 | 0.156 | 0.168 |
| Dhanusha | Janakpur | 0.404 | 0.722 | 0.399 | 0.541 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.402 | 0.477 | 0.467 | 0.473 | 0.511 |
| Dhanusha | Nagarain | 0.128 | 0.601 | 0.341 | 0.43 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.119 | 0.142 | 0.139 | 0.141 | 0.152 |
| Mahottari | Bardibas | 0.294 | 0.532 | 0.622 | 0 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.154 | 0.185 | 0.182 | 0.184 | 0.197 |
| Mahottari | Gaushala | 0.249 | 0.476 | 0.403 | 0.066 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.181 | 0.217 | 0.214 | 0.215 | 0.231 |
| Mahottari | Aurahi | 0.092 | 0.465 | 0.364 | 0.128 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.07 | 0.084 | 0.083 | 0.083 | 0.089 |
| Mahottari | Bhangaha | 0.152 | 0.482 | 0.32 | 0.252 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.126 | 0.151 | 0.149 | 0.15 | 0.161 |

| District | Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | RIsk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mahottari | Loharpatti | 0.135 | 0.526 | 0.375 | 0.219 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.11 | 0.132 | 0.13 | 0.131 | 0.14 |
| Mahottari | Balwa | 0.125 | 0.523 | 0.409 | 0.145 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.096 | 0.115 | 0.114 | 0.115 | 0.123 |
| Mahottari | Ramgopalpur | 0.087 | 0.521 | 0.373 | 0.215 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.071 | 0.085 | 0.083 | 0.084 | 0.09 |
| Mahottari | Manra Siswa | 0.122 | 0.513 | 0.341 | 0.264 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.102 | 0.123 | 0.121 | 0.122 | 0.131 |
| Mahottari | Matihani | 0.093 | 0.448 | 0.375 | 0.074 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.068 | 0.081 | 0.08 | 0.081 | 0.086 |
| Mahottari | Jaleswor | 0.168 | 0.464 | 0.478 | 0 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.104 | 0.125 | 0.124 | 0.125 | 0.133 |
| Sarlahi | Lalbandi | 0.369 | 0.513 | 0.438 | 0.066 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.274 | 0.333 | 0.331 | 0.324 | 0.347 |
| Sarlahi | Hariwan | 0.171 | 0.42 | 0.379 | 0.012 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.122 | 0.148 | 0.148 | 0.144 | 0.154 |
| Sarlahi | Bagmati | 0.152 | 0.314 | 0.489 | 0 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.07 | 0.085 | 0.084 | 0.082 | 0.088 |
| Sarlahi | Barahathawa | 0.242 | 0.395 | 0.477 | 0 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.137 | 0.166 | 0.165 | 0.162 | 0.173 |
| Sarlahi | Haripur | 0.248 | 0.47 | 0.345 | 0.178 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.202 | 0.245 | 0.244 | 0.239 | 0.255 |
| Sarlahi | Ishworpur | 0.224 | 0.542 | 0.373 | 0.252 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.192 | 0.234 | 0.232 | 0.227 | 0.243 |
| Sarlahi | Haripurwa | 0.093 | 0.427 | 0.371 | 0.041 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.068 | 0.083 | 0.082 | 0.08 | 0.086 |
| Sarlahi | Kabilasi | 0.211 | 0.401 | 0.342 | 0.054 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.155 | 0.189 | 0.188 | 0.184 | 0.196 |
| Sarlahi | Balara | 0.135 | 0.317 | 0.48 | 0 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.064 | 0.077 | 0.077 | 0.075 | 0.081 |
| Sarlahi | Godaita | 0.145 | 0.423 | 0.335 | 0.107 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.112 | 0.136 | 0.135 | 0.133 | 0.142 |
| Sarlahi | Malangawa | 0.111 | 0.393 | 0.369 | 0 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.077 | 0.094 | 0.093 | 0.091 | 0.098 |
| Rautahat | Brindaban | 0.303 | 0.46 | 0.733 | 0 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.098 | 0.12 | 0.12 | 0.113 | 0.122 |
| Rautahat | Gujara | 0.205 | 0.371 | 0.519 | 0 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.1 | 0.123 | 0.123 | 0.116 | 0.125 |
| Rautahat | Phatuwa Bijayapur | 0.125 | 0.465 | 0.43 | 0 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.088 | 0.108 | 0.108 | 0.102 | 0.11 |
| Rautahat | Katahariya | 0.108 | 0.34 | 0.417 | 0 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.063 | 0.077 | 0.077 | 0.073 | 0.078 |
| Rautahat | Brindaban | 0.139 | 0.359 | 0.488 | 0 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.071 | 0.087 | 0.087 | 0.083 | 0.089 |
| Rautahat | Gadhimai | 0.105 | 0.361 | 0.47 | 0 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.057 | 0.069 | 0.069 | 0.066 | 0.07 |
| Rautahat | Madhav Narayan | 0.111 | 0.363 | 0.469 | 0 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.06 | 0.074 | 0.074 | 0.07 | 0.075 |
| Rautahat | Garuda | 0.204 | 0.472 | 0.525 | 0 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.122 | 0.149 | 0.149 | 0.142 | 0.152 |
| Rautahat | Dewahhi Gonahi | 0.096 | 0.368 | 0.439 | 0 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.056 | 0.069 | 0.069 | 0.065 | 0.07 |
| Rautahat | Maulapur | 0.075 | 0.367 | 0.437 | 0 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.044 | 0.054 | 0.054 | 0.051 | 0.055 |
| Rautahat | Baudhimai | 0.103 | 0.369 | 0.555 | 0 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.046 | 0.056 | 0.056 | 0.053 | 0.057 |
| Rautahat | Paroha | 0.097 | 0.466 | 0.411 | 0.033 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.071 | 0.087 | 0.087 | 0.082 | 0.088 |
| Rautahat | Rajpur | 0.128 | 0.472 | 0.426 | 0.012 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.092 | 0.113 | 0.113 | 0.107 | 0.115 |
| Rautahat | Rajdevi | 0.11 | 0.405 | 0.476 | 0 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.064 | 0.078 | 0.078 | 0.074 | 0.079 |
| Rautahat | Gaur | 0.125 | 0.425 | 0.506 | 0 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.071 | 0.087 | 0.087 | 0.082 | 0.088 |
| Rautahat | Ishanath | 0.112 | 0.365 | 0.401 | 0 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.07 | 0.086 | 0.086 | 0.082 | 0.088 |
| Bara | Nijgadh | 0.198 | 0.563 | 0.546 | 0 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.136 | 0.164 | 0.165 | 0.158 | 0.169 |
| Bara | Kolhabi | 0.223 | 0.372 | 0.545 | 0 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.104 | 0.125 | 0.126 | 0.121 | 0.129 |
| Bara | Jitpur Simara | 0.453 | 0.55 | 0.634 | 0 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.255 | 0.306 | 0.31 | 0.296 | 0.316 |
| Bara | Kalaiya | 0.401 | 0.421 | 0.576 | 0 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.195 | 0.234 | 0.237 | 0.226 | 0.242 |
| Bara | Simraungadh | 0.144 | 0.527 | 0.491 | 0 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.103 | 0.124 | 0.125 | 0.12 | 0.128 |
| Bara | Pacharauta | 0.131 | 0.437 | 0.536 | 0 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.073 | 0.087 | 0.088 | 0.084 | 0.09 |
| Bara | Mahagadhimai | 0.157 | 0.504 | 0.538 | 0 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.099 | 0.119 | 0.12 | 0.115 | 0.123 |
| Parsa | Parsagadhi | 0.149 | 0.439 | 0.341 | 0.124 | 0.625 | 0.733 | 0.75 | 0.726 | 0.778 | 0.121 | 0.142 | 0.145 | 0.141 | 0.151 |
| Parsa | Birgunj | 0.598 | 0.692 | 0.825 | 0 | 0.625 | 0.733 | 0.75 | 0.726 | 0.778 | 0.293 | 0.344 | 0.352 | 0.34 | 0.365 |
| Parsa | Bahudaramai | 0.129 | 0.437 | 0.303 | 0.198 | 0.625 | 0.733 | 0.75 | 0.726 | 0.778 | 0.111 | 0.13 | 0.133 | 0.129 | 0.138 |
| Parsa | Pokhariya | 0.08 | 0.569 | 0.359 | 0.335 | 0.625 | 0.733 | 0.75 | 0.726 | 0.778 | 0.075 | 0.088 | 0.09 | 0.088 | 0.094 |

| District | Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | Risk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dolakha | Jiri | 0.163 | 0.813 | 0.405 | 0.698 | 0.622 | 0.709 | 0.704 | 0.694 | 0.77 | 0.19 | 0.216 | 0.214 | 0.211 | 0.235 |
| Dolakha | Bhimeshwor | 0.317 | 0.929 | 0.58 | 0.554 | 0.622 | 0.709 | 0.704 | 0.694 | 0.77 | 0.341 | 0.388 | 0.385 | 0.38 | 0.421 |
| Sindhupalchok | Melamchi | 0.317 | 0.765 | 0.516 | 0.38 | 0.631 | 0.74 | 0.75 | 0.719 | 0.792 | 0.31 | 0.364 | 0.369 | 0.354 | 0.39 |
| Sindhupalchok | Chautara SangachokGadhi | 0.33 | 0.775 | 0.425 | 0.583 | 0.631 | 0.74 | 0.75 | 0.719 | 0.792 | 0.365 | 0.429 | 0.434 | 0.416 | 0.459 |
| Sindhupalchok | Barhabise | 0.185 | 0.759 | 0.453 | 0.5 | 0.631 | 0.74 | 0.75 | 0.719 | 0.792 | 0.195 | 0.228 | 0.231 | 0.222 | 0.244 |
| Dhading | Nilakantha | 0.323 | 1 | 0.518 | 0.818 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.397 | 0.483 | 0.494 | 0.449 | 0.492 |
| Dhading | Dhunibesi | 0.229 | 0.842 | 0.552 | 0.45 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.23 | 0.279 | 0.285 | 0.26 | 0.284 |
| Nuwakot | Bidur | 0.357 | 0.8 | 0.633 | 0.207 | 0.626 | 0.771 | 0.778 | 0.715 | 0.781 | 0.308 | 0.38 | 0.383 | 0.352 | 0.384 |
| Nuwakot | Belkotgadhi | 0.301 | 0.754 | 0.5 | 0.393 | 0.626 | 0.771 | 0.778 | 0.715 | 0.781 | 0.295 | 0.363 | 0.367 | 0.337 | 0.368 |
| Kathmandu | Shankharapur | 0.14 | 0.698 | 0.537 | 0.211 | 0.632 | 0.779 | 0.767 | 0.711 | 0.782 | 0.122 | 0.151 | 0.149 | 0.138 | 0.152 |
| Kathmandu | Kageshwori Manahora | 0.23 | 0.551 | 0.544 | 0 | 0.632 | 0.779 | 0.767 | 0.711 | 0.782 | 0.159 | 0.196 | 0.193 | 0.179 | 0.197 |
| Kathmandu | Gokarneshwor | 0.364 | 0.547 | 0.559 | 0 | 0.632 | 0.779 | 0.767 | 0.711 | 0.782 | 0.243 | 0.3 | 0.295 | 0.274 | 0.301 |
| Kathmandu | Budhanilakantha | 0.313 | 0.616 | 0.525 | 0.083 | 0.632 | 0.779 | 0.767 | 0.711 | 0.782 | 0.248 | 0.306 | 0.301 | 0.279 | 0.307 |
| Kathmandu | Tokha | 0.26 | 0.612 | 0.596 | 0 | 0.632 | 0.779 | 0.767 | 0.711 | 0.782 | 0.181 | 0.223 | 0.219 | 0.203 | 0.224 |
| Kathmandu | Tarakeshwor | 0.274 | 0.604 | 0.519 | 0.07 | 0.632 | 0.779 | 0.767 | 0.711 | 0.782 | 0.215 | 0.265 | 0.261 | 0.242 | 0.266 |
| Kathmandu | Nagarjun | 0.21 | 0.595 | 0.511 | 0.07 | 0.632 | 0.779 | 0.767 | 0.711 | 0.782 | 0.165 | 0.204 | 0.201 | 0.186 | 0.205 |
| Kathmandu | Kathmandu | 0.728 | 0.659 | 1 | 0 | 0.632 | 0.779 | 0.767 | 0.711 | 0.782 | 0.167 | 0.206 | 0.202 | 0.188 | 0.207 |
| Kathmandu | Kirtipur | 0.207 | 0.555 | 0.523 | 0 | 0.632 | 0.779 | 0.767 | 0.711 | 0.782 | 0.15 | 0.185 | 0.182 | 0.168 | 0.185 |
| Kathmandu | Chandragiri | 0.322 | 0.601 | 0.52 | 0.062 | 0.632 | 0.779 | 0.767 | 0.711 | 0.782 | 0.251 | 0.31 | 0.305 | 0.282 | 0.311 |
| Kathmandu | Dakshinkali | 0.196 | 0.682 | 0.553 | 0.149 | 0.632 | 0.779 | 0.767 | 0.711 | 0.782 | 0.164 | 0.202 | 0.198 | 0.184 | 0.202 |
| Bhaktapur | Changunarayan | 0.356 | 0.632 | 0.855 | 0 | 0.638 | 0.775 | 0.764 | 0.711 | 0.791 | 0.138 | 0.167 | 0.165 | 0.153 | 0.171 |
| Bhaktapur | Bhaktapur | 0.211 | 0.559 | 0.741 | 0 | 0.638 | 0.775 | 0.764 | 0.711 | 0.791 | 0.094 | 0.115 | 0.113 | 0.105 | 0.117 |
| Bhaktapur | Madhyapur Thimi | 0.228 | 0.545 | 0.633 | 0 | 0.638 | 0.775 | 0.764 | 0.711 | 0.791 | 0.131 | 0.159 | 0.157 | 0.146 | 0.162 |
| Bhaktapur | Suryabinayak | 0.364 | 0.492 | 0.714 | 0 | 0.638 | 0.775 | 0.764 | 0.711 | 0.791 | 0.148 | 0.18 | 0.177 | 0.165 | 0.183 |
| Lalitpur | Mahalaxmi | 0.256 | 0.596 | 0.522 | 0.05 | 0.617 | 0.75 | 0.749 | 0.709 | 0.791 | 0.193 | 0.235 | 0.234 | 0.222 | 0.248 |
| Lalitpur | Lalitpur | 0.681 | 0.675 | 0.865 | 0 | 0.617 | 0.75 | 0.749 | 0.709 | 0.791 | 0.281 | 0.342 | 0.341 | 0.323 | 0.36 |
| Lalitpur | Godawari | 0.382 | 0.77 | 0.57 | 0.277 | 0.617 | 0.75 | 0.749 | 0.709 | 0.791 | 0.341 | 0.415 | 0.414 | 0.392 | 0.438 |
| Kavre | Mandandeupur | 0.176 | 0.708 | 0.401 | 0.508 | 0.632 | 0.763 | 0.754 | 0.722 | 0.799 | 0.187 | 0.226 | 0.223 | 0.214 | 0.236 |
| Kavre | Banepa | 0.269 | 0.86 | 0.406 | 0.785 | 0.632 | 0.763 | 0.754 | 0.722 | 0.799 | 0.333 | 0.401 | 0.397 | 0.38 | 0.421 |
| Kavre | Dhulikhel | 0.24 | 0.765 | 0.511 | 0.388 | 0.632 | 0.763 | 0.754 | 0.722 | 0.799 | 0.237 | 0.286 | 0.283 | 0.271 | 0.3 |
| Kavre | Panchkhal | 0.239 | 0.936 | 0.371 | 1 | 0.632 | 0.763 | 0.754 | 0.722 | 0.799 | 0.327 | 0.395 | 0.391 | 0.374 | 0.414 |
| Kavre | Namobuddha | 0.195 | 0.748 | 0.414 | 0.558 | 0.632 | 0.763 | 0.754 | 0.722 | 0.799 | 0.213 | 0.257 | 0.255 | 0.244 | 0.27 |
| Kavre | Panauti | 0.284 | 0.876 | 0.489 | 0.645 | 0.632 | 0.763 | 0.754 | 0.722 | 0.799 | 0.326 | 0.393 | 0.388 | 0.372 | 0.412 |
| Ramechhap | Ramechhap | 0.266 | 0.636 | 0.358 | 0.459 | 0.596 | 0.694 | 0.681 | 0.674 | 0.749 | 0.258 | 0.301 | 0.296 | 0.292 | 0.325 |
| Ramechhap | Manthali | 0.34 | 0.697 | 0.42 | 0.45 | 0.596 | 0.694 | 0.681 | 0.674 | 0.749 | 0.328 | 0.383 | 0.376 | 0.372 | 0.413 |
| Sindhuli | Dudhouli | 0.381 | 0.616 | 0.518 | 0.095 | 0.6 | 0.728 | 0.713 | 0.705 | 0.764 | 0.29 | 0.352 | 0.345 | 0.341 | 0.369 |
| Sindhuli | Kamalamai | 0.432 | 0.591 | 0.576 | 0 | 0.6 | 0.728 | 0.713 | 0.705 | 0.764 | 0.286 | 0.347 | 0.34 | 0.336 | 0.364 |
| Makawanpur | Thaha | 0.269 | 0.819 | 0.447 | 0.624 | 0.635 | 0.764 | 0.778 | 0.723 | 0.791 | 0.306 | 0.368 | 0.375 | 0.349 | 0.381 |
| Makawanpur | Hetauda | 0.507 | 0.603 | 0.554 | 0 | 0.635 | 0.764 | 0.778 | 0.723 | 0.791 | 0.376 | 0.453 | 0.461 | 0.429 | 0.468 |
| Chitawan | Rapti | 0.358 | 0.696 | 0.677 | 0 | 0.649 | 0.778 | 0.789 | 0.736 | 0.809 | 0.254 | 0.305 | 0.309 | 0.288 | 0.317 |
| Chitawan | Kalika | 0.224 | 0.601 | 0.509 | 0.083 | 0.649 | 0.778 | 0.789 | 0.736 | 0.809 | 0.182 | 0.219 | 0.222 | 0.207 | 0.227 |
| Chitawan | Bharatpur | 1 | 0.486 | 0.997 | 0 | 0.649 | 0.778 | 0.789 | 0.736 | 0.809 | 0.027 | 0.032 | 0.033 | 0.03 | 0.033 |

| District | Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | RIsk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chitawan | Ratnanagar | 0.342 | 0.566 | 0.496 | 0.045 | 0.649 | 0.778 | 0.789 | 0.736 | 0.809 | 0.27 | 0.324 | 0.329 | 0.307 | 0.337 |
| Chitawan | Khairahani | 0.309 | 0.724 | 0.571 | 0.19 | 0.649 | 0.778 | 0.789 | 0.736 | 0.809 | 0.273 | 0.327 | 0.332 | 0.31 | 0.34 |
| Chitawan | Madi | 0.23 | 0.568 | 0.524 | 0 | 0.649 | 0.778 | 0.789 | 0.736 | 0.809 | 0.174 | 0.208 | 0.211 | 0.197 | 0.217 |
| Gorkha | Palungtar | 0.298 | 0.712 | 0.394 | 0.529 | 0.541 | 0.647 | 0.678 | 0.614 | 0.671 | 0.274 | 0.328 | 0.344 | 0.311 | 0.34 |
| Gorkha | Gorkha | 0.31 | 0.74 | 0.56 | 0.244 | 0.541 | 0.647 | 0.678 | 0.614 | 0.671 | 0.237 | 0.283 | 0.297 | 0.269 | 0.294 |
| Myagdi | Beni | 0.21 | 0.612 | 0.642 | 0 | 0.544 | 0.652 | 0.676 | 0.636 | 0.687 | 0.115 | 0.137 | 0.142 | 0.134 | 0.145 |
| Kaski | Pokhara Lekhnath | 0.998 | 0.856 | 0.77 | 0.029 | 0.69 | 0.801 | 0.831 | 0.778 | 0.834 | 0.827 | 0.96 | 0.997 | 0.933 | 1 |
| Lamjung | MadhyaNepal | 0.199 | 0.841 | 0.419 | 0.723 | 0.653 | 0.765 | 0.802 | 0.736 | 0.795 | 0.246 | 0.288 | 0.302 | 0.277 | 0.299 |
| Lamjung | Besishahar | 0.265 | 0.721 | 0.518 | 0.293 | 0.653 | 0.765 | 0.802 | 0.736 | 0.795 | 0.254 | 0.297 | 0.312 | 0.286 | 0.309 |
| Lamjung | Sundarbazar | 0.226 | 0.805 | 0.444 | 0.603 | 0.653 | 0.765 | 0.802 | 0.736 | 0.795 | 0.262 | 0.307 | 0.322 | 0.295 | 0.319 |
| Lamjung | Rainas | 0.197 | 0.799 | 0.39 | 0.702 | 0.653 | 0.765 | 0.802 | 0.736 | 0.795 | 0.241 | 0.283 | 0.296 | 0.272 | 0.294 |
| Tanahu | Bhanu | 0.454 | 0.653 | 0.473 | 0.256 | 0.725 | 0.867 | 0.886 | 0.827 | 0.871 | 0.47 | 0.562 | 0.575 | 0.537 | 0.565 |
| Tanahu | Byas | 0.466 | 0.742 | 0.617 | 0.128 | 0.725 | 0.867 | 0.886 | 0.827 | 0.871 | 0.439 | 0.525 | 0.537 | 0.502 | 0.528 |
| Tanahu | Shuklagandaki | 0.297 | 0.61 | 0.534 | 0.05 | 0.725 | 0.867 | 0.886 | 0.827 | 0.871 | 0.263 | 0.315 | 0.322 | 0.3 | 0.316 |
| Tanahu | Bhimad | 0.274 | 0.666 | 0.412 | 0.405 | 0.725 | 0.867 | 0.886 | 0.827 | 0.871 | 0.314 | 0.375 | 0.384 | 0.358 | 0.377 |
| Nawalpur | Gaidakot | 0.283 | 0.838 | 0.46 | 0.632 | 0.653 | 0.779 | 0.784 | 0.744 | 0.815 | 0.334 | 0.398 | 0.4 | 0.38 | 0.416 |
| Nawalpur | Devchuli | 0.21 | 0.761 | 0.459 | 0.488 | 0.653 | 0.779 | 0.784 | 0.744 | 0.815 | 0.228 | 0.272 | 0.273 | 0.259 | 0.284 |
| Nawalpur | Kawasoti | 0.314 | 0.822 | 0.48 | 0.562 | 0.653 | 0.779 | 0.784 | 0.744 | 0.815 | 0.355 | 0.424 | 0.427 | 0.405 | 0.443 |
| Nawalpur | Madhyabindu | 0.246 | 0.717 | 0.435 | 0.455 | 0.653 | 0.779 | 0.784 | 0.744 | 0.815 | 0.261 | 0.312 | 0.314 | 0.298 | 0.326 |
| Syangja | Putalibazar | 0.28 | 0.774 | 0.455 | 0.521 | 0.739 | 0.878 | 0.897 | 0.838 | 0.885 | 0.35 | 0.416 | 0.425 | 0.397 | 0.419 |
| Syangja | Bhirkot | 0.172 | 0.702 | 0.422 | 0.455 | 0.739 | 0.878 | 0.897 | 0.838 | 0.885 | 0.207 | 0.246 | 0.251 | 0.235 | 0.248 |
| Syangja | Chapakot | 0.252 | 0.656 | 0.422 | 0.368 | 0.739 | 0.878 | 0.897 | 0.838 | 0.885 | 0.287 | 0.342 | 0.349 | 0.326 | 0.344 |
| Syangja | Waling | 0.292 | 0.7 | 0.422 | 0.45 | 0.739 | 0.878 | 0.897 | 0.838 | 0.885 | 0.349 | 0.415 | 0.424 | 0.396 | 0.418 |
| Syangja | Galyang | 0.281 | 0.773 | 0.441 | 0.55 | 0.739 | 0.878 | 0.897 | 0.838 | 0.885 | 0.358 | 0.425 | 0.434 | 0.406 | 0.428 |
| Parbat | Kushma | 0.301 | 0.895 | 0.462 | 0.736 | 0.726 | 0.857 | 0.879 | 0.822 | 0.868 | 0.417 | 0.492 | 0.505 | 0.472 | 0.498 |
| Parbat | Phalebas | 0.188 | 0.74 | 0.404 | 0.562 | 0.726 | 0.857 | 0.879 | 0.822 | 0.868 | 0.237 | 0.279 | 0.286 | 0.268 | 0.283 |
| Baglung | Baglung | 0.342 | 0.607 | 0.584 | 0 | 0.605 | 0.728 | 0.753 | 0.694 | 0.746 | 0.231 | 0.277 | 0.287 | 0.264 | 0.284 |
| Baglung | Dhorpatan | 0.173 | 0.726 | 0.344 | 0.657 | 0.605 | 0.728 | 0.753 | 0.694 | 0.746 | 0.192 | 0.23 | 0.238 | 0.22 | 0.236 |
| Baglung | Galkot | 0.243 | 0.747 | 0.454 | 0.475 | 0.605 | 0.728 | 0.753 | 0.694 | 0.746 | 0.242 | 0.291 | 0.302 | 0.278 | 0.299 |
| Baglung | Jaimini | 0.198 | 0.694 | 0.378 | 0.529 | 0.605 | 0.728 | 0.753 | 0.694 | 0.746 | 0.203 | 0.244 | 0.253 | 0.233 | 0.25 |
| Rolpa | Rolpa | 0.357 | 0.765 | 0.462 | 0.488 | 0.503 | 0.628 | 0.643 | 0.57 | 0.626 | 0.299 | 0.373 | 0.382 | 0.339 | 0.372 |
| Pyuthan | Pyuthan | 0.267 | 0.858 | 0.487 | 0.612 | 0.549 | 0.691 | 0.702 | 0.64 | 0.691 | 0.261 | 0.329 | 0.334 | 0.305 | 0.329 |
| Pyuthan | Sworgadwary | 0.255 | 0.822 | 0.473 | 0.574 | 0.549 | 0.691 | 0.702 | 0.64 | 0.691 | 0.245 | 0.308 | 0.313 | 0.285 | 0.308 |
| Gulmi | Musikot | 0.269 | 0.793 | 0.48 | 0.508 | 0.615 | 0.757 | 0.777 | 0.721 | 0.765 | 0.278 | 0.342 | 0.351 | 0.326 | 0.346 |
| Gulmi | Resunga | 0.24 | 0.776 | 0.593 | 0.24 | 0.615 | 0.757 | 0.777 | 0.721 | 0.765 | 0.209 | 0.257 | 0.264 | 0.245 | 0.26 |
| Arghakhanchi | Bhumekasthan | 0.253 | 0.811 | 0.44 | 0.624 | 0.576 | 0.718 | 0.732 | 0.68 | 0.744 | 0.262 | 0.326 | 0.333 | 0.309 | 0.338 |
| Arghakhanchi | Sandhikharka | 0.334 | 0.9 | 0.491 | 0.682 | 0.576 | 0.718 | 0.732 | 0.68 | 0.744 | 0.357 | 0.445 | 0.453 | 0.421 | 0.461 |
| Arghakhanchi | Sitganga | 0.451 | 0.817 | 0.462 | 0.587 | 0.576 | 0.718 | 0.732 | 0.68 | 0.744 | 0.457 | 0.569 | 0.581 | 0.539 | 0.591 |
| Palpa | Rampur | 0.281 | 0.922 | 0.462 | 0.785 | 0.653 | 0.794 | 0.802 | 0.746 | 0.809 | 0.359 | 0.436 | 0.441 | 0.41 | 0.445 |
| Palpa | Tansen | 0.365 | 0.793 | 0.495 | 0.475 | 0.653 | 0.794 | 0.802 | 0.746 | 0.809 | 0.392 | 0.476 | 0.481 | 0.448 | 0.485 |
| Parasi | Bardaghat | 0.231 | 0.559 | 0.523 | 0 | 0.653 | 0.779 | 0.784 | 0.744 | 0.815 | 0.174 | 0.207 | 0.208 | 0.198 | 0.217 |
| Parasi | Sunwal | 0.251 | 0.705 | 0.4 | 0.504 | 0.653 | 0.779 | 0.784 | 0.744 | 0.815 | 0.276 | 0.329 | 0.331 | 0.314 | 0.344 |
| Parasi | Ramgram | 0.202 | 0.641 | 0.366 | 0.455 | 0.653 | 0.779 | 0.784 | 0.744 | 0.815 | 0.214 | 0.255 | 0.257 | 0.244 | 0.267 |
| Rupandehi | Devdaha | 0.277 | 0.569 | 0.584 | 0 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.178 | 0.211 | 0.211 | 0.203 | 0.221 |

| District | Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | Risk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rupandehi | Butwal | 0.433 | 0.659 | 0.968 | 0 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.114 | 0.135 | 0.136 | 0.131 | 0.142 |
| Rupandehi | Sainamaina | 0.271 | 0.585 | 0.597 | 0 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.174 | 0.207 | 0.207 | 0.199 | 0.217 |
| Rupandehi | Tillotama | 0.452 | 0.445 | 0.655 | 0 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.184 | 0.219 | 0.219 | 0.211 | 0.23 |
| Rupandehi | Siddharthanagar | 0.211 | 0.538 | 0.543 | 0 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.138 | 0.164 | 0.164 | 0.158 | 0.172 |
| Rupandehi | Lumbini Sanskritik | 0.191 | 0.477 | 0.49 | 0 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.125 | 0.148 | 0.148 | 0.142 | 0.155 |
| Kapilbastu | Banganga | 0.327 | 0.708 | 0.431 | 0.446 | 0.58 | 0.718 | 0.729 | 0.676 | 0.743 | 0.307 | 0.38 | 0.386 | 0.357 | 0.393 |
| Kapilbastu | Buddhabhumi | 0.297 | 0.547 | 0.338 | 0.335 | 0.58 | 0.718 | 0.729 | 0.676 | 0.743 | 0.26 | 0.321 | 0.326 | 0.302 | 0.333 |
| Kapilbastu | Shivaraj | 0.27 | 0.654 | 0.291 | 0.632 | 0.58 | 0.718 | 0.729 | 0.676 | 0.743 | 0.283 | 0.35 | 0.355 | 0.329 | 0.362 |
| Kapilbastu | Krishnanagar | 0.216 | 0.547 | 0.303 | 0.409 | 0.58 | 0.718 | 0.729 | 0.676 | 0.743 | 0.198 | 0.245 | 0.249 | 0.231 | 0.254 |
| Kapilbastu | Maharajgunj | 0.19 | 0.487 | 0.298 | 0.302 | 0.58 | 0.718 | 0.729 | 0.676 | 0.743 | 0.163 | 0.201 | 0.204 | 0.189 | 0.208 |
| Kapilbastu | Kapilbastu | 0.27 | 0.368 | 0.651 | 0 | 0.58 | 0.718 | 0.729 | 0.676 | 0.743 | 0.083 | 0.102 | 0.104 | 0.096 | 0.106 |
| Dang | Ghorahi | 0.687 | 0.595 | 0.677 | 0 | 0.529 | 0.662 | 0.676 | 0.61 | 0.669 | 0.329 | 0.411 | 0.419 | 0.378 | 0.415 |
| Dang | Tulsipur | 0.626 | 0.602 | 0.72 | 0 | 0.529 | 0.662 | 0.676 | 0.61 | 0.669 | 0.275 | 0.344 | 0.351 | 0.317 | 0.347 |
| Dang | Lamahi | 0.252 | 0.706 | 0.386 | 0.537 | 0.529 | 0.662 | 0.676 | 0.61 | 0.669 | 0.228 | 0.285 | 0.291 | 0.263 | 0.288 |
| Banke | Kohalpur | 0.326 | 0.56 | 0.429 | 0.169 | 0.507 | 0.615 | 0.64 | 0.58 | 0.646 | 0.222 | 0.269 | 0.28 | 0.254 | 0.283 |
| Banke | Nepalgunj | 0.476 | 0.469 | 0.535 | 0 | 0.507 | 0.615 | 0.64 | 0.58 | 0.646 | 0.231 | 0.28 | 0.292 | 0.264 | 0.295 |
| Bardiya | Bansagadhi | 0.23 | 0.547 | 0.485 | 0.033 | 0.513 | 0.605 | 0.64 | 0.579 | 0.642 | 0.142 | 0.168 | 0.178 | 0.16 | 0.178 |
| Bardiya | Barbardiya | 0.321 | 0.747 | 0.421 | 0.541 | 0.513 | 0.605 | 0.64 | 0.579 | 0.642 | 0.282 | 0.333 | 0.352 | 0.318 | 0.353 |
| Bardiya | Thakurbaba | 0.168 | 0.595 | 0.411 | 0.273 | 0.513 | 0.605 | 0.64 | 0.579 | 0.642 | 0.124 | 0.147 | 0.155 | 0.14 | 0.156 |
| Bardiya | Rajapur | 0.26 | 0.795 | 0.384 | 0.707 | 0.513 | 0.605 | 0.64 | 0.579 | 0.642 | 0.251 | 0.296 | 0.314 | 0.283 | 0.314 |
| Bardiya | Madhuwan | 0.197 | 0.713 | 0.414 | 0.492 | 0.513 | 0.605 | 0.64 | 0.579 | 0.642 | 0.168 | 0.198 | 0.21 | 0.19 | 0.21 |
| Bardiya | Gulariya | 0.262 | 0.521 | 0.465 | 0.025 | 0.513 | 0.605 | 0.64 | 0.579 | 0.642 | 0.161 | 0.19 | 0.201 | 0.181 | 0.201 |
| Dolpa | Tripurasundari | 0.185 | 0.762 | 0.421 | 0.57 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.091 | 0.121 | 0.127 | 0.107 | 0.125 |
| Dolpa | Thuli Bheri | 0.162 | 0.767 | 0.406 | 0.607 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.082 | 0.109 | 0.114 | 0.096 | 0.112 |
| Mugu | Chhayanath Rara | 0.233 | 0.839 | 0.345 | 0.868 | 0.33 | 0.423 | 0.421 | 0.351 | 0.409 | 0.157 | 0.201 | 0.2 | 0.167 | 0.194 |
| Jumla | Chandannath | 0.165 | 0.662 | 0.391 | 0.442 | 0.465 | 0.566 | 0.563 | 0.497 | 0.552 | 0.124 | 0.151 | 0.15 | 0.132 | 0.147 |
| Kalikot | Raskot | 0.148 | 0.644 | 0.346 | 0.5 | 0.403 | 0.51 | 0.525 | 0.442 | 0.496 | 0.1 | 0.126 | 0.13 | 0.11 | 0.123 |
| Kalikot | Khandachakra | 0.125 | 0.912 | 0.384 | 0.926 | 0.403 | 0.51 | 0.525 | 0.442 | 0.496 | 0.106 | 0.134 | 0.138 | 0.116 | 0.13 |
| Kalikot | Tilagufa | 0.176 | 0.874 | 0.395 | 0.831 | 0.403 | 0.51 | 0.525 | 0.442 | 0.496 | 0.142 | 0.18 | 0.186 | 0.156 | 0.175 |
| Dailekh | Aathabis | 0.166 | 0.904 | 0.362 | 0.955 | 0.44 | 0.546 | 0.572 | 0.5 | 0.553 | 0.155 | 0.193 | 0.202 | 0.176 | 0.195 |
| Dailekh | Chamunda Bindrasaini | 0.153 | 0.848 | 0.337 | 0.905 | 0.44 | 0.546 | 0.572 | 0.5 | 0.553 | 0.14 | 0.174 | 0.182 | 0.159 | 0.176 |
| Dailekh | Dullu | 0.221 | 0.836 | 0.335 | 0.884 | 0.44 | 0.546 | 0.572 | 0.5 | 0.553 | 0.2 | 0.248 | 0.26 | 0.227 | 0.252 |
| Dailekh | Narayan | 0.21 | 0.864 | 0.404 | 0.793 | 0.44 | 0.546 | 0.572 | 0.5 | 0.553 | 0.182 | 0.226 | 0.236 | 0.207 | 0.229 |
| Jajarkot | Chhedagad | 0.277 | 0.72 | 0.349 | 0.636 | 0.478 | 0.594 | 0.608 | 0.531 | 0.587 | 0.239 | 0.298 | 0.305 | 0.266 | 0.294 |
| Jajarkot | Bheri | 0.262 | 0.837 | 0.365 | 0.822 | 0.478 | 0.594 | 0.608 | 0.531 | 0.587 | 0.25 | 0.311 | 0.318 | 0.278 | 0.307 |
| Jajarkot | Nalagad | 0.227 | 0.788 | 0.343 | 0.777 | 0.478 | 0.594 | 0.608 | 0.531 | 0.587 | 0.211 | 0.263 | 0.269 | 0.235 | 0.26 |
| Western rukum | Aathbiskot | 0.383 | 0.833 | 0.399 | 0.748 | 0.487 | 0.601 | 0.605 | 0.542 | 0.598 | 0.358 | 0.442 | 0.445 | 0.399 | 0.44 |
| Western rukum | Musikot | 0.186 | 0.868 | 0.451 | 0.707 | 0.487 | 0.601 | 0.605 | 0.542 | 0.598 | 0.17 | 0.21 | 0.212 | 0.189 | 0.209 |
| Western rukum | Chaurjahari | 0.128 | 0.786 | 0.341 | 0.777 | 0.487 | 0.601 | 0.605 | 0.542 | 0.598 | 0.122 | 0.15 | 0.151 | 0.135 | 0.149 |
| Salyan | Bangad Kupinde | 0.28 | 0.571 | 0.427 | 0.198 | 0.494 | 0.607 | 0.633 | 0.565 | 0.614 | 0.19 | 0.233 | 0.243 | 0.217 | 0.236 |
| Salyan | Bagchaur | 0.311 | 0.64 | 0.445 | 0.289 | 0.494 | 0.607 | 0.633 | 0.565 | 0.614 | 0.225 | 0.276 | 0.288 | 0.257 | 0.279 |
| Salyan | Sharada | 0.297 | 0.728 | 0.401 | 0.545 | 0.494 | 0.607 | 0.633 | 0.565 | 0.614 | 0.252 | 0.31 | 0.323 | 0.288 | 0.313 |
| Surkhet | Lekbeshi | 0.261 | 0.567 | 0.391 | 0.264 | 0.489 | 0.584 | 0.615 | 0.551 | 0.608 | 0.183 | 0.219 | 0.231 | 0.207 | 0.228 |

| District | Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | RIsk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Surkhet | Gurbhakot | 0.313 | 0.729 | 0.365 | 0.62 | 0.489 | 0.584 | 0.615 | 0.551 | 0.608 | 0.274 | 0.328 | 0.345 | 0.309 | 0.341 |
| Surkhet | Bheriganga | 0.259 | 0.66 | 0.304 | 0.616 | 0.489 | 0.584 | 0.615 | 0.551 | 0.608 | 0.226 | 0.27 | 0.285 | 0.255 | 0.282 |
| Surkhet | Birendranagar | 0.516 | 0.581 | 0.629 | 0 | 0.489 | 0.584 | 0.615 | 0.551 | 0.608 | 0.246 | 0.294 | 0.31 | 0.277 | 0.306 |
| Surkhet | Panchpuri | 0.325 | 0.704 | 0.37 | 0.566 | 0.489 | 0.584 | 0.615 | 0.551 | 0.608 | 0.276 | 0.33 | 0.347 | 0.311 | 0.343 |
| Bajura | Budhinanda | 0.15 | 0.716 | 0.321 | 0.686 | 0.357 | 0.459 | 0.471 | 0.406 | 0.462 | 0.1 | 0.128 | 0.131 | 0.113 | 0.129 |
| Bajura | Badimalika | 0.149 | 0.908 | 0.346 | 1 | 0.357 | 0.459 | 0.471 | 0.406 | 0.462 | 0.115 | 0.149 | 0.152 | 0.131 | 0.15 |
| Bajura | Budhiganga | 0.11 | 0.851 | 0.297 | 0.992 | 0.357 | 0.459 | 0.471 | 0.406 | 0.462 | 0.085 | 0.109 | 0.112 | 0.097 | 0.11 |
| Bajura | Tribeni | 0.109 | 0.589 | 0.394 | 0.298 | 0.357 | 0.459 | 0.471 | 0.406 | 0.462 | 0.057 | 0.074 | 0.075 | 0.065 | 0.074 |
| Bajhang | Bungal | 0.241 | 0.586 | 0.347 | 0.388 | 0.392 | 0.494 | 0.513 | 0.437 | 0.493 | 0.147 | 0.186 | 0.193 | 0.164 | 0.186 |
| Bajhang | JayaPrithivi | 0.186 | 0.947 | 0.445 | 0.868 | 0.392 | 0.494 | 0.513 | 0.437 | 0.493 | 0.149 | 0.188 | 0.194 | 0.166 | 0.187 |
| Darchula | Mahakali | 0.176 | 0.873 | 0.392 | 0.839 | 0.461 | 0.548 | 0.572 | 0.503 | 0.558 | 0.163 | 0.194 | 0.202 | 0.178 | 0.197 |
| Darchula | Shailyashikhar | 0.155 | 0.88 | 0.392 | 0.851 | 0.461 | 0.548 | 0.572 | 0.503 | 0.558 | 0.145 | 0.172 | 0.179 | 0.158 | 0.175 |
| Baitadi | Purchaudi | 0.228 | 0.569 | 0.348 | 0.355 | 0.507 | 0.601 | 0.629 | 0.556 | 0.621 | 0.177 | 0.209 | 0.219 | 0.194 | 0.216 |
| Baitadi | Dasharathchanda | 0.191 | 0.691 | 0.528 | 0.215 | 0.507 | 0.601 | 0.629 | 0.556 | 0.621 | 0.134 | 0.159 | 0.167 | 0.147 | 0.165 |
| Baitadi | Melauli | 0.143 | 0.65 | 0.448 | 0.302 | 0.507 | 0.601 | 0.629 | 0.556 | 0.621 | 0.107 | 0.127 | 0.133 | 0.117 | 0.131 |
| Baitadi | Patan | 0.265 | 0.798 | 0.386 | 0.707 | 0.507 | 0.601 | 0.629 | 0.556 | 0.621 | 0.253 | 0.3 | 0.314 | 0.278 | 0.31 |
| Dadeldhura | Amargadhi | 0.155 | 0.768 | 0.443 | 0.533 | 0.499 | 0.586 | 0.611 | 0.555 | 0.618 | 0.132 | 0.155 | 0.161 | 0.147 | 0.163 |
| Dadeldhura | Parashuram | 0.314 | 0.694 | 0.387 | 0.512 | 0.499 | 0.586 | 0.611 | 0.555 | 0.618 | 0.264 | 0.31 | 0.323 | 0.294 | 0.327 |
| Doti | Shikhar | 0.252 | 0.845 | 0.389 | 0.789 | 0.478 | 0.573 | 0.604 | 0.527 | 0.59 | 0.236 | 0.283 | 0.298 | 0.26 | 0.292 |
| Doti | Dipayal Silgadi | 0.236 | 0.855 | 0.381 | 0.826 | 0.478 | 0.573 | 0.604 | 0.527 | 0.59 | 0.225 | 0.27 | 0.285 | 0.248 | 0.278 |
| Achham | Panchadewal Binayak | 0.157 | 0.679 | 0.369 | 0.521 | 0.449 | 0.546 | 0.576 | 0.5 | 0.563 | 0.119 | 0.145 | 0.153 | 0.133 | 0.15 |
| Achham | Sanphebagar | 0.238 | 0.754 | 0.439 | 0.517 | 0.449 | 0.546 | 0.576 | 0.5 | 0.563 | 0.181 | 0.22 | 0.232 | 0.201 | 0.226 |
| Achham | Mangalsen | 0.198 | 0.806 | 0.38 | 0.736 | 0.449 | 0.546 | 0.576 | 0.5 | 0.563 | 0.17 | 0.207 | 0.218 | 0.189 | 0.213 |
| Achham | Kamalbazar | 0.149 | 0.814 | 0.342 | 0.826 | 0.449 | 0.546 | 0.576 | 0.5 | 0.563 | 0.134 | 0.163 | 0.171 | 0.149 | 0.168 |
| Kailali | Godawari | 0.38 | 0.606 | 0.407 | 0.306 | 0.531 | 0.618 | 0.647 | 0.587 | 0.652 | 0.298 | 0.346 | 0.363 | 0.329 | 0.365 |
| Kailali | Gauriganga | 0.214 | 0.507 | 0.375 | 0.186 | 0.531 | 0.618 | 0.647 | 0.587 | 0.652 | 0.154 | 0.18 | 0.188 | 0.171 | 0.189 |
| Kailali | Ghodaghodi | 0.334 | 0.577 | 0.415 | 0.231 | 0.531 | 0.618 | 0.647 | 0.587 | 0.652 | 0.249 | 0.29 | 0.303 | 0.275 | 0.305 |
| Kailali | Lamkichuha | 0.256 | 0.533 | 0.415 | 0.149 | 0.531 | 0.618 | 0.647 | 0.587 | 0.652 | 0.179 | 0.209 | 0.219 | 0.198 | 0.22 |
| Kailali | Tikapur | 0.26 | 0.756 | 0.397 | 0.607 | 0.531 | 0.618 | 0.647 | 0.587 | 0.652 | 0.246 | 0.286 | 0.299 | 0.272 | 0.301 |
| Kailali | Bhajani | 0.233 | 0.866 | 0.421 | 0.764 | 0.531 | 0.618 | 0.647 | 0.587 | 0.652 | 0.24 | 0.279 | 0.292 | 0.265 | 0.294 |
| Kailali | Dhangadhi | 0.534 | 0.669 | 0.57 | 0.087 | 0.531 | 0.618 | 0.647 | 0.587 | 0.652 | 0.357 | 0.416 | 0.436 | 0.395 | 0.438 |
| Kanchanpur | Krishnapur | 0.243 | 0.574 | 0.349 | 0.364 | 0.531 | 0.618 | 0.64 | 0.581 | 0.654 | 0.198 | 0.231 | 0.239 | 0.217 | 0.244 |
| Kanchanpur | Shuklaphanta | 0.177 | 0.5 | 0.335 | 0.252 | 0.531 | 0.618 | 0.64 | 0.581 | 0.654 | 0.134 | 0.156 | 0.162 | 0.147 | 0.165 |
| Kanchanpur | Bedkot | 0.217 | 0.453 | 0.448 | 0 | 0.531 | 0.618 | 0.64 | 0.581 | 0.654 | 0.127 | 0.148 | 0.153 | 0.139 | 0.157 |
| Kanchanpur | Bhimdatta | 0.474 | 0.602 | 0.432 | 0.244 | 0.531 | 0.618 | 0.64 | 0.581 | 0.654 | 0.357 | 0.416 | 0.431 | 0.391 | 0.441 |
| Kanchanpur | Mahakali | 0.157 | 0.558 | 0.333 | 0.368 | 0.531 | 0.618 | 0.64 | 0.581 | 0.654 | 0.128 | 0.149 | 0.155 | 0.141 | 0.158 |
| Kanchanpur | Punarbas | 0.188 | 0.577 | 0.377 | 0.314 | 0.531 | 0.618 | 0.64 | 0.581 | 0.654 | 0.148 | 0.172 | 0.179 | 0.162 | 0.183 |
| Kanchanpur | Belauri | 0.189 | 0.441 | 0.469 | 0 | 0.531 | 0.618 | 0.64 | 0.581 | 0.654 | 0.104 | 0.122 | 0.126 | 0.114 | 0.129 |

# Annex 11: Numerical Index Value of Vulnerability, Hazard and Risk for all 460 Rural Municipalities

| Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | Risk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phaktanglung | 0.409 | 0.513 | 0.607 | 0.549 | 0.757 | 0.871 | 0.889 | 0.836 | 0.904 | 0.301 | 0.346 | 0.353 | 0.332 | 0.359 |
| Mikwakhola | 0.22 | 0.268 | 0.535 | 0.409 | 0.757 | 0.871 | 0.889 | 0.836 | 0.904 | 0.121 | 0.139 | 0.142 | 0.133 | 0.144 |
| Meringden | 0.255 | 0.359 | 0.562 | 0.461 | 0.757 | 0.871 | 0.889 | 0.836 | 0.904 | 0.157 | 0.181 | 0.185 | 0.174 | 0.188 |
| Maiwakhola | 0.209 | 0.306 | 0.559 | 0.418 | 0.757 | 0.871 | 0.889 | 0.836 | 0.904 | 0.117 | 0.135 | 0.137 | 0.129 | 0.14 |
| Aathrai Tribeni | 0.162 | 0.363 | 0.562 | 0.465 | 0.757 | 0.871 | 0.889 | 0.836 | 0.904 | 0.101 | 0.116 | 0.118 | 0.111 | 0.12 |
| Pathibhara Yangwarak | 0.222 | 0.45 | 0.557 | 0.543 | 0.757 | 0.871 | 0.889 | 0.836 | 0.904 | 0.161 | 0.186 | 0.19 | 0.178 | 0.193 |
| Sirijangha | 0.362 | 0.391 | 0.607 | 0.445 | 0.757 | 0.871 | 0.889 | 0.836 | 0.904 | 0.216 | 0.248 | 0.253 | 0.238 | 0.258 |
| Sidingba | 0.263 | 0.347 | 0.558 | 0.454 | 0.757 | 0.871 | 0.889 | 0.836 | 0.904 | 0.16 | 0.184 | 0.188 | 0.177 | 0.191 |
| Bhotkhola | 0.432 | 0.406 | 0.539 | 0.523 | 0.757 | 0.871 | 0.889 | 0.836 | 0.904 | 0.303 | 0.348 | 0.355 | 0.334 | 0.361 |
| Makalu | 0.488 | 0.315 | 0.616 | 0.372 | 0.757 | 0.871 | 0.889 | 0.836 | 0.904 | 0.243 | 0.28 | 0.286 | 0.268 | 0.29 |
| Silichong | 0.356 | 0.288 | 0.577 | 0.386 | 0.757 | 0.871 | 0.889 | 0.836 | 0.904 | 0.184 | 0.212 | 0.216 | 0.203 | 0.22 |
| Chichila | 0.204 | 0.185 | 0.529 | 0.345 | 0.757 | 0.871 | 0.889 | 0.836 | 0.904 | 0.094 | 0.108 | 0.111 | 0.104 | 0.113 |
| Sabhapokhari | 0.25 | 0.29 | 0.535 | 0.428 | 0.757 | 0.871 | 0.889 | 0.836 | 0.904 | 0.143 | 0.165 | 0.168 | 0.158 | 0.171 |
| Khumbupasanglahmu | 0.366 | 0.395 | 0.581 | 0.473 | 0.798 | 0.907 | 0.92 | 0.883 | 0.961 | 0.244 | 0.278 | 0.282 | 0.27 | 0.294 |
| Mahakulung | 0.31 | 0.197 | 0.569 | 0.316 | 0.798 | 0.907 | 0.92 | 0.883 | 0.961 | 0.138 | 0.157 | 0.159 | 0.153 | 0.167 |
| Sotang | 0.242 | 0.281 | 0.54 | 0.416 | 0.798 | 0.907 | 0.92 | 0.883 | 0.961 | 0.142 | 0.162 | 0.164 | 0.157 | 0.171 |
| Dudhkoshi | 0.301 | 0.327 | 0.574 | 0.422 | 0.798 | 0.907 | 0.92 | 0.883 | 0.961 | 0.179 | 0.204 | 0.207 | 0.198 | 0.216 |
| Thulung Dudhkoshi | 0.272 | 0.386 | 0.612 | 0.436 | 0.798 | 0.907 | 0.92 | 0.883 | 0.961 | 0.167 | 0.19 | 0.193 | 0.185 | 0.202 |
| Nechasalyan | 0.214 | 0.309 | 0.594 | 0.387 | 0.798 | 0.907 | 0.92 | 0.883 | 0.961 | 0.117 | 0.133 | 0.135 | 0.129 | 0.141 |
| Likhupike | 0.142 | 0.301 | 0.504 | 0.467 | 0.594 | 0.68 | 0.683 | 0.656 | 0.732 | 0.07 | 0.08 | 0.08 | 0.077 | 0.086 |
| Chisankhugadhi | 0.243 | 0.409 | 0.52 | 0.544 | 0.594 | 0.68 | 0.683 | 0.656 | 0.732 | 0.139 | 0.159 | 0.16 | 0.153 | 0.171 |
| Molung | 0.236 | 0.537 | 0.541 | 0.632 | 0.567 | 0.667 | 0.657 | 0.652 | 0.728 | 0.15 | 0.176 | 0.173 | 0.172 | 0.192 |
| Khijidemba | 0.311 | 0.464 | 0.539 | 0.573 | 0.567 | 0.667 | 0.657 | 0.652 | 0.728 | 0.179 | 0.21 | 0.207 | 0.206 | 0.23 |
| Likhu | 0.244 | 0.37 | 0.538 | 0.493 | 0.567 | 0.667 | 0.657 | 0.652 | 0.728 | 0.121 | 0.142 | 0.14 | 0.139 | 0.155 |
| Champadevi | 0.297 | 0.458 | 0.524 | 0.582 | 0.567 | 0.667 | 0.657 | 0.652 | 0.728 | 0.173 | 0.204 | 0.201 | 0.199 | 0.223 |
| Sunkoshi | 0.317 | 0.588 | 0.553 | 0.665 | 0.567 | 0.667 | 0.657 | 0.652 | 0.728 | 0.211 | 0.249 | 0.245 | 0.243 | 0.271 |
| Manebhanjyang | 0.329 | 0.573 | 0.6 | 0.607 | 0.567 | 0.667 | 0.657 | 0.652 | 0.728 | 0.2 | 0.236 | 0.232 | 0.23 | 0.257 |
| Kepilasagadhi | 0.289 | 0.406 | 0.61 | 0.455 | 0.567 | 0.667 | 0.657 | 0.652 | 0.728 | 0.132 | 0.155 | 0.153 | 0.152 | 0.169 |
| Ainselukhark | 0.262 | 0.424 | 0.615 | 0.465 | 0.567 | 0.667 | 0.657 | 0.652 | 0.728 | 0.122 | 0.144 | 0.142 | 0.141 | 0.157 |
| Rawa Besi | 0.236 | 0.368 | 0.616 | 0.417 | 0.567 | 0.667 | 0.657 | 0.652 | 0.728 | 0.099 | 0.116 | 0.114 | 0.114 | 0.127 |
| Sakela | 0.178 | 0.323 | 0.588 | 0.405 | 0.558 | 0.659 | 0.65 | 0.639 | 0.725 | 0.071 | 0.084 | 0.083 | 0.081 | 0.092 |
| Diprung | 0.32 | 0.478 | 0.625 | 0.502 | 0.558 | 0.659 | 0.65 | 0.639 | 0.725 | 0.159 | 0.187 | 0.185 | 0.182 | 0.206 |
| Khotehang | 0.358 | 0.531 | 0.64 | 0.532 | 0.558 | 0.659 | 0.65 | 0.639 | 0.725 | 0.188 | 0.222 | 0.219 | 0.215 | 0.244 |
| Jantedhunga | 0.248 | 0.39 | 0.6 | 0.451 | 0.558 | 0.659 | 0.65 | 0.639 | 0.725 | 0.11 | 0.13 | 0.129 | 0.126 | 0.143 |
| Barahapokhari | 0.27 | 0.374 | 0.593 | 0.443 | 0.558 | 0.659 | 0.65 | 0.639 | 0.725 | 0.118 | 0.139 | 0.138 | 0.135 | 0.153 |
| Salpasilichho | 0.324 | 0.357 | 0.56 | 0.461 | 0.6 | 0.708 | 0.701 | 0.677 | 0.765 | 0.159 | 0.187 | 0.185 | 0.179 | 0.202 |
| Tyamkemaiyung | 0.313 | 0.479 | 0.622 | 0.506 | 0.6 | 0.708 | 0.701 | 0.677 | 0.765 | 0.168 | 0.198 | 0.196 | 0.19 | 0.214 |
| Arun | 0.274 | 0.465 | 0.567 | 0.547 | 0.6 | 0.708 | 0.701 | 0.677 | 0.765 | 0.159 | 0.188 | 0.186 | 0.18 | 0.203 |
| Pauwadungma | 0.245 | 0.378 | 0.55 | 0.488 | 0.6 | 0.708 | 0.701 | 0.677 | 0.765 | 0.127 | 0.15 | 0.148 | 0.143 | 0.162 |
| Ramprasad Rai | 0.289 | 0.512 | 0.591 | 0.563 | 0.6 | 0.708 | 0.701 | 0.677 | 0.765 | 0.173 | 0.204 | 0.202 | 0.195 | 0.22 |

| Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | Risk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hatuwagadhi | 0.304 | 0.522 | 0.599 | 0.564 | 0.6 | 0.708 | 0.701 | 0.677 | 0.765 | 0.182 | 0.215 | 0.213 | 0.205 | 0.232 |
| Aamchowk | 0.32 | 0.453 | 0.585 | 0.519 | 0.6 | 0.708 | 0.701 | 0.677 | 0.765 | 0.176 | 0.208 | 0.206 | 0.199 | 0.225 |
| Chhathar Jorpati | 0.274 | 0.435 | 0.733 | 0.361 | 0.631 | 0.739 | 0.746 | 0.721 | 0.801 | 0.11 | 0.129 | 0.131 | 0.126 | 0.14 |
| Shahidbhumi | 0.307 | 0.411 | 0.663 | 0.408 | 0.631 | 0.739 | 0.746 | 0.721 | 0.801 | 0.14 | 0.164 | 0.165 | 0.16 | 0.177 |
| Sangurigadhi | 0.334 | 0.58 | 0.735 | 0.482 | 0.631 | 0.739 | 0.746 | 0.721 | 0.801 | 0.18 | 0.21 | 0.212 | 0.205 | 0.228 |
| Chaubise | 0.346 | 0.448 | 0.7 | 0.403 | 0.631 | 0.739 | 0.746 | 0.721 | 0.801 | 0.156 | 0.182 | 0.184 | 0.178 | 0.198 |
| Aathrai | 0.378 | 0.53 | 0.726 | 0.448 | 0.663 | 0.789 | 0.785 | 0.763 | 0.836 | 0.199 | 0.236 | 0.235 | 0.229 | 0.25 |
| Phedap | 0.297 | 0.42 | 0.713 | 0.368 | 0.663 | 0.789 | 0.785 | 0.763 | 0.836 | 0.128 | 0.153 | 0.152 | 0.148 | 0.162 |
| Menchayam | 0.157 | 0.213 | 0.641 | 0.26 | 0.663 | 0.789 | 0.785 | 0.763 | 0.836 | 0.048 | 0.057 | 0.057 | 0.055 | 0.06 |
| Chhathar | 0.279 | 0.39 | 0.682 | 0.372 | 0.663 | 0.789 | 0.785 | 0.763 | 0.836 | 0.122 | 0.145 | 0.144 | 0.14 | 0.153 |
| Yangwarak | 0.357 | 0.499 | 0.658 | 0.488 | 0.706 | 0.831 | 0.827 | 0.796 | 0.868 | 0.218 | 0.256 | 0.255 | 0.245 | 0.268 |
| Hilihang | 0.412 | 0.638 | 0.715 | 0.552 | 0.706 | 0.831 | 0.827 | 0.796 | 0.868 | 0.284 | 0.334 | 0.333 | 0.32 | 0.349 |
| Falelung | 0.374 | 0.523 | 0.67 | 0.497 | 0.706 | 0.831 | 0.827 | 0.796 | 0.868 | 0.232 | 0.273 | 0.272 | 0.262 | 0.285 |
| Falgunanda | 0.366 | 0.519 | 0.707 | 0.457 | 0.706 | 0.831 | 0.827 | 0.796 | 0.868 | 0.209 | 0.246 | 0.245 | 0.236 | 0.257 |
| Kummayak | 0.304 | 0.354 | 0.577 | 0.442 | 0.706 | 0.831 | 0.827 | 0.796 | 0.868 | 0.168 | 0.198 | 0.197 | 0.189 | 0.206 |
| Tumbewa | 0.251 | 0.296 | 0.618 | 0.353 | 0.706 | 0.831 | 0.827 | 0.796 | 0.868 | 0.111 | 0.13 | 0.13 | 0.125 | 0.136 |
| Miklajung | 0.397 | 0.564 | 0.674 | 0.528 | 0.706 | 0.831 | 0.827 | 0.796 | 0.868 | 0.262 | 0.308 | 0.307 | 0.295 | 0.322 |
| Maijogmai | 0.33 | 0.57 | 0.781 | 0.43 | 0.791 | 0.902 | 0.899 | 0.875 | 0.945 | 0.199 | 0.226 | 0.226 | 0.22 | 0.237 |
| Sandakpur | 0.301 | 0.438 | 0.661 | 0.432 | 0.791 | 0.902 | 0.899 | 0.875 | 0.945 | 0.182 | 0.207 | 0.207 | 0.201 | 0.217 |
| Fakphokthum | 0.398 | 0.506 | 0.764 | 0.391 | 0.791 | 0.902 | 0.899 | 0.875 | 0.945 | 0.218 | 0.248 | 0.247 | 0.241 | 0.26 |
| Mangsebung | 0.358 | 0.435 | 0.657 | 0.434 | 0.791 | 0.902 | 0.899 | 0.875 | 0.945 | 0.217 | 0.248 | 0.247 | 0.241 | 0.26 |
| Chulachuli | 0.307 | 0.427 | 0.739 | 0.348 | 0.791 | 0.902 | 0.899 | 0.875 | 0.945 | 0.149 | 0.17 | 0.17 | 0.165 | 0.179 |
| Rong | 0.305 | 0.447 | 0.672 | 0.43 | 0.791 | 0.902 | 0.899 | 0.875 | 0.945 | 0.184 | 0.209 | 0.209 | 0.203 | 0.219 |
| Buddhashanti | 0.501 | 0.709 | 0.999 | 0.338 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.256 | 0.29 | 0.288 | 0.284 | 0.3 |
| Kamal | 0.544 | 0.749 | 0.883 | 0.484 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.398 | 0.451 | 0.449 | 0.442 | 0.466 |
| Gauriganj | 0.417 | 0.576 | 0.735 | 0.479 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.302 | 0.342 | 0.34 | 0.335 | 0.353 |
| Jhapa | 0.441 | 0.661 | 0.725 | 0.561 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.374 | 0.424 | 0.421 | 0.415 | 0.438 |
| Barhadashi | 0.428 | 0.624 | 0.798 | 0.459 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.297 | 0.336 | 0.335 | 0.329 | 0.348 |
| Haldibari | 0.402 | 0.557 | 0.742 | 0.456 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.277 | 0.314 | 0.312 | 0.307 | 0.324 |
| Kachankawal | 0.628 | 0.674 | 0.798 | 0.502 | 0.855 | 0.968 | 0.963 | 0.948 | 1 | 0.477 | 0.54 | 0.537 | 0.529 | 0.558 |
| Miklajung | 0.395 | 0.537 | 0.686 | 0.493 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.25 | 0.287 | 0.286 | 0.281 | 0.299 |
| Kerabari | 0.485 | 0.597 | 0.796 | 0.439 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.273 | 0.314 | 0.313 | 0.308 | 0.327 |
| Kanepokhari | 0.503 | 0.679 | 0.783 | 0.52 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.335 | 0.386 | 0.385 | 0.378 | 0.402 |
| Gramthan | 0.569 | 0.572 | 0.713 | 0.497 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.363 | 0.417 | 0.416 | 0.409 | 0.435 |
| Budhiganga | 0.692 | 0.705 | 0.371 | 0.94 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.834 | 0.96 | 0.956 | 0.94 | 1 |
| Katahari | 0.69 | 0.567 | 0.783 | 0.425 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.376 | 0.433 | 0.431 | 0.424 | 0.451 |
| Dhanpalthan | 0.548 | 0.57 | 0.663 | 0.544 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.382 | 0.44 | 0.438 | 0.431 | 0.458 |
| Jahada | 0.665 | 0.582 | 0.708 | 0.51 | 0.725 | 0.834 | 0.831 | 0.817 | 0.869 | 0.435 | 0.5 | 0.499 | 0.49 | 0.521 |
| Koshi | 0.767 | 0.718 | 0.726 | 0.609 | 0.654 | 0.767 | 0.753 | 0.757 | 0.808 | 0.54 | 0.634 | 0.622 | 0.626 | 0.668 |
| Bhokraha Narsingh | 0.736 | 0.622 | 0.768 | 0.487 | 0.654 | 0.767 | 0.753 | 0.757 | 0.808 | 0.415 | 0.486 | 0.477 | 0.48 | 0.512 |
| Gadhi | 0.675 | 0.537 | 0.717 | 0.463 | 0.654 | 0.767 | 0.753 | 0.757 | 0.808 | 0.362 | 0.424 | 0.416 | 0.419 | 0.447 |
| Harinagar | 0.728 | 0.537 | 0.674 | 0.505 | 0.654 | 0.767 | 0.753 | 0.757 | 0.808 | 0.425 | 0.499 | 0.49 | 0.492 | 0.526 |
| Dewanganj | 0.621 | 0.505 | 0.658 | 0.492 | 0.654 | 0.767 | 0.753 | 0.757 | 0.808 | 0.353 | 0.415 | 0.407 | 0.409 | 0.437 |
| Barju | 0.607 | 0.441 | 0.691 | 0.406 | 0.654 | 0.767 | 0.753 | 0.757 | 0.808 | 0.285 | 0.334 | 0.328 | 0.33 | 0.352 |

| Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | Risk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rautamai | 0.403 | 0.574 | 0.636 | 0.573 | 0.577 | 0.692 | 0.677 | 0.676 | 0.739 | 0.236 | 0.283 | 0.277 | 0.276 | 0.302 |
| Sunkoshi | 0.201 | 0.306 | 0.42 | 0.553 | 0.577 | 0.692 | 0.677 | 0.676 | 0.739 | 0.113 | 0.136 | 0.133 | 0.133 | 0.145 |
| Tapli | 0.248 | 0.349 | 0.553 | 0.461 | 0.577 | 0.692 | 0.677 | 0.676 | 0.739 | 0.117 | 0.14 | 0.137 | 0.137 | 0.149 |
| Udayapurgadhi | 0.487 | 0.653 | 0.646 | 0.631 | 0.577 | 0.692 | 0.677 | 0.676 | 0.739 | 0.314 | 0.376 | 0.368 | 0.367 | 0.402 |
| Agnisair Krishna Savaran | 0.341 | 0.397 | 0.351 | 0.697 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.254 | 0.299 | 0.291 | 0.295 | 0.314 |
| Rupani | 0.325 | 0.421 | 0.356 | 0.712 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.247 | 0.291 | 0.283 | 0.287 | 0.305 |
| Balan Bihul | 0.274 | 0.325 | 0.398 | 0.59 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.173 | 0.203 | 0.198 | 0.2 | 0.213 |
| Belhi Chapena | 0.376 | 0.363 | 0.39 | 0.63 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.253 | 0.298 | 0.29 | 0.294 | 0.313 |
| Bishnupur | 0.281 | 0.344 | 0.38 | 0.624 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.187 | 0.221 | 0.215 | 0.217 | 0.231 |
| Mahadeva | 0.317 | 0.384 | 0.404 | 0.634 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.215 | 0.253 | 0.246 | 0.249 | 0.265 |
| Tirahut | 0.282 | 0.304 | 0.339 | 0.629 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.19 | 0.223 | 0.217 | 0.22 | 0.234 |
| Tilathi Koiladi | 0.363 | 0.449 | 0.392 | 0.701 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.272 | 0.32 | 0.312 | 0.316 | 0.336 |
| Chhinnamasta | 0.325 | 0.421 | 0.391 | 0.679 | 0.604 | 0.711 | 0.692 | 0.701 | 0.746 | 0.236 | 0.278 | 0.27 | 0.274 | 0.291 |
| Naraha | 0.463 | 0.262 | 0.259 | 0.67 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.322 | 0.379 | 0.365 | 0.375 | 0.4 |
| Bishnupur | 0.296 | 0.28 | 0.27 | 0.674 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.207 | 0.244 | 0.235 | 0.241 | 0.257 |
| Arnama | 0.274 | 0.316 | 0.269 | 0.707 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.201 | 0.236 | 0.228 | 0.234 | 0.249 |
| Laxmipur Patari | 0.558 | 0.365 | 0.275 | 0.743 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.43 | 0.506 | 0.488 | 0.501 | 0.534 |
| Sakhuwanankarkatti | 0.311 | 0.32 | 0.274 | 0.705 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.227 | 0.268 | 0.258 | 0.265 | 0.282 |
| Bhagawanpur | 0.283 | 0.336 | 0.334 | 0.661 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.194 | 0.228 | 0.22 | 0.226 | 0.241 |
| Nawarajpur | 0.344 | 0.317 | 0.304 | 0.674 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.24 | 0.283 | 0.273 | 0.28 | 0.299 |
| Bariyarpatti | 0.359 | 0.409 | 0.29 | 0.766 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.285 | 0.336 | 0.324 | 0.332 | 0.354 |
| Aurahi | 0.28 | 0.372 | 0.228 | 0.794 | 0.586 | 0.69 | 0.666 | 0.683 | 0.728 | 0.23 | 0.271 | 0.262 | 0.269 | 0.286 |
| Bateshwor | 0.475 | 0.303 | 0.297 | 0.669 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.327 | 0.388 | 0.38 | 0.385 | 0.416 |
| Lakshminiya | 0.444 | 0.437 | 0.355 | 0.726 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.331 | 0.394 | 0.385 | 0.391 | 0.422 |
| Janaknandani | 0.605 | 0.611 | 0.343 | 0.887 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.552 | 0.656 | 0.642 | 0.65 | 0.703 |
| Aaurahi | 0.346 | 0.384 | 0.329 | 0.707 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.251 | 0.299 | 0.293 | 0.296 | 0.32 |
| Dhanauji | 0.307 | 0.304 | 0.302 | 0.664 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.21 | 0.249 | 0.244 | 0.247 | 0.267 |
| Mukhiyapatti Musarmiya | 0.32 | 0.357 | 0.365 | 0.649 | 0.581 | 0.691 | 0.676 | 0.685 | 0.74 | 0.213 | 0.254 | 0.248 | 0.252 | 0.272 |
| Sonama | 0.415 | 0.546 | 0.293 | 0.879 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.377 | 0.452 | 0.446 | 0.45 | 0.481 |
| Samsi | 0.341 | 0.491 | 0.245 | 0.879 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.31 | 0.372 | 0.366 | 0.37 | 0.396 |
| Ekdanra | 0.333 | 0.426 | 0.229 | 0.839 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.289 | 0.346 | 0.342 | 0.344 | 0.369 |
| Mahottari | 0.319 | 0.428 | 0.246 | 0.824 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.272 | 0.326 | 0.321 | 0.324 | 0.347 |
| Pipra | 0.464 | 0.537 | 0.275 | 0.889 | 0.584 | 0.701 | 0.691 | 0.697 | 0.746 | 0.426 | 0.512 | 0.504 | 0.509 | 0.544 |
| Parsa | 0.225 | 0.314 | 0.256 | 0.717 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.172 | 0.209 | 0.208 | 0.203 | 0.217 |
| Bramhapuri | 0.292 | 0.41 | 0.277 | 0.778 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.242 | 0.294 | 0.293 | 0.286 | 0.306 |
| Chandranagar | 0.35 | 0.437 | 0.275 | 0.804 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.3 | 0.364 | 0.362 | 0.354 | 0.379 |
| Chakraghatta | 0.303 | 0.356 | 0.319 | 0.693 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.224 | 0.272 | 0.27 | 0.264 | 0.283 |
| Basbariya | 0.257 | 0.311 | 0.305 | 0.668 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.183 | 0.222 | 0.221 | 0.216 | 0.231 |
| Dhankaul | 0.258 | 0.333 | 0.271 | 0.719 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.198 | 0.24 | 0.239 | 0.234 | 0.25 |
| Ramnagar | 0.302 | 0.367 | 0.282 | 0.737 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.237 | 0.288 | 0.287 | 0.28 | 0.3 |
| Bishnu | 0.262 | 0.34 | 0.311 | 0.687 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.192 | 0.233 | 0.232 | 0.227 | 0.242 |
| Kaudena | 0.288 | 0.35 | 0.275 | 0.73 | 0.603 | 0.732 | 0.728 | 0.712 | 0.761 | 0.224 | 0.272 | 0.271 | 0.265 | 0.283 |

| Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | Risk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Yemunamai | 0.34 | 0.378 | 0.186 | 0.839 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.306 | 0.375 | 0.375 | 0.355 | 0.381 |
| Durga Bhagwati | 0.343 | 0.365 | 0.223 | 0.792 | 0.607 | 0.743 | 0.743 | 0.704 | 0.754 | 0.292 | 0.357 | 0.357 | 0.338 | 0.362 |
| Parwanipur | 0.408 | 0.261 | 0.389 | 0.544 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.244 | 0.292 | 0.296 | 0.282 | 0.302 |
| Prasauni | 0.52 | 0.28 | 0.374 | 0.574 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.328 | 0.393 | 0.398 | 0.38 | 0.406 |
| Bishrampur | 0.39 | 0.274 | 0.391 | 0.553 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.237 | 0.284 | 0.287 | 0.274 | 0.293 |
| Pheta | 0.399 | 0.304 | 0.386 | 0.583 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.256 | 0.306 | 0.31 | 0.296 | 0.316 |
| Karaiyamai | 0.38 | 0.318 | 0.497 | 0.489 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.204 | 0.245 | 0.248 | 0.236 | 0.252 |
| Baragadhi | 0.297 | 0.394 | 0.476 | 0.574 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.187 | 0.224 | 0.227 | 0.217 | 0.232 |
| Adarshkotwal | 0.305 | 0.463 | 0.407 | 0.698 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.234 | 0.28 | 0.284 | 0.271 | 0.289 |
| Devtal | 0.331 | 0.311 | 0.455 | 0.523 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.19 | 0.228 | 0.231 | 0.22 | 0.235 |
| Suwarna | 0.308 | 0.376 | 0.409 | 0.622 | 0.621 | 0.744 | 0.753 | 0.719 | 0.768 | 0.21 | 0.252 | 0.255 | 0.244 | 0.26 |
| Thori | 0.278 | 0.444 | 0.452 | 0.64 | 0.625 | 0.733 | 0.75 | 0.726 | 0.778 | 0.197 | 0.231 | 0.236 | 0.229 | 0.245 |
| Jirabhawani | 0.267 | 0.389 | 0.424 | 0.619 | 0.625 | 0.733 | 0.75 | 0.726 | 0.778 | 0.183 | 0.214 | 0.219 | 0.212 | 0.227 |
| Jagarnathpur | 0.364 | 0.376 | 0.516 | 0.519 | 0.625 | 0.733 | 0.75 | 0.726 | 0.778 | 0.209 | 0.245 | 0.251 | 0.243 | 0.26 |
| Paterwasugauli | 0.294 | 0.31 | 0.409 | 0.567 | 0.625 | 0.733 | 0.75 | 0.726 | 0.778 | 0.184 | 0.216 | 0.221 | 0.214 | 0.229 |
| SakhuwaPrasauni | 0.379 | 0.407 | 0.451 | 0.609 | 0.625 | 0.733 | 0.75 | 0.726 | 0.778 | 0.255 | 0.299 | 0.306 | 0.296 | 0.318 |
| Kalikamai | 0.223 | 0.243 | 0.412 | 0.507 | 0.625 | 0.733 | 0.75 | 0.726 | 0.778 | 0.125 | 0.147 | 0.15 | 0.145 | 0.156 |
| Dhobini | 0.209 | 0.236 | 0.398 | 0.514 | 0.625 | 0.733 | 0.75 | 0.726 | 0.778 | 0.119 | 0.139 | 0.143 | 0.138 | 0.148 |
| Chhipaharmai | 0.277 | 0.302 | 0.428 | 0.542 | 0.625 | 0.733 | 0.75 | 0.726 | 0.778 | 0.166 | 0.195 | 0.199 | 0.193 | 0.207 |
| Pakahamainpur | 0.228 | 0.235 | 0.386 | 0.524 | 0.625 | 0.733 | 0.75 | 0.726 | 0.778 | 0.132 | 0.155 | 0.159 | 0.153 | 0.164 |
| Bindabasini | 0.318 | 0.298 | 0.413 | 0.552 | 0.625 | 0.733 | 0.75 | 0.726 | 0.778 | 0.194 | 0.228 | 0.233 | 0.225 | 0.242 |
| Gaurishankar | 0.431 | 0.594 | 0.563 | 0.66 | 0.622 | 0.709 | 0.704 | 0.694 | 0.77 | 0.313 | 0.357 | 0.354 | 0.349 | 0.387 |
| Bigu | 0.454 | 0.681 | 0.584 | 0.714 | 0.622 | 0.709 | 0.704 | 0.694 | 0.77 | 0.357 | 0.407 | 0.404 | 0.398 | 0.442 |
| Kalinchok | 0.366 | 0.721 | 0.581 | 0.751 | 0.622 | 0.709 | 0.704 | 0.694 | 0.77 | 0.302 | 0.345 | 0.342 | 0.337 | 0.374 |
| Baiteshwor | 0.28 | 0.609 | 0.554 | 0.682 | 0.622 | 0.709 | 0.704 | 0.694 | 0.77 | 0.21 | 0.24 | 0.238 | 0.234 | 0.26 |
| Tamakoshi | 0.29 | 0.563 | 0.491 | 0.703 | 0.622 | 0.709 | 0.704 | 0.694 | 0.77 | 0.224 | 0.256 | 0.254 | 0.25 | 0.278 |
| Melung | 0.301 | 0.631 | 0.534 | 0.72 | 0.622 | 0.709 | 0.704 | 0.694 | 0.77 | 0.238 | 0.272 | 0.27 | 0.266 | 0.295 |
| Sailung | 0.295 | 0.609 | 0.559 | 0.676 | 0.622 | 0.709 | 0.704 | 0.694 | 0.77 | 0.219 | 0.25 | 0.248 | 0.245 | 0.272 |
| Bhotekoshi | 0.336 | 0.621 | 0.536 | 0.709 | 0.631 | 0.74 | 0.75 | 0.719 | 0.792 | 0.266 | 0.312 | 0.316 | 0.303 | 0.334 |
| Jugal | 0.407 | 0.55 | 0.506 | 0.677 | 0.631 | 0.74 | 0.75 | 0.719 | 0.792 | 0.308 | 0.361 | 0.366 | 0.35 | 0.386 |
| Panchpokhari Thangpal | 0.381 | 0.521 | 0.493 | 0.666 | 0.631 | 0.74 | 0.75 | 0.719 | 0.792 | 0.283 | 0.332 | 0.337 | 0.323 | 0.356 |
| Helambu | 0.312 | 0.554 | 0.466 | 0.719 | 0.631 | 0.74 | 0.75 | 0.719 | 0.792 | 0.25 | 0.294 | 0.298 | 0.285 | 0.314 |
| Indrawati | 0.393 | 0.653 | 0.565 | 0.708 | 0.631 | 0.74 | 0.75 | 0.719 | 0.792 | 0.311 | 0.364 | 0.369 | 0.354 | 0.39 |
| Balefi | 0.283 | 0.643 | 0.52 | 0.743 | 0.631 | 0.74 | 0.75 | 0.719 | 0.792 | 0.235 | 0.275 | 0.279 | 0.267 | 0.295 |
| Tripurasundari | 0.292 | 0.505 | 0.226 | 0.909 | 0.631 | 0.74 | 0.75 | 0.719 | 0.792 | 0.296 | 0.347 | 0.352 | 0.338 | 0.372 |
| Lisangkhu Pakhar | 0.23 | 0.377 | 0.478 | 0.557 | 0.631 | 0.74 | 0.75 | 0.719 | 0.792 | 0.143 | 0.168 | 0.17 | 0.163 | 0.179 |
| Sunkoshi | 0.258 | 0.524 | 0.608 | 0.557 | 0.631 | 0.74 | 0.75 | 0.719 | 0.792 | 0.16 | 0.188 | 0.191 | 0.183 | 0.201 |
| Gosaikunda | 0.34 | 0.499 | 0.434 | 0.704 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.262 | 0.318 | 0.325 | 0.296 | 0.324 |
| Parbati Kunda | 0.169 | 0.187 | 0.362 | 0.507 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.094 | 0.114 | 0.116 | 0.106 | 0.116 |
| Uttargaya | 0.169 | 0.366 | 0.381 | 0.642 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.119 | 0.144 | 0.147 | 0.134 | 0.147 |
| Kalika | 0.173 | 0.354 | 0.782 | 0.245 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.046 | 0.056 | 0.058 | 0.052 | 0.057 |
| Naukunda | 0.225 | 0.339 | 0.411 | 0.59 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.145 | 0.176 | 0.18 | 0.164 | 0.18 |
| Rubi Valley | 0.291 | 0.387 | 0.481 | 0.563 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.179 | 0.218 | 0.223 | 0.203 | 0.222 |

| Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | Risk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Khaniyabash | 0.252 | 0.33 | 0.54 | 0.458 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.126 | 0.153 | 0.157 | 0.143 | 0.156 |
| Gangajamuna | 0.285 | 0.444 | 0.598 | 0.499 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.155 | 0.189 | 0.193 | 0.176 | 0.192 |
| Tripura Sundari | 0.216 | 0.577 | 0.589 | 0.621 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.147 | 0.178 | 0.182 | 0.166 | 0.182 |
| Netrawati Dabjong | 0.311 | 0.445 | 0.524 | 0.57 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.194 | 0.236 | 0.241 | 0.219 | 0.24 |
| Jwalamukhi | 0.361 | 0.569 | 0.547 | 0.654 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.258 | 0.314 | 0.321 | 0.292 | 0.32 |
| Siddhalek | 0.337 | 0.647 | 0.567 | 0.701 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.258 | 0.314 | 0.321 | 0.292 | 0.32 |
| Benighat Rorang | 0.506 | 0.881 | 0.68 | 0.792 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.438 | 0.532 | 0.544 | 0.496 | 0.542 |
| Gajuri | 0.382 | 0.73 | 0.677 | 0.666 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.278 | 0.338 | 0.346 | 0.315 | 0.344 |
| Galchi | 0.36 | 0.635 | 0.631 | 0.63 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.248 | 0.301 | 0.308 | 0.28 | 0.307 |
| Thakre | 0.484 | 0.798 | 0.693 | 0.709 | 0.618 | 0.751 | 0.768 | 0.699 | 0.765 | 0.375 | 0.456 | 0.466 | 0.424 | 0.464 |
| Dupcheshwar | 0.347 | 0.685 | 0.537 | 0.763 | 0.626 | 0.771 | 0.778 | 0.715 | 0.781 | 0.293 | 0.361 | 0.364 | 0.335 | 0.366 |
| Tadi | 0.262 | 0.436 | 0.511 | 0.576 | 0.626 | 0.771 | 0.778 | 0.715 | 0.781 | 0.167 | 0.206 | 0.208 | 0.191 | 0.209 |
| Suryagadhi | 0.242 | 0.382 | 0.503 | 0.538 | 0.626 | 0.771 | 0.778 | 0.715 | 0.781 | 0.144 | 0.178 | 0.179 | 0.165 | 0.18 |
| Kispang | 0.213 | 0.478 | 0.523 | 0.6 | 0.626 | 0.771 | 0.778 | 0.715 | 0.781 | 0.142 | 0.174 | 0.176 | 0.162 | 0.177 |
| Meghang | 0.226 | 0.373 | 0.524 | 0.51 | 0.626 | 0.771 | 0.778 | 0.715 | 0.781 | 0.128 | 0.157 | 0.159 | 0.146 | 0.159 |
| Tarkeshwar | 0.207 | 0.4 | 0.527 | 0.529 | 0.626 | 0.771 | 0.778 | 0.715 | 0.781 | 0.121 | 0.149 | 0.151 | 0.139 | 0.151 |
| Likhu | 0.277 | 0.581 | 0.516 | 0.695 | 0.626 | 0.771 | 0.778 | 0.715 | 0.781 | 0.213 | 0.263 | 0.265 | 0.244 | 0.266 |
| Panchakanya | 0.215 | 0.479 | 0.474 | 0.648 | 0.626 | 0.771 | 0.778 | 0.715 | 0.781 | 0.154 | 0.19 | 0.192 | 0.176 | 0.192 |
| Shivapuri | 0.318 | 0.626 | 0.527 | 0.722 | 0.626 | 0.771 | 0.778 | 0.715 | 0.781 | 0.254 | 0.313 | 0.316 | 0.29 | 0.317 |
| Kakani | 0.405 | 0.619 | 0.59 | 0.655 | 0.626 | 0.771 | 0.778 | 0.715 | 0.781 | 0.294 | 0.362 | 0.365 | 0.336 | 0.367 |
| Konjyosom | 0.194 | 0.196 | 0.881 | 0.015 | 0.617 | 0.75 | 0.749 | 0.709 | 0.791 | 0.003 | 0.004 | 0.004 | 0.004 | 0.004 |
| Mahankal | 0.174 | 0.23 | 0.912 | 0.014 | 0.617 | 0.75 | 0.749 | 0.709 | 0.791 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| Bagmati | 0.267 | 0.42 | 0.628 | 0.449 | 0.617 | 0.75 | 0.749 | 0.709 | 0.791 | 0.131 | 0.159 | 0.159 | 0.15 | 0.168 |
| Chaurideurali | 0.33 | 0.564 | 0.728 | 0.476 | 0.632 | 0.763 | 0.754 | 0.722 | 0.799 | 0.176 | 0.212 | 0.21 | 0.201 | 0.222 |
| Bhumlu | 0.307 | 0.53 | 0.741 | 0.434 | 0.632 | 0.763 | 0.754 | 0.722 | 0.799 | 0.149 | 0.18 | 0.178 | 0.17 | 0.188 |
| Temal | 0.334 | 0.518 | 0.695 | 0.468 | 0.632 | 0.763 | 0.754 | 0.722 | 0.799 | 0.175 | 0.211 | 0.209 | 0.2 | 0.221 |
| Bethanchowk | 0.268 | 0.417 | 0.672 | 0.405 | 0.632 | 0.763 | 0.754 | 0.722 | 0.799 | 0.121 | 0.147 | 0.145 | 0.139 | 0.153 |
| Roshi | 0.483 | 0.697 | 0.773 | 0.545 | 0.632 | 0.763 | 0.754 | 0.722 | 0.799 | 0.294 | 0.355 | 0.351 | 0.336 | 0.372 |
| Mahabharat | 0.35 | 0.399 | 0.667 | 0.394 | 0.632 | 0.763 | 0.754 | 0.722 | 0.799 | 0.154 | 0.186 | 0.184 | 0.176 | 0.195 |
| Khanikhola | 0.317 | 0.364 | 0.701 | 0.331 | 0.632 | 0.763 | 0.754 | 0.722 | 0.799 | 0.117 | 0.142 | 0.14 | 0.134 | 0.148 |
| Umakunda | 0.392 | 0.428 | 0.575 | 0.507 | 0.596 | 0.694 | 0.681 | 0.674 | 0.749 | 0.21 | 0.244 | 0.239 | 0.237 | 0.263 |
| Gokulganga | 0.338 | 0.505 | 0.596 | 0.553 | 0.596 | 0.694 | 0.681 | 0.674 | 0.749 | 0.197 | 0.229 | 0.225 | 0.223 | 0.248 |
| Likhu Tamakoshi | 0.31 | 0.531 | 0.643 | 0.53 | 0.596 | 0.694 | 0.681 | 0.674 | 0.749 | 0.173 | 0.202 | 0.198 | 0.196 | 0.218 |
| Khadadevi | 0.399 | 0.611 | 0.579 | 0.659 | 0.596 | 0.694 | 0.681 | 0.674 | 0.749 | 0.277 | 0.323 | 0.317 | 0.314 | 0.348 |
| Doramba | 0.366 | 0.54 | 0.624 | 0.555 | 0.596 | 0.694 | 0.681 | 0.674 | 0.749 | 0.214 | 0.249 | 0.245 | 0.242 | 0.269 |
| Sunapati | 0.274 | 0.494 | 0.584 | 0.556 | 0.596 | 0.694 | 0.681 | 0.674 | 0.749 | 0.161 | 0.187 | 0.184 | 0.182 | 0.202 |
| Phikkal | 0.349 | 0.471 | 0.468 | 0.647 | 0.6 | 0.728 | 0.713 | 0.705 | 0.764 | 0.24 | 0.291 | 0.285 | 0.282 | 0.305 |
| Tinpatan | 0.595 | 0.758 | 0.622 | 0.743 | 0.6 | 0.728 | 0.713 | 0.705 | 0.764 | 0.469 | 0.569 | 0.558 | 0.551 | 0.598 |
| Golanjor | 0.367 | 0.502 | 0.476 | 0.666 | 0.6 | 0.728 | 0.713 | 0.705 | 0.764 | 0.259 | 0.315 | 0.308 | 0.305 | 0.33 |
| Sunkoshi | 0.374 | 0.557 | 0.602 | 0.591 | 0.6 | 0.728 | 0.713 | 0.705 | 0.764 | 0.235 | 0.285 | 0.279 | 0.276 | 0.299 |
| Ghanglekh | 0.267 | 0.319 | 0.431 | 0.553 | 0.6 | 0.728 | 0.713 | 0.705 | 0.764 | 0.157 | 0.19 | 0.186 | 0.184 | 0.2 |
| Marin | 0.468 | 0.59 | 0.469 | 0.748 | 0.6 | 0.728 | 0.713 | 0.705 | 0.764 | 0.372 | 0.451 | 0.442 | 0.437 | 0.473 |
| Hariharpurgadhi | 0.488 | 0.6 | 0.463 | 0.762 | 0.6 | 0.728 | 0.713 | 0.705 | 0.764 | 0.395 | 0.479 | 0.469 | 0.464 | 0.503 |
| Indrasarowar | 0.283 | 0.447 | 0.623 | 0.477 | 0.635 | 0.764 | 0.778 | 0.723 | 0.791 | 0.152 | 0.182 | 0.186 | 0.173 | 0.189 |

| Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | Risk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kailash | 0.417 | 0.598 | 0.68 | 0.551 | 0.635 | 0.764 | 0.778 | 0.723 | 0.791 | 0.258 | 0.311 | 0.316 | 0.294 | 0.322 |
| Raksirang | 0.458 | 0.671 | 0.541 | 0.747 | 0.635 | 0.764 | 0.778 | 0.723 | 0.791 | 0.384 | 0.462 | 0.471 | 0.438 | 0.479 |
| Manahari | 0.539 | 0.926 | 0.777 | 0.737 | 0.635 | 0.764 | 0.778 | 0.723 | 0.791 | 0.446 | 0.537 | 0.547 | 0.508 | 0.556 |
| Bhimphedi | 0.657 | 0.872 | 0.691 | 0.774 | 0.635 | 0.764 | 0.778 | 0.723 | 0.791 | 0.571 | 0.687 | 0.7 | 0.65 | 0.712 |
| Makawanpurgadhi | 0.448 | 0.664 | 0.689 | 0.599 | 0.635 | 0.764 | 0.778 | 0.723 | 0.791 | 0.301 | 0.363 | 0.369 | 0.343 | 0.376 |
| Bakaiya | 0.733 | 1 | 0.767 | 0.809 | 0.635 | 0.764 | 0.778 | 0.723 | 0.791 | 0.666 | 0.801 | 0.816 | 0.758 | 0.83 |
| Bagmati | 0.699 | 0.706 | 0.325 | 0.985 | 0.635 | 0.764 | 0.778 | 0.723 | 0.791 | 0.773 | 0.931 | 0.948 | 0.881 | 0.963 |
| Ichchhyakamana | 0.473 | 0.65 | 1 | 0.287 | 0.649 | 0.778 | 0.789 | 0.736 | 0.809 | 0.156 | 0.187 | 0.189 | 0.177 | 0.194 |
| Chum Nubri | 0.427 | 0.449 | 0.561 | 0.539 | 0.541 | 0.647 | 0.678 | 0.614 | 0.671 | 0.22 | 0.263 | 0.276 | 0.25 | 0.273 |
| Ajirkot | 0.323 | 0.507 | 0.624 | 0.527 | 0.541 | 0.647 | 0.678 | 0.614 | 0.671 | 0.163 | 0.195 | 0.204 | 0.185 | 0.202 |
| Sulikot | 0.422 | 0.657 | 0.675 | 0.606 | 0.541 | 0.647 | 0.678 | 0.614 | 0.671 | 0.245 | 0.293 | 0.307 | 0.278 | 0.304 |
| Dharche | 0.395 | 0.37 | 0.611 | 0.423 | 0.541 | 0.647 | 0.678 | 0.614 | 0.671 | 0.16 | 0.191 | 0.2 | 0.181 | 0.198 |
| Aarughat | 0.366 | 0.659 | 0.717 | 0.567 | 0.541 | 0.647 | 0.678 | 0.614 | 0.671 | 0.199 | 0.238 | 0.249 | 0.225 | 0.246 |
| Bhimsen | 0.338 | 0.592 | 0.632 | 0.593 | 0.541 | 0.647 | 0.678 | 0.614 | 0.671 | 0.192 | 0.229 | 0.24 | 0.218 | 0.238 |
| Siranchok | 0.376 | 0.798 | 0.701 | 0.701 | 0.541 | 0.647 | 0.678 | 0.614 | 0.671 | 0.252 | 0.302 | 0.316 | 0.286 | 0.313 |
| Sahid Lakhan | 0.471 | 0.764 | 0.744 | 0.631 | 0.541 | 0.647 | 0.678 | 0.614 | 0.671 | 0.284 | 0.34 | 0.356 | 0.323 | 0.353 |
| Gandaki | 0.359 | 0.585 | 0.677 | 0.543 | 0.541 | 0.647 | 0.678 | 0.614 | 0.671 | 0.187 | 0.223 | 0.234 | 0.212 | 0.231 |
| Narphu | 0.164 | 0.126 | 0.626 | 0.201 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.016 | 0.022 | 0.023 | 0.019 | 0.023 |
| Neshyang | 0.174 | 0.161 | 0.655 | 0.203 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.018 | 0.023 | 0.025 | 0.021 | 0.024 |
| Chame | 0.063 | 0.064 | 0.648 | 0.127 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.004 | 0.005 | 0.006 | 0.005 | 0.005 |
| Nashong | 0.217 | 0.211 | 0.66 | 0.24 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.026 | 0.035 | 0.036 | 0.03 | 0.036 |
| Dalome | 0.224 | 0.107 | 0.471 | 0.334 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.037 | 0.05 | 0.052 | 0.044 | 0.051 |
| Gharapjhong | 0.141 | 0.16 | 0.494 | 0.357 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.025 | 0.033 | 0.035 | 0.029 | 0.035 |
| Barhagaun Muktikhsetra | 0.192 | 0.199 | 0.49 | 0.394 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.038 | 0.05 | 0.053 | 0.044 | 0.052 |
| Lomanthang | 0.174 | 0.16 | 0.478 | 0.372 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.032 | 0.043 | 0.045 | 0.038 | 0.044 |
| Thasang | 0.151 | 0.175 | 0.48 | 0.383 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.029 | 0.038 | 0.04 | 0.034 | 0.04 |
| Annapurna | 0.468 | 0.735 | 0.997 | 0.363 | 0.544 | 0.652 | 0.676 | 0.636 | 0.687 | 0.163 | 0.196 | 0.203 | 0.191 | 0.206 |
| Raghuganga | 0.4 | 0.493 | 0.662 | 0.479 | 0.544 | 0.652 | 0.676 | 0.636 | 0.687 | 0.184 | 0.221 | 0.229 | 0.216 | 0.233 |
| Dhaulagiri | 0.452 | 0.419 | 0.668 | 0.41 | 0.544 | 0.652 | 0.676 | 0.636 | 0.687 | 0.178 | 0.214 | 0.222 | 0.209 | 0.225 |
| Malika | 0.303 | 0.467 | 0.62 | 0.497 | 0.544 | 0.652 | 0.676 | 0.636 | 0.687 | 0.145 | 0.174 | 0.18 | 0.169 | 0.183 |
| Mangala | 0.275 | 0.432 | 0.655 | 0.433 | 0.544 | 0.652 | 0.676 | 0.636 | 0.687 | 0.115 | 0.137 | 0.142 | 0.134 | 0.145 |
| Madi | 0.477 | 0.809 | 0.4 | 1 | 0.69 | 0.801 | 0.831 | 0.778 | 0.834 | 0.582 | 0.676 | 0.701 | 0.657 | 0.704 |
| Machhapuchchhre | 0.45 | 0.687 | 0.976 | 0.342 | 0.69 | 0.801 | 0.831 | 0.778 | 0.834 | 0.188 | 0.218 | 0.226 | 0.212 | 0.227 |
| Annapurna | 0.366 | 0.835 | 0.64 | 0.791 | 0.69 | 0.801 | 0.831 | 0.778 | 0.834 | 0.353 | 0.41 | 0.426 | 0.398 | 0.427 |
| Rupa | 0.245 | 0.391 | 0.829 | 0.231 | 0.653 | 0.765 | 0.802 | 0.736 | 0.795 | 0.065 | 0.077 | 0.08 | 0.074 | 0.08 |
| Dordi | 0.344 | 0.598 | 0.686 | 0.545 | 0.653 | 0.765 | 0.802 | 0.736 | 0.795 | 0.217 | 0.254 | 0.266 | 0.244 | 0.264 |
| Marsyangdi | 0.483 | 0.748 | 0.739 | 0.622 | 0.653 | 0.765 | 0.802 | 0.736 | 0.795 | 0.347 | 0.407 | 0.426 | 0.391 | 0.423 |
| Kwholasothar | 0.226 | 0.391 | 0.648 | 0.405 | 0.653 | 0.765 | 0.802 | 0.736 | 0.795 | 0.106 | 0.124 | 0.13 | 0.119 | 0.129 |
| Dudhpokhari | 0.267 | 0.32 | 0.625 | 0.367 | 0.653 | 0.765 | 0.802 | 0.736 | 0.795 | 0.113 | 0.133 | 0.139 | 0.128 | 0.138 |
| Myagde | 0.347 | 0.592 | 0.78 | 0.449 | 0.725 | 0.867 | 0.886 | 0.827 | 0.871 | 0.2 | 0.239 | 0.244 | 0.228 | 0.24 |
| Ghiring | 0.359 | 0.429 | 0.719 | 0.37 | 0.725 | 0.867 | 0.886 | 0.827 | 0.871 | 0.17 | 0.204 | 0.208 | 0.194 | 0.205 |
| Rhishing | 0.424 | 0.561 | 0.694 | 0.506 | 0.725 | 0.867 | 0.886 | 0.827 | 0.871 | 0.275 | 0.329 | 0.336 | 0.314 | 0.331 |
| Devghat | 0.322 | 0.509 | 0.69 | 0.465 | 0.725 | 0.867 | 0.886 | 0.827 | 0.871 | 0.192 | 0.23 | 0.235 | 0.219 | 0.231 |
| Bandipur | 0.358 | 0.664 | 0.79 | 0.502 | 0.725 | 0.867 | 0.886 | 0.827 | 0.871 | 0.231 | 0.276 | 0.282 | 0.263 | 0.277 |

| Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | Risk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Anbukhaireni | 0.402 | 0.648 | 0.876 | 0.405 | 0.725 | 0.867 | 0.886 | 0.827 | 0.871 | 0.209 | 0.25 | 0.255 | 0.238 | 0.251 |
| Bulingtar | 0.318 | 0.449 | 0.658 | 0.445 | 0.653 | 0.779 | 0.784 | 0.744 | 0.815 | 0.163 | 0.195 | 0.196 | 0.186 | 0.204 |
| Bungdikali | 0.267 | 0.34 | 0.638 | 0.372 | 0.653 | 0.779 | 0.784 | 0.744 | 0.815 | 0.115 | 0.137 | 0.138 | 0.131 | 0.143 |
| Hupsekot | 0.385 | 0.42 | 0.734 | 0.348 | 0.653 | 0.779 | 0.784 | 0.744 | 0.815 | 0.155 | 0.185 | 0.186 | 0.176 | 0.193 |
| Binayee Tribeni | 0.525 | 0.639 | 0.781 | 0.489 | 0.739 | 0.878 | 0.897 | 0.838 | 0.885 | 0.336 | 0.399 | 0.407 | 0.381 | 0.402 |
| Phedikhola | 0.235 | 0.352 | 0.76 | 0.264 | 0.739 | 0.878 | 0.897 | 0.838 | 0.885 | 0.081 | 0.096 | 0.098 | 0.092 | 0.097 |
| Aandhikhola | 0.297 | 0.522 | 0.776 | 0.394 | 0.739 | 0.878 | 0.897 | 0.838 | 0.885 | 0.153 | 0.182 | 0.186 | 0.173 | 0.183 |
| Arjunchaupari | 0.273 | 0.438 | 0.782 | 0.316 | 0.739 | 0.878 | 0.897 | 0.838 | 0.885 | 0.113 | 0.134 | 0.137 | 0.128 | 0.135 |
| Biruwa | 0.293 | 0.451 | 0.739 | 0.368 | 0.739 | 0.878 | 0.897 | 0.838 | 0.885 | 0.141 | 0.167 | 0.171 | 0.16 | 0.169 |
| Harinas | 0.331 | 0.415 | 0.715 | 0.362 | 0.739 | 0.878 | 0.897 | 0.838 | 0.885 | 0.157 | 0.186 | 0.19 | 0.178 | 0.188 |
| Kaligandagi | 0.291 | 0.471 | 0.755 | 0.37 | 0.739 | 0.878 | 0.897 | 0.838 | 0.885 | 0.141 | 0.167 | 0.171 | 0.16 | 0.169 |
| Modi | 0.368 | 0.775 | 0.761 | 0.625 | 0.726 | 0.857 | 0.879 | 0.822 | 0.868 | 0.295 | 0.349 | 0.358 | 0.334 | 0.353 |
| Jaljala | 0.319 | 0.556 | 0.752 | 0.446 | 0.726 | 0.857 | 0.879 | 0.822 | 0.868 | 0.183 | 0.216 | 0.221 | 0.207 | 0.218 |
| Mahashila | 0.163 | 0.287 | 0.63 | 0.334 | 0.726 | 0.857 | 0.879 | 0.822 | 0.868 | 0.07 | 0.083 | 0.085 | 0.079 | 0.084 |
| Bihadi | 0.23 | 0.395 | 0.666 | 0.391 | 0.726 | 0.857 | 0.879 | 0.822 | 0.868 | 0.116 | 0.136 | 0.14 | 0.131 | 0.138 |
| Painyu | 0.227 | 0.387 | 0.724 | 0.329 | 0.726 | 0.857 | 0.879 | 0.822 | 0.868 | 0.096 | 0.113 | 0.116 | 0.109 | 0.115 |
| Kanthekhola | 0.385 | 0.582 | 0.773 | 0.448 | 0.605 | 0.728 | 0.753 | 0.694 | 0.746 | 0.185 | 0.222 | 0.23 | 0.212 | 0.228 |
| Tara Khola | 0.259 | 0.359 | 0.591 | 0.433 | 0.605 | 0.728 | 0.753 | 0.694 | 0.746 | 0.12 | 0.144 | 0.149 | 0.138 | 0.148 |
| Taman Khola | 0.218 | 0.278 | 0.584 | 0.371 | 0.605 | 0.728 | 0.753 | 0.694 | 0.746 | 0.087 | 0.104 | 0.108 | 0.099 | 0.107 |
| Nisikhola | 0.388 | 0.697 | 0.635 | 0.679 | 0.605 | 0.728 | 0.753 | 0.694 | 0.746 | 0.282 | 0.339 | 0.351 | 0.323 | 0.348 |
| Badigad | 0.48 | 0.679 | 0.71 | 0.591 | 0.605 | 0.728 | 0.753 | 0.694 | 0.746 | 0.304 | 0.365 | 0.378 | 0.348 | 0.374 |
| Bareng | 0.223 | 0.339 | 0.6 | 0.408 | 0.605 | 0.728 | 0.753 | 0.694 | 0.746 | 0.097 | 0.117 | 0.121 | 0.112 | 0.12 |
| Putha Uttarganga | 0.407 | 0.51 | 0.46 | 0.687 | 0.503 | 0.628 | 0.643 | 0.57 | 0.626 | 0.249 | 0.311 | 0.318 | 0.282 | 0.31 |
| Sisne | 0.338 | 0.617 | 0.459 | 0.78 | 0.503 | 0.628 | 0.643 | 0.57 | 0.626 | 0.235 | 0.293 | 0.3 | 0.266 | 0.292 |
| Bhume | 0.215 | 0.493 | 0.443 | 0.69 | 0.503 | 0.628 | 0.643 | 0.57 | 0.626 | 0.132 | 0.165 | 0.169 | 0.15 | 0.164 |
| Sunchhahari | 0.294 | 0.457 | 0.346 | 0.753 | 0.503 | 0.628 | 0.643 | 0.57 | 0.626 | 0.197 | 0.246 | 0.252 | 0.223 | 0.245 |
| Thawang | 0.191 | 0.335 | 0.323 | 0.67 | 0.503 | 0.628 | 0.643 | 0.57 | 0.626 | 0.114 | 0.142 | 0.146 | 0.129 | 0.142 |
| Duikholi | 0.335 | 0.509 | 0.388 | 0.756 | 0.503 | 0.628 | 0.643 | 0.57 | 0.626 | 0.225 | 0.281 | 0.288 | 0.255 | 0.28 |
| Sukidaha | 0.321 | 0.457 | 0.468 | 0.634 | 0.503 | 0.628 | 0.643 | 0.57 | 0.626 | 0.181 | 0.226 | 0.232 | 0.205 | 0.225 |
| Madi | 0.281 | 0.44 | 0.598 | 0.495 | 0.503 | 0.628 | 0.643 | 0.57 | 0.626 | 0.124 | 0.155 | 0.158 | 0.14 | 0.154 |
| Tribeni | 0.38 | 0.553 | 0.253 | 0.924 | 0.503 | 0.628 | 0.643 | 0.57 | 0.626 | 0.312 | 0.39 | 0.399 | 0.354 | 0.389 |
| Runtigadi | 0.446 | 0.63 | 0.449 | 0.801 | 0.503 | 0.628 | 0.643 | 0.57 | 0.626 | 0.318 | 0.397 | 0.406 | 0.36 | 0.396 |
| Suwarnabati | 0.383 | 0.637 | 0.365 | 0.888 | 0.503 | 0.628 | 0.643 | 0.57 | 0.626 | 0.303 | 0.378 | 0.387 | 0.343 | 0.377 |
| Lungri | 0.334 | 0.488 | 0.401 | 0.726 | 0.503 | 0.628 | 0.643 | 0.57 | 0.626 | 0.216 | 0.269 | 0.276 | 0.245 | 0.269 |
| Gaumukhi | 0.349 | 0.508 | 0.486 | 0.661 | 0.549 | 0.691 | 0.702 | 0.64 | 0.691 | 0.224 | 0.282 | 0.286 | 0.261 | 0.282 |
| Naubahini | 0.426 | 0.606 | 0.497 | 0.734 | 0.549 | 0.691 | 0.702 | 0.64 | 0.691 | 0.304 | 0.382 | 0.388 | 0.354 | 0.382 |
| Jhimruk | 0.395 | 0.591 | 0.522 | 0.697 | 0.549 | 0.691 | 0.702 | 0.64 | 0.691 | 0.267 | 0.337 | 0.342 | 0.312 | 0.337 |
| Mandavi | 0.245 | 0.455 | 0.422 | 0.678 | 0.549 | 0.691 | 0.702 | 0.64 | 0.691 | 0.161 | 0.203 | 0.206 | 0.188 | 0.203 |
| Mallarani | 0.25 | 0.413 | 0.449 | 0.616 | 0.549 | 0.691 | 0.702 | 0.64 | 0.691 | 0.15 | 0.188 | 0.191 | 0.174 | 0.188 |
| Ayirabati | 0.359 | 0.509 | 0.431 | 0.715 | 0.549 | 0.691 | 0.702 | 0.64 | 0.691 | 0.249 | 0.314 | 0.319 | 0.291 | 0.314 |
| Sarumarani | 0.298 | 0.411 | 0.382 | 0.679 | 0.549 | 0.691 | 0.702 | 0.64 | 0.691 | 0.197 | 0.247 | 0.251 | 0.229 | 0.247 |
| Kaligandaki | 0.326 | 0.504 | 0.626 | 0.523 | 0.615 | 0.757 | 0.777 | 0.721 | 0.765 | 0.185 | 0.228 | 0.234 | 0.217 | 0.231 |
| Satyawati | 0.381 | 0.59 | 0.689 | 0.536 | 0.615 | 0.757 | 0.777 | 0.721 | 0.765 | 0.222 | 0.273 | 0.281 | 0.26 | 0.276 |
| Chandrakot | 0.33 | 0.547 | 0.67 | 0.517 | 0.615 | 0.757 | 0.777 | 0.721 | 0.765 | 0.186 | 0.228 | 0.235 | 0.218 | 0.231 |
| Isma | 0.3 | 0.581 | 0.593 | 0.621 | 0.615 | 0.757 | 0.777 | 0.721 | 0.765 | 0.203 | 0.249 | 0.256 | 0.238 | 0.252 |

| Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | Risk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Malika | 0.329 | 0.586 | 0.656 | 0.563 | 0.615 | 0.757 | 0.777 | 0.721 | 0.765 | 0.202 | 0.248 | 0.255 | 0.236 | 0.251 |
| Madane | 0.385 | 0.597 | 0.62 | 0.608 | 0.615 | 0.757 | 0.777 | 0.721 | 0.765 | 0.255 | 0.313 | 0.322 | 0.299 | 0.317 |
| Dhurkot | 0.295 | 0.643 | 0.619 | 0.649 | 0.615 | 0.757 | 0.777 | 0.721 | 0.765 | 0.208 | 0.256 | 0.263 | 0.244 | 0.259 |
| Gulmidarbar | 0.328 | 0.516 | 0.651 | 0.509 | 0.615 | 0.757 | 0.777 | 0.721 | 0.765 | 0.182 | 0.224 | 0.229 | 0.213 | 0.226 |
| Chatrakot | 0.335 | 0.492 | 0.623 | 0.515 | 0.615 | 0.757 | 0.777 | 0.721 | 0.765 | 0.188 | 0.231 | 0.237 | 0.22 | 0.233 |
| Ruru | 0.305 | 0.497 | 0.651 | 0.493 | 0.615 | 0.757 | 0.777 | 0.721 | 0.765 | 0.164 | 0.201 | 0.207 | 0.192 | 0.203 |
| Chhatradev | 0.364 | 0.61 | 0.697 | 0.545 | 0.576 | 0.718 | 0.732 | 0.68 | 0.744 | 0.202 | 0.252 | 0.257 | 0.239 | 0.261 |
| Malarani | 0.405 | 0.631 | 0.746 | 0.515 | 0.576 | 0.718 | 0.732 | 0.68 | 0.744 | 0.213 | 0.265 | 0.27 | 0.251 | 0.275 |
| Panini | 0.417 | 0.618 | 0.707 | 0.542 | 0.576 | 0.718 | 0.732 | 0.68 | 0.744 | 0.23 | 0.287 | 0.293 | 0.272 | 0.297 |
| Purbakhola | 0.31 | 0.429 | 0.681 | 0.406 | 0.653 | 0.794 | 0.802 | 0.746 | 0.809 | 0.145 | 0.177 | 0.179 | 0.166 | 0.18 |
| Rambha | 0.339 | 0.641 | 0.744 | 0.526 | 0.653 | 0.794 | 0.802 | 0.746 | 0.809 | 0.206 | 0.25 | 0.253 | 0.235 | 0.255 |
| Bagnaskali | 0.316 | 0.564 | 0.776 | 0.429 | 0.653 | 0.794 | 0.802 | 0.746 | 0.809 | 0.157 | 0.19 | 0.192 | 0.179 | 0.194 |
| Ribdikot | 0.303 | 0.484 | 0.771 | 0.366 | 0.653 | 0.794 | 0.802 | 0.746 | 0.809 | 0.128 | 0.156 | 0.157 | 0.146 | 0.159 |
| Rainadevi Chhahara | 0.418 | 0.58 | 0.725 | 0.492 | 0.653 | 0.794 | 0.802 | 0.746 | 0.809 | 0.238 | 0.289 | 0.292 | 0.271 | 0.294 |
| Tinau | 0.38 | 0.464 | 0.707 | 0.411 | 0.653 | 0.794 | 0.802 | 0.746 | 0.809 | 0.18 | 0.219 | 0.222 | 0.206 | 0.224 |
| Mathagadhi | 0.419 | 0.527 | 0.785 | 0.389 | 0.653 | 0.794 | 0.802 | 0.746 | 0.809 | 0.188 | 0.229 | 0.231 | 0.215 | 0.233 |
| Nisdi | 0.417 | 0.506 | 0.715 | 0.439 | 0.653 | 0.794 | 0.802 | 0.746 | 0.809 | 0.211 | 0.257 | 0.26 | 0.242 | 0.262 |
| Palhi Nandan | 0.476 | 0.559 | 0.712 | 0.487 | 0.653 | 0.779 | 0.784 | 0.744 | 0.815 | 0.268 | 0.319 | 0.322 | 0.305 | 0.334 |
| Sarawal | 0.569 | 0.601 | 0.646 | 0.586 | 0.653 | 0.779 | 0.784 | 0.744 | 0.815 | 0.385 | 0.46 | 0.462 | 0.439 | 0.481 |
| Pratappur | 0.741 | 0.66 | 0.675 | 0.609 | 0.653 | 0.779 | 0.784 | 0.744 | 0.815 | 0.521 | 0.622 | 0.626 | 0.594 | 0.651 |
| Susta | 0.668 | 0.546 | 0.631 | 0.553 | 0.653 | 0.779 | 0.784 | 0.744 | 0.815 | 0.427 | 0.509 | 0.512 | 0.486 | 0.533 |
| Kanchan | 0.372 | 0.632 | 0.726 | 0.536 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.217 | 0.257 | 0.257 | 0.247 | 0.269 |
| Gaidahawa | 0.543 | 0.692 | 0.67 | 0.641 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.378 | 0.448 | 0.449 | 0.432 | 0.47 |
| Sudhdhodhan | 0.412 | 0.573 | 0.748 | 0.464 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.208 | 0.246 | 0.247 | 0.237 | 0.258 |
| Siyari | 0.619 | 0.628 | 0.716 | 0.542 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.364 | 0.432 | 0.433 | 0.416 | 0.453 |
| Omsatiya | 0.481 | 0.579 | 0.758 | 0.459 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.24 | 0.284 | 0.285 | 0.274 | 0.298 |
| Rohini | 0.504 | 0.606 | 0.684 | 0.554 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.303 | 0.36 | 0.36 | 0.346 | 0.377 |
| Mayadevi | 0.776 | 0.714 | 0.486 | 0.837 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.706 | 0.836 | 0.838 | 0.805 | 0.878 |
| Kotahimai | 0.442 | 0.607 | 0.616 | 0.62 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.298 | 0.353 | 0.353 | 0.34 | 0.37 |
| Sammarimai | 0.435 | 0.579 | 0.621 | 0.592 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.28 | 0.332 | 0.332 | 0.319 | 0.348 |
| Marchawari | 0.45 | 0.561 | 0.659 | 0.54 | 0.614 | 0.728 | 0.729 | 0.701 | 0.764 | 0.264 | 0.313 | 0.313 | 0.301 | 0.328 |
| Bijayanagar | 0.538 | 0.532 | 0.408 | 0.756 | 0.58 | 0.718 | 0.729 | 0.676 | 0.743 | 0.417 | 0.517 | 0.525 | 0.486 | 0.535 |
| Yashodhara | 0.462 | 0.542 | 0.444 | 0.73 | 0.58 | 0.718 | 0.729 | 0.676 | 0.743 | 0.346 | 0.428 | 0.435 | 0.403 | 0.443 |
| Mayadevi | 0.62 | 0.661 | 0.653 | 0.631 | 0.58 | 0.718 | 0.729 | 0.676 | 0.743 | 0.401 | 0.497 | 0.505 | 0.468 | 0.514 |
| Suddhodhan | 0.514 | 0.658 | 0.413 | 0.859 | 0.58 | 0.718 | 0.729 | 0.676 | 0.743 | 0.453 | 0.561 | 0.569 | 0.528 | 0.58 |
| Banglachuli | 0.392 | 0.56 | 0.715 | 0.485 | 0.529 | 0.662 | 0.676 | 0.61 | 0.669 | 0.178 | 0.223 | 0.227 | 0.205 | 0.225 |
| Shantinagar | 0.327 | 0.454 | 0.692 | 0.417 | 0.529 | 0.662 | 0.676 | 0.61 | 0.669 | 0.128 | 0.16 | 0.163 | 0.147 | 0.161 |
| Babai | 0.422 | 0.658 | 0.68 | 0.602 | 0.529 | 0.662 | 0.676 | 0.61 | 0.669 | 0.238 | 0.298 | 0.304 | 0.274 | 0.301 |
| Dangisharan | 0.367 | 0.336 | 0.566 | 0.438 | 0.529 | 0.662 | 0.676 | 0.61 | 0.669 | 0.15 | 0.188 | 0.192 | 0.173 | 0.19 |
| Rapti | 0.762 | 0.689 | 0.777 | 0.535 | 0.529 | 0.662 | 0.676 | 0.61 | 0.669 | 0.382 | 0.477 | 0.488 | 0.44 | 0.482 |
| Gadhawa | 0.605 | 0.638 | 0.636 | 0.628 | 0.529 | 0.662 | 0.676 | 0.61 | 0.669 | 0.356 | 0.445 | 0.454 | 0.41 | 0.45 |
| Rajpur | 0.557 | 0.462 | 0.32 | 0.783 | 0.529 | 0.662 | 0.676 | 0.61 | 0.669 | 0.408 | 0.511 | 0.522 | 0.471 | 0.516 |
| Rapti Sonari | 1 | 0.893 | 0.695 | 0.788 | 0.507 | 0.615 | 0.64 | 0.58 | 0.646 | 0.707 | 0.857 | 0.892 | 0.809 | 0.901 |
| Baijanath | 0.722 | 0.805 | 0.692 | 0.715 | 0.507 | 0.615 | 0.64 | 0.58 | 0.646 | 0.463 | 0.562 | 0.584 | 0.53 | 0.59 |

| Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | Risk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Khajura | 0.84 | 0.753 | 0.697 | 0.667 | 0.507 | 0.615 | 0.64 | 0.58 | 0.646 | 0.503 | 0.61 | 0.634 | 0.575 | 0.64 |
| Janki | 0.676 | 0.552 | 0.575 | 0.614 | 0.507 | 0.615 | 0.64 | 0.58 | 0.646 | 0.372 | 0.452 | 0.47 | 0.426 | 0.474 |
| Duduwa | 0.678 | 0.577 | 0.611 | 0.599 | 0.507 | 0.615 | 0.64 | 0.58 | 0.646 | 0.364 | 0.442 | 0.46 | 0.417 | 0.464 |
| Narainapur | 0.478 | 0.537 | 0.59 | 0.586 | 0.507 | 0.615 | 0.64 | 0.58 | 0.646 | 0.251 | 0.305 | 0.317 | 0.287 | 0.32 |
| Geruwa | 0.403 | 0.579 | 0.538 | 0.671 | 0.513 | 0.605 | 0.64 | 0.579 | 0.642 | 0.245 | 0.289 | 0.306 | 0.277 | 0.307 |
| Badhaiyatal | 0.579 | 0.812 | 0.63 | 0.782 | 0.513 | 0.605 | 0.64 | 0.579 | 0.642 | 0.411 | 0.485 | 0.513 | 0.464 | 0.514 |
| Dolpo Buddha | 0.187 | 0.152 | 0.191 | 0.642 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.06 | 0.08 | 0.084 | 0.07 | 0.082 |
| Shey Phoksundo | 0.262 | 0.196 | 0.209 | 0.662 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.087 | 0.115 | 0.121 | 0.102 | 0.119 |
| Jagadulla | 0.195 | 0.129 | 0.179 | 0.633 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.062 | 0.082 | 0.086 | 0.072 | 0.085 |
| Mudkechula | 0.152 | 0.189 | 0.184 | 0.68 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.052 | 0.069 | 0.072 | 0.061 | 0.071 |
| Kaike | 0.186 | 0.134 | 0.187 | 0.63 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.058 | 0.078 | 0.082 | 0.069 | 0.08 |
| Chharka Tangsong | 0.214 | 0.16 | 0.184 | 0.655 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.07 | 0.093 | 0.098 | 0.082 | 0.096 |
| Mugum Karmarong | 0.428 | 0.28 | 0.213 | 0.729 | 0.33 | 0.423 | 0.421 | 0.351 | 0.409 | 0.182 | 0.233 | 0.232 | 0.194 | 0.226 |
| Soru | 0.333 | 0.259 | 0.236 | 0.69 | 0.33 | 0.423 | 0.421 | 0.351 | 0.409 | 0.134 | 0.172 | 0.171 | 0.143 | 0.166 |
| Khatyad | 0.285 | 0.499 | 0.269 | 0.862 | 0.33 | 0.423 | 0.421 | 0.351 | 0.409 | 0.143 | 0.184 | 0.183 | 0.153 | 0.178 |
| Chankheli | 0.352 | 0.226 | 0.152 | 0.743 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.13 | 0.174 | 0.183 | 0.153 | 0.18 |
| Kharpunath | 0.272 | 0.294 | 0.136 | 0.816 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.111 | 0.148 | 0.155 | 0.13 | 0.152 |
| Simkot | 0.335 | 0.424 | 0.187 | 0.877 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.147 | 0.195 | 0.205 | 0.172 | 0.202 |
| Namkha | 0.315 | 0.369 | 0.152 | 0.865 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.136 | 0.181 | 0.19 | 0.16 | 0.187 |
| Sarkegad | 0.26 | 0.405 | 0.158 | 0.889 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.115 | 0.154 | 0.162 | 0.135 | 0.159 |
| Adanchuli | 0.159 | 0.402 | 0.122 | 0.921 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.073 | 0.097 | 0.102 | 0.086 | 0.101 |
| Tanjakot | 0.144 | 0.283 | 0.102 | 0.839 | 0.282 | 0.376 | 0.395 | 0.331 | 0.388 | 0.06 | 0.08 | 0.084 | 0.071 | 0.083 |
| Patrasi | 0.362 | 0.34 | 0.292 | 0.705 | 0.465 | 0.566 | 0.563 | 0.497 | 0.552 | 0.21 | 0.256 | 0.254 | 0.224 | 0.249 |
| Kanakasundari | 0.234 | 0.389 | 0.29 | 0.748 | 0.465 | 0.566 | 0.563 | 0.497 | 0.552 | 0.144 | 0.175 | 0.174 | 0.154 | 0.171 |
| Sinja | 0.184 | 0.42 | 0.264 | 0.8 | 0.465 | 0.566 | 0.563 | 0.497 | 0.552 | 0.121 | 0.147 | 0.147 | 0.129 | 0.144 |
| Guthichaur | 0.23 | 0.291 | 0.272 | 0.682 | 0.465 | 0.566 | 0.563 | 0.497 | 0.552 | 0.129 | 0.157 | 0.156 | 0.138 | 0.153 |
| Tatopani | 0.331 | 0.476 | 0.318 | 0.796 | 0.465 | 0.566 | 0.563 | 0.497 | 0.552 | 0.217 | 0.264 | 0.262 | 0.232 | 0.257 |
| Tila | 0.257 | 0.481 | 0.279 | 0.837 | 0.465 | 0.566 | 0.563 | 0.497 | 0.552 | 0.177 | 0.215 | 0.214 | 0.189 | 0.21 |
| Hima | 0.191 | 0.271 | 0.257 | 0.68 | 0.465 | 0.566 | 0.563 | 0.497 | 0.552 | 0.107 | 0.13 | 0.129 | 0.114 | 0.127 |
| Palata | 0.334 | 0.326 | 0.255 | 0.729 | 0.403 | 0.51 | 0.525 | 0.442 | 0.496 | 0.174 | 0.22 | 0.226 | 0.19 | 0.214 |
| Pachaljharana | 0.225 | 0.321 | 0.223 | 0.755 | 0.403 | 0.51 | 0.525 | 0.442 | 0.496 | 0.121 | 0.153 | 0.158 | 0.133 | 0.149 |
| Sanni Tribeni | 0.226 | 0.322 | 0.193 | 0.785 | 0.403 | 0.51 | 0.525 | 0.442 | 0.496 | 0.126 | 0.16 | 0.165 | 0.139 | 0.156 |
| Naraharinath | 0.348 | 0.431 | 0.282 | 0.792 | 0.403 | 0.51 | 0.525 | 0.442 | 0.496 | 0.196 | 0.249 | 0.256 | 0.216 | 0.242 |
| Mahawai | 0.263 | 0.327 | 0.188 | 0.795 | 0.403 | 0.51 | 0.525 | 0.442 | 0.496 | 0.149 | 0.189 | 0.194 | 0.163 | 0.183 |
| Kalika | 0.623 | 0.302 | 0.617 | 0.359 | 0.403 | 0.51 | 0.525 | 0.442 | 0.496 | 0.159 | 0.202 | 0.208 | 0.175 | 0.196 |
| Naumule | 0.375 | 0.643 | 0.458 | 0.803 | 0.44 | 0.546 | 0.572 | 0.5 | 0.553 | 0.234 | 0.291 | 0.305 | 0.266 | 0.295 |
| Mahabu | 0.3 | 0.451 | 0.408 | 0.688 | 0.44 | 0.546 | 0.572 | 0.5 | 0.553 | 0.161 | 0.199 | 0.209 | 0.183 | 0.202 |
| Bhairabi | 0.333 | 0.474 | 0.398 | 0.717 | 0.44 | 0.546 | 0.572 | 0.5 | 0.553 | 0.186 | 0.231 | 0.242 | 0.211 | 0.234 |
| Thantikandh | 0.309 | 0.427 | 0.465 | 0.612 | 0.44 | 0.546 | 0.572 | 0.5 | 0.553 | 0.147 | 0.183 | 0.191 | 0.167 | 0.185 |
| Bhagawatimai | 0.327 | 0.519 | 0.456 | 0.699 | 0.44 | 0.546 | 0.572 | 0.5 | 0.553 | 0.178 | 0.221 | 0.231 | 0.202 | 0.224 |
| Dungeshwor | 0.267 | 0.497 | 0.452 | 0.684 | 0.44 | 0.546 | 0.572 | 0.5 | 0.553 | 0.142 | 0.176 | 0.185 | 0.162 | 0.179 |
| Gurans | 0.378 | 0.571 | 0.467 | 0.733 | 0.44 | 0.546 | 0.572 | 0.5 | 0.553 | 0.216 | 0.268 | 0.28 | 0.245 | 0.271 |
| Barekot | 0.433 | 0.409 | 0.351 | 0.707 | 0.478 | 0.594 | 0.608 | 0.531 | 0.587 | 0.259 | 0.322 | 0.329 | 0.288 | 0.318 |
| Kuse | 0.38 | 0.458 | 0.343 | 0.756 | 0.478 | 0.594 | 0.608 | 0.531 | 0.587 | 0.243 | 0.302 | 0.309 | 0.27 | 0.298 |
| Junichande | 0.451 | 0.536 | 0.38 | 0.787 | 0.478 | 0.594 | 0.608 | 0.531 | 0.587 | 0.3 | 0.373 | 0.382 | 0.333 | 0.369 |

| Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | Risk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Shiwalaya | 0.259 | 0.37 | 0.303 | 0.72 | 0.478 | 0.594 | 0.608 | 0.531 | 0.587 | 0.158 | 0.196 | 0.201 | 0.175 | 0.194 |
| Sani Bheri | 0.337 | 0.577 | 0.523 | 0.685 | 0.487 | 0.601 | 0.605 | 0.542 | 0.598 | 0.199 | 0.245 | 0.247 | 0.221 | 0.244 |
| Banfikot | 0.324 | 0.443 | 0.524 | 0.569 | 0.487 | 0.601 | 0.605 | 0.542 | 0.598 | 0.159 | 0.196 | 0.197 | 0.177 | 0.195 |
| Tribeni | 0.33 | 0.408 | 0.484 | 0.578 | 0.487 | 0.601 | 0.605 | 0.542 | 0.598 | 0.164 | 0.203 | 0.204 | 0.183 | 0.202 |
| Darma | 0.299 | 0.425 | 0.463 | 0.613 | 0.494 | 0.607 | 0.633 | 0.565 | 0.614 | 0.16 | 0.197 | 0.205 | 0.183 | 0.199 |
| Kumakhmalika | 0.41 | 0.683 | 0.475 | 0.821 | 0.494 | 0.607 | 0.633 | 0.565 | 0.614 | 0.294 | 0.361 | 0.377 | 0.336 | 0.366 |
| Dhorchaur | 0.268 | 0.354 | 0.486 | 0.53 | 0.494 | 0.607 | 0.633 | 0.565 | 0.614 | 0.124 | 0.153 | 0.159 | 0.142 | 0.154 |
| Chhatreshwori | 0.347 | 0.553 | 0.52 | 0.666 | 0.494 | 0.607 | 0.633 | 0.565 | 0.614 | 0.202 | 0.248 | 0.259 | 0.231 | 0.251 |
| Kalimati | 0.519 | 0.618 | 0.507 | 0.734 | 0.494 | 0.607 | 0.633 | 0.565 | 0.614 | 0.333 | 0.409 | 0.427 | 0.381 | 0.414 |
| Tribeni | 0.273 | 0.46 | 0.54 | 0.568 | 0.494 | 0.607 | 0.633 | 0.565 | 0.614 | 0.136 | 0.167 | 0.174 | 0.155 | 0.168 |
| Kapurkot | 0.276 | 0.43 | 0.539 | 0.544 | 0.494 | 0.607 | 0.633 | 0.565 | 0.614 | 0.131 | 0.161 | 0.168 | 0.15 | 0.163 |
| Simta | 0.452 | 0.757 | 0.654 | 0.711 | 0.489 | 0.584 | 0.615 | 0.551 | 0.608 | 0.278 | 0.332 | 0.35 | 0.313 | 0.346 |
| Chingad | 0.275 | 0.454 | 0.628 | 0.478 | 0.489 | 0.584 | 0.615 | 0.551 | 0.608 | 0.114 | 0.136 | 0.143 | 0.128 | 0.141 |
| Barahtal | 0.558 | 0.764 | 0.66 | 0.711 | 0.489 | 0.584 | 0.615 | 0.551 | 0.608 | 0.343 | 0.41 | 0.432 | 0.387 | 0.427 |
| Chaukune | 0.472 | 0.621 | 0.694 | 0.557 | 0.489 | 0.584 | 0.615 | 0.551 | 0.608 | 0.227 | 0.272 | 0.286 | 0.256 | 0.283 |
| Himali | 0.358 | 0.348 | 0.194 | 0.805 | 0.357 | 0.459 | 0.471 | 0.406 | 0.462 | 0.182 | 0.234 | 0.24 | 0.207 | 0.236 |
| Gaumul | 0.238 | 0.307 | 0.182 | 0.783 | 0.357 | 0.459 | 0.471 | 0.406 | 0.462 | 0.118 | 0.151 | 0.155 | 0.134 | 0.152 |
| Swami Kartik | 0.21 | 0.277 | 0.178 | 0.761 | 0.357 | 0.459 | 0.471 | 0.406 | 0.462 | 0.101 | 0.13 | 0.133 | 0.115 | 0.131 |
| Pandav Gupha | 0.188 | 0.276 | 0.182 | 0.756 | 0.357 | 0.459 | 0.471 | 0.406 | 0.462 | 0.09 | 0.115 | 0.118 | 0.102 | 0.116 |
| Chhededaha | 0.277 | 0.383 | 0.247 | 0.785 | 0.357 | 0.459 | 0.471 | 0.406 | 0.462 | 0.137 | 0.177 | 0.181 | 0.156 | 0.178 |
| Kanda | 0.275 | 0.266 | 0.179 | 0.751 | 0.392 | 0.494 | 0.513 | 0.437 | 0.493 | 0.143 | 0.18 | 0.187 | 0.16 | 0.18 |
| Surma | 0.189 | 0.194 | 0.178 | 0.69 | 0.392 | 0.494 | 0.513 | 0.437 | 0.493 | 0.09 | 0.114 | 0.118 | 0.101 | 0.114 |
| Talkot | 0.289 | 0.333 | 0.205 | 0.783 | 0.392 | 0.494 | 0.513 | 0.437 | 0.493 | 0.157 | 0.198 | 0.205 | 0.175 | 0.197 |
| Masta | 0.236 | 0.284 | 0.205 | 0.741 | 0.392 | 0.494 | 0.513 | 0.437 | 0.493 | 0.121 | 0.153 | 0.159 | 0.135 | 0.153 |
| Chabispathivera | 0.262 | 0.417 | 0.216 | 0.843 | 0.392 | 0.494 | 0.513 | 0.437 | 0.493 | 0.153 | 0.193 | 0.2 | 0.171 | 0.193 |
| Durgathali | 0.191 | 0.286 | 0.171 | 0.775 | 0.392 | 0.494 | 0.513 | 0.437 | 0.493 | 0.103 | 0.129 | 0.134 | 0.114 | 0.129 |
| Kedarseu | 0.32 | 0.438 | 0.243 | 0.836 | 0.392 | 0.494 | 0.513 | 0.437 | 0.493 | 0.186 | 0.234 | 0.243 | 0.207 | 0.233 |
| Bithadchir | 0.237 | 0.366 | 0.18 | 0.835 | 0.392 | 0.494 | 0.513 | 0.437 | 0.493 | 0.137 | 0.173 | 0.18 | 0.153 | 0.173 |
| Thalara | 0.281 | 0.369 | 0.249 | 0.771 | 0.392 | 0.494 | 0.513 | 0.437 | 0.493 | 0.15 | 0.189 | 0.197 | 0.167 | 0.189 |
| Khaptadchhanna | 0.252 | 0.41 | 0.246 | 0.809 | 0.392 | 0.494 | 0.513 | 0.437 | 0.493 | 0.141 | 0.178 | 0.185 | 0.158 | 0.178 |
| Byas | 0.316 | 0.309 | 0.648 | 0.335 | 0.461 | 0.548 | 0.572 | 0.503 | 0.558 | 0.086 | 0.103 | 0.107 | 0.094 | 0.104 |
| Dunhu | 0.156 | 0.226 | 0.415 | 0.489 | 0.461 | 0.548 | 0.572 | 0.503 | 0.558 | 0.062 | 0.074 | 0.077 | 0.068 | 0.075 |
| Naugad | 0.29 | 0.291 | 0.45 | 0.511 | 0.461 | 0.548 | 0.572 | 0.503 | 0.558 | 0.121 | 0.144 | 0.15 | 0.132 | 0.146 |
| Apihimal | 0.277 | 0.204 | 0.402 | 0.483 | 0.461 | 0.548 | 0.572 | 0.503 | 0.558 | 0.109 | 0.13 | 0.135 | 0.119 | 0.132 |
| Marma | 0.312 | 0.321 | 0.448 | 0.538 | 0.461 | 0.548 | 0.572 | 0.503 | 0.558 | 0.137 | 0.163 | 0.17 | 0.149 | 0.166 |
| Malikaarjun | 0.294 | 0.404 | 0.495 | 0.564 | 0.461 | 0.548 | 0.572 | 0.503 | 0.558 | 0.135 | 0.161 | 0.168 | 0.148 | 0.164 |
| Lekam | 0.251 | 0.331 | 0.432 | 0.562 | 0.461 | 0.548 | 0.572 | 0.503 | 0.558 | 0.115 | 0.137 | 0.143 | 0.126 | 0.139 |
| Dilasaini | 0.385 | 0.618 | 0.443 | 0.797 | 0.507 | 0.601 | 0.629 | 0.556 | 0.621 | 0.275 | 0.326 | 0.341 | 0.302 | 0.337 |
| Dogadakedar | 0.411 | 0.627 | 0.467 | 0.781 | 0.507 | 0.601 | 0.629 | 0.556 | 0.621 | 0.288 | 0.341 | 0.357 | 0.316 | 0.353 |
| Surnaya | 0.297 | 0.45 | 0.431 | 0.665 | 0.507 | 0.601 | 0.629 | 0.556 | 0.621 | 0.177 | 0.21 | 0.22 | 0.194 | 0.217 |
| Pancheshwar | 0.279 | 0.421 | 0.443 | 0.628 | 0.507 | 0.601 | 0.629 | 0.556 | 0.621 | 0.157 | 0.186 | 0.195 | 0.172 | 0.192 |
| Shivanath | 0.251 | 0.358 | 0.39 | 0.626 | 0.507 | 0.601 | 0.629 | 0.556 | 0.621 | 0.141 | 0.167 | 0.175 | 0.155 | 0.173 |
| Sigas | 0.401 | 0.509 | 0.415 | 0.731 | 0.507 | 0.601 | 0.629 | 0.556 | 0.621 | 0.263 | 0.312 | 0.326 | 0.288 | 0.322 |
| Nawadurga | 0.304 | 0.465 | 0.495 | 0.616 | 0.499 | 0.586 | 0.611 | 0.555 | 0.618 | 0.165 | 0.194 | 0.202 | 0.184 | 0.205 |

| Palika | Exposure | Sensitivity | Adaptive Capacity | Vulnerability | Climate Extreme events baseline | Climate extreme event RCP 4.5 2030 | Climate extreme event RCP 4.5 2050 | Climate extreme events RCP 8.5. 2030 | Climate extreme events RCP 8.5. 2050 | Baseline Risk | Risk RCP 4.5 2030 | Risk RCP 4.5. 2050 | Risk RCP 8.5. 2030 | Risk RCP 8.5 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ajaymeru | 0.274 | 0.418 | 0.494 | 0.577 | 0.499 | 0.586 | 0.611 | 0.555 | 0.618 | 0.14 | 0.164 | 0.171 | 0.155 | 0.173 |
| Bhageshwar | 0.28 | 0.373 | 0.468 | 0.563 | 0.499 | 0.586 | 0.611 | 0.555 | 0.618 | 0.139 | 0.163 | 0.17 | 0.155 | 0.172 |
| Alital | 0.369 | 0.486 | 0.491 | 0.638 | 0.499 | 0.586 | 0.611 | 0.555 | 0.618 | 0.208 | 0.244 | 0.254 | 0.231 | 0.257 |
| Ganayapdhura | 0.336 | 0.522 | 0.475 | 0.684 | 0.499 | 0.586 | 0.611 | 0.555 | 0.618 | 0.203 | 0.238 | 0.248 | 0.226 | 0.251 |
| Purbichauki | 0.362 | 0.524 | 0.423 | 0.735 | 0.478 | 0.573 | 0.604 | 0.527 | 0.59 | 0.225 | 0.27 | 0.284 | 0.248 | 0.278 |
| Sayal | 0.289 | 0.399 | 0.408 | 0.643 | 0.478 | 0.573 | 0.604 | 0.527 | 0.59 | 0.157 | 0.188 | 0.199 | 0.173 | 0.194 |
| Adharsha | 0.341 | 0.491 | 0.432 | 0.698 | 0.478 | 0.573 | 0.604 | 0.527 | 0.59 | 0.201 | 0.241 | 0.254 | 0.222 | 0.248 |
| K I Singh | 0.326 | 0.512 | 0.384 | 0.762 | 0.478 | 0.573 | 0.604 | 0.527 | 0.59 | 0.21 | 0.252 | 0.265 | 0.232 | 0.259 |
| Bogtan | 0.364 | 0.591 | 0.357 | 0.855 | 0.478 | 0.573 | 0.604 | 0.527 | 0.59 | 0.263 | 0.315 | 0.333 | 0.29 | 0.325 |
| Badikedar | 0.377 | 0.532 | 0.374 | 0.789 | 0.478 | 0.573 | 0.604 | 0.527 | 0.59 | 0.252 | 0.302 | 0.318 | 0.277 | 0.31 |
| Jorayal | 0.497 | 0.722 | 0.409 | 0.918 | 0.478 | 0.573 | 0.604 | 0.527 | 0.59 | 0.386 | 0.462 | 0.488 | 0.425 | 0.476 |
| Ramaroshan | 0.406 | 0.476 | 0.359 | 0.756 | 0.449 | 0.546 | 0.576 | 0.5 | 0.563 | 0.244 | 0.296 | 0.313 | 0.271 | 0.306 |
| Mellekh | 0.373 | 0.5 | 0.377 | 0.759 | 0.449 | 0.546 | 0.576 | 0.5 | 0.563 | 0.225 | 0.273 | 0.288 | 0.25 | 0.282 |
| Chaurpati | 0.396 | 0.576 | 0.37 | 0.83 | 0.449 | 0.546 | 0.576 | 0.5 | 0.563 | 0.261 | 0.317 | 0.335 | 0.291 | 0.327 |
| Bannigadhi Jayagadh | 0.237 | 0.352 | 0.257 | 0.749 | 0.449 | 0.546 | 0.576 | 0.5 | 0.563 | 0.141 | 0.171 | 0.181 | 0.157 | 0.177 |
| Dhakari | 0.364 | 0.48 | 0.305 | 0.811 | 0.449 | 0.546 | 0.576 | 0.5 | 0.563 | 0.234 | 0.285 | 0.301 | 0.261 | 0.294 |
| Turmakhad | 0.446 | 0.583 | 0.326 | 0.878 | 0.449 | 0.546 | 0.576 | 0.5 | 0.563 | 0.311 | 0.378 | 0.399 | 0.346 | 0.39 |
| Mohanyal | 0.366 | 0.635 | 0.611 | 0.649 | 0.531 | 0.618 | 0.647 | 0.587 | 0.652 | 0.223 | 0.26 | 0.272 | 0.247 | 0.274 |
| Chure | 0.484 | 0.62 | 0.539 | 0.706 | 0.531 | 0.618 | 0.647 | 0.587 | 0.652 | 0.321 | 0.374 | 0.391 | 0.355 | 0.394 |
| Bardagoriya | 0.384 | 0.562 | 0.532 | 0.663 | 0.531 | 0.618 | 0.647 | 0.587 | 0.652 | 0.239 | 0.278 | 0.291 | 0.264 | 0.294 |
| Janaki | 0.33 | 0.519 | 0.632 | 0.53 | 0.531 | 0.618 | 0.647 | 0.587 | 0.652 | 0.164 | 0.191 | 0.2 | 0.182 | 0.202 |
| Joshipur | 0.413 | 0.548 | 0.56 | 0.624 | 0.531 | 0.618 | 0.647 | 0.587 | 0.652 | 0.242 | 0.282 | 0.295 | 0.268 | 0.297 |
| Kailari | 0.628 | 0.73 | 0.613 | 0.729 | 0.531 | 0.618 | 0.647 | 0.587 | 0.652 | 0.43 | 0.501 | 0.524 | 0.475 | 0.528 |
| Laljhadi | 0.327 | 0.382 | 0.527 | 0.514 | 0.531 | 0.618 | 0.64 | 0.581 | 0.654 | 0.158 | 0.184 | 0.19 | 0.173 | 0.194 |
| Beldandi | 0.272 | 0.399 | 0.518 | 0.538 | 0.531 | 0.618 | 0.64 | 0.581 | 0.654 | 0.137 | 0.16 | 0.166 | 0.15 | 0.169 |

# Annex 12: Risk rank of the municipalities in different projected scenario

### 1. Risk rank of the municipalities RCP 4.5 (2030)

| Rank | Province | Municipality |
|---|---|---|
| Very High (More than 0.485) | Province 1 | Suryodaya |
| | Gandaki Province | Bhanu, Byas, Pokhara Lekhnath, Kushma |
| | Lumbini Province | Sitganga |
| High (0.310 - 0.485) | Province 1 | Phidim, Deumai, Illam, Mai, Arjundhara, Bhadrapur, Birtamod, Gauradhaha, Mechinagar, Shivasataxi, Biratnagar, Patahrishanishchare, Rangeli, Sundarharaicha, Barah, Itahari, Chainpur, Khandbari, Panchakhapan, Shadananda, Solududhakunda, Siddhicharan, Halesi Tuwachung, Rupakot Majhuwagadhi, Katari |
| | Province 2 | Janakpur, Lalbandi, Birgunj |
| | Bagmati Province | Dudhouli, Kamalamai, Manthali, Bhimeshwor, Chautara SangachokGadhi, Melamchi, Banepa, Panauti, Panchkhal, Godawari, Lalitpur, Chandragiri, Belkotgadhi, Bidur, Nilakantha, Hetauda, Thaha, Khairahani, Ratnanagar |
| | Gandaki Province | Palungtar, Bhimad, Shuklagandaki, Chapakot, Galyang, Putalibazar, Waling, Gaidakot, Kawasoti, Madhyabindu |
| | Lumbini Province | Musikot, Rampur, Tansen, Sunwal, Banganga, Buddhabhumi, Shivaraj, Bhumekasthan, Sandhikharka, Pyuthan, Ghorahi, Tulsipur, Barbardiya, Rolpa |
| | Karnali Province | Aathbiskot, Sharada, Gurbhakot, Panchpuri, Bheri |
| | Sudhurpaschim Province | Dhangadhi, Godawari, Bhimdatta, Parashuram |
| Moderate (0.215 - 0.309) | Province 1 | Phungling, Belbari, Letang, Ratuwamai, Sunwarshi, Uralabari, Duhabi, Inaruwa, Ramdhuni, Mahalaxmi, Pakhribas, Dharmadevi, Bhojpur, Chaudandigadhi, Triyuga |
| | Province 2 | Hanumannagar Kankalini, Lahan, Siraha, Chhireshwornath, Gaushala, Haripur, Ishworpur, Jitpur Simara, Kalaiya |
| | Bagmati Province | Ramechhap, Jiri, Barhabise, Dhulikhel, Mandandeupur, Namobuddha, Mahalaxmi, Budhanilakantha, Gokarneshwor, Tarakeshwor, Tokha, Dhunibesi, Kalika, Rapti |
| | Gandaki Province | Gorkha, Besishahar, MadhyaNepal, Rainas, Sundarbazar, Bhirkot, Phalebas, Baglung, Dhorpatan, Galkot, Jaimuni, Devchuli |
| | Lumbini Province | Resunga, Ramgram, Tillotama, Krishnanagar, Sworgadwary, Lamahi, Kohalpur, Nepalgunj, Rajapur |
| | Karnali Province | Bagchaur, Bangad Kupinde, Bheriganga, Birendranagar, Lekbeshi, Dullu, Narayan, Chhedagad, Tribeni Nalagad |
| | Sudhurpaschim Province | Sanphebagar, Dipayal Silgadi, Shikhar, Bhajani, Ghodaghodi, Tikapur, Krishnapur, Patan |
| Low (0.138 - 0.214) | Province 1 | Damak, Kankai, Dhankuta, Laligurans, Myanglung, Madi, Belaka |
| | Province 2 | Dakneshwori, Kanchanrup, Rajbiraj, Surunga, Dhangadhimai, Golbazar, Kalyanpur, Mirchaiya, Sukhipur, Bideha, Ganeshman Charnath, Kamala, Mithila, Mithila Bihari, Nagarain, Sabaila, Sahidnagar, Bardibas, Bhangaha, Barahathawa, Hariwan, Kabilasi, Garuda, Nijgadh, Parsagadhi |
| | Bagmati Province | Changunarayan, Madhyapur Thimi, Suryabinayak, Dakshinkali, Kageshwori Manahora, Kathmandu, Kirtipur, Nagarjun, Shankharapur, Madi |
| | Gandaki Province | |
| | Lumbini Province | Bardaghat, Devdaha, Lumbini Sanskritik, Sainamaina, Siddharthanagar, Maharajgunj, Bansagadhi, Gulariya, Madhuwan, Thakurbaba, Bansagadhi_a |
| | Karnali Province | Chaurjahari, Aathabis, Chamunda Bindrasaini, Chandannath, Tilagufa, Chhayanath Rara, Musikot |
| | Sudhurpaschim Province | Badimalika, Bungal, JayaPrithivi, Kamalbazar, Mangalsen, Panchadewal Binayak, Gauriganga, Lamkichuha, Bedkot, Mahakali, Punarbas, Shuklaphanta, Amargadhi, Dasharathchanda, Purchaudi, Mahakali, Shailyashikhar |

| Rank | Province | Municipality |
|---|---|---|
| Very Low (Less than 0.138) | Province 1 | Dharan |
| | Province 2 | Bode Barsain, Khadak, Saptakoshi, Shambhunath, Karjanha, Dhanusadham, Hansapur, Aurahi, Balwa, Jaleswor, Loharpatti, Manra Siswa, Matihani, Ramgopalpur, Bagmati, Balara, Godaita, Haripurwa, Malangawa, Baudhimai, Brindaban, Chandrapur, Dewahhi Gonahi, Gadhimai, Gaur, Gujara, Ishanath, Katahariya, Madhav Narayan, Maulapur, Paroha, Phatuwa Bijayapur, Rajdevi, Rajpur, Kolhabi, Mahagadhimai, Pacharauta, Simraungadh, Bahudaramai, Pokhariya |
| | Bagmati Province | Bhaktapur, Bharatpur |
| | Gandaki Province | Beni |
| | Lumbini Province | Butwal, Kapilbastu |
| | Karnali Province | Thuli Bheri, Tripurasundari, Khandachakra, Raskot |
| | Sudhurpaschim Province | Budhiganga, Budhinanda, Tribeni, Belauri, Melauli |

## 2. Risk rank of the municipalities RCP 4.5 (2050)

| Rank | Province | Municipality |
|---|---|---|
| Very High ( More than 0.485) | Province 1 | Suryodaya |
| | Bagmati Province | Nilakantha |
| | Gandaki Province | Bhanu, Byas, Pokhara Lekhnath. Kushma |
| | Lumbini Province | Sitganga |
| High (0.310 - 0.485) | Province 1 | Phidim, Illam, Mai, Arjundhara, Bhadrapur, Birtamod, Gauradhaha, Mechinagar, Shivasataxi, Biratnagar, Patahrishanishchare, Rangeli, Sundarharaicha, Barah, Itahari, Chainpur, Khandbari, Panchakhapan, Shadananda, Solududhakunda, Siddhicharan, Halesi Tuwachung, Rupakot Majhuwagadhi, Katari |
| | Province 2 | Janakpur, Lalbandi, Jitpur Simara, Birgunj |
| | Bagmati Province | Dudhouli, Kamalamai, Manthali, Bhimeshwor, Chautara SangachokGadhi, Melamchi, Banepa, Panauti, Panchkhal, Godawari, Lalitpur, Belkotgadhi, Bidur, Hetauda, Thaha, Khairahani, Ratnanagar |
| | Gandaki Province | Palungtar, Besishahar, Sundarbazar, Bhimad, Shuklagandaki, Chapakot, Galyang, Putalibazar, Waling, Gaidakot, Kawasoti, Madhyabindu |
| | Lumbini Province | Musikot, Rampur, Tansen, Sunwal, Banganga, Buddhabhumi, Shivaraj, Bhumekasthan, Sandhikharka, Pyuthan, Sworgadwary, Ghorahi, Tulsipur, Barbardiya, Rajapur, Rolpa |
| | Karnali Province | Aathbiskot, Sharada, Birendranagar, Gurbhakot, Panchpuri, Bheri |
| | Sudhurpaschim Province | Dhangadhi, Godawari, Bhimdatta, Parashuram, Patan |
| Moderate (0.215 - 0.309) | Province 1 | Phungling, Deumai, Belbari, Letang, Ratuwamai, Sunwarshi, Uralabari, Duhabi, Inaruwa, Ramdhuni, Mahalaxmi, Pakhribas, Dharmadevi, Bhojpur, Chaudandigadhi, Triyuga |
| | Province 2 | Hanumannagar Kankalini, Lahan, Siraha, Chhireshwornath, Haripur, Ishworpur, Kalaiya |
| | Bagmati Province | Ramechhap, Barhabise, Dhulikhel, Mandandeupur, Namobuddha, Mahalaxmi, Budhanilakantha, Chandragiri, Gokarneshwor, Tarakeshwor, Tokha, Dhunibesi, Kalika, Rapti |
| | Gandaki Province | Gorkha, MadhyaNepal, Rainas, Bhirkot, Phalebas, Baglung, Dhorpatan, Galkot, Jaimuni, Devchuli |
| | Lumbini Province | Resunga, Ramgram, Tillotama, Krishnanagar, Lamahi, Kohalpur, Nepalgunj |
| | Karnali Province | Bagchaur, Bangad Kupinde, Bheriganga, Lekbeshi, Dullu, Narayan, Chhedagad, Tribeni Nalagad |
| | Sudhurpaschim Province | Mangalsen, Sanphebagar, Dipayal Silgadi, Shikhar, Bhajani, Ghodaghodi, Lamkichuha, Tikapur, Krishnapur, Purchaudi |
| Low (0.138 - 0.214) | Province 1 | Damak, Kankai, Dhankuta, Laligurans, Myanglung, Madi, Belaka |
| | Province 2 | Dakneshwori, Kanchanrup, Rajbiraj, Surunga, Dhangadhimai, Golbazar, Kalyanpur, Mirchaiya, Sukhipur, Bideha, Ganeshman Charnath, Kamala, Mithila, Mithila Bihari, Nagarain, Sabaila, Sahidnagar, Bardibas, Bhangaha, Gaushala, Barahathawa, Hariwan, Kabilasi, Garuda, Nijgadh, Parsagadhi |
| | Bagmati Province | Jiri, Changunarayan, Madhyapur Thimi, Suryabinayak, Dakshinkali, Kageshwori Manahora, Kathmandu, Kirtipur, Nagarjun, Shankharapur, Madi |
| | Gandaki Province | Beni |
| | Lumbini Province | Bardaghat, Devdaha, Lumbini Sanskritik, Sainamaina, Siddharthanagar, Maharajgunj, Bansagadhi, Gulariya, Madhuwan, Thakurbaba, Bansagadhi_a |
| | Karnali Province | Chaurjahari, Aathabis, Chamunda Bindrasaini, Chandannath, Khandachakra, Tilagufa, Chhayanath Rara, Musikot |
| | Sudhurpaschim Province | Badimalika, Bungal, JayaPrithivi, Kamalbazar, Panchadewal Binayak, Gauriganga, Bedkot, Mahakali, Punarbas, Shuklaphanta, Amargadhi, Dasharathchanda, Mahakali, Shailyashikhar |

| Rank | Province | Municipality |
|---|---|---|
| Very Low (Less than 0.138) | Province 1 | Dharan |
| | Province 2 | Bode Barsain, Khadak, Saptakoshi, Shambhunath, Karjanha, Dhanusadham, Hansapur, Aurahi, Balwa, Jaleswor, Loharpatti, Manra Siswa, Matihani, Ramgopalpur, Bagmati, Balara, Godaita, Haripurwa, Malangawa, Baudhimai, Brindaban, Chandrapur, Dewahhi Gonahi, Gadhimai, Gaur, Gujara, Ishanath, Katahariya, Madhav Narayan, Maulapur, Paroha, Phatuwa Bijayapur, Rajdevi, Rajpur, Kolhabi, Mahagadhimai, Pacharauta, Simraungadh, Bahudaramai, Pokhariya |
| | Bagmati Province | Bhaktapur, Bharatpur |
| | Gandaki Province | |
| | Lumbini Province | Butwal, Kapilbastu |
| | Karnali Province | Thuli Bheri, Tripurasundari, Raskot |
| | Sudhurpaschim Province | Budhiganga, Budhinanda, Tribeni, Belauri, Melauli |

### 3. Risk rank of the municipalities RCP 8.5 (2030)

| Rank | Province | Municipality |
|---|---|---|
| Very High (More than 0.485) | Province 1 | Suryodaya |
| | Gandaki Province | Bhanu, Byas, Pokhara Lekhnath |
| | | |
| | Lumbini Province | Sitganga |
| High (0.310 - 0.485) | Province 1 | Phidim, Illam, Mai, Arjundhara, Bhadrapur, Birtamod, Gauradhaha, Mechinagar, Shivasataxi, Biratnagar, Patahrishanishchare, Rangeli, Sundarharaicha, Barah, Itahari, Chainpur, Khandbari, Panchakhapan, Shadananda, Solududhakunda, Siddhicharan, Halesi Tuwachung, Rupakot Majhuwagadhi, Katari |
| | Province 2 | Janakpur, Lalbandi, Birgunj |
| | Bagmati Province | Dudhouli, Kamalamai, Manthali, Bhimeshwor, Chautara SangachokGadhi, Melamchi, Banepa, Panauti, Panchkhal, Godawari, Lalitpur, Belkotgadhi, Bidur, Nilakantha, Hetauda, Thaha, Khairahani |
| | Gandaki Province | Palungtar, Bhimad, Chapakot, Galyang, Putalibazar, Waling, Kushma, Gaidakot, Kawasoti |
| | Lumbini Province | Musikot, Rampur, Tansen, Sunwal, Banganga, Shivaraj, Sandhikharka, Ghorahi, Tulsipur, Barbardiya, Rolpa |
| | Karnali Province | Aathbiskot, Panchpuri |
| | Sudhurpaschim Province | Dhangadhi, Godawari, Bhimdatta |
| Moderate (0.215 - 0.309) | Province 1 | Phungling, Deumai, Belbari, Ratuwamai, Sunwarshi, Uralabari, Duhabi, Inaruwa, Ramdhuni, Mahalaxmi, Dharmadevi, Bhojpur, Chaudandigadhi, Triyuga |
| | Province 2 | Hanumannagar Kankalini, Lahan, Siraha, Chhireshwornath, Gaushala, Haripur, Ishworpur, Jitpur Simara, Kalaiya |
| | Bagmati Province | Ramechhap, Barhabise, Dhulikhel, Namobuddha, Mahalaxmi, Budhanilakantha, Chandragiri, Gokarneshwor, Tarakeshwor, Dhunibesi, Rapti, Ratnanagar |
| | Gandaki Province | Gorkha, Besishahar, MadhyaNepal, Rainas, Sundarbazar, Shuklagandaki, Bhirkot, Phalebas, Baglung, Dhorpatan, Galkot, Jaimuni, Devchuli, Madhyabindu |
| | Lumbini Province | Resunga, Ramgram, Buddhabhumi, Krishnanagar, Bhumekasthan, Pyuthan, Sworgadwary, Lamahi, Kohalpur, Nepalgunj, Rajapur |
| | Karnali Province | Bagchaur, Bangad Kupinde, Sharada, Bheriganga, Birendranagar, Gurbhakot, Dullu, Bheri, Chhedagad, Tribeni Nalagad |
| | Sudhurpaschim Province | Dipayal Silgadi, Shikhar, Bhajani, Ghodaghodi, Tikapur, Krishnapur, Parashuram, Patan |
| Low (0.138 - 0.214) | Province 1 | Damak, Kankai, Letang, Dhankuta, Pakhribas, Laligurans, Myanglung, Madi, Belaka |
| | Province 2 | Dakneshwori, Kanchanrup, Rajbiraj, Surunga, Dhangadhimai, Golbazar, Kalyanpur, Mirchaiya, Sukhipur, Bideha, Ganeshman Charnath, Kamala, Mithila, Mithila Bihari, Nagarain, Sabaila, Sahidnagar, Bardibas, Bhangaha, Barahathawa, Hariwan, Kabilasi, Garuda, Nijgadh, Parsagadhi |
| | Bagmati Province | Jiri, Mandandeupur, Changunarayan, Madhyapur Thimi, Suryabinayak, Dakshinkali, Kageshwori Manahora, Kathmandu, Kirtipur, Nagarjun, Shankharapur, Tokha, Kalika, Madi |
| | Gandaki Province | |
| | Lumbini Province | Bardaghat, Devdaha, Lumbini Sanskritik, Sainamaina, Siddharthanagar, Tillotama, Maharajgunj, Bansagadhi, Gulariya, Madhuwan, Thakurbaba, Bansagadhi_a |
| | Karnali Province | Lekbeshi, Aathabis, Chamunda Bindrasaini, Narayan, Tilagufa, Chhayanath Rara, Musikot |
| | Sudhurpaschim Province | Bungal, JayaPrithivi, Kamalbazar, Mangalsen, Sanphebagar, Gauriganga, Lamkichuha, Bedkot, Mahakali, Punarbas, Shuklaphanta, Amargadhi, Dasharathchanda, Purchaudi, Mahakali, Shailyashikhar |

| Rank | Province | Municipality |
|---|---|---|
| Very Low (Less than 0.138) | Province 1 | Dharan |
| | Province 2 | Bode Barsain, Khadak, Saptakoshi, Shambhunath, Karjanha, Dhanusadham, Hansapur, Aurahi, Balwa, Jaleswor, Loharpatti, Manra Siswa, Matihani, Ramgopalpur, Bagmati, Balara, Godaita, Haripurwa, Malangawa, Baudhimai, Brindaban, Chandrapur, Dewahhi Gonahi, Gadhimai, Gaur, Gujara, Ishanath, Katahariya, Madhav Narayan, Maulapur, Paroha, Phatuwa Bijayapur, Rajdevi, Rajpur, Kolhabi, Mahagadhimai, Pacharauta, Simraungadh, Bahudaramai, Pokhariya |
| | Bagmati Province | Bhaktapur, Bharatpur |
| | Gandaki Province | Beni |
| | Lumbini Province | Butwal, Kapilbastu |
| | Karnali Province | Chaurjahari, Thuli Bheri, Tripurasundari, Chandannath, Khandachakra, Raskot |
| | Sudhurpaschim Province | Badimalika, Budhiganga, Budhinanda, Tribeni, Panchadewal Binayak, Belauri, Melauli |

## 4. Risk rank of the municipalities RCP 8.5 (2050)

| Rank | Province | Municipality |
|---|---|---|
| Very High (More than 0.485) | Province 1 | Suryodaya, Rupakot Majhuwagadhi |
| | Province 2 | Janakpur |
| | Bagmati Province | Nilakantha |
| | Gandaki Province | Bhanu, Byas, Pokhara Lekhnath, Kushma |
| | Lumbini Province | Sitganga |
| High (0.310 - 0.485) | Province 1 | Phidim, Deumai, Illam, Mai, Arjundhara, Bhadrapur, Birtamod, Gauradhaha, Mechinagar, Shivasataxi, Belbari, Biratnagar, Patahrishanishchare, Rangeli, Sundarharaicha, Sunwarshi, Barah, Itahari, Chainpur, Khandbari, Panchakhapan, Bhojpur, Shadananda, Solududhakunda, Siddhicharan, Halesi Tuwachung, Chaudandigadhi, Katari |
| | Province 2 | Lalbandi, Jitpur Simara, Birgunj |
| | Bagmati Province | Dudhouli, Kamalamai, Manthali, Ramechhap, Bhimeshwor, Chautara SangachokGadhi, Melamchi, Banepa, Panauti, Panchkhal, Godawari, Lalitpur, Chandragiri, Belkotgadhi, Bidur, Hetauda, Thaha, Khairahani, Rapti, Ratnanagar |
| | Gandaki Province | Palungtar, Sundarbazar, Bhimad, Shuklagandaki, Chapakot, Galyang, Putalibazar, Waling, Gaidakot, Kawasoti, Madhyabindu |
| | Lumbini Province | Musikot, Rampur, Tansen, Sunwal, Banganga, Buddhabhumi, Shivaraj, Bhumekasthan, Sandhikharka, Pyuthan, Ghorahi, Tulsipur, Barbardiya, Rajapur, Rolpa |
| | Karnali Province | Aathbiskot, Sharada, Gurbhakot, Panchpuri |
| | Sudhurpaschim Province | Dhangadhi, Godawari, Bhimdatta, Parashuram, Patan |
| Moderate (0.215 - 0.309) | Province 1 | Phungling, Letang, Ratuwamai, Uralabari, Duhabi, Inaruwa, Ramdhuni, Dhankuta, Mahalaxmi, Pakhribas, Myanglung, Dharmadevi, Belaka, Triyuga |
| | Province 2 | Hanumannagar Kankalini, Dhangadhimai, Lahan, Siraha, Chhireshwornath, Sahidnagar, Gaushala, Haripur, Ishworpur, Kalaiya |
| | Bagmati Province | Jiri, Barhabise, Dhulikhel, Mandandeupur, Namobuddha, Mahalaxmi, Budhanilakantha, Gokarneshwor, Tarakeshwor, Tokha, Dhunibesi, Kalika, Madi |
| | Gandaki Province | Gorkha, Besishahar, MadhyaNepal, Rainas, Bhirkot, Phalebas, Baglung, Dhorpatan, Galkot, Jaimuni, Devchuli |
| | Lumbini Province | Resunga, Bardaghat, Ramgram, Devdaha, Sainamaina, Tillotama, Krishnanagar, Sworgadwary, Lamahi, Kohalpur, Nepalgunj |
| | Karnali Province | Bagchaur, Bangad Kupinde, Bheriganga, Birendranagar, Lekbeshi, Dullu, Narayan, Bheri, Chhedagad, Tribeni Nalagad |
| | Sudhurpaschim Province | Sanphebagar, Dipayal Silgadi, Shikhar, Bhajani, Ghodaghodi, Lamkichuha, Tikapur, Krishnapur, Purchaudi |
| Low (0.138 - 0.214) | Province 1 | Damak, Kankai, Dharan, Laligurans, Madi |
| | Province 2 | Bode Barsain, Dakneshwori, Kanchanrup, Rajbiraj, Shambhunath, Surunga, Golbazar, Kalyanpur, Mirchaiya, Sukhipur, Bideha, Dhanusadham, Ganeshman Charnath, Hansapur, Kamala, Mithila, Mithila Bihari, Nagarain, Sabaila, Bardibas, Bhangaha, Loharpatti, Barahathawa, Godaita, Hariwan, Kabilasi, Garuda, Nijgadh, Bahudaramai, Parsagadhi |
| | Bagmati Province | Changunarayan, Madhyapur Thimi, Suryabinayak, Dakshinkali, Kageshwori Manahora, Kathmandu, Kirtipur, Nagarjun, Shankharapur |
| | Gandaki Province | Beni |
| | Lumbini Province | Butwal, Lumbini Sanskritik, Siddharthanagar, Maharajgunj, Bansagadhi, Gulariya, Madhuwan, Thakurbaba, Bansagadhi_a |
| | Karnali Province | Chaurjahari, Aathabis, Chamunda Bindrasaini, Chandannath, Tilagufa, Chhayanath Rara, Musikot |
| | Sudhurpaschim Province | Badimalika, Bungal, JayaPrithivi, Kamalbazar, Mangalsen, Panchadewal Binayak, Gauriganga, Bedkot, Mahakali, Punarbas, Shuklaphanta, Amargadhi, Dasharathchanda, Mahakali, Shailyashikhar |

| Rank | Province | Municipality |
|---|---|---|
| Very Low (Less than 0.138) | Province 1 | |
| | Province 2 | Khadak, Saptakoshi, Karjanha, Aurahi, Balwa, Jaleswor, Manra Siswa, Matihani, Ramgopalpur, Bagmati, Balara, Haripurwa, Malangawa, Baudhimai, Brindaban, Chandrapur, Dewahhi Gonahi, Gadhimai, Gaur, Gujara, Ishanath, Katahariya, Madhav Narayan, Maulapur, Paroha, Phatuwa Bijayapur, Rajdevi, Rajpur, Kolhabi, Mahagadhimai, Pacharauta, Simraungadh, Pokhariya |
| | Bagmati Province | Bhaktapur, Bharatpur |
| | Gandaki Province | |
| | Lumbini Province | Kapilbastu |
| | Karnali Province | Thuli Bheri, Tripurasundari, Khandachakra, Raskot |
| | Sudhurpaschim Province | Budhiganga, Budhinanda, Tribeni, Belauri, Melauli |

# Annex 13: Risk rank of rural municipalities in different projected scenario

## 1. Risk rank of the rural municipalities at baseline

| Climate risk rank (Baseline) | Palika |
|---|---|
| Very High (More than 0.520) | Budhiganga, Koshi, Janaknandani, Bagmati, Bakaiya, Bhimphedi, Madi, Pratappur, Mayadevi, Rapti Sonari |
| High (0.336 - 0.520) | Jhapa, Kachankawal, Kamal, Dhanpalthan, Gramthan, Jahada, Katahari, Bhokraha Narsingh, Dewanganj, Gadhi, Harinagar, Laxmipur Patari, Pipra, Sonama, Hariharpurgadhi, Marin, Tinpatan, Bigu, Benighat Rorang, Thakre, Manahari, Raksirang, Marsyangdi, Annapurna, Sarawal, Susta, Gaidahawa, Siyari, Bijayanagar, Mayadevi, Suddhodhan, Yashodhara, Gadhawa, Rajpur, Rapti, Baijanath, Duduwa, Janki, Khajura, Badhaiyatal, Barahtal, Jorayal, Kailari, Binayee Tribeni |
| Moderate (0.227 - 0.335) | Phaktanglung, Falelung, Hilihang, Miklajung, Barhadashi, Buddhashanti, Gauriganj, Haldibari, Kanepokhari, Kerabari, Miklajung, Barju, Bhotkhola, Makalu, Khumbupasanglahmu, Rautamai, Udayapurgadhi, Agnisair Krishna Savaran, Belhi Chapena, Chhinnamasta, Rupani, Tilathi Koiladi, Aurahi, Bariyarpatti, Naraha, Nawarajpur, Sakhuwanankarkatti, Aaurahi, Bateshwor, Lakshminiya, Ekdanra, Mahottari, Samsi, Bramhapuri, Chandranagar, Ramnagar, Golanjor, Phikkal, Sunkoshi, Khadadevi, Gaurishankar, Kalinchok, Melung, Balefi, Bhotekoshi, Helambu, Indrawati, Jugal, Panchpokhari Thangpal, Tripurasundari, Roshi, Dupcheshwar, Kakani, Shivapuri, Gosaikunda, Gajuri, Galchi, Jwalamukhi, Siddhalek, Kailash, Makawanpurgadhi, Durga Bhagwati, Yemunamai, Adarshkotwal, Bishrampur, Parwanipur, Pheta, Prasauni, SakhuwaPrasauni, Sahid Lakhan, Siranchok, Barpak Sulikot, Bandipur, Rhishing, Modi, Badigad, Nisikhola, Madane, Rainadevi Chhahara, Palhi Nandan, Kotahimai, Marchawari, Omsatiya, Rohini, Sammarimai, Panini, Ayirabati, Jhimruk, Naubahini, Runtigadi, Suwarnabati, Tribeni, Kalimati, Kumakha, Babai, Narainapur, Geruwa, Chaukune, Simta, Naumule, Barekot, Junichande, Kuse, Chaurpati, Dhakari, Ramaroshan, Turmakhad, Badikedar, Bogtan, Bardagoriya, Chure, Joshipur, Dilasaini, Dogadakedar, Sigas, Putha Uttarganga, Sisne |
| Low (0.145 - 0.226) | Meringden, Sidingba, Sirijangha, Pathibhara Yangwarak, Falgunanda, Kummayak, Yangwarak, Chulachuli, Fakphokthum, Maijogmai, Mangsebung, Rong, Sandakpur, Chaubise, Sangurigadhi, Aathrai, Silichong, Aamchowk, Arun, Hatuwagadhi, Ramprasad Rai, Salpasilichho, Tyamkemaiyung, Thulung Dudhkoshi, Dudhkoshi, Champadevi, Khijidemba, Manebhanjyang, Molung, Sunkoshi, Diprung, Khotehang, Balan Bihul, Bishnupur, Mahadeva, Tirahut, Arnama, Bhagawanpur, Bishnupur, Dhanauji, Mukhiyapatti Musarmiya, Basbariya, Bishnu, Chakraghatta, Dhankaul, Kaudena, Parsa, Ghanglekh, Doramba, Gokulganga, Likhu Tamakoshi, Sunapati, Umakunda, Baiteshwor, Sailung, Tamakoshi, Sunkoshi, Bhumlu, Chaurideurali, Mahabharat, Temal, Likhu, Panchakanya, Tadi, Naukunda, Gangajamuna, Netrawati Dabjong, Rubi Valley, Tripura Sundari, Indrasarowar, Baragadhi, Devtal, Karaiyamai, Suwarna, Bindabasini, Chhipaharmai, Jagarnathpur, Jirabhawani, Paterwasugauli, Thori, Ichchhyakamana, Aarughat, Ajirkot, Bhimsen Thapa, Chum Nubri, Dharche, Gandaki, Dordi, Anbukhaireni, Devghat, Ghiring, Myagde, Aandhikhola, Harinas, Machhapuchchhre, Annapurna, Dhaulagiri, Malika, Raghuganga, Jaljala, Kanthekhola, Chandrakot, Chatrakot, Dhurkot, Gulmidarbar, Isma, Kaligandaki, Malika, Ruru, Satyawati, Bagnaskali, Mathagadhi, Nisdi, Purbakhola, Rambha, Tinau, Kanchan, Sudhdhodhan, Chhatradev, Malarani, Gaumukhi, Mallarani, Mandavi, Sarumarani, Pariwartan, Lungri, Sukidaha, Sunchhahari, Banfikot, Sani Bheri, Tribeni, Chhatreshwori, Darma, Banglachuli, Dangisharan, Bhagawatimai, Bhairabi, Gurans, Mahabu, Thantikandh, Shiwalaya, Patrasi, Tatopani, Tila, Kalika, Mahawai, Naraharinath, Palata, Mugu mkarmarong, Simkot, Himali, Chabispathivera, Kedarseu, Talkot, Thalara, Mellekh, Adharsha, K I Sin, Purbichauki, Sayal, Janaki, Mohanyal, Laljhadi, Alital, Ganayapdhura, Nawadurga, Pancheshwar, Surnaya, Bulingtar, Hupsekot |

| Climate risk rank (Baseline) | Palika |
|---|---|
| Very Low (Less than 0.144) | Aathrai Tribeni, Maiwakhola, Mikwakhola, Tumbewa, Chhathar Jorpati, Shahidbhumi, Chhathar, Menchayam, Phedap, Chichila, Sabhapokhari, Pauwadungma, Likhupike, Mahakulung, Nechasalyan, Sotang, Chisankhugadhi, Likhu, Ainselukhark, Barahapokhari, Jantedhunga, Kepilasagadhi, Rawa Besi, Sakela, Sunkoshi, Tapli, Lisangkhu Pakhar, Bethanchowk, Khanikhola, Bagmati, Konjyosom, Mahankal, Kispang, Myagang, Suryagadhi, Tarkeshwar, Kalika, Aamachodingmo, Uttargaya, Khaniyabash, Dhobini, Kalikamai, Pakahamainpur, Dudhpokhari, Kwholasothar, Arjunchaupari, Biruwa, Kaligandagi, Phedikhola, Rupa, Chame, Narpa Bhumi, Nasho, Manang Nshiang, Waragun Muktikshetra, Lo-Ghekar Damodarkunda, Gharapjhong, Lomanthang, Thasang, Mangala, Bihadi, Mahashila, Painyu, Bareng, Taman Khola, Tara Khola, Ribdikot, Madi, Thawang, Siddha Kumakha, Kapurkot, Tribeni, Shantinagar, Chingad, Dungeshwor, Chharka Tangsong, Dolpo Buddha, Jagadulla, Kaike, Mudkechula, Shey Phoksundo, Guthichaur, Hima, Kanakasundari, Sinja, Pachaljharana, Sanni Tribeni, Khatyad, Soru, Adanchuli, Chankheli, Kharpunath, Namkha, Sarkegad, Tanjakot, Chhededaha, Gaumul, Jagannath, Swami Kartik, Bithadchir, Durgathali, Saa Paal, Khaptadchhanna, Masta, Surma, Bannigadhi Jayagadh, Beldandi, Ajaymeru, Bhageshwar, Shivanath, Apihimal, Byas, Dunhu, Lekam, Malikaarjun, Marma, Naugad, Bungdikali, Bhume |

## 2. Risk rank of the rural municipalities at RCP 4.5 (2030)

| Climate risk rank (RCP4.5 2030) | Palika |
|---|---|
| Very High (More than 0.520) | Kachankawal, Budhiganga, Koshi, Janaknandani, Tinpatan, Benighat Rorang, Bagmati, Bakaiya, Bhimphedi, Manahari, Madi, Pratappur, Mayadevi, Suddhodhan, Baijanath, Khajura, Rapti Sonari |
| High (0.336 - 0.520) | Phaktanglung, Barhadashi, Gauriganj, Jhapa, Kamal, Dhanpalthan, Gramthan, Jahada, Kanepokhari, Katahari, Bhokraha Narsingh, Dewanganj, Gadhi, Harinagar, Bhotkhola, Udayapurgadhi, Bariyarpatti, Laxmipur Patari, Naraha, Bateshwor, Lakshminiya, Ekdanra, Pipra, Samsi, Sonama, Chandranagar, Hariharpurgadhi, Marin, Bigu, Gaurishankar, Kalinchok, Indrawati, Jugal, Tripurasundari, Roshi, Dupcheshwar, Kakani, Gajuri, Thakre, Makawanpurgadhi, Raksirang, Durga Bhagwati, Yemunamai, Prasauni, Sahid Lakhan, Marsyangdi, Annapurna, Modi, Badigad, Nisikhola, Sarawal, Susta, Gaidahawa, Kotahimai, Rohini, Siyari, Bijayanagar, Mayadevi, Yashodhara, Jhimruk, Naubahini, Runtigadi, Suwarnabati, Tribeni, Kalimati, Kumakha, Gadhawa, Rajpur, Rapti, Duduwa, Janki, Badhaiyatal, Barahtal, Junichande, Turmakhad, Jorayal, Chure, Kailari, Dogadakedar, Binayee Tribeni |
| Moderate (0.227 - 0.335) | Sirijangha, Falelung, Falgunanda, Hilihang, Miklajung, Yangwarak, Fakphokthum, Mangsebung, Buddhashanti, Haldibari, Kerabari, Miklajung, Barju, Aathrai, Makalu, Khumbupasanglahmu, Manebhanjyang, Sunkoshi, Rautamai, Agnisair Krishna Savaran, Belhi Chapena, Chhinnamasta, Mahadeva, Rupani, Tilathi Koiladi, Arnama, Aurahi, Bhagawanpur, Bishnupur, Nawarajpur, Sakhuwanankarkatti, Aaurahi, Dhanauji, Mukhiyapatti Musarmiya, Mahottari, Bishnu, Bramhapuri, Chakraghatta, Dhankaul, Kaudena, Ramnagar, Golanjor, Phikkal, Sunkoshi, Doramba, Gokulganga, Khadadevi, Umakunda, Baiteshwor, Melung, Sailung, Tamakoshi, Balefi, Bhotekoshi, Helambu, Panchpokhari Thangpal, Likhu, Shivapuri, Gosaikunda, Galchi, Jwalamukhi, Netrawati Dabjong, Siddhalek, Kailash, Adarshkotwal, Bishrampur, Devtal, Karaiyamai, Parwanipur, Pheta, Suwarna, Bindabasini, Jagarnathpur, SakhuwaPrasauni, Thori, Aarughat, Bhimsen Thapa, Chum Nubri, Siranchok, Barpak Sulikot, Dordi, Anbukhaireni, Bandipur, Devghat, Myagde, Rhishing, Chandrakot, Chatrakot, Dhurkot, Isma, Kaligandaki, Madane, Malika, Satyawati, Mathagadhi, Nisdi, Rainadevi Chhahara, Rambha, Palhi Nandan, Kanchan, Marchawari, Omsatiya, Sammarimai, Sudhdhodhan, Chhatradev, Malarani, Panini, Ayirabati, Gaumukhi, Sarumarani, Pariwartan, Lungri, Sunchhahari, Sani Bheri, Chhatreshwori, Babai, Narainapur, Geruwa, Chaukune, Simta, Bhairabi, Gurans, Naumule, Barekot, Kuse, Patrasi, Tatopani, Naraharinath, Mugu mkarmarong, Himali, Kedarseu, Chaurpati, Dhakari, Mellekh, Ramaroshan, Adharsha, Badikedar, Bogtan, K I Sin, Purbichauki, Bardagoriya, Joshipur, Mohanyal, Alital, Ganayapdhura, Dilasaini, Sigas, Putha Uttarganga, Sisne |
| Low (0.145 - 0.226) | Meringden, Sidingba, Pathibhara Yangwarak, Kummayak, Chulachuli, Maijogmai, Rong, Sandakpur, Chaubise, Shahidbhumi, Sangurigadhi, Chhathar, Phedap, Sabhapokhari, Silichong, Aamchowk, Arun, Hatuwagadhi, Pauwadungma, Ramprasad Rai, Salpasilichho, Tyamkemaiyung, Thulung Dudhkoshi, Dudhkoshi, Mahakulung, Sotang, Champadevi, Chisankhugadhi, Khijidemba, Molung, Diprung, Kepilasagadhi, Khotehang, Balan Bihul, Bishnupur, Tirahut, Basbariya, Parsa, Ghanglekh, Likhu Tamakoshi, Sunapati, Lisangkhu Pakhar, Sunkoshi, Bethanchowk, Bhumlu, Chaurideurali, Mahabharat, Temal, Bagmati, Kispang, Myagang, Panchakanya, Suryagadhi, Tadi, Tarkeshwar, Naukunda, Gangajamuna, Khaniyabash, Rubi Valley, Tripura Sundari, Indrasarowar, Baragadhi, Chhipaharmai, Jirabhawani, Kalikamai, Pakahamainpur, Paterwasugauli, Ichchhyakamana, Ajirkot, Dharche, Gandaki, Ghiring, Aandhikhola, Biruwa, Harinas, Kaligandagi, Machhapuchchhre, Annapurna, Dhaulagiri, Malika, Raghuganga, Jaljala, Kanthekhola, Gulmidarbar, Ruru, Bagnaskali, Purbakhola, Ribdikot, Tinau, Mallarani, Mandavi, Madi, Sukidaha, Banfikot, Tribeni, Darma, Siddha Kumakha, Kapurkot, Tribeni, Banglachuli, Dangisharan, Shantinagar, Bhagawatimai, Dungeshwor, Mahabu, Thantikandh, Shiwalaya, Guthichaur, Kanakasundari, Sinja, Tila, Kalika, Mahawai, Pachaljharana, Palata, Sanni Tribeni, Khatyad, Soru, Chankheli, Kharpunath, Namkha, Sarkegad, Simkot, Chhededaha, Gaumul, Bithadchir, Chabispathivera, Saa Paal, Khaptadchhanna, Masta, Talkot, Thalara, Bannigadhi Jayagadh, Sayal, Janaki, Beldandi, Laljhadi, Ajaymeru, Bhageshwar, Nawadurga, Pancheshwar, Shivanath, Surnaya, Malikaarjun, Marma, Bulingtar, Hupsekot, Bhume |
| Very Low (Less than 0.144) | Aathrai Tribeni, Maiwakhola, Mikwakhola, Tumbewa, Chhathar Jorpati, Menchayam, Chichila, Likhupike, Nechasalyan, Likhu, Ainselukhark, Barahapokhari, Jantedhunga, Rawa Besi, Sakela, Sunkoshi, Tapli, Khanikhola, Konjyosom, Mahankal, Kalika, Aamachodingmo, Uttargaya, Dhobini, Dudhpokhari, Kwholasothar, Arjunchaupari, Phedikhola, Rupa, Chame, Narpa Bhumi, Nasho, Manang Nshiang, Waragun Muktikshetra, Lo-Ghekar Damodarkunda, Gharapjhong, Lomanthang, Thasang, Mangala, Bihadi, Mahashila, Painyu, Bareng, Taman Khola, Tara Khola, Thawang, Chingad, Chharka Tangsong, Dolpo Buddha, Jagadulla, Kaike, Mudkechula, Shey Phoksundo, Hima, Adanchuli, Tanjakot, Jagannath, Swami Kartik, Durgathali, Surma, Apihimal, Byas, Dunhu, Lekam, Naugad, Bungdikali |

### 3. Risk rank of the rural municipalities at RCP 4.5 (2050)

| Climate risk rank (RCP4.5 2050) | Palika |
|---|---|
| Very High (More than 0.520) | Kachankawal, Budhiganga, Koshi, Janaknandani, Tinpatan, Benighat Rorang, Bagmati, Bakaiya, Bhimphedi, Manahari, Madi, Pratappur, Mayadevi, Bijayanagar, Suddhodhan, Rajpur, Baijanath, Khajura, Rapti Sonari, Kailari |
| High (0.336 - 0.520) | Phaktanglung, Gauriganj, Jhapa, Kamal, Dhanpalthan, Gramthan, Jahada, Kanepokhari, Katahari, Bhokraha Narsingh, Dewanganj, Gadhi, Harinagar, Bhotkhola, Udayapurgadhi, Laxmipur Patari, Naraha, Bateshwor, Lakshminiya, Ekdanra, Pipra, Samsi, Sonama, Chandranagar, Hariharpurgadhi, Marin, Bigu, Gaurishankar, Kalinchok, Indrawati, Jugal, Panchpokhari Thangpal, Tripurasundari, Roshi, Dupcheshwar, Kakani, Gajuri, Thakre, Makawanpurgadhi, Raksirang, Durga Bhagwati, Yemunamai, Prasauni, Sahid Lakhan, Marsyangdi, Rhishing, Annapurna, Modi, Badigad, Nisikhola, Sarawal, Susta, Gaidahawa, Kotahimai, Rohini, Siyari, Mayadevi, Yashodhara, Jhimruk, Naubahini, Runtigadi, Suwarnabati, Tribeni, Kalimati, Kumakha, Gadhawa, Rapti, Duduwa, Janki, Badhaiyatal, Barahtal, Simta, Junichande, Turmakhad, Jorayal, Chure, Dilasaini, Dogadakedar, Binayee Tribeni |
| Moderate (0.227 - 0.335) | Sirijangha, Falelung, Falgunanda, Hilihang, Miklajung, Yangwarak, Fakphokthum, Mangsebung, Barhadashi, Buddhashanti, Haldibari, Kerabari, Miklajung, Barju, Aathrai, Makalu, Khumbupasanglahmu, Manebhanjyang, Sunkoshi, Rautamai, Agnisair Krishna Savaran, Belhi Chapena, Chhinnamasta, Mahadeva, Rupani, Tilathi Koiladi, Arnama, Aurahi, Bariyarpatti, Bishnupur, Nawarajpur, Sakhuwanankarkatti, Aaurahi, Dhanauji, Mukhiyapatti Musarmiya, Mahottari, Bishnu, Bramhapuri, Chakraghatta, Dhankaul, Kaudena, Ramnagar, Golanjor, Phikkal, Sunkoshi, Doramba, Khadadevi, Umakunda, Baiteshwor, Melung, Sailung, Tamakoshi, Balefi, Bhotekoshi, Helambu, Likhu, Shivapuri, Gosaikunda, Galchi, Jwalamukhi, Netrawati Dabjong, Siddhalek, Kailash, Adarshkotwal, Baragadhi, Bishrampur, Devtal, Karaiyamai, Parwanipur, Pheta, Suwarna, Bindabasini, Jagarnathpur, SakhuwaPrasauni, Thori, Aarughat, Bhimsen Thapa, Chum Nubri, Gandaki, Siranchok, Barpak Sulikot, Dordi, Anbukhaireni, Bandipur, Devghat, Myagde, Raghuganga, Kanthekhola, Chandrakot, Chatrakot, Dhurkot, Gulmidarbar, Isma, Kaligandaki, Madane, Malika, Satyawati, Mathagadhi, Nisdi, Rainadevi Chhahara, Rambha, Palhi Nandan, Kanchan, Marchawari, Omsatiya, Sammarimai, Sudhdhodhan, Chhatradev, Malarani, Panini, Ayirabati, Gaumukhi, Sarumarani, Pariwartan, Lungri, Sukidaha, Sunchhahari, Sani Bheri, Chhatreshwori, Babai, Banglachuli, Narainapur, Geruwa, Chaukune, Bhagawatimai, Bhairabi, Gurans, Naumule, Barekot, Kuse, Patrasi, Tatopani, Naraharinath, Mugu mkarmarong, Himali, Kedarseu, Chaurpati, Dhakari, Mellekh, Ramaroshan, Adharsha, Badikedar, Bogtan, K I Sin, Purbichauki, Bardagoriya, Joshipur, Mohanyal, Alital, Ganayapdhura, Sigas, Putha Uttarganga, Sisne |
| Low (0.145 - 0.226) | Meringden, Sidingba, Pathibhara Yangwarak, Kummayak, Chulachuli, Maijogmai, Rong, Sandakpur, Chaubise, Shahidbhumi, Sangurigadhi, Phedap, Sabhapokhari, Silichong, Aamchowk, Arun, Hatuwagadhi, Pauwadungma, Ramprasad Rai, Salpasilichho, Tyamkemaiyung, Thulung Dudhkoshi, Dudhkoshi, Mahakulung, Sotang, Champadevi, Chisankhugadhi, Khijidemba, Molung, Diprung, Kepilasagadhi, Khotehang, Balan Bihul, Bishnupur, Tirahut, Bhagawanpur, Basbariya, Parsa, Ghanglekh, Gokulganga, Likhu Tamakoshi, Sunapati, Lisangkhu Pakhar, Sunkoshi, Bethanchowk, Bhumlu, Chaurideurali, Mahabharat, Temal, Bagmati, Kispang, Myagang, Panchakanya, Suryagadhi, Tadi, Tarkeshwar, Naukunda, Uttargaya, Gangajamuna, Khaniyabash, Rubi Valley, Tripura Sundari, Indrasarowar, Chhipaharmai, Jirabhawani, Kalikamai, Pakahamainpur, Paterwasugauli, Ichchhyakamana, Ajirkot, Dharche, Ghiring, Aandhikhola, Biruwa, Harinas, Kaligandagi, Machhapuchchhre, Annapurna, Dhaulagiri, Malika, Jaljala, Tara Khola, Ruru, Bagnaskali, Purbakhola, Ribdikot, Tinau, Mallarani, Mandavi, Madi, Thawang, Banfikot, Tribeni, Darma, Siddha Kumakha, Kapurkot, Tribeni, Dangisharan, Shantinagar, Dungeshwor, Mahabu, Thantikandh, Shiwalaya, Guthichaur, Kanakasundari, Sinja, Tila, Kalika, Mahawai, Pachaljharana, Palata, Sanni Tribeni, Khatyad, Soru, Chankheli, Kharpunath, Namkha, Sarkegad, Simkot, Chhededaha, Gaumul, Bithadchir, Chabispathivera, Saa Paal, Khaptadchhanna, Masta, Talkot, Thalara, Bannigadhi Jayagadh, Sayal, Janaki, Beldandi, Laljhadi, Ajaymeru, Bhageshwar, Nawadurga, Pancheshwar, Shivanath, Surnaya, Malikaarjun, Marma, Naugad, Bulingtar, Hupsekot, Bhume |
| Very Low (Less than 0.144) | Aathrai Tribeni, Maiwakhola, Mikwakhola, Tumbewa, Chhathar Jorpati, Chhathar, Menchayam, Chichila, Likhupike, Nechasalyan, Likhu, Ainselukhark, Barahapokhari, Jantedhunga, Rawa Besi, Sakela, Sunkoshi, Tapli, Khanikhola, Konjyosom, Mahankal, Kalika, Aamachodingmo, Dhobini, Dudhpokhari, Kwholasothar, Arjunchaupari, Phedikhola, Rupa, Chame, Narpa Bhumi, Nasho, Manang Nshiang, Waragun Muktikshetra, Lo-Ghekar Damodarkunda, Gharapjhong, Lomanthang, Thasang, Mangala, Bihadi, Mahashila, Painyu, Bareng, Taman Khola, Chingad, Chharka Tangsong, Dolpo Buddha, Jagadulla, Kaike, Mudkechula, Shey Phoksundo, Hima, Adanchuli, Tanjakot, Jagannath, Swami Kartik, Durgathali, Surma, Apihimal, Byas, Dunhu, Lekam, Bungdikali |

## 4. Risk rank of the rural municipalities at RCP 8.5 (2030)

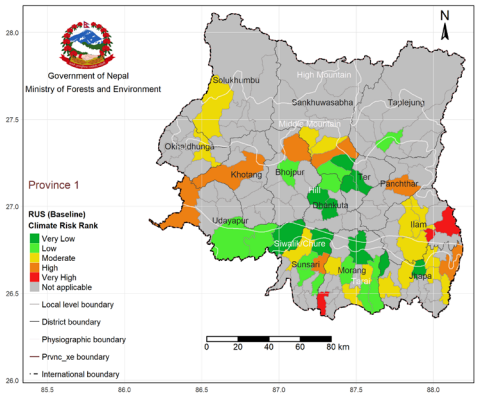
| Climate risk rank (RCP8.5 2030) | Palika |
|---|---|
| Very High (More than 0.520) | Kachankawal, Budhiganga, Koshi, Janaknandani, Tinpatan, Bagmati, Bakaiya, Bhimphedi, Madi, Pratappur, Mayadevi, Suddhodhan, Baijanath, Khajura, Rapti Sonari |
| High (0.336 - 0.520) | Jhapa, Kamal, Dhanpalthan, Gramthan, Jahada, Kanepokhari, Katahari, Bhokraha Narsingh, Dewanganj, Gadhi, Harinagar, Udayapurgadhi, Laxmipur Patari, Naraha, Bateshwor, Lakshminiya, Ekdanra, Pipra, Samsi, Sonama, Chandranagar, Hariharpurgadhi, Marin, Bigu, Gaurishankar, Kalinchok, Indrawati, Jugal, Tripurasundari, Roshi, Kakani, Benighat Rorang, Thakre, Makawanpurgadhi, Manahari, Raksirang, Durga Bhagwati, Yemunamai, Prasauni, Marsyangdi, Annapurna, Badigad, Sarawal, Susta, Gaidahawa, Kotahimai, Rohini, Siyari, Bijayanagar, Mayadevi, Yashodhara, Naubahini, Runtigadi, Suwarnabati, Tribeni, Kalimati, Kumakha, Gadhawa, Rajpur, Rapti, Duduwa, Janki, Badhaiyatal, Barahtal, Turmakhad, Jorayal, Chure, Kailari, Binayee Tribeni |
| Moderate (0.227 - 0.335) | Phaktanglung, Sirijangha, Falelung, Falgunanda, Hilihang, Miklajung, Yangwarak, Fakphokthum, Mangsebung, Barhadashi, Buddhashanti, Gauriganj, Haldibari, Kerabari, Miklajung, Barju, Aathrai, Bhotkhola, Makalu, Khumbupasanglahmu, Manebhanjyang, Sunkoshi, Rautamai, Agnisair Krishna Savaran, Belhi Chapena, Chhinnamasta, Mahadeva, Rupani, Tilathi Koiladi, Arnama, Aurahi, Bariyarpatti, Bishnupur, Nawarajpur, Sakhuwanankarkatti, Aaurahi, Dhanauji, Mukhiyapatti Musarmiya, Mahottari, Bishnu, Bramhapuri, Chakraghatta, Dhankaul, Kaudena, Ramnagar, Golanjor, Phikkal, Sunkoshi, Doramba, Khadadevi, Umakunda, Baiteshwor, Melung, Sailung, Tamakoshi, Balefi, Bhotekoshi, Helambu, Panchpokhari Thangpal, Dupcheshwar, Likhu, Shivapuri, Gosaikunda, Gajuri, Galchi, Jwalamukhi, Siddhalek, Kailash, Adarshkotwal, Bishrampur, Karaiyamai, Parwanipur, Pheta, Suwarna, Jagarnathpur, SakhuwaPrasauni, Thori, Chum Nubri, Sahid Lakhan, Siranchok, Barpak Sulikot, Dordi, Anbukhaireni, Bandipur, Myagde, Rhishing, Modi, Nisikhola, Dhurkot, Isma, Madane, Malika, Satyawati, Nisdi, Rainadevi Chhahara, Rambha, Palhi Nandan, Kanchan, Marchawari, Omsatiya, Sammarimai, Sudhdhodhan, Chhatradev, Malarani, Panini, Ayirabati, Gaumukhi, Jhimruk, Sarumarani, Pariwartan, Lungri, Chhatreshwori, Babai, Narainapur, Geruwa, Chaukune, Simta, Gurans, Naumule, Barekot, Junichande, Kuse, Tatopani, Chaurpati, Dhakari, Mellekh, Ramaroshan, Badikedar, Bogtan, K I Sin, Purbichauki, Bardagoriya, Joshipur, Mohanyal, Alital, Dilasaini, Dogadakedar, Sigas, Putha Uttarganga, Sisne |
| Low (0.145 - 0.226) | Meringden, Sidingba, Pathibhara Yangwarak, Kummayak, Chulachuli, Maijogmai, Rong, Sandakpur, Chaubise, Shahidbhumi, Sangurigadhi, Phedap, Sabhapokhari, Silichong, Aamchowk, Arun, Hatuwagadhi, Ramprasad Rai, Salpasilichho, Tyamkemaiyung, Thulung Dudhkoshi, Dudhkoshi, Mahakulung, Sotang, Champadevi, Chisankhugadhi, Khijidemba, Molung, Diprung, Kepilasagadhi, Khotehang, Balan Bihul, Bishnupur, Tirahut, Bhagawanpur, Basbariya, Parsa, Ghanglekh, Gokulganga, Likhu Tamakoshi, Sunapati, Lisangkhu Pakhar, Sunkoshi, Bhumlu, Chaurideurali, Mahabharat, Temal, Bagmati, Kispang, Myagang, Panchakanya, Suryagadhi, Tadi, Naukunda, Gangajamuna, Netrawati Dabjong, Rubi Valley, Tripura Sundari, Indrasarowar, Baragadhi, Devtal, Bindabasini, Chhipaharmai, Jirabhawani, Kalikamai, Pakahamainpur, Paterwasugauli, Ichchhyakamana, Aarughat, Ajirkot, Bhimsen Thapa, Dharche, Gandaki, Devghat, Ghiring, Aandhikhola, Biruwa, Harinas, Kaligandagi, Machhapuchchhre, Annapurna, Dhaulagiri, Malika, Raghuganga, Jaljala, Kanthekhola, Chandrakot, Chatrakot, Gulmidarbar, Kaligandaki, Ruru, Bagnaskali, Mathagadhi, Purbakhola, Ribdikot, Tinau, Mallarani, Mandavi, Sukidaha, Sunchhahari, Banfikot, Sani Bheri, Tribeni, Darma, Kapurkot, Tribeni, Banglachuli, Dangisharan, Shantinagar, Bhagawatimai, Bhairabi, Dungeshwor, Mahabu, Thantikandh, Shiwalaya, Kanakasundari, Patrasi, Tila, Kalika, Mahawai, Naraharinath, Palata, Khatyad, Mugu mkarmarong, Chankheli, Namkha, Simkot, Chhededaha, Himali, Bithadchir, Chabispathivera, Saa Paal, Kedarseu, Khaptadchhanna, Talkot, Thalara, Bannigadhi Jayagadh, Adharsha, Sayal, Janaki, Beldandi, Laljhadi, Ajaymeru, Bhageshwar, Ganayapdhura, Nawadurga, Pancheshwar, Shivanath, Surnaya, Malikaarjun, Marma, Bulingtar, Hupsekot, Bhume |
| Very Low (Less than 0.144) | Aathrai Tribeni, Maiwakhola, Mikwakhola, Tumbewa, Chhathar Jorpati, Chhathar, Menchayam, Chichila, Pauwadungma, Likhupike, Nechasalyan, Likhu, Ainselukhark, Barahapokhari, Jantedhunga, Rawa Besi, Sakela, Sunkoshi, Tapli, Bethanchowk, Khanikhola, Konjyosom, Mahankal, Tarkeshwar, Kalika, Aamachodingmo, Uttargaya, Khaniyabash, Dhobini, Dudhpokhari, Kwholasothar, Arjunchaupari, Phedikhola, Rupa, Chame, Narpa Bhumi, Nasho, Manang Nshiang, Waragun Muktikshetra, Lo-Ghekar Damodarkunda, Gharapjhong, Lomanthang, Thasang, Mangala, Bihadi, Mahashila, Painyu, Bareng, Taman Khola, Tara Khola, Madi, Thawang, Siddha Kumakha, Chingad, Chharka Tangsong, Dolpo Buddha, Jagadulla, Kaike, Mudkechula, Shey Phoksundo, Guthichaur, Hima, Sinja, Pachaljharana, Sanni Tribeni, Soru, Adanchuli, Kharpunath, Sarkegad, Tanjakot, Gaumul, Jagannath, Swami Kartik, Durgathali, Masta, Surma, Apihimal, Byas, Dunhu, Lekam, Naugad, Bungdikali |

## 5. Risk rank of the rural municipalities at RCP 8.5 (2050)

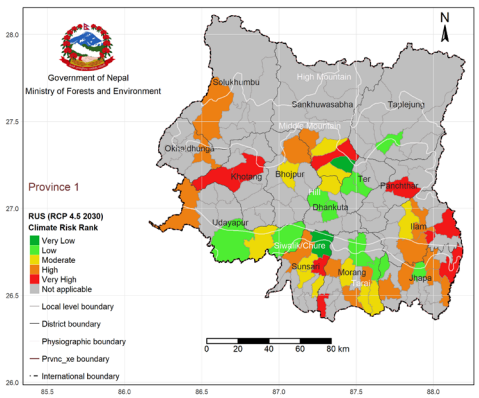
| Climate risk rank (RCP8.5 2050) | Palika |
|---|---|
| Very High (More than 0.520) | Kachankawal, Budhiganga, Jahada, Harinagar, Koshi, Laxmipur Patari, Janaknandani, Pipra, Tinpatan, Benighat Rorang, Bagmati, Bakaiya, Bhimphedi, Manahari, Madi, Pratappur, Susta, Mayadevi, Bijayanagar, Suddhodhan, Baijanath, Khajura, Rapti Sonari, Kailari |
| High (0.336 - 0.520) | Phaktanglung, Hilihang, Barhadashi, Gauriganj, Jhapa, Kamal, Dhanpalthan, Gramthan, Kanepokhari, Katahari, Barju, Bhokraha Narsingh, Dewanganj, Gadhi, Bhotkhola, Udayapurgadhi, Tilathi Koiladi, Bariyarpatti, Naraha, Bateshwor, Lakshminiya, Ekdanra, Mahottari, Samsi, Sonama, Chandranagar, Hariharpurgadhi, Marin, Khadadevi, Bigu, Gaurishankar, Kalinchok, Indrawati, Jugal, Panchpokhari Thangpal, Tripurasundari, Roshi, Dupcheshwar, Kakani, Gajuri, Thakre, Makawanpurgadhi, Raksirang, Durga Bhagwati, Yemunamai, Prasauni, Sahid Lakhan, Marsyangdi, Annapurna, Modi, Badigad, Nisikhola, Sarawal, Gaidahawa, Kotahimai, Rohini, Sammarimai, Siyari, Mayadevi, Yashodhara, Jhimruk, Naubahini, Runtigadi, Suwarnabati, Tribeni, Kalimati, Kumakha, Gadhawa, Rajpur, Rapti, Duduwa, Janki, Badhaiyatal, Barahtal, Simta, Junichande, Turmakhad, Jorayal, Chure, Dilasaini, Dogadakedar, Binayee Tribeni |
| Moderate (0.227 - 0.335) | Sirijangha, Falelung, Falgunanda, Miklajung, Yangwarak, Fakphokthum, Maijogmai, Mangsebung, Buddhashanti, Haldibari, Kerabari, Miklajung, Sangurigadhi, Aathrai, Makalu, Hatuwagadhi, Khumbupasanglahmu, Khijidemba, Manebhanjyang, Sunkoshi, Khotehang, Rautamai, Agnisair Krishna Savaran, Belhi Chapena, Bishnupur, Chhinnamasta, Mahadeva, Rupani, Tirahut, Arnama, Aurahi, Bhagawanpur, Bishnupur, Nawarajpur, Sakhuwanankarkatti, Aaurahi, Dhanauji, Mukhiyapatti Musarmiya, Basbariya, Bishnu, Bramhapuri, Chakraghatta, Dhankaul, Kaudena, Ramnagar, Golanjor, Phikkal, Sunkoshi, Doramba, Gokulganga, Umakunda, Baiteshwor, Melung, Sailung, Tamakoshi, Balefi, Bhotekoshi, Helambu, Likhu, Shivapuri, Gosaikunda, Galchi, Jwalamukhi, Netrawati Dabjong, Siddhalek, Kailash, Adarshkotwal, Baragadhi, Bishrampur, Devtal, Karaiyamai, Parwanipur, Pheta, Suwarna, Bindabasini, Jagarnathpur, Jirabhawani, Paterwasugauli, SakhuwaPrasauni, Thori, Aarughat, Bhimsen Thapa, Chum Nubri, Gandaki, Siranchok, Barpak Sulikot, Dordi, Anbukhaireni, Bandipur, Devghat, Myagde, Rhishing, Machhapuchchhre, Raghuganga, Kanthekhola, Chandrakot, Chatrakot, Dhurkot, Isma, Kaligandaki, Madane, Malika, Satyawati, Mathagadhi, Nisdi, Rainadevi Chhahara, Rambha, Palhi Nandan, Kanchan, Marchawari, Omsatiya, Sudhdhodhan, Chhatradev, Malarani, Panini, Ayirabati, Gaumukhi, Sarumarani, Pariwartan, Lungri, Sunchhahari, Sani Bheri, Chhatreshwori, Babai, Narainapur, Geruwa, Chaukune, Bhairabi, Gurans, Naumule, Barekot, Kuse, Patrasi, Tatopani, Naraharinath, Himali, Kedarseu, Chaurpati, Dhakari, Mellekh, Ramaroshan, Adharsha, Badikedar, Bogtan, K I Sin, Purbichauki, Bardagoriya, Joshipur, Mohanyal, Alital, Ganayapdhura, Sigas, Putha Uttarganga, Sisne |
| Low (0.145 - 0.226) | Meringden, Sidingba, Pathibhara Yangwarak, Kummayak, Chulachuli, Rong, Sandakpur, Chaubise, Shahidbhumi, Chhathar, Phedap, Sabhapokhari, Silichong, Aamchowk, Arun, Pauwadungma, Ramprasad Rai, Salpasilichho, Tyamkemaiyung, Thulung Dudhkoshi, Dudhkoshi, Mahakulung, Sotang, Champadevi, Chisankhugadhi, Likhu, Molung, Ainselukhark, Barahapokhari, Diprung, Kepilasagadhi, Sunkoshi, Tapli, Balan Bihul, Parsa, Ghanglekh, Likhu Tamakoshi, Sunapati, Lisangkhu Pakhar, Sunkoshi, Bethanchowk, Bhumlu, Chaurideurali, Khanikhola, Mahabharat, Temal, Bagmati, Kispang, Myagang, Panchakanya, Suryagadhi, Tadi, Tarkeshwar, Naukunda, Uttargaya, Gangajamuna, Khaniyabash, Rubi Valley, Tripura Sundari, Indrasarowar, Chhipaharmai, Dhobini, Kalikamai, Pakahamainpur, Ichchhyakamana, Ajirkot, Dharche, Ghiring, Aandhikhola, Biruwa, Harinas, Kaligandagi, Annapurna, Dhaulagiri, Malika, Mangala, Jaljala, Tara Khola, Gulmidarbar, Ruru, Bagnaskali, Purbakhola, Ribdikot, Tinau, Mallarani, Mandavi, Madi, Sukidaha, Banfikot, Tribeni, Darma, Siddha Kumakha, Kapurkot, Tribeni, Banglachuli, Dangisharan, Shantinagar, Bhagawatimai, Dungeshwor, Mahabu, Thantikandh, Shiwalaya, Guthichaur, Kanakasundari, Tila, Kalika, Mahawai, Pachaljharana, Palata, Sanni Tribeni, Khatyad, Mugu mkarmarong, Soru, Chankheli, Kharpunath, Namkha, Sarkegad, Simkot, Chhededaha, Gaumul, Bithadchir, Chabispathivera, Saa Paal, Khaptadchhanna, Masta, Talkot, Thalara, Bannigadhi Jayagadh, Sayal, Janaki, Beldandi, Laljhadi, Ajaymeru, Bhageshwar, Nawadurga, Pancheshwar, Shivanath, Surnaya, Malikaarjun, Marma, Naugad, Bulingtar, Hupsekot, Bhume |
| Very Low (Less than 0.144) | Aathrai Tribeni, Maiwakhola, Mikwakhola, Tumbewa, Chhathar Jorpati, Menchayam, Chichila, Likhupike, Nechasalyan, Jantedhunga, Rawa Besi, Sakela, Konjyosom, Mahankal, Kalika, Aamachodingmo, Dudhpokhari, Kwholasothar, Arjunchaupari, Phedikhola, Rupa, Chame, Narpa Bhumi, Nasho, Manang Nshiang, Waragun Muktikshetra, Lo-Ghekar Damodarkunda, Gharapjhong, Lomanthang, Thasang, Bihadi, Mahashila, Painyu, Bareng, Taman Khola, Thawang, Chingad, Chharka Tangsong, Dolpo Buddha, Jagadulla, Kaike, Mudkechula, Shey Phoksundo, Hima, Sinja, Adanchuli, Tanjakot, Jagannath, Swami Kartik, Durgathali, Surma, Apihimal, Byas, Dunhu, Lekam, Bungdikali |

# Annex 14: Risk Maps of Municipalities at the Provincial Level- Baseline and Projected Scenarios RCP 4.5 (2030, 2050) and RCP 8.5 (2030, 2050)

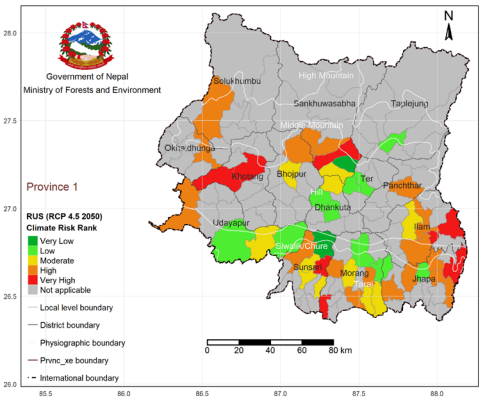
## Province 1



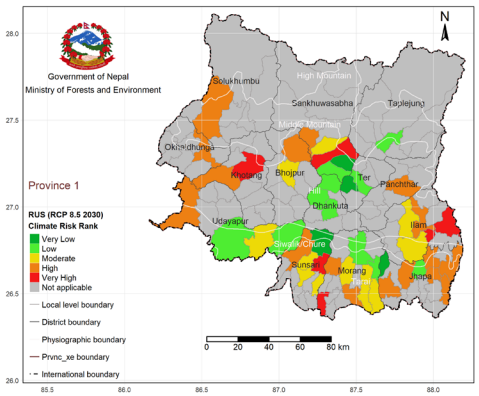

Baseline risk



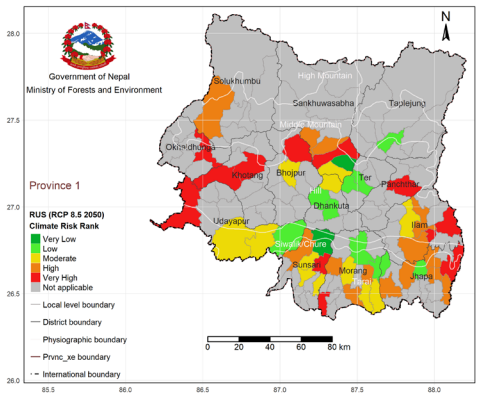

Risk- RCP 4.5 2030




Risk- RCP 4.5 2050

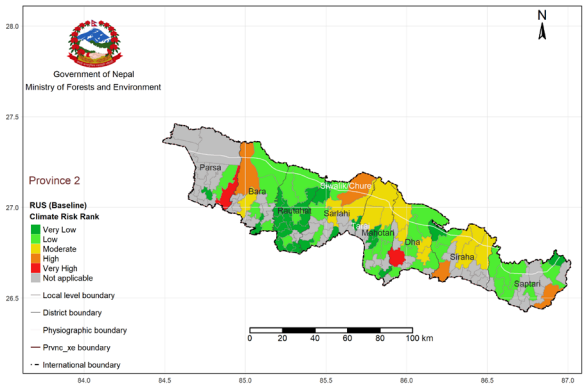



Risk- RCP 8.5 2030

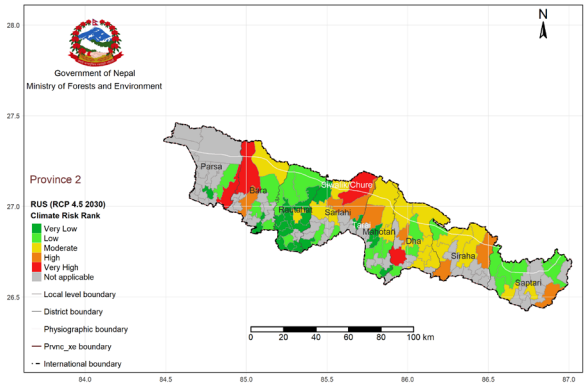



Risk- RCP 8.5 2050

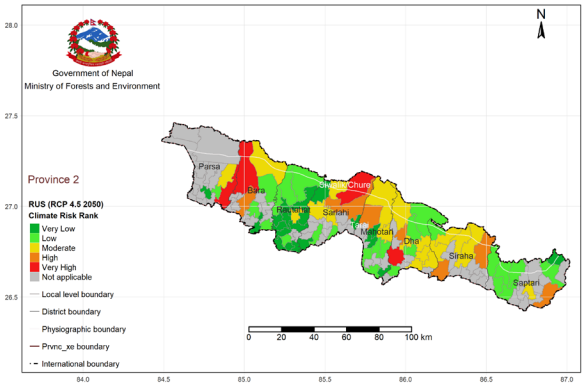
## Province 2



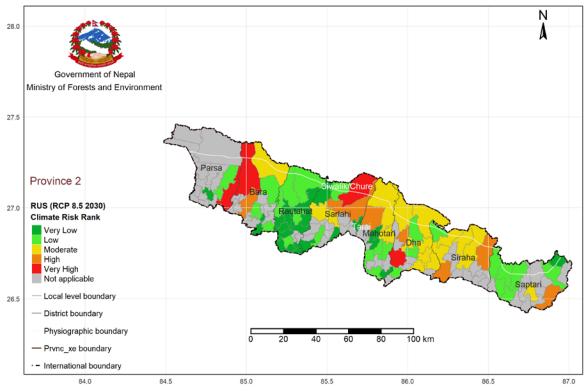

Baseline risk



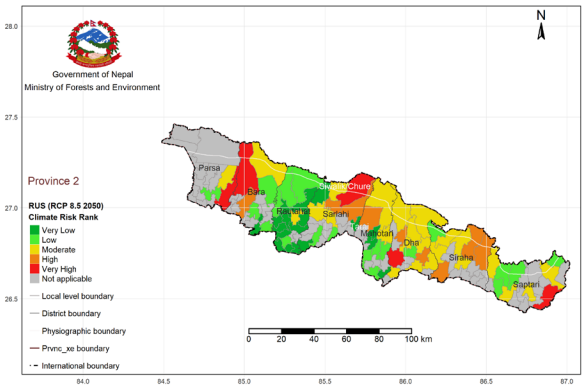

Risk- RCP 4.5 2030




Risk- RCP 4.5 2050

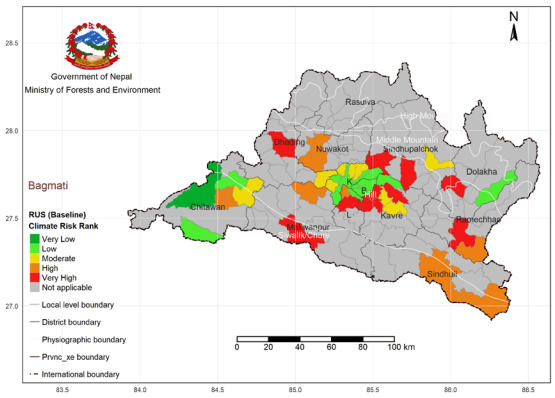



Risk- RCP 8.5 2030

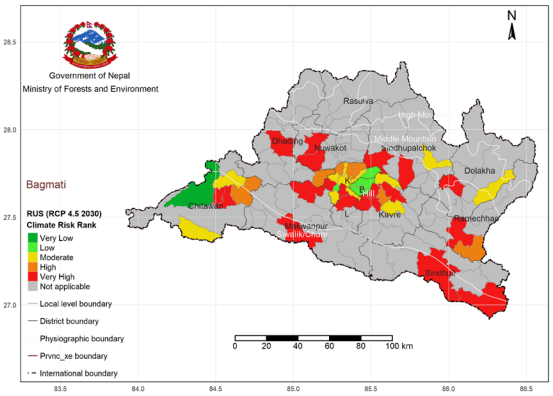



Risk- RCP 8.5 2050

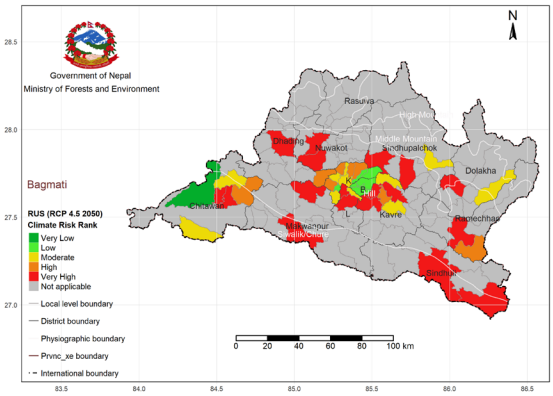
## Bagmati Province



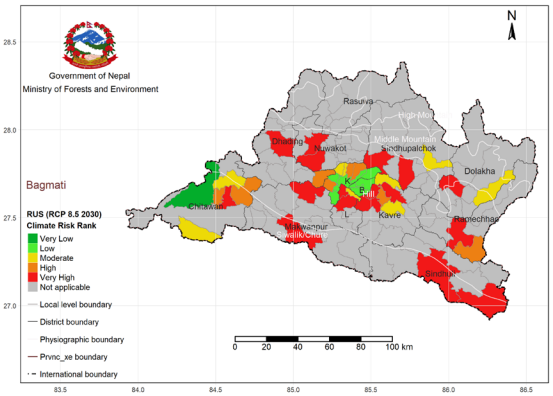

Baseline risk



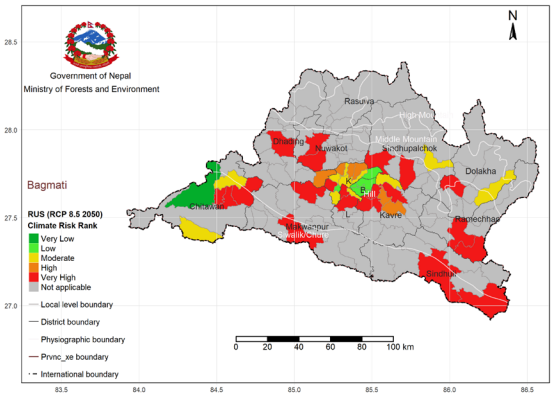

Risk- RCP 4.5 2030




Risk- RCP 4.5 2050

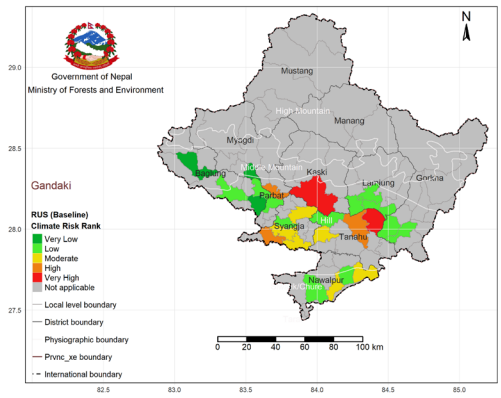



Risk- RCP 8.5 2030

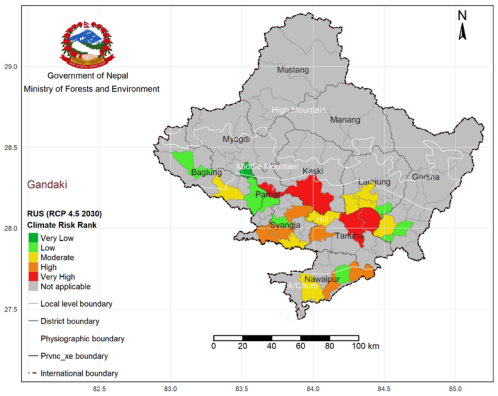



Risk- RCP 8.5 2050

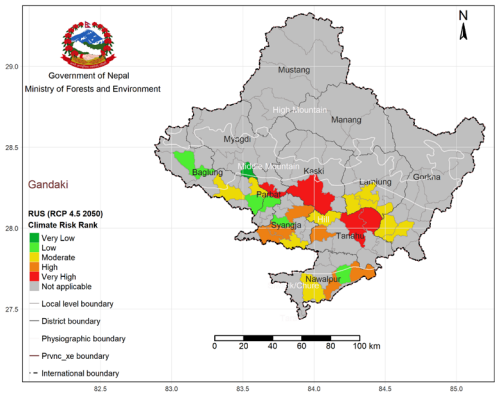
## Gandaki Province



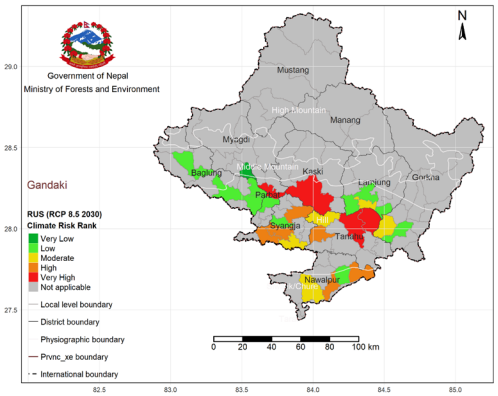

Baseline risk



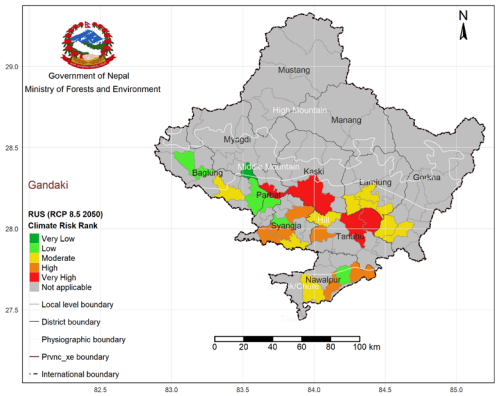

Risk- RCP 4.5 2030




Risk- RCP 4.5 2050

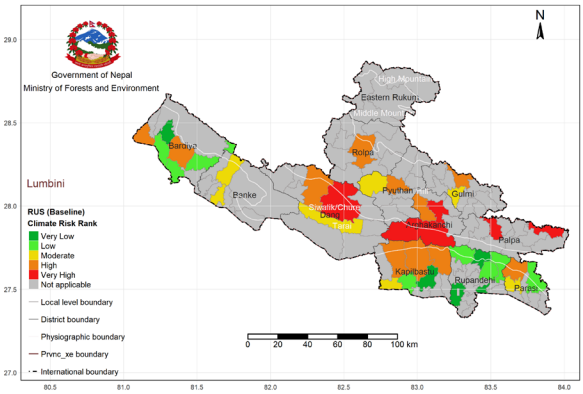



Risk- RCP 8.5 2030

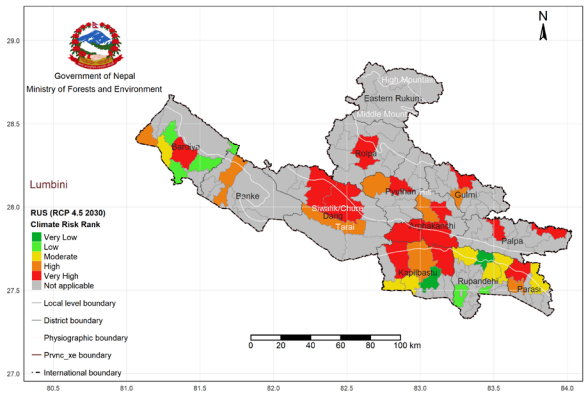



Risk- RCP 8.5 2050

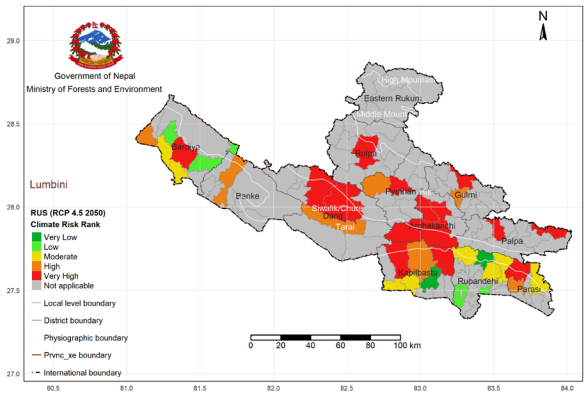
## Lumbini Province



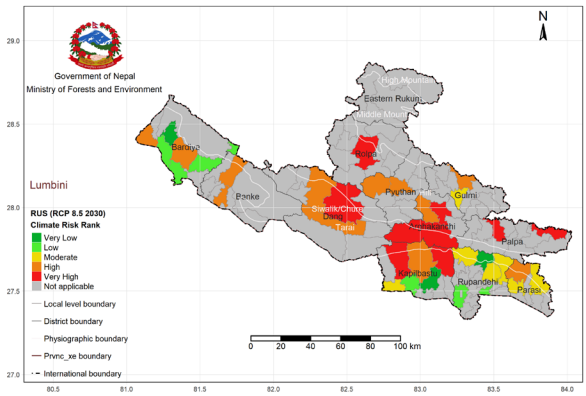

Baseline risk



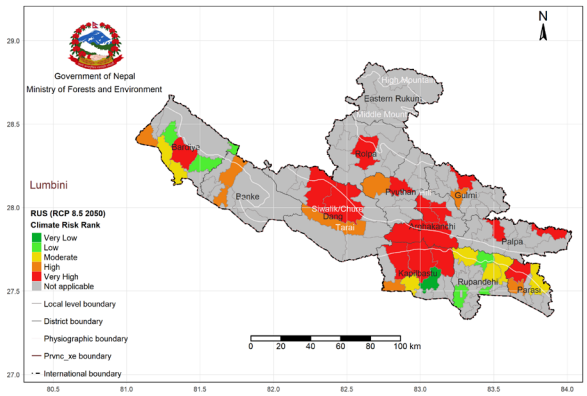

Risk- RCP 4.5 2030




Risk- RCP 4.5 2050

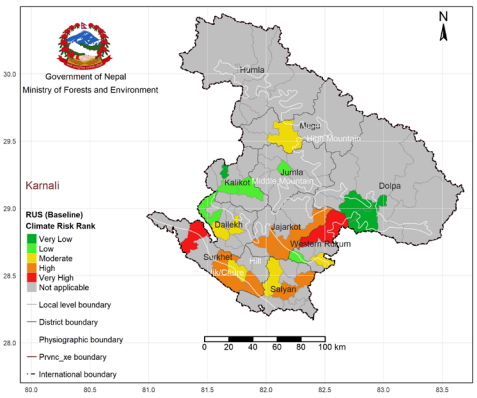



Risk- RCP 8.5 2030

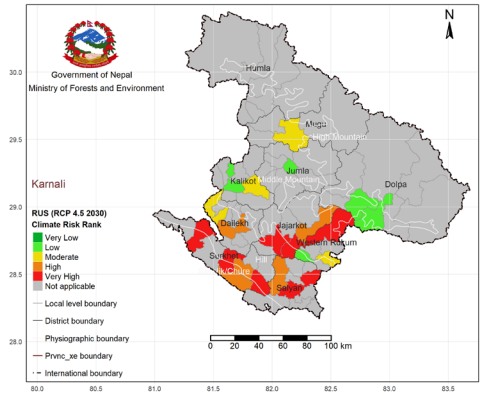



Risk- RCP 8.5 2050

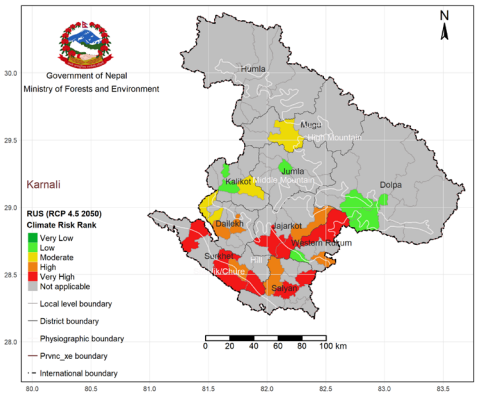
## Karnali Province



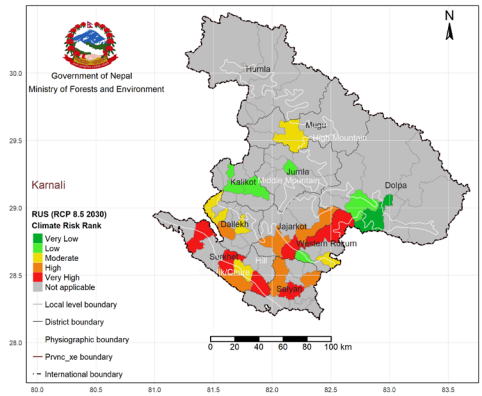

Baseline risk



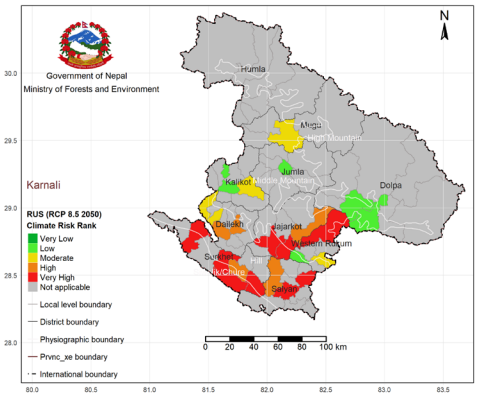

Risk- RCP 4.5 2030




Risk- RCP 4.5 2050

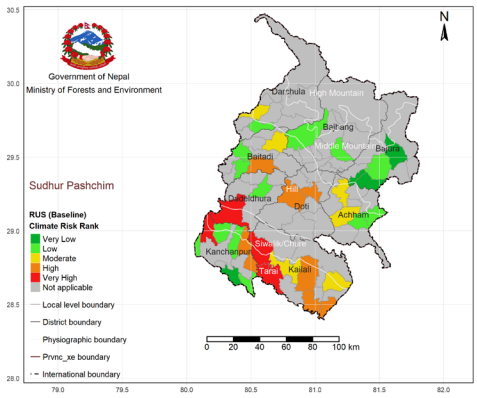



Risk- RCP 8.5 2030

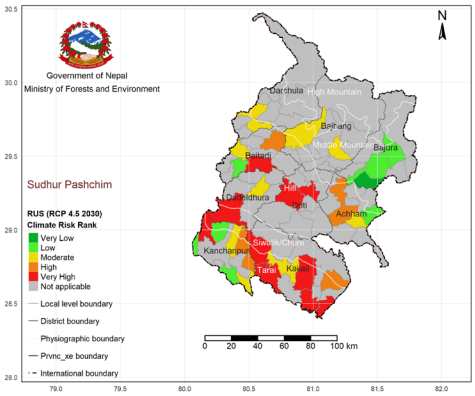



Risk- RCP 8.5 2050

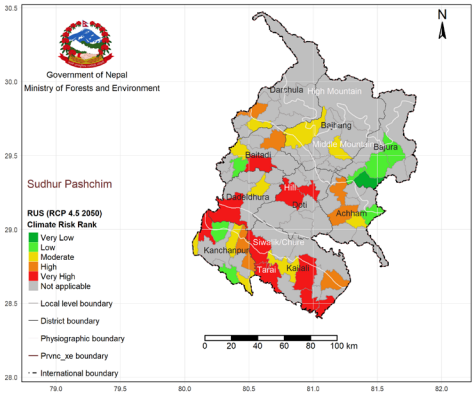
## Sudurpaschim Province



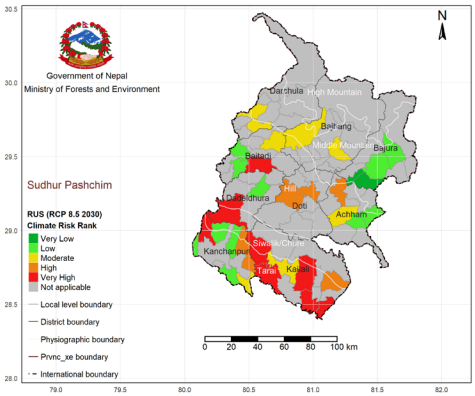

Baseline risk



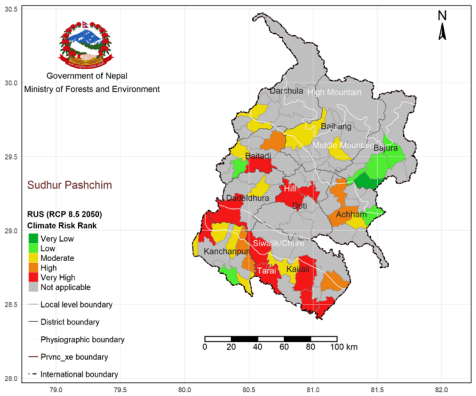

Risk- RCP 4.5 2030




Risk- RCP 4.5 2050



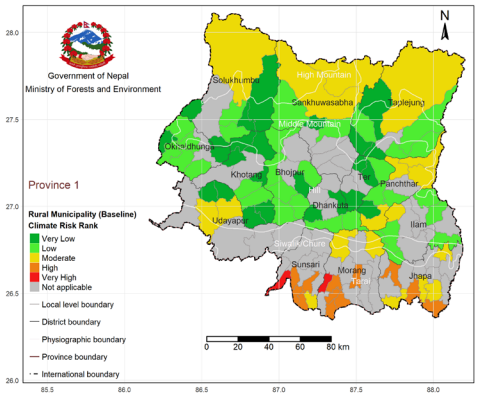

Risk- RCP 8.5 2030



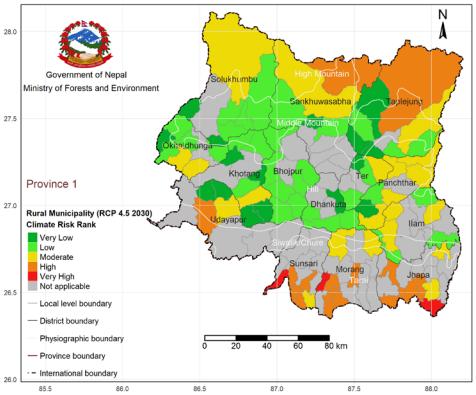

Risk- RCP 8.5 2050

# Annex 15: Risk Maps of Rural Municipalities at the Provincial Level-Baseline and Projected Scenarios RCP 4.5 (2030, 2050) and RCP 8.5 (2030, 2050)

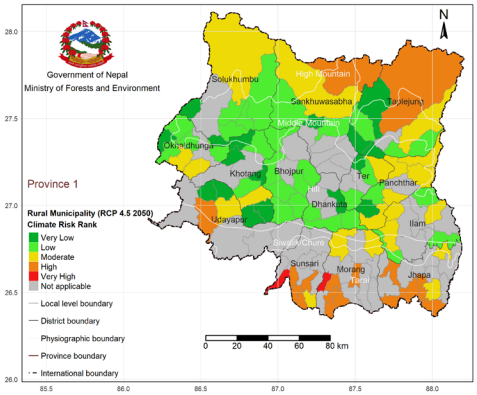
## Province 1



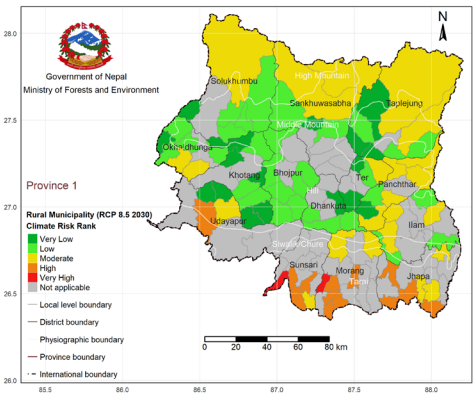

Baseline risk



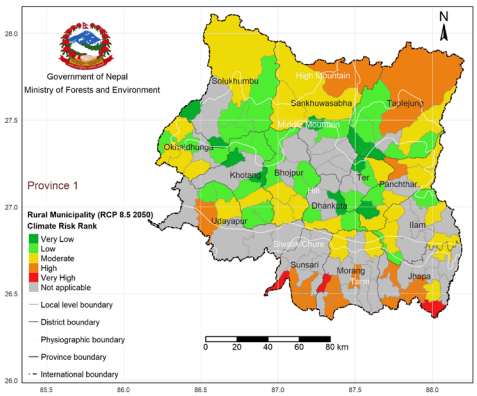

Risk- RCP 4.5 2030




Risk- RCP 4.5 2050

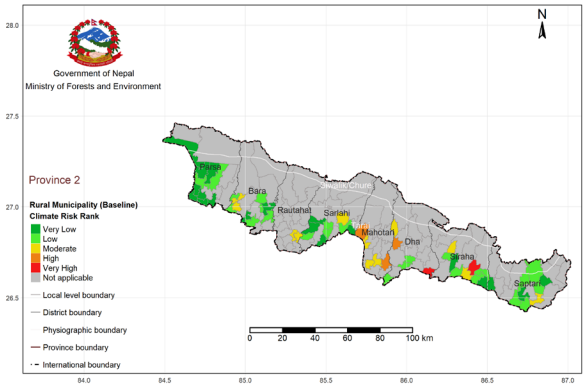



Risk- RCP 8.5 2030

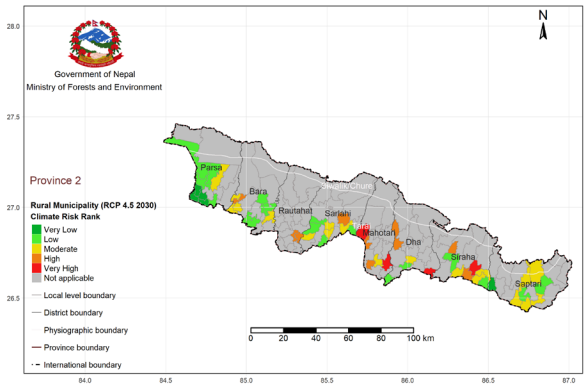



Risk- RCP 8.5 2050

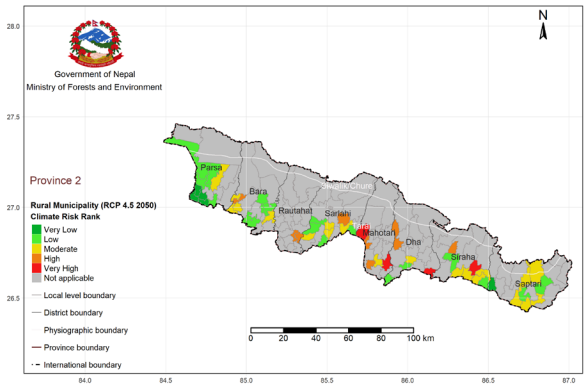
## Province 2



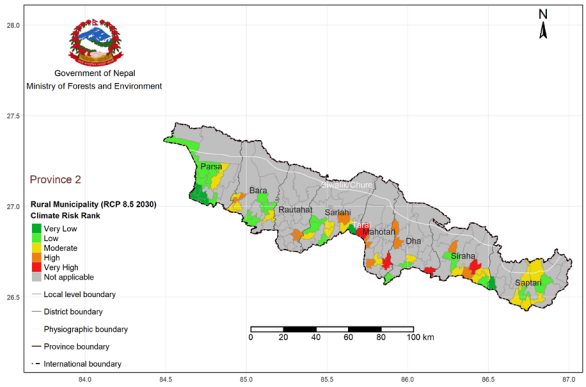

Baseline risk



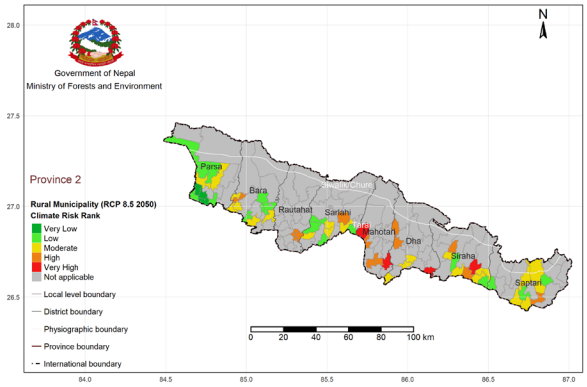

Risk- RCP 4.5 2030




Risk- RCP 4.5 2050

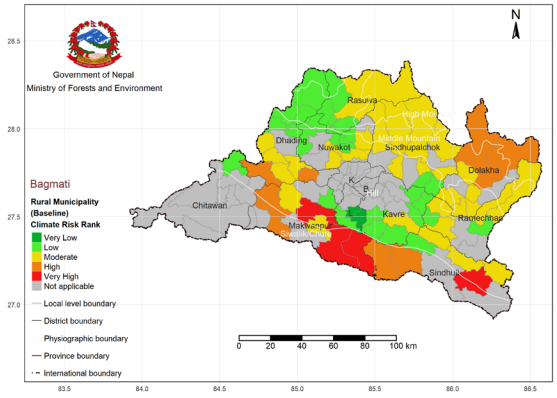



Risk- RCP 8.5 2030

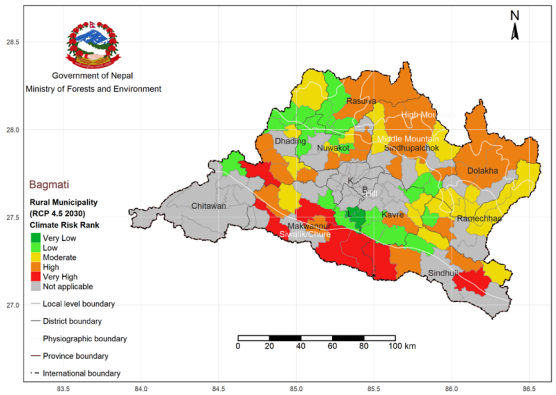



Risk- RCP 8.5 2050

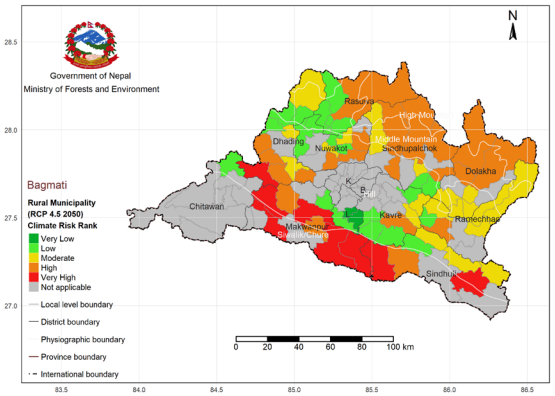
## Bagmati Province



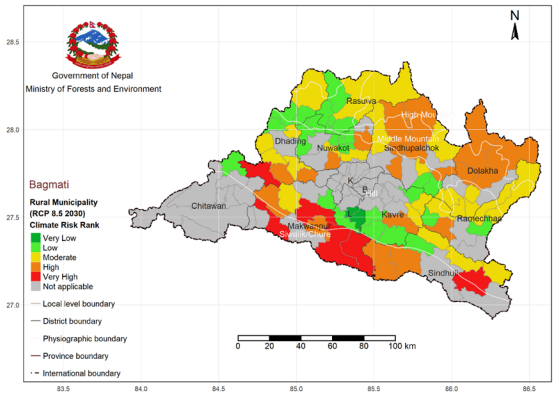

Baseline risk



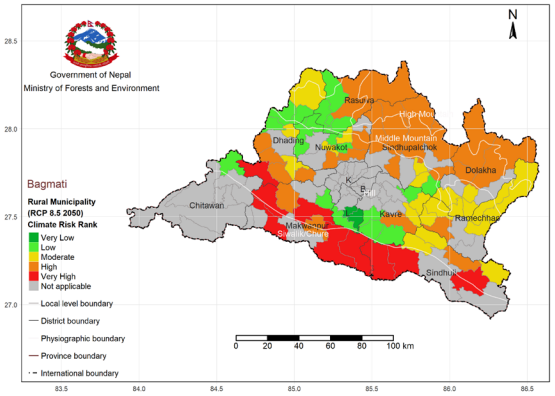

Risk- RCP 4.5 2030




Risk- RCP 4.5 2050

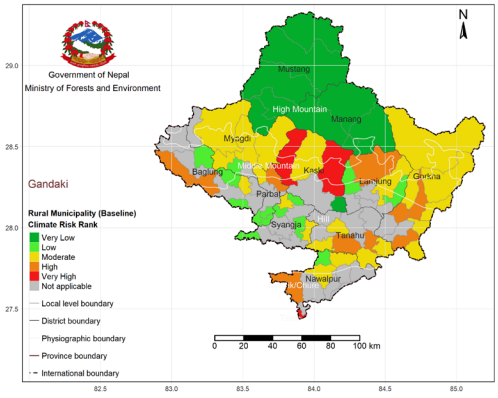



Risk- RCP 8.5 2030

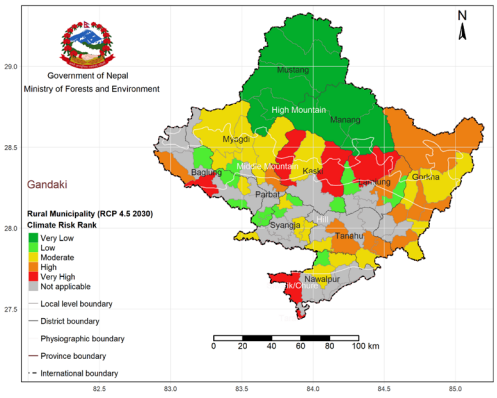



Risk- RCP 8.5 2050

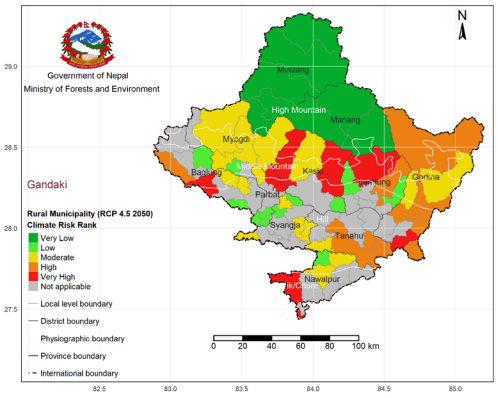
## Gandaki Province



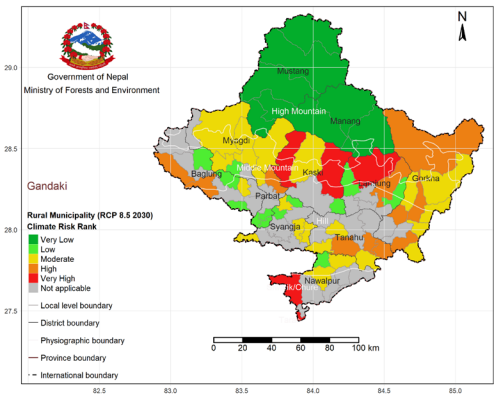

Baseline risk



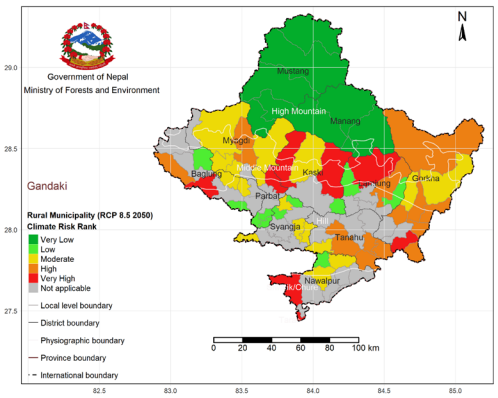

Risk- RCP 4.5 2030




Risk- RCP 4.5 2050

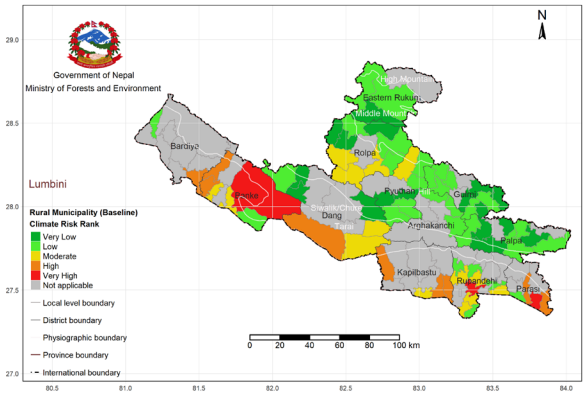



Risk- RCP 8.5 2030

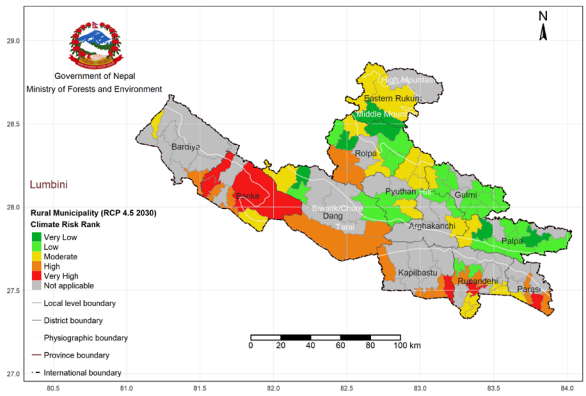



Risk- RCP 8.5 2050

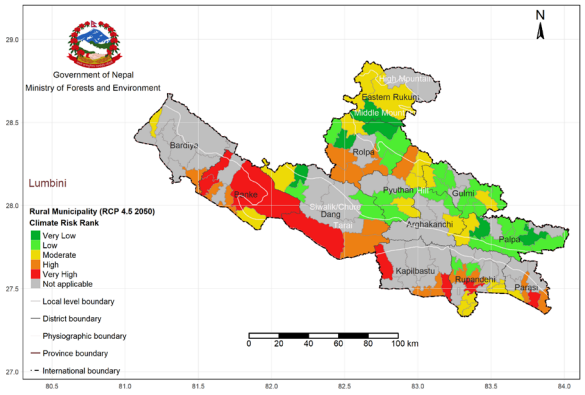
## Lumbini Province



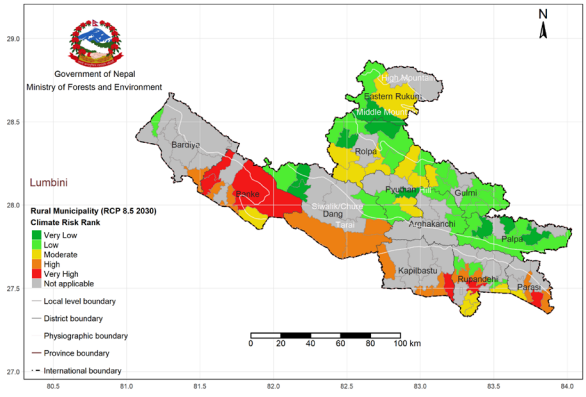

Baseline risk



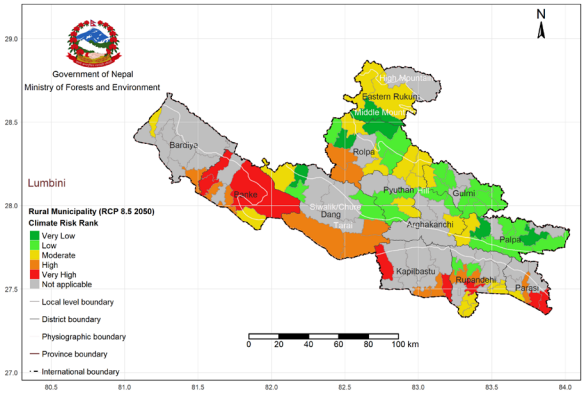

Risk- RCP 4.5 2030




Risk- RCP 4.5 2050

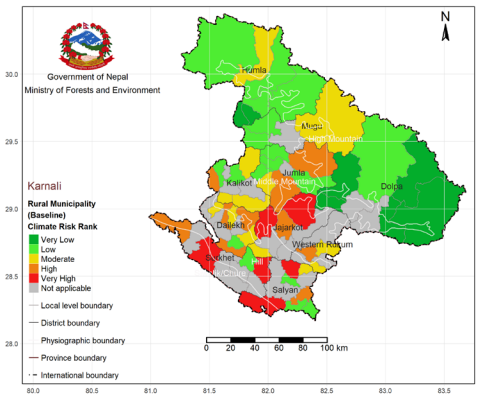



Risk- RCP 8.5 2030

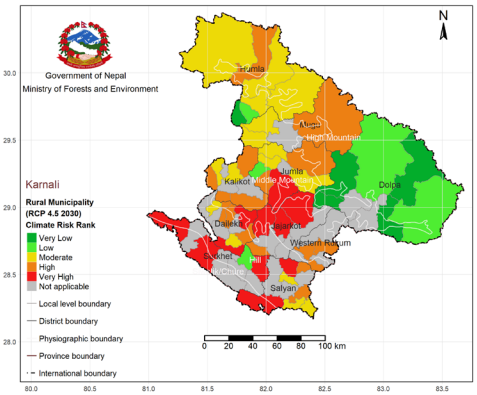



Risk- RCP 8.5 2050

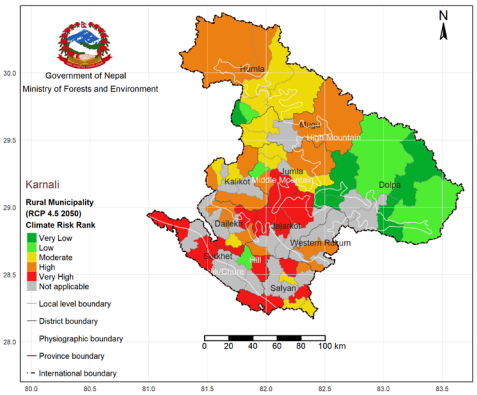
## Karnali Province



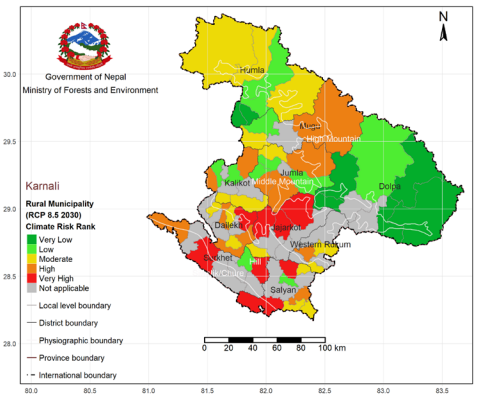

Baseline risk



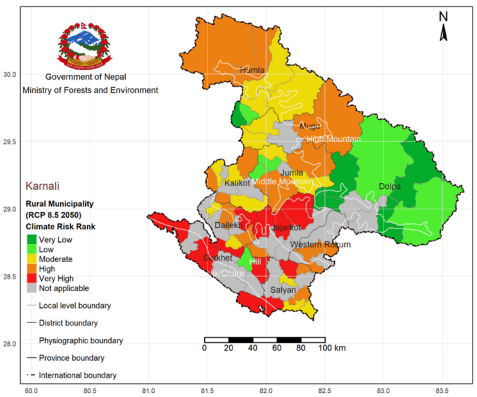

Risk- RCP 4.5 2030




Risk- RCP 4.5 2050

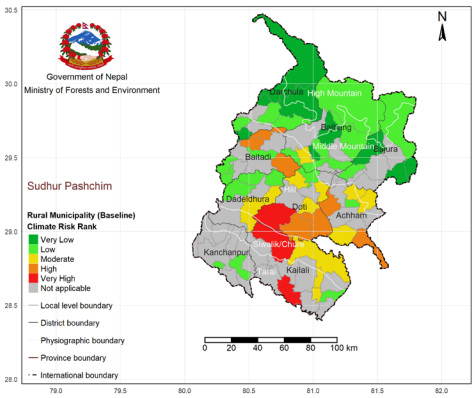



Risk- RCP 8.5 2030

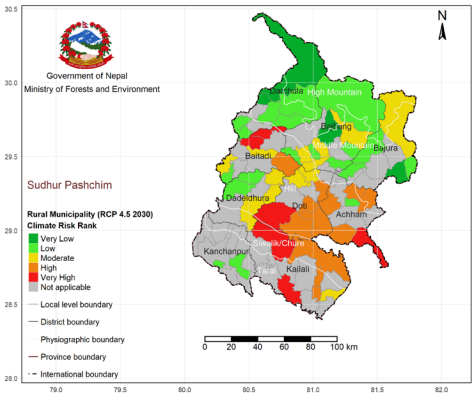



Risk- RCP 8.5 2050

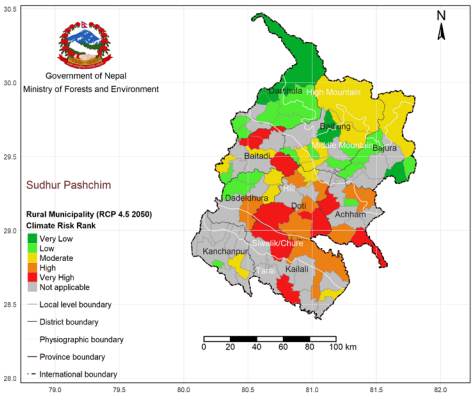
## Sudurpaschim Province



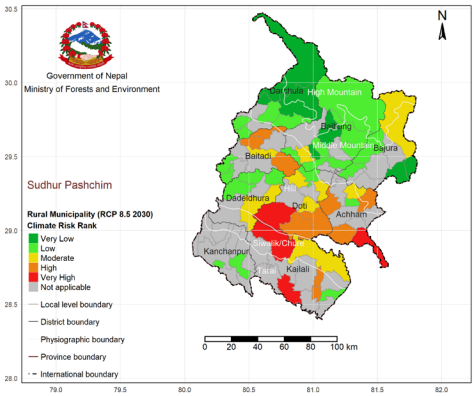

Baseline risk



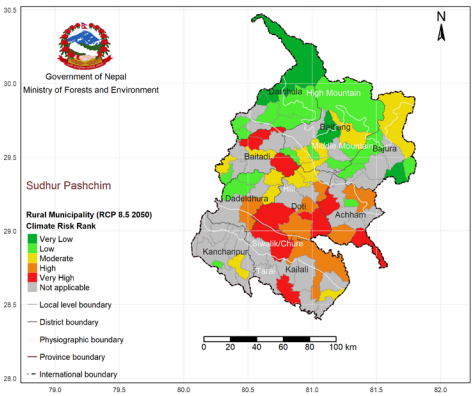

Risk- RCP 4.5 2030




Risk- RCP 4.5 2050




Risk- RCP 8.5 2030




Risk- RCP 8.5 2050