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Climate Change and Adaptive Strategies for Community Resilience: Insights from the Kamala River Basin, Nepal

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Author's Contribution:

Author 1 and author 2 work jointly from conceptualization of the study, design methodology, conduct data collection, analyze the data, interpret the findings and prepare the initial draft of the manuscript and finalize the manuscript. Author 3 reviewed and provided critical revisions. All authors reviewed the final version and approved for submission.

Abstract

Climate change poses an escalating threat to riverine communities worldwide, with flooding remaining the most pervasive and disruptive hazard across Nepal's river basins. Despite the growing body of climate adaptation research, empirically grounded evidence on how local understanding of climate change shape adaptive practices and community resilience across heterogeneous socio-ecological and geographic contexts remains limited. This study examined how residents of two municipalities, Siraha and Dudhauri across Kamala River Basin, perceive climate change and climate-induced disasters, and how these understanding influence the nature and distribution of local adaptation responses. Drawing on a mixed-methods research design that integrates household surveys with in-depth qualitative interviews and focus group discussions, this study explored community understandings of climate risks and the strategies adopted to cope with and adapt to recurrent hazards across contrasting ecological and socio-economic settings. The findings revealed that while communities are aware of climate change, understanding varies across locations, with deforestation and land-use changes commonly identified as underlying drivers. Adaptation strategies are largely reactive and short-term, constrained by limited access to early warning systems, weak institutional coordination, and inadequate climate education. Long-term and transformative measures, such as livelihood diversification, land-use planning, and community preparedness remain underdeveloped, especially in the marginalized communities. The study addresses a critical research gap by the integrated analysis of community's understanding about climate change, institutional access, and local socio-ecological dynamics to figure out adaptive capacity across geographically and socially diverse settings.

Keywords: climate change, community perception, adaptation, flood, kamala river basin, resilience

1. Introduction

Climate change constitutes one of the biggest environmental, economic, equity and global security challenges of the twenty-first century (IPCC, 2023; Khatri & Pasa, 2023; Pandey & Dahal, 2022). Accelerating global warming and increasing climatic variability have intensified the frequency and magnitude of climate-induced hazards such as floods, droughts and heatwaves that greatly affect populations who depend heavily on natural resources. These impacts are particularly noticeable in developing countries which have limited institutional capacities, adaptation finance and technologies, and are more susceptible to higher levels of exposures to multi-faceted climate risks (Pandey et al., 2023; Pandey, 2021). South Asia, including the Hindu Kush Himalaya (HKH) region, is among the most climate-vulnerable regions due to its complex topography, socio-economic inequalities and ecological diversity (Paudel et al., 2021; Wester et al., 2019). Nepal, being one of the South Asian countries, is located in the HKH region, is encountering severe impacts of climate change. Studies demonstrate that erratic precipitation, increasing temperatures and extreme weather events have been negatively impacting ecological and human ecosystems and raising serious concerns about, inter alia, water, food, infrastructure and livelihood securities in Nepal (Pandey, 2025; Magar et al., 2024; Asad et al., 2023; Pandey et al., 2023).

Climate-induced hydro-meteorological hazards such as floods have been frequent and affecting riverine communities in Nepal. In the Kamala River Basin (KRB), recurrent floods, land degradation and unpredictable rainfalls are causing agricultural losses, infrastructural damages and livelihood insecurities (Dawadi et al., 2022; MoFE, 2021; GoN, 2020). These climate risks are further compounded by deforestation, land use change and embankment management practices underscoring the complex, the multi-driver nature of flood hazards in the basin. In this context, understanding how communities perceive climate change and related hazards is critical for designing effective adaptation and disaster risk reduction strategies (Htitich et al., 2024; Whitmarsh, 2011). Literature demonstrates that understanding of climate change varies across geographic locations and social groups, influenced

by lived experiences, socio-economic status and access to institutional supports (Pandey, 2025; Nash et al, 2019; Devkota, 2014). In the Terai and river basin contexts, studies report that while communities recognize increasing climate risks, adaptation responses tend to remain short term, reactive and incremental. These responses are constrained by limited resources, weak institutional coordination, unequal access to early warning systems and adaptation supports which force marginalized groups to face disproportionate barriers to planned and transformative adaptation (Pandey, 2025). In this context, long-term meteorological data from the Department of Hydrology and Meteorology (DHM) was examined for assessing climatic trends in the Kamala River Basin. These records enable the validation of community insights by linking observed impacts with measured changes in temperature and precipitation. The integration of DHM data with household-level evidence strengthens the reliability of climate impact assessment and support in local adaptation planning process.

While previous studies have broadly examined perception and adaptation relationship in Nepal, a detailed empirical comparative investigation of communities' understanding of climate change and adaptation strategies across different geographic zones in KRB remains limited. In this background, this study investigates the following two interconnected research questions: 1. How do communities in the Kamala River Basin understand and experience climate change and climate-induced disasters? 2. What adaptation strategies are being adopted by communities for coping, and do these strategies vary across geographic and social contexts of Terai and mid-hill regions? By situating local experiences of climate change along with localized adaptation strategies and bridging empirical climate data with lived experience, this study advances understanding of how community-level actions both shape and are shaped by understanding of climate change and broader climate adaptation and disaster risk reduction agendas, while contributing to more effective flood risk governance. Thus, this study contributes to climate adaptation and community resilient literature and informs context sensitive resilience building and policy interventions in KRB.

2. Literature Review

Climate change is a central driver of the increasing frequency, intensity, and spatial reach of climate-related hazards worldwide, including floods, droughts, storms, heatwaves, and extreme precipitation events. The IPCC identifies anthropogenic greenhouse gas (GHG) emissions as the dominant cause of observed global warming since the mid-twentieth century, with rising temperatures contributing directly to the escalation of climate-related disasters (IPCC, 2023). These changes pose significant risks to human populations, ecosystems, and socio-economic systems, particularly through adverse impacts on agriculture, water resources, and natural environments (IPCC, 2022; IPCC, 2023). Climate change affects the hydrological cycle by altering precipitation patterns, accelerating glacial melt, and increasing evapotranspiration, thereby reshaping river flows and flood regimes. Evidence suggests that increasing temperature trends and climate variability have intensified flood frequency and magnitude in the downstream basin areas of rivers (IPCC, 2022).

However, climate hazards do not inherently result in disasters since disaster outcomes are socially produced through interactions among exposure, vulnerability, and risk, which determine the extent and distribution of losses (IPCC, 2014; UNDRR, 2020). From this perspective, climate change acts as a risk multiplier, amplifying pre-existing social, economic, and environmental vulnerabilities. The impacts of climate change are especially severe in regions characterized by fragile ecosystems, high dependence on climate-sensitive livelihoods, and limited adaptive capacity. Marginalized populations and low-income countries face disproportionate risks, reflecting structural inequalities and governance constraints that shape vulnerability and adaptive options (Pandey, 2025; Pandey et al., 2023). In agriculture-dependent regions, climate-induced hazards undermine food production, livelihoods, and resource security, reinforcing cycles of vulnerability and poverty. Nepal is highly vulnerable to climate change due to its diverse topography, fragile geology, and socio-economic conditions. Empirical studies document rising temperatures, erratic rainfall patterns, accelerated glacial retreat, and an increasing frequency of extreme events such as floods and droughts (Gyawali et al., 2021; Karki et al.,

2017). Flood risk in Nepal is primarily driven by monsoon rainfall, however, non-climatic factors such as, inter alia, deforestation, land-use change, riverbed aggradation, weak land governance, and unplanned settlement expansion play a critical role in shaping flood exposure and impacts (Diwadi et al., 2022).

These interacting climatic and socio-institutional drivers influence how climate change is perceived and experienced locally, often reinforcing experiential knowledge grounded in observable environmental change rather than abstract climate science. Flood risk in Nepal's river basins reflects the combined influence of intensified monsoon dynamics, governance challenges, and land-use pressures, underscoring the need for integrated socio-hydrological and political–ecological approaches to risk assessment and management. The KRB represents one of the most flood-prone regions in Nepal, owing to its fragile geology, low-lying terrain, dynamic river morphology, and recurrent climate-induced hazards. Research indicates that repeated flooding in districts such as Siraha, Dhanusha and Sindhuli has affected large numbers of households, even following the construction of embankments and other structural flood-control measures (Kafle, 2020; GoN, 2020). These recurrent hydrological events, in the absence of adaptation, have resulted in crop losses, irrigation constraints, and increasing food insecurity, thereby undermining household livelihoods and resilience (Pandey, 2025; Pandit & Bhattarai, 2023; Dawadi et al., 2022).

Adaptation refers to the processes through which natural and human systems adjust to actual or anticipated climate impacts to reduce harm or exploit potential benefits (IPCC, 2014). Adaptation strategies are commonly categorized as autonomous or planned (Pandey, 2012). Autonomous adaptation involves spontaneous, reactive responses by individuals or households, whereas planned adaptation consists of deliberate interventions implemented through policies, institutions, or development programs (IPCC, 2014). Studies note that in flood-prone areas, adaptation strategies are often dominated by short-term, event-specific responses, commencing with the use of early warning systems, rescue, evacuation, temporary migration, reliefs and reliance on social networks (Bista, 2022;

Devkota et al., 2014). These responses demonstrate the importance of locally embedded and context-specific practices in coping with immediate climate hazards (Matandirotya et al., 2024). However, adaptation measures requiring long-term anticipation of climate change such as, among others, livelihood diversification, social safety guards, crop and cattle insurance, sustainable and effective EWS, risk-sensitive land-use planning, and planned relocation are less frequently adopted, affecting the marginalized communities with limited institutional and financial supports. These long-term anticipated adaptation practices remain under-recognized and weakly institutionalized, constraining the potential for sustained and effective climate adaptation.

Empirical studies highlight the role of public understanding in shaping climate adaptation and resilience outcomes (Chaudhary et al., 2021; Pandey, 2025). Chaudhary et al. (2021) report that indigenous Tharu communities in Gulariya Municipality are aware that increasing temperatures and decreasing rainfall connect with local climate signals and the vulnerability of their climate-dependent livelihoods, however, this awareness alone does not necessarily translate into actions of climate adaptation and resilience. Nash et al. (2019) identify an understanding, an action gap in Nepal's Terai region, where climate change awareness has not consistently led to meaningful or sustained adaptive responses, underscoring the influence of socio-economic and institutional constraints.

Evidence from Nepal indicates that while limited absorptive and adaptive capacities are operational at the community level, transformative adaptation remains constrained by governance deficiencies, socio-economic inequalities, and weak institutional coordination, resulting in a persistent disconnect between short-term coping mechanisms and long-term structural resilience (Pandey & Basnet, 2022; Pandey et al., 2023). This gap is particularly striking provided the growing emphasis on climate adaptation and resilience within global and national policy frameworks such as the Sendai Framework for Disaster Risk Reduction (2015–2030), Nepal's Disaster Risk Reduction and Management Act (2017), and the National Adaptation Plan (2021–2050), which prioritize community participation, integration of local knowledge, and risk-informed planning. Despite these policy commitments,

empirical studies consistently document shortcomings in program design and implementation to translate climate change awareness into preparedness, mitigation and participation into sustained and transformative adaptation outcomes (Khanal et al., 2019).

Resilience to climate change and disasters is increasingly conceptualized as a multidimensional construct encompassing absorptive, adaptive, and transformative capacities, consistent with the analytical framing advanced by the Sendai Framework for Disaster Risk Reduction and the IPCC (Pandey et al., 2023; IPCC, 2022). Absorptive capacity refers to the ability of households, communities, and institutions to anticipate, withstand, and recover from climate-related shocks through preparedness measures and short-term coping and response mechanisms. Adaptive capacity denotes the capability to undertake incremental and anticipatory adjustments in livelihoods, technologies, and governance practices, enabling risk reduction over time through learning processes, income diversification, and preventive action. Transformative capacity extends beyond incremental change and short-term recovery to address the structural and institutional drivers of vulnerability, thereby enabling fundamental shifts in development pathways and governance arrangements that reduce long-term climate risk (Pandey et al., 2023; UNDRR, 2022; Devkota, 2021; Cutter et al., 2021).

Building on this multidimensional understanding, this study adopts an integrated resilience lens to examine how social–ecological and institutional systems cope with, adjust to, and fundamentally reconfigure in response to recurrent climate shocks and stresses in the KRB, with specific attention to Siraha and Dudhauri municipalities. This framework provides an analytical basis for situating communities along a continuum of resilience capacities, absorptive, adaptive, and transformative, and for assessing the extent to which prevailing community-level adaptation strategies in riverine settings contribute to progressive shifts in resilience. Drawing on the conceptual distinctions between absorptive, adaptive, and transformative capacities, we argue that absorptive capacity, manifested through short-term coping, preparedness, and recovery mechanisms, primarily serves to stabilize livelihoods and institutional functioning in the immediate aftermath of climate-related hazards.

Adaptive capacity, reflected in incremental and anticipatory adjustments in livelihood strategies, technologies, and governance practices, enables learning, diversification, and risk reduction over time. It is the cumulative and sustained strengthening of such adaptive practices that progressively generates the social, institutional, and economic preconditions for transformative capacity, through which existing system functions, power relations, and structural drivers of vulnerability can be fundamentally reconfigured to achieve durable and equitable reductions in long-term climate risk.

3. Research Method and Study Sites

This study employed a convergent mixed-method approach, which integrates both quantitative and qualitative data to explore an in-depth understanding of the phenomena through the convergence and triangulation of diverse data sources and analytical techniques (Creswell 2021; Creswell 2018). Quantitative data was collected through a structured household survey using questionnaires from ward 11 of Dudhauri and ward 12 of Siraha municipalities, as shown in figure 1. A total of 408 households across Dudhauri and Siraha municipalities participated in the survey to provide valuable insights on climate change awareness, experiences, and community adaptation. The sample size was determined using Yamane's formula (1967), which provides an efficient method for calculating an adequate sample size based on population parameters. The sample size distribution was proportionate to the population size of each municipality to ensure balanced representation of local contexts. The survey is carried out by collecting information on climate change awareness, perceived hazards, experienced impacts, and adaptation strategies.

Qualitative data were collected through two focus group discussions (FGD), one at each location with community leaders and women's group and 20 key informant interviews (KIIs) were conducted with the representatives from the Department of Hydrology and Meteorology (2), Municipalities (7), NGOs (3), schools (4), and residents (4). Furthermore, the observed historical climate data of maximum and minimum temperature, precipitation, and humidity were collected from the Department of Hydrology

and Meteorology (DHM), Babarmahal, from 1994 to 2024. The nearby meteorological and climatology stations of KRB were selected to conduct trend analysis of temperature and precipitation. Secondary data sources such as government publications, scholarly articles, and policy documents were examined to complement the primary data. The quantitative data was analyzed using SPSS, while the qualitative data was coded and analyzed thematically and merged them for analysis. Research ethics practice was maintained by informing the participants/respondents about the objectives and procedures of the study prior to the data collection. Participants were also informed that the participation was voluntary with the option to withdraw at any time and the information collected would remain confidential and used for research purposes only.

The study was conducted in Dudhauri Municipality in Sindhuli district and Siraha Municipality in Siraha district along the KRB. The KRB basin extends from mid Hills to Terai plains with diverse topography and climatic condition. The basin is characterized by moderate slopes in the south and steeper slopes in the north. Its geological structure comprises alluvial sediments, including sand, silt, and clay (Shrestha et al. 2023). The fragile structures and other interrelated factors such as geography, socioeconomics, and proximity to rivers play a crucial role in turning hazards into disasters (GoN 2020). The primary occupation of the communities was farming but they encounter recurrent landslides, inundations and flood disasters (Dahal, 2020; Pandey, 2025). Limited infrastructure of the study sites further complicates climate adaptation efforts, making resilience building a significant challenge for the local population.

The research protocol was approved by Kathmandu University, School of Arts. To carry out this research we obtain verbal informed consent from the participants prior to interview and explain that we maintain anonymity and confidentiality throughout the data collection and analysis process. In addition, permission was taken from the respective municipal offices before initiating field work.

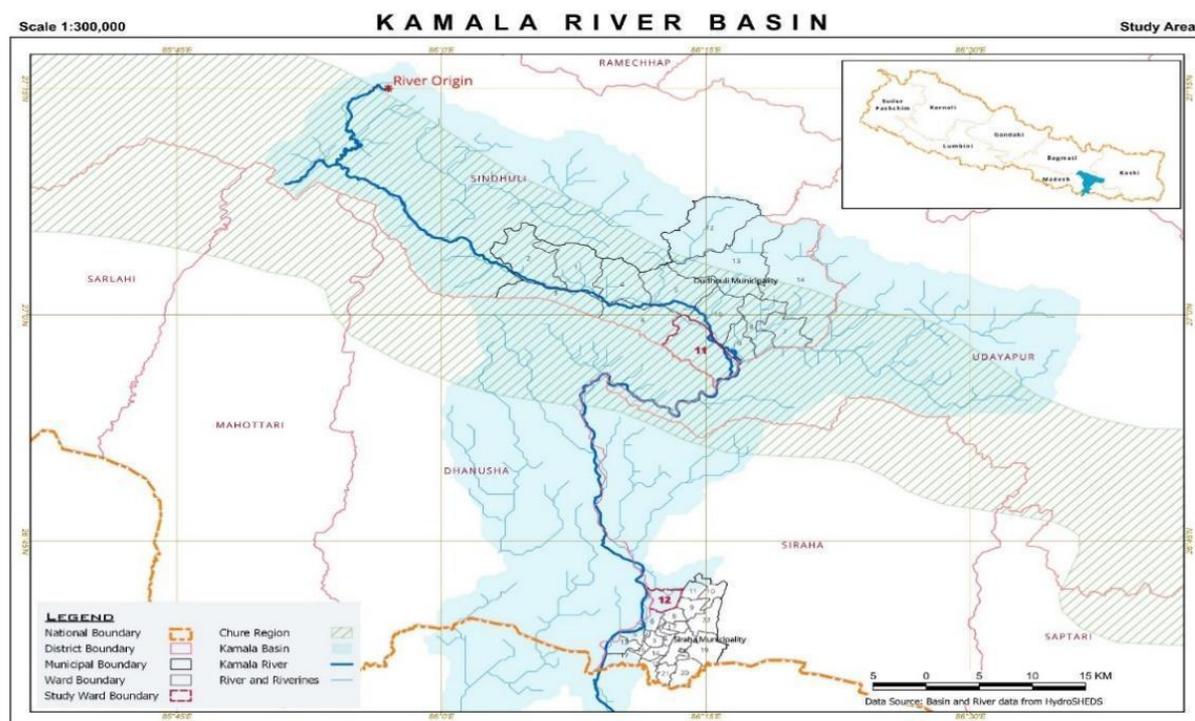


Figure 1: Map of the Kamala River basin showing the study area

4. Findings

This section presents empirical findings on understanding communities and lived experiences of climate change and climate-induced disasters in the KRB, with particular attention to how these experiences shape local adaptation responses. Addressing the first research question, the analysis examines how communities across the Terai and mid-hill regions understand, interpret, and experience climate variability and extreme events—especially flooding—as everyday risks that intersect with livelihoods, social relations, and institutional support systems. In response to the second research question, the findings explore the range of adaptation strategies adopted at the community level, assessing their prevalence, functionality, and perceived effectiveness across diverse geographic and social contexts.

4.1 Understanding, Experiences of Climate Change and Disasters

The findings noted, as shown in figure 2, that a large number of respondents noticed observable changes in climate systems over the past decade. 82% of respondents in Siraha and 69% in Dudhauri

reported noticeable shifts in temperature, and rainfall patterns and connect these dimensions to climate change. Only 9 % in Siraha and 11% of respondents in Dudhauri shared that they did not experience noticeable changes of climate systems. This shows that a considerably large proportion of the population is experiencing noticeable changes and this is further illustrated by qualitative data. A participant from Dudhauri, despite having no formal education, described changing weather patterns characterized by hot days and increasingly erratic rainfall. The participant of key informant interview in June 2024, stated:

“Water comes at once or not at all. In these years, the rainfall pattern has changed with intensive waterfall in a short time followed by long gaps without rain. This shows climate is becoming extreme and unpredictable”.

This shows that the communities of KRB have fair level of understanding of climate change and climate-induced disasters, however, they do not have understanding about the localized level of intensity which varies across Siraha and Dudhauri municipalities and this indicates uneven awareness.

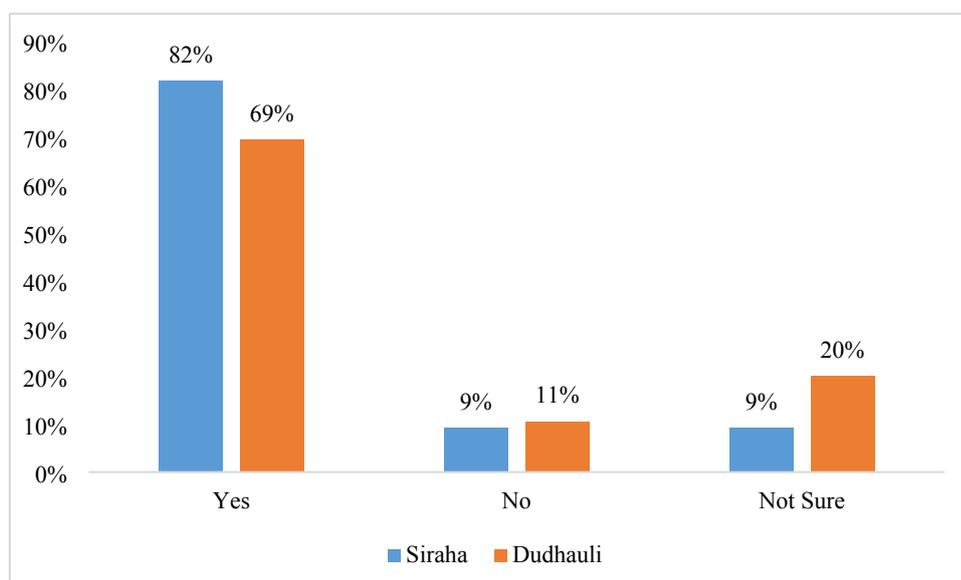


Figure 2: Community's understanding of climate change

The findings show that flooding was the most frequently experienced hazard among all climate-induced hazards and disasters. Table 1 demonstrates that 38% of respondents in Siraha and 35% in

Dudhauli, the largest percentage, shared that flood is most frequently experienced climate-induced disaster. Drought was identified as the second most frequent disaster by 16% of respondents in Siraha and 14% in Dudhauli, followed closely by heatwaves (14% in Siraha, 13% in Dudhauli) and heavy rainfall (14% in Siraha, 10% in Dudhauli). These patterns indicate that irregular and intensive monsoon rainfall, rising temperatures and poor drainage infrastructure jointly exacerbate localized risks, particularly flooding. Other hazards were reported at a minimum level across both municipalities [See Table 1 for details].

Table 1: Community experiences on the occurrences of climate-induced disasters

Climate-induced disasters	Siraha	Dudhauli
Flood	38%	35%
Drought	14%	16%
Heat waves	14%	13%
Heavy rain	14%	10%
Others	7%	7%
Diseases/pests	7%	3%
Windstorms	4%	7%
Thunderstorms	2%	4%
Fire in the forest	0%	4%

The researchers asked to categorize the observed causes of climate change in their local context. Human-induced drivers such as deforestation and land-use change [53% in Dudhauli & 38% in Siraha], and unregulated urban expansion [17% in Dudhauli & 29% in Siraha] were considered to be key factors contributing to the enhancement of climate-induced hazards. The findings of the qualitative data concur with quantitative analysis and highlights that dense forest cover created a natural cooling effect

in the past days in the Terai, but deforestation has remarkably intensified the present heat stress. A participant of key informant interview in April 2024 notes:

“Chure forests act as a key driver of sedimentation, soil erosion, and agricultural decline. The historical memory of abundant tree covers in the Terai marked the natural cooling effect in the past. However, deforestation has remarkably intensified the heat stress in the present”.

Siraha's low-lying terrain is prone to seasonal flooding and inundation, while Dudhauri, in the mid-hills with dense forest cover, experiences fewer floods but greater agricultural stress due to topography, land use, and environmental and livelihood systems. An increasing urbanization trend associated with land encroachment, waste management issues, and infrastructure expansion is reflected by 29% and 17% respondents in Siraha and Dudhauri, respectively. Over-exploitation of natural resources was described by 22% and 20% respectively in Siraha and Dudhauri municipality, indicating shared recognition of pressure on forest and water resources. Fewer respondents recognized industrialization with 11% in Siraha and 10% in Dudhauri, reflecting limited direct exposure and relatively low industrial development in both areas. However, this low reporting does not necessarily mean industrial activities do not contribute to climate change; rather, respondents do not consider them as primary local drivers compared to land use change and resource extraction. These results suggest that people from Siraha and Dudhauri build their understanding of climate change predominantly from visible local pressures such as resource depletion, urbanization and social vulnerabilities rather than from abstract global drivers of climate change. Community understanding of climate change appeared to be context-specific and shaped by localized multiple vulnerabilities (See figure 3 for details).

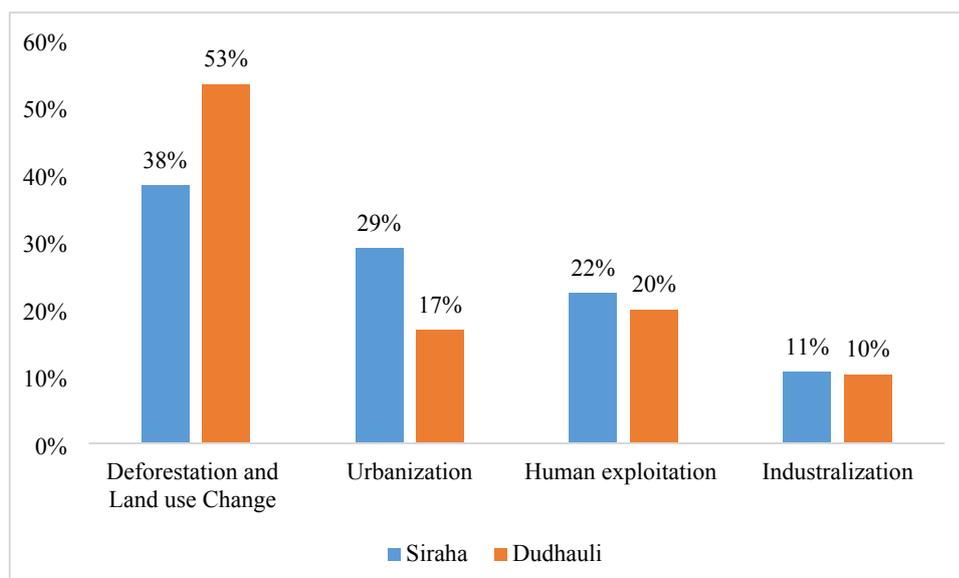


Figure 3: Community’s Understanding about the Causes of Climate Change

The findings suggest that the understanding and impacts of climate change are uneven by socioeconomic groups and geo-spatial settings and this recognition of climate impacts was shaped by the direct experiences of people in the communities. In addition, participants from key Informant interview in April 2024 and Focus Group Discussion on June 2024 shared:

“A major flood in 2050 B.S., disproportionately impacted marginalized groups with limited income. However, the people with better income sources were able to recover from this event rapidly, though partially. Since then, the marginalized groups continued to face prolonged difficulties and struggled to reccover their livelihood”.

The study further explored the level of concern regarding climate change impacts on the communities. A high degree of concern ‘more concerned’ was realized in both areas, though with slight variation in intensity. The study revealed that 48% of respondents in Siraha and 31% in Dudhauri were ‘more concerned’ about climate change impacts while 48% of respondents in Siraha and 67% in Dudhauri conveyed that they were ‘concerned’ about climate change impacts (See Table 3 for details). Moreover, the extent of concern about climate change between geographic locations was also assessed using a chi square test (See Table 3 for details). The result shows the level of concern was relatively uniform

($\chi^2 = 2.931$, $df = 2$, $p = 0.231$) across different respondent groups regardless of their background or status within Siraha municipality. The concern level was found to be statistically significant ($\chi^2 = 6.476$, $df = 2$, $p = 0.039$) in Dudhauri Municipality, demonstrating that the degree of concern varies systematically among respondents. This significant association implies that concern about climate change is shaped by localized differences in exposure, livelihood dependence on climate sensitive resources and access to information and services. While the concern about climate change is widespread in both municipalities, the degree of concern is shaped by the nature and frequency of localized climate impacts and communities' exposure to vulnerability.

Table 3: People's concern about the impact of climate change and climate-induced disasters

Municipality	More concerned	Concerned	Not concerned	Chi-square test (χ^2, df, p)
Siraha	80 (48%)	80 (48%)	6 (4%)	2.931, 2, 0.231
Dudhauri	74 (31%)	163 (67%)	5 (2%)	6.476, 2, 0.039

To contextualize the localized changes of temperature and precipitation patterns, we analyzed the temperature and precipitation data from 1995 to 2025 collected by Department of Hydrology and Meteorology, Government of Nepal. The analysis of the data shows that both maximum and minimum temperatures are increasing significantly following the global patterns. The seasonal temperature variations from maximum to minimum over 30 years show clear cyclical trends with fluctuations. The maximum temperature fluctuates between 30°C and 40°C, while the minimum temperature fluctuates between 10°C and 20°C, suggesting that temperature extremes have not shifted significantly over time (See figure 4 for details). However, the trend was found to be gradually increasing.

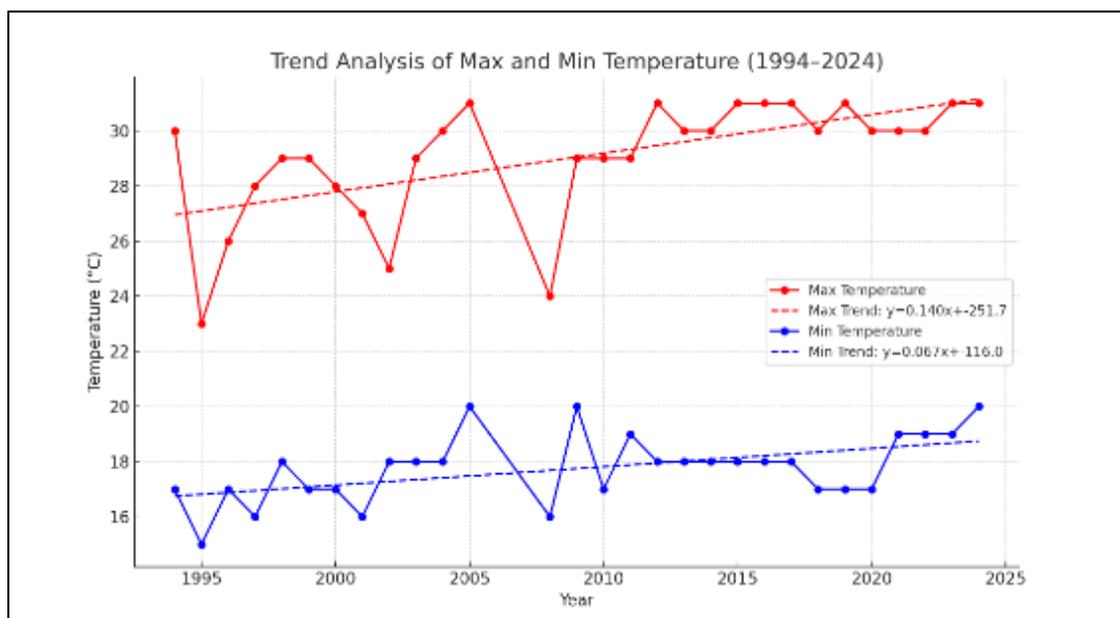


Figure 4: Observed maximum and minimum temperatures of the Kamala River basin

Figure 5 shows annual precipitation pattern in KRB over the period of 30 years. Despite strong interannual variability, the fitted linear trend indicates a clear long-term increase in rainfall. The trend line, linear regression equation $y = -1.93E3 + 1.02 * x$ shows an annual average precipitation increase by approximately 1.02 mm across the observed period in the KRB. The notable low-rainfall years occur in mid-2000s followed by a generally higher and more frequent extreme rainfall years after 2010. Overall, the basis is experiencing a gradual wetting trend, with increasing precipitation intensity in recent decades, which has robust implications for water resources management primarily of flood risks followed by droughts.

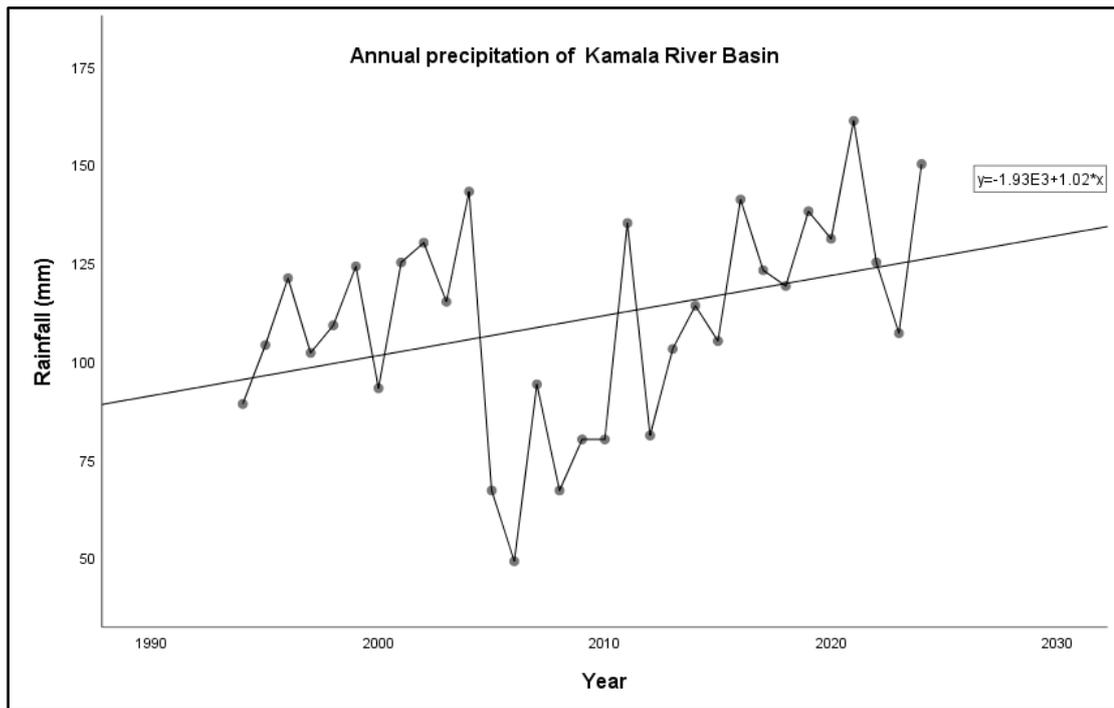


Fig 5: Annual precipitation in the Kamala River basin

The findings demonstrate that riverine communities of KRB are highly susceptible to floods, inundation and droughts due to its fragile geological formations and rough topography in the era of Anthropocene.

4.2 Adaptation Practices and Community Resilience

The findings revealed that early warning systems (EWS) emerged as the most widely recognized and adopted adaptation mechanism in both municipalities, reported by 54% of respondents in Dudhauri and 40% in Siraha (See Figure 6 for details). This indicates that technical adaptation measures are to some extent present and acknowledged across socially differentiated communities, with EWS and associated information dissemination mechanisms prioritized to mitigate climate-related risks.

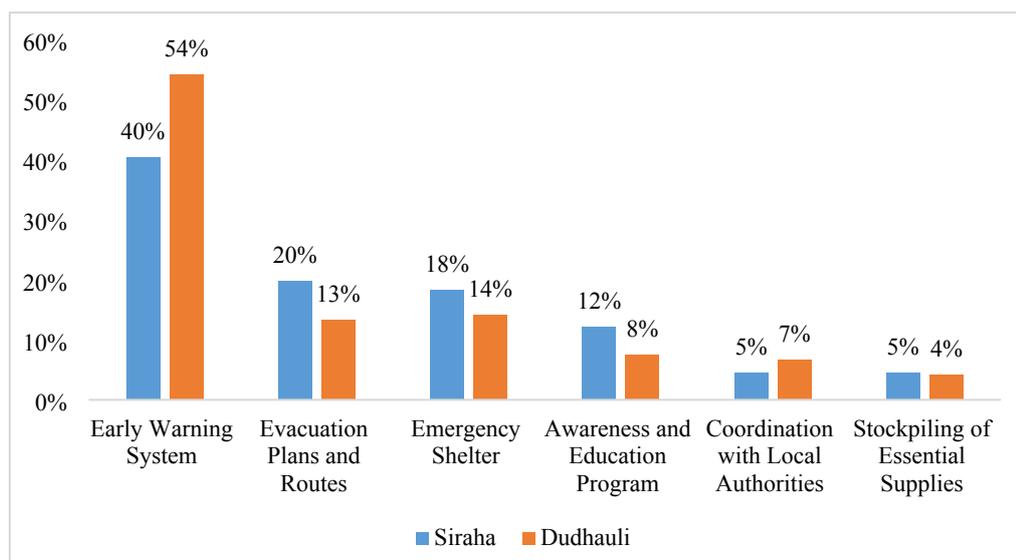


Fig. 6: Community's understanding of existing disaster response practices

However, qualitative findings indicate that the functionality and equity of these systems remain constrained according to key informant participant in April 2024:

“An early warning system installed at Ranibas has helped to enhance community resilience to climate hazards; however, the effectiveness of information dissemination has been affected due to unequal access to information. Although having limited effectiveness, communities successfully managed to disseminate flood hazard warning information through SMS”.

Communities shared that an EW system installed in Ranibas contributed to enhancing community resilience to climate hazards, however, the effectiveness of information dissemination has been undermined by unequal access to communication channels. Although limited in scope, communities rely on short message service (SMS) alerts to circulate flood warnings, but such practices reveal that early warnings are typically issued only when flooding is imminent, aiming to reduce immediate losses rather than addressing long-term vulnerability and exposure to climate-induced disasters. While this integration has supported short-term resilience, it has not translated into transformative or anticipatory adaptation. This limitation is further underscored by testimonies from marginalized groups. An elderly

participant from the Dalit community in Siraha highlighted persistent inequities in the distribution of risk information, noting that flood early warnings are unevenly disseminated between wealthier and poorer communities.

“Despite the issuance of flood early warnings, the does not reach all household equally. Wealthier population receive warnings in a timely manner whereas poor and marginalized households often receive them late or not at all. This unequal access reduces the ability to prepare in advance thus have increased exposure climate risks”.

The finding underscores how social stratification continues to shape access to adaptation tools, even when systems such as EWS are technically established and recognized, there are disparities in access to information and in the capacity to effectively utilize these systems remain pronounced, particularly among socially marginalized groups. The findings suggest that the presence of adaptation infrastructure alone is insufficient but equitable access, institutional prioritization of preparedness, and community-level capacity building are critical for functional adaptation. The limited emphasis on preparedness reflects a broader institutional orientation toward reactive disaster management, characterized by relief distribution and post-disaster reconstruction, rather than proactive strategies such as land-use zoning, climate-resilient infrastructure development, and ecosystem-based adaptation. This observation indicates that adaptation strategies, including EWS and crop diversification, remain underutilized due to infrastructural constraints and limited awareness.

Evacuation planning and emergency shelters were identified as the second most prominent adaptation mechanisms. Awareness of evacuation plans and routes was reported by 20% of respondents in Siraha and 13% in Dudhauri, while 18% and 14%, respectively, acknowledged relocating to safer areas during flood events. Awareness and education programs ranked as the third most important adaptation strategy, recognized by 12% of respondents in Siraha and 8% in Dudhauri (See figure 6 for details). However, low levels of coordination with relevant stakeholders and limited stockpiling of essential supplies highlight significant gaps in preparedness and institutional support. This is corroborated by

KII, which revealed that local governments and humanitarian organizations, such as the Red Cross, only engage during emergencies through the distribution of relief items, including tarpaulins, temporary shelters, food supplies, and hygiene materials. The participant shared:

“Local governments and the Red Cross distribute disaster relief packages including tarpaulins, Chinese tents, sanitary pads, soaps, sacks of rice (each of 25 kg), and other essential items to affected populations during flood emergencies only and these institutions do not focus on preparedness and mitigation or say-whole cycle of disaster risk reduction and management”.

When respondents were asked to identify preferred future adaptation strategies to reduce climate change impacts, EWS were again prioritized, with 44% of respondents in Dudhauri and 40% in Siraha emphasizing their importance for enhancing community resilience but they suggested that the EWS needs to be more accurate and robust. Flood-resilient infrastructure also emerged as a key strategy, supported by 25% of respondents in Dudhauri and 20% in Siraha, reflecting strong recognition of structural and nature-based interventions for flood risk reduction. In contrast, institutional and governance-based measures, such as operational community-based disaster risk management (CBDRM) committees, received limited attention, cited by only 11% of respondents in Dudhauri and 9% in Siraha. Notably, economic resilience and spatial planning were among the least emphasized adaptation strategies. Fewer than 10% of respondents identified livelihood diversification as a critical economic adaptation measure, while land-use planning and zoning regulations were rarely mentioned. This reveals a significant gap in long-term planning, policy enforcement, and transformative adaptation, with current practices remaining largely reactive and event-driven rather than preventive and systemic both from government’s priority and communities’ understanding.

Additionally, to reflect the status of preparedness of communities, a Likert scale assessment was performed to identify communities’ preparation for disaster response. The assessment shows preparedness remains concentrated at the lower end of the scale in both municipalities, with 44% of respondents reflected not being prepared and 26% slightly prepared in Siraha. The data shows weaker

profile of Dudhauri, with 54% reporting not prepared and only 1% indicating high preparedness (See Figure 7 for details).

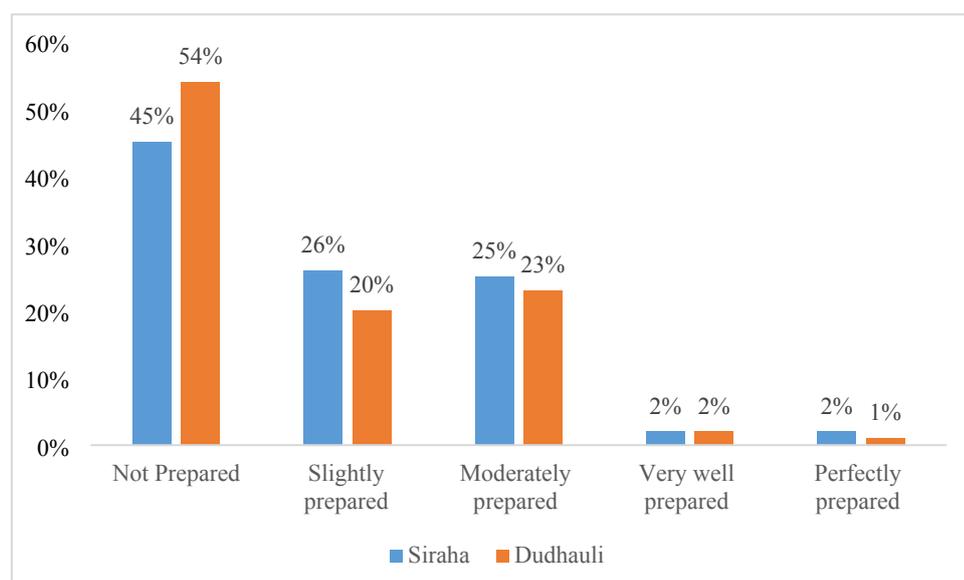


Figure 7: Preparation Plan and Disaster Response Mechanisms

This finding has strengthened qualitative evidence, where adaptation practices although technically present in the form of EWS and evacuation arrangements have not been translated into initialized preparedness. The dominance of low preparedness categories suggests that disaster management remains largely reactive, and event driven, focused on early warning and relief distribution rather than anticipatory planning and risk reduction. Unequal access to warning information, limited coordination among stakeholders, and the absence of routine preparedness activities constrain communities' absorptive and adaptive capacities, particularly among marginalized groups.

3. Discussion

Climate change in the KRB is experienced as a set of immediate and visible problems rather than a distant global process. Communities mainly relate climate change to flooding, drought and heat stress, and livelihood disruption. The high proportion of respondents reported changes in temperature and rainfall in both Siraha and Dudhauri, indicate that climatic variability has become a part of everyday life. Similar evidence from South Asia shows that repeated exposure to hazards strengthens experiential climate knowledge effectively compared to formal climate education (Pandey 2025;

Maharjan & Dongol, 2024; Gemeda et al., 2023; Devkota, 2021). Depletion of forest area and increased settlement is crucial to intensify local temperature (Neupane & Dhakal, 2017). Similar pattern is observed in the KRB, where experiential grounding explains why community's associate climate change with local drivers such as deforestation, urban expansion, and resource depletion. The understanding is therefore grounded in lived experiential change, however, it remains focused on proximate causes rather than broader climatic processes.

Despite being located within the same river basin, Siraha and Dudhauri show distinctly different vulnerabilities. Siraha, located in the lowlands, experiences frequent flooding and heat stress, while Dudhauri, in the mid-hills, faces relatively fewer floods but greater agricultural stress linked to topography and land use. The spatial difference of the lowland Siraha and the mid-hill Dudhauri underscore that vulnerability is fundamentally shaped by pre-existing structural inequalities, not just geographic exposure (Panthi et al., 2025; Kapri, 2024; Maharjan, 2023; SAWTEE, 2016). Climate change as a threat multiplier that intensifies existing socioeconomic and ecological factors (Maharjan & Dongol, 2024; Paudel et al., 2024). Perception is demonstrated as a crucial mediating factor which determines how physical hazards are internalized as risks. However, strong perception does not automatically lead to a proactive or long-term adaptation (Poortinga et al., 2019; Phuyal et al., 2026). Communities may clearly recognize climate impacts yet rely mainly on short-term responses. This shows experience is not only a means of awareness but also tool which acts as a foundation for transformative resilience to enable communities to reduce future climate risks.

Flooding emerged as the most frequently experienced hazard in both municipalities, reflecting the basin's fragile geology, monsoon variability, and unplanned settlement pattern. While Dudhauri experienced slightly fewer floods than Siraha, its agricultural stress illustrates how topography and land use systems produce differentiated risks. This spatial differentiation supports the idea that climate impacts are socially produced through the interactions between hazards, exposure, and institutional capacity rather than by climatic trends alone (Maharjan & Dongol, 2024; IPCC, 2023). The observed

climate trends are consistent with wider scientific studies in South Asia, which increased climate impact (Pandey 2025; Magar et al. 2024; Gameda et al. 2023; Amadio et al., 2023;). But these uneven challenges reflect poverty, weak governance, and limited infrastructures (Wong & Abdullah, 2022; Hussain et al., 2021). Vulnerability is further intensified by social exclusion, where marginalized groups, particularly Dalit communities in both municipalities, experience more severe and prolonged impacts due to limited access to resources, information, and institutional support. This suggests that access to information, prior exposure, and social stratification influence climate risk perception and have shaped differential engagement with adaptation strategies. This shows that climate risk perception and adaptation are shaped by both exposure and social position. Therefore, the findings establish that exposure and vulnerability are often differentiated even within the same river basin.

Adaptation responses in the KRB are mostly reactive and short-term including both autonomous and planned adaptation. Autonomous adaptation includes experiential knowledge, crop diversification short term migration, and informal information sharing. These practices are common in agrarian and riverine areas where farmers adjust planting times or diversify agriculture activities based on climatic indications (Matandirotya et al., 2024), where autonomous strategies primarily strengthen absorptive capacity by helping households to cope with immediate shocks. However, they do not significantly reduce long term exposure. For long-term sustainability, the concerned agencies must adopt both mitigation and preparedness (Sadiq et al., 2024).

Planned climate change adaptation in the KRB through early warning systems (EWS), designated emergency shelters, and post-disaster relief mechanisms remain predominantly reactive and short term across both municipalities, albeit with comparatively better coverage and access in Dudhauri than in Siraha. Empirical evidence indicates that, despite the presence of EWS infrastructure, these systems rarely translate into anticipatory or preparedness-oriented action at the household and community levels (Pandey, 2025; Pandey & Basnet, 2023; UNDRR, 2023). Instead, institutional priorities continue to center on emergency evacuation and relief delivery, while structurally preventive and risk-

reducing measures such as land-use zoning in flood-prone areas, livelihood diversification, and the development of climate-resilient infrastructure remain marginal within local adaptation planning (Daiyan et al., 2025). These planned interventions are largely designed and implemented by government agencies and humanitarian actors, with limited integration of community-based risk knowledge and locally grounded planning processes. Persistent gaps in information dissemination and risk communication disproportionately affect marginalized and socially differentiated groups, resulting in uneven and exclusionary access to adaptation benefits. This pattern reflects a broader disconnect between local-level planned adaptation practices and national policy frameworks, as well as a failure to meet internationally recognized standards for disaster preparedness, mitigation, response, and risk communication, largely due to weak institutional coordination and inadequate multi-sectoral planning. Consistent with previous assessments of flood risk governance in Nepal, the KRB case demonstrates that while technical and structural measures are increasingly available, their effectiveness is constrained by fragile institutional linkages and limited social inclusion (Paudel et al., 2021; Dixit et al., 2020). Thus, planned adaptation outcomes in the basin are shaped less by the mere presence of infrastructure and more by prevailing patterns of social stratification and local institutional capacity.

The absence of effective integration between household level autonomous and planned adaptation undermines adaptive capacity in the KRB. Autonomous practices with inadequate institutional support through extension services, financial resources or climate information platforms constrain their effectiveness and scalability. At the same time, planned interventions often neglect local knowledge and settlement realities, showing a mismatch between policy objectives and community needs. Recent scholarships argue that adaptation is effective when formal planning strengthens existing autonomous strategies rather than replacing them (Kelman et al. 2024; Eriksen et al., 2024). In the KRB limited linkage between these two forms of adaptation underpins short term coping mechanisms that prevent adaptive learning and innovation. Strengthening communities' resilience therefore requires aligning

autonomous and planned adaptation to enable the system to move beyond irregular coping mechanisms towards adaptive and finally transformative community resilience.

Overall, the analysis shows that climate change in the KRB is widely recognized but unevenly experienced, with vulnerability shaped by geography, livelihoods, and social inequality. Adaptation remains focused on coping rather than transformation. Strengthening community resilience therefore requires moving beyond reactive responses toward anticipatory and transformative strategies. This involves improving institutional coordination, ensuring equitable access to information and resources, and aligning local practices with national policies. Only by linking experiential knowledge with structured planning can communities shift from short-term survival to long-term resilience.

4. Conclusion

This study examines community's understanding of climate change, experience of its effects, and the choice of adaptation measures adopted in Siraha and Dudhauri municipalities. The findings revealed communities perceive climate change through everyday experience of rising temperatures, unpredictable rainfall, and a frequent rise in extreme events. Concern level varies by location and hazard profile, where Siraha is frequently exposed to floods and heat stress, demonstrates higher concern on climate impacts. Whereas Dudhauri, experienced gradual decline in crop productivity. Despite widespread awareness of climate risks, adaptation remains largely reactive. Emergency relief, temporary evacuation, and EWS were prevalent, while proactive approaches like institutional coordination, land use planning, and livelihood diversification remain weak in both municipalities.

The study demonstrates both autonomous and planned adaptation was presented in the KRB, but their effectiveness is uneven and socially differentiated. Households rely on experiential knowledge, crop diversification, short-term migration, and informal information sharing to cope with immediate shocks to strengthen absorptive capacity. Although planned interventions, including early warning systems and emergency shelters provide limited technical protection. This shows unequal access and weak

coordination across institutions. These inadequacies disproportionately affect marginalized groups, particularly Dalit and low-income households who possess restricted access to information, resources, and services.

Community resilience in riverine settings cannot be achieved through technical measures only. It depends on the integration of local knowledge with formal planning, equitable access to adaptation resources and governance arrangements. The dominance of short-term coping strategies indicates that current adaptation pathways remain trapped at the absorptive level, with limited progression toward adaptive learning or transformative change. As a result, resilience in the KRB is shaped not only by environmental exposure but also by social stratification, governance efforts, and institutional reach. Advancing resilience therefore requires a shift from event-based response to anticipatory and comprehensive adaptation practices that address structural drivers of risk, strengthens municipal institutions, and embeds community participation within decision-making processes.

The study highlights two key insights for strengthening adaptation and community resilience in the KRB. First, local climate perception provides a critical foundation for identifying context-specific risks and designing socially acceptable interventions. Second, adaptation strategies must extend beyond reactive measures to include a proactive and transformative approach and to connect ecosystems, infrastructure, and livelihoods. Therefore, municipal implementation and institutional coordination must align with national climate policies and prioritize transformative resilience strategies to tackle urgent policy and practice priorities to enhance community resilience.

However, the study is limited to the geographic scope of two municipalities within a single river basin and may not capture the full diversity of climate experiences across Nepal or South Asia. Hence, further research should explore how education, governance, and local innovation can enable transformative adaptation and long-term resilience. Comparative studies to other river basins would

provide how localized vulnerabilities intersect with national policy frameworks, thereby informing more effective and equitable climate governance.

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References

- Amadio M, Behrer AP, Bosch L, Kaila HK, Krishnan N, Molinario G. *Climate risks, exposure, vulnerability and resilience in Nepal*. World Bank Group; 2023. (World Bank Publications – Reports; no. 40597).
- Asad SA, Abid M, Ahmad I, Thapa G, Dendup T. Climate change risk perceptions, vulnerability, and adaptation in high altitude farming regions of Hindu Kush Himalaya. *APN Sci Bull*. 2023;13:87-101.
- Bista RB. Examining determinants of household vulnerability in Nepal: Descriptive statistics analysis of flood disasters. *Patan Pragya*. 2022 Dec 31;11(02):139-52.
- Kapri CS. Climate Change-Induced Disaster and Its Impact on the National Security of Nepal. *Unity Journal*. 2024 Mar 25;5(1):223-38.
- Chaudhary BR, Acciaioli G, Erskine W, Chaudhary P. Responses of the Tharu to climate change-related hazards in the water sector: Indigenous perceptions, vulnerability and adaptations in the western Tarai of Nepal. *Climate and Development*. 2021 Oct 21;13(9):816-29.
- Creswell JW, Creswell JD. *Research design: qualitative, quantitative, and mixed methods approaches*. 5th ed. Los Angeles: SAGE Publications; 2018.
- Creswell JW. *A concise introduction to mixed methods research*. SAGE publications; 2021 Jul 30.
- Cutter SL, Ash KD, Emrich CT. The geographies of community disaster resilience. *Global environmental change*. 2014 Nov 1;29:65-77.

- Dahal K. Integrated Urban Development Plan (IUDP) as a Guiding Tool to Municipal Development: Insights from Dudhauri Municipality, Nepal. *Journal of Geographical Research/Mağallaḥ Al-buḥūt Al-Ğuğrāfiyyā*. 2020 Jul 1;3(3).
- Daiyan A MM, Sakib A SN, Pasha A AB. Assessing Community Resilience against Climatic Disasters: A Case Study on Local Adaptation Strategies in the Barguna District. *INTI Journal*. 2025 Jan 1;2025(1).
- Dawadi S, Mishra Y, Lamichhane M, Tamrakar J. Impact of climate change on crop water requirement in Kamala River Basin of Nepal. *Advances in Engineering and Technology: An International Journal*. 2022 Dec 31;2(01):47-58.
- Devkota RP. Climate change: trends and people's perception in Nepal. *Journal of Environmental Protection*. 2014 Mar 18;5(4):255-65.
- Devkota RP, Cockfield G, Maraseni TN. Perceived community-based flood adaptation strategies under climate change in Nepal. *International Journal of Global Warming*. 2014 Jan 1;6(1):113-24.
- Devkota R. Conceptualizing Flooding Systems Globally and Preferred Adaptation Strategies Locally under Climate Change. *Jalawaayu*. 2021 Apr 21;1(1):47-59.
- Gemeda DO, Korecha D, Garedew W. Climate change perception and vulnerability assessment of the farming communities in the Southwest Parts of Ethiopia. *Climate*. 2023 Sep 5;11(9):183.
- Gharti Magar B, Poudel JM, Paudel B, Pokharel B. Climate change in outskirts of Kathmandu Valley: local perception and narratives. *Natural Hazards*. 2024 Jul;120(9):8103-20.
- Government of Nepal. State of the Kamala River Basin, Nepal. WECS and CSIRO. 2020.
- Gyawali N, Devkota D, Chaudhary P, Chhetri A, Devkota NR. Rural Strategies for Flood Resilience: Analysis of Community Actions in Narayani River Basin, Nepal. *International Journal of Agricultural Extension and Rural Development Studies*. 2021 Oct 2;8(5):1-5.

- Htitch M, Harmáček J, Lisney J, Krylova P. Multidimensional Cross-Country Measurement of Climate Change Perceptions. Measurement: *Interdisciplinary Research and Perspectives*. 2024. 1-16.
- Hussain A, Rasul G, Mahapatra B, Wahid S, Tuladhar S. Climate change-induced hazards and local adaptations in agriculture: a study from Koshi River Basin, Nepal. *Natural Hazards*. 2018 Apr;91(3):1365-83.
- IPCC. *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva: Intergovernmental Panel on Climate Change; 2014.
- IPCC. *Climate Change 2022: Impacts, Adaptation and Vulnerability*. Cambridge: Cambridge University Press; 2022
- IPCC. *AR6 Synthesis Report: Climate Change 2023*. Geneva: IPCC; 2023.
- Kafle MR. Comparative study of flood impacts and damages by major trans-boundary rivers in Nepal using MCDM. *Journal of Water Resources and Pollution Studies*. 2020;5(2):258135326.
- Karki R, Hasson SU, Schickhoff U, Scholten T, Böhner J. Rising precipitation extremes across Nepal. *Climate*. 2017 Jan 13;5(1):4.
- Kelman I, Glantz MH. Early warning systems defined. In *Reducing disaster: Early warning systems for climate change* 2014 Jan 27 (pp. 89-108). Dordrecht: Springer Netherlands.
- Khanal P, Wagle BH, Upadhaya S, Ghimire P, Acharya S. Perceived climate change impacts and adaptation strategy of indigenous community (Chepangs) in rural mid-hills of Nepal. *Forestry: Journal of Institute of Forestry, Nepal*. 2019 Nov 30;16:48-61.
- Khatri BB, Pasa RB. People's perception on climate change: The context of local and global discourse. *Asian Journal of Population Sciences*. 2023 Jan 10:68-79.
- Maharjan K. Transboundary river governance and climate vulnerability: Community perspectives in Nepal's Koshi river basin. *Geographical Research*. 2023 Nov;61(4):512-24.

- Maharjan K, Dangol S. Climate Change and flood vulnerability analysis in the Narayani River of Nepal. *Journal on Geoinformatics, Nepal*. 2024 May 29:19-33.
- Matandirotya NR, Filho WL, Mahed G, Dinis MAP, Mathe P. Local knowledge of climate change adaptation strategies from the vhaVenda and baTonga communities living in the Limpopo and Zambezi River Basins, Southern Africa. *Inland Waters*. 2025;1–13.
- Ministry of Forests and Environment (MoFE), Government of Nepal. *Vulnerability and Risk Assessment and Identifying Adaptation Options: Sectoral Report – Disaster Risk Reduction and Management*. Kathmandu: MoFE; 2021.
- Nash N, Capstick S, Whitmarsh L, Chaudhary I, Manandhar R. Perceptions of local environmental issues and the relevance of climate change in Nepal's Terai: Perspectives from two communities. *Frontiers in Sociology*. 2019 Aug 20;4:60.
- Neupane M, Dhakal S. Climatic variability and land use change in Kamala Watershed, Sindhuli District, Nepal. *Climate*. 2017 Feb 18;5(1):11.
- Pandey CL. The impact of climate change on agriculture and adaptation in Nepal. *Agribusiness and Information Management*. 2012;4(1):13-23.
- Pandey CL. Managing urban security: challenges and prospects in Nepal. *Environ Dev Sustain*. 2021;23(1):141–257.
- Pandey CL, Dahal N. Rethinking climate diplomacy gains: strategic benefits to nepal. *Journal of Foreign Affairs*. 2022 Sep 5;2(01):69-87.
- Pandey CL, Joseph J, Deshar R, Niraula P. Transboundary flood resilience: insights from Narayani and Mahakali Basins. *International Journal of Disaster Risk Reduction*. 2023 Feb 15;86:103535.
- Pandey C, Niraula P. Climate Change-induced Livelihood Insecurity in Narayani-Gandak Basin of Nepal. *Bharatpur Pragya: Journal of Multidisciplinary Studies*. 2024 May 28;2(01):16-32.

- Pandey CL. Climate Change, Floods, and Community Resilience: A Study of the Kamala River Basin, Nepal. *Journal of Flood Risk Management*. 2025 Jun;18(2):e70069.
- Pandit B, Bhattarai P. Flood risk mapping of Kamla River Basin using HEC-RAS 2D model. *Advances in Engineering and Technology: An International Journal*. 2023 Dec 15;3(1):31-45.
- Panthi TR, Thapa RB, Paudyal IK. Climate Change Perception, Agricultural Impacts, and Adaptation Strategies: A Case of Palanta, Kalikot, Nepal. *Journal of Agriculture and Forestry University*. 2025 May 27;6(1):260-74.
- Paudel B, Wang Z, Zhang Y, Rai MK, Paul PK. Climate change and its impacts on farmer's livelihood in different physiographic regions of the trans-boundary koshi river basin, central himalayas. *International Journal of Environmental Research and Public Health*. 2021 Jul 3;18(13):7142.
- Poudel K, Karki S, Lamichhane K, Timilsina A, Dijkerman S, Ghimire J. Perception of Climate Change Vulnerability and its Impact on Sexual and Reproductive Health and Rights in Khutiya and Banganga River Basins. *Journal of Nepal Health Research Council*. 2024 Jun 21;22(01):25-33.
- Phuyal P, Kramer IM, Kadel I, Wouters E, Magdeburg A, Groneberg DA, Kuch U, Ahrens B, Dhimal ML, Dhimal M, Müller R. On people's perceptions of climate change and its impacts in a hotspot of global warming. *PLoS One*. 2025 Feb 13;20(2):e0317786.
- Poortinga W, Whitmarsh L, Steg L, Böhm G, Fisher S. Climate change perceptions and their individual-level determinants: A cross-European analysis. *Global environmental change*. 2019 Mar 1;55:25-35.
- Sadiq AA, Dougherty RB, Entress R, Adhikari B, McCoy KW, Rott E, Chikoto-Schultz GL, Maharajh S. Mitigating and Preparing for Disasters at the Organizational Level: A Global Systematic Literature Review. *International Journal of Disaster Risk Science*. 2025 Apr 2:1-3.SAWTEE. (2016). A study of effect of Chure degradation on water: A case of Kamala Basin in Nepal (Briefing paper). South Asia Watch on Trade, Economics and Environment.

United Nations Office for Disaster Risk Reduction (UNDRR). *Global Assessment Report on Disaster Risk Reduction 2022*. Geneva: UNDRR; 2022.

Wester P, Mishra A, Mukherji A, Shrestha AB. *The Hindu Kush Himalaya assessment: mountains, climate change, sustainability and people*. Cham: Springer Nature; 2019. p. 627.

Whitmarsh L. Scepticism and uncertainty about climate change: dimensions, determinants and change over time. *Glob Environ Change*. 2011;21(2):690–700.

Wong SK, Abdullah RG. Towards a Resilient Riverine Community: A Case Study in Sadong Jaya, Sarawak, Malaysia. In *Creating Resilient Futures: Integrating Disaster Risk Reduction, Sustainable Development Goals and Climate Change Adaptation Agendas 2021* Oct 31 (pp. 205-224). Cham: Springer International Publishing.

Disclosure Statement

We are pleased to submit our original research article, entitled “**Climate Change and Adaptive Strategies for Community Resilience: Insights from the Kamala River Basin, Nepal**” for public publication (open access), as the researchers are from a developing country, Nepal. We confirm that this research has not been previously published and is not currently under consideration for publication elsewhere.

This study investigates the localized climate perceptions and adaptation response varies within two geographically distinct areas of the same river basin, and is influenced by topography, land use, and exposure to climate hazards. Adaptation measures are reactive, which focus on short-term coping strategies with limited long-term planning. As per the scope, we believe this manuscript is suitable for publication in PLOS Climate and can contribute to the scholarly world.

We state, this research was conducted in accordance with ethical guidelines endorsed by School of Arts, Kathmandu University. Prior to the data collection, verbally informed consent was obtained from all the participants and assure confidentiality of their identity.

For any queries regarding this manuscript, please direct correspondence to me via email goma.sigdel@kuso.edu.np.

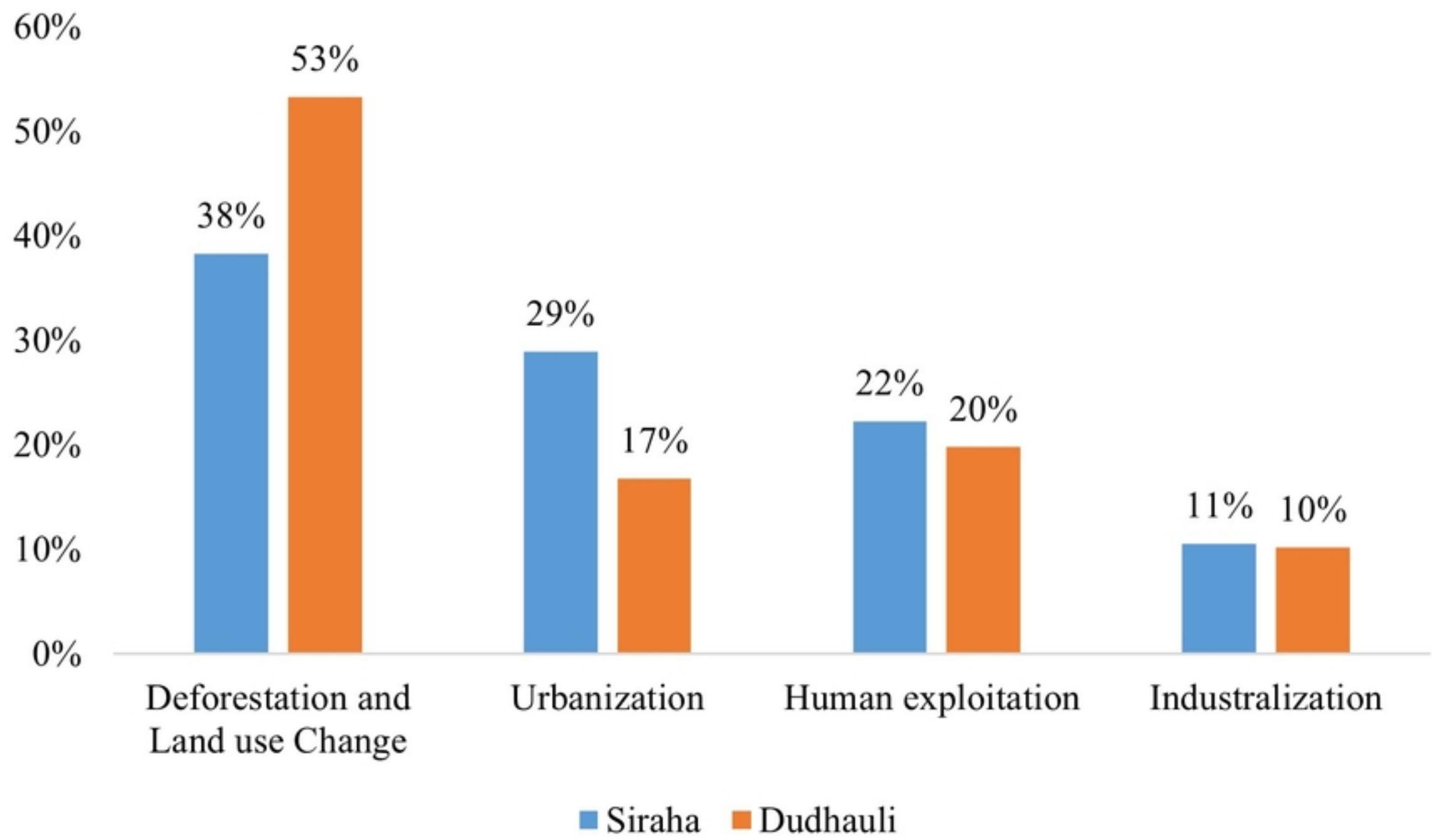


Figure 3

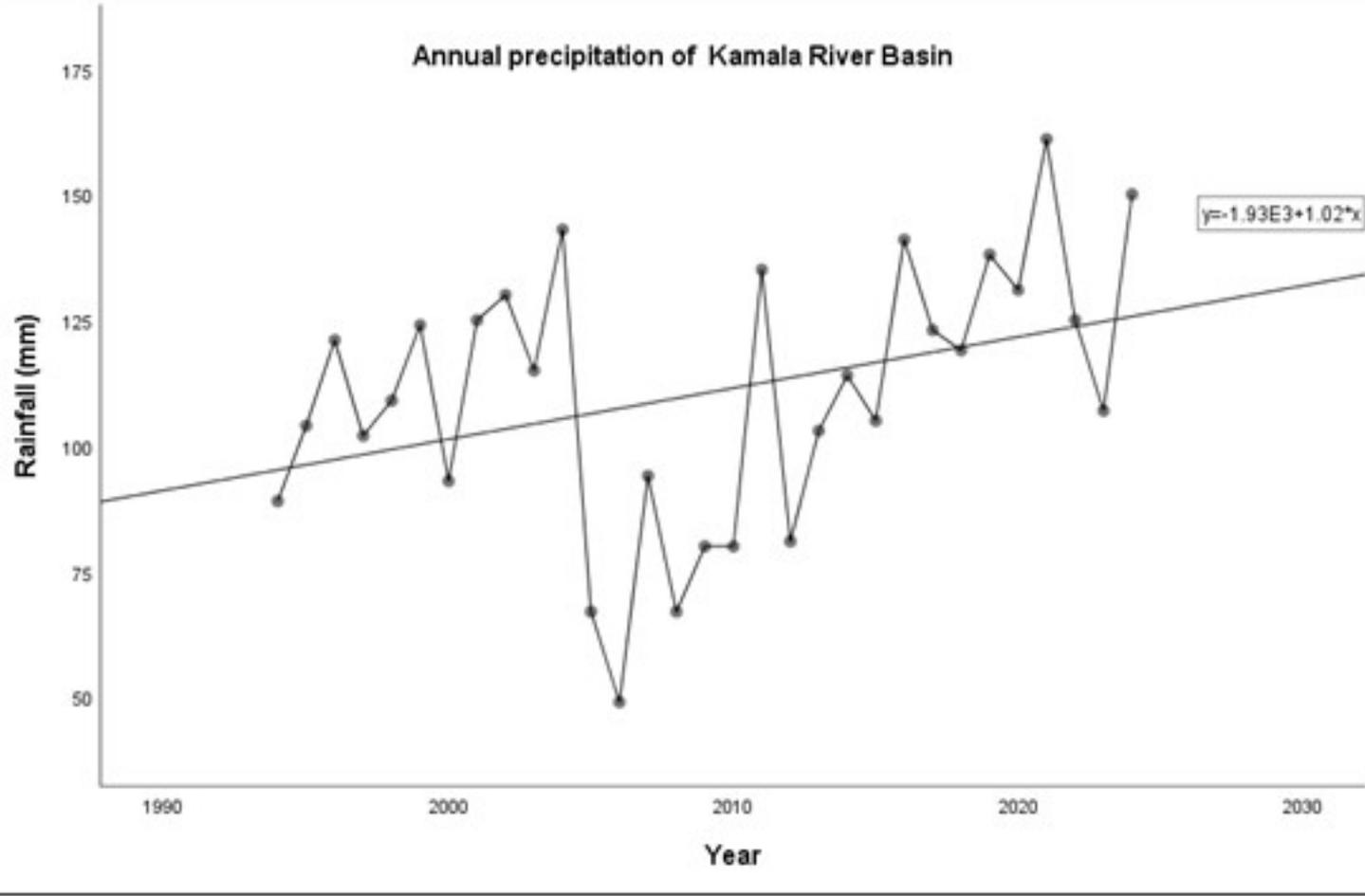


Figure 5

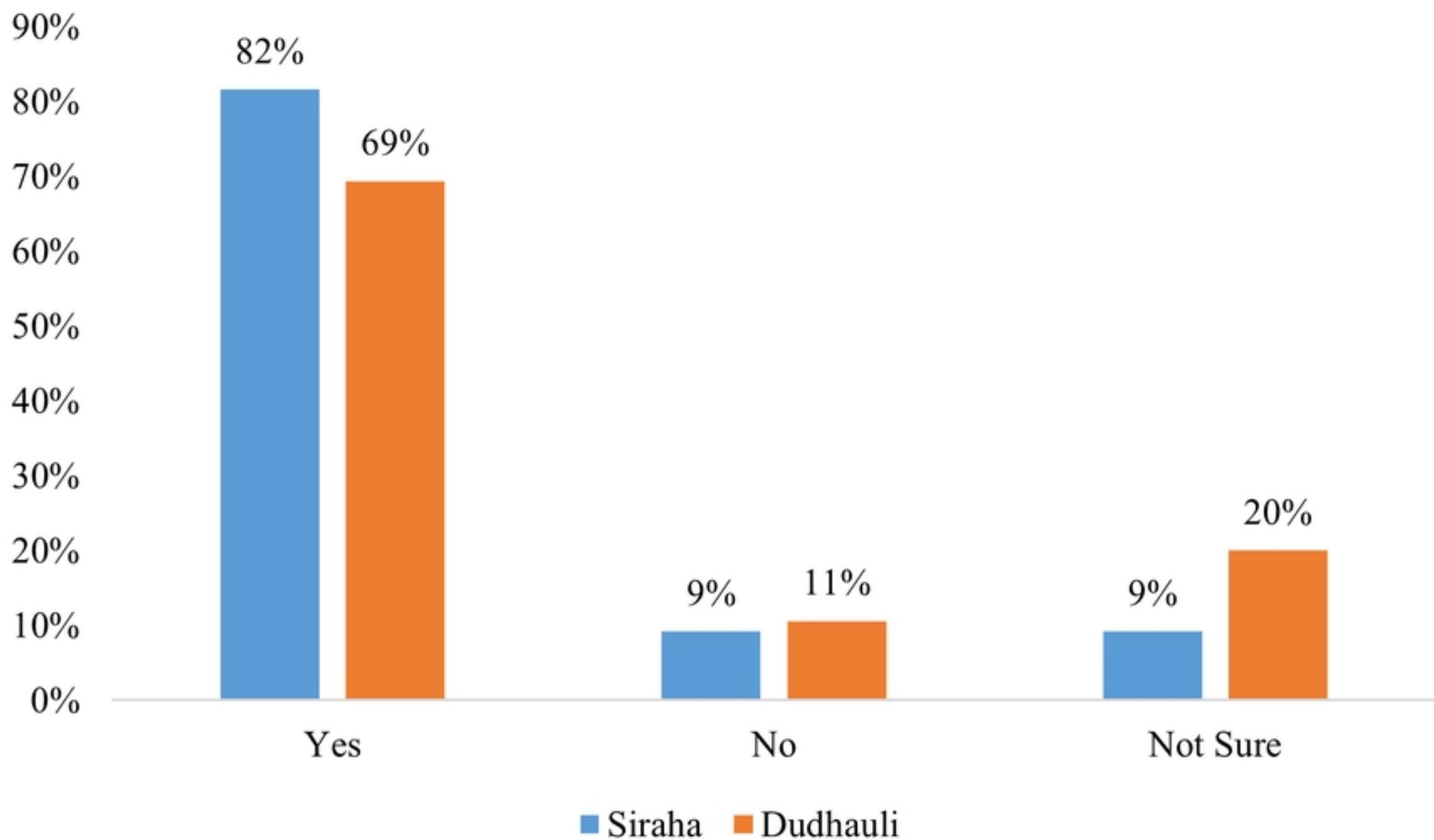


Figure 2

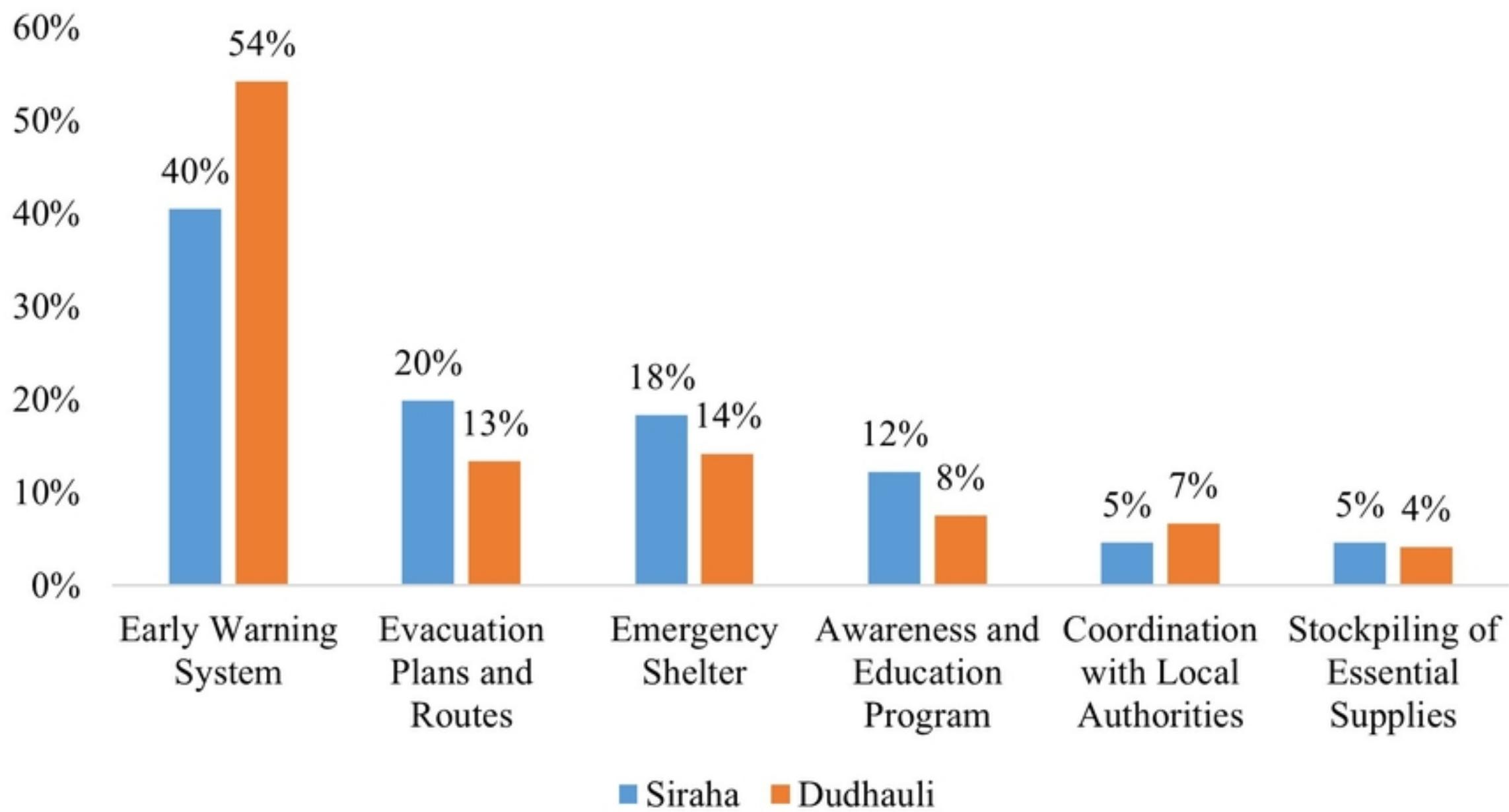


Figure 6

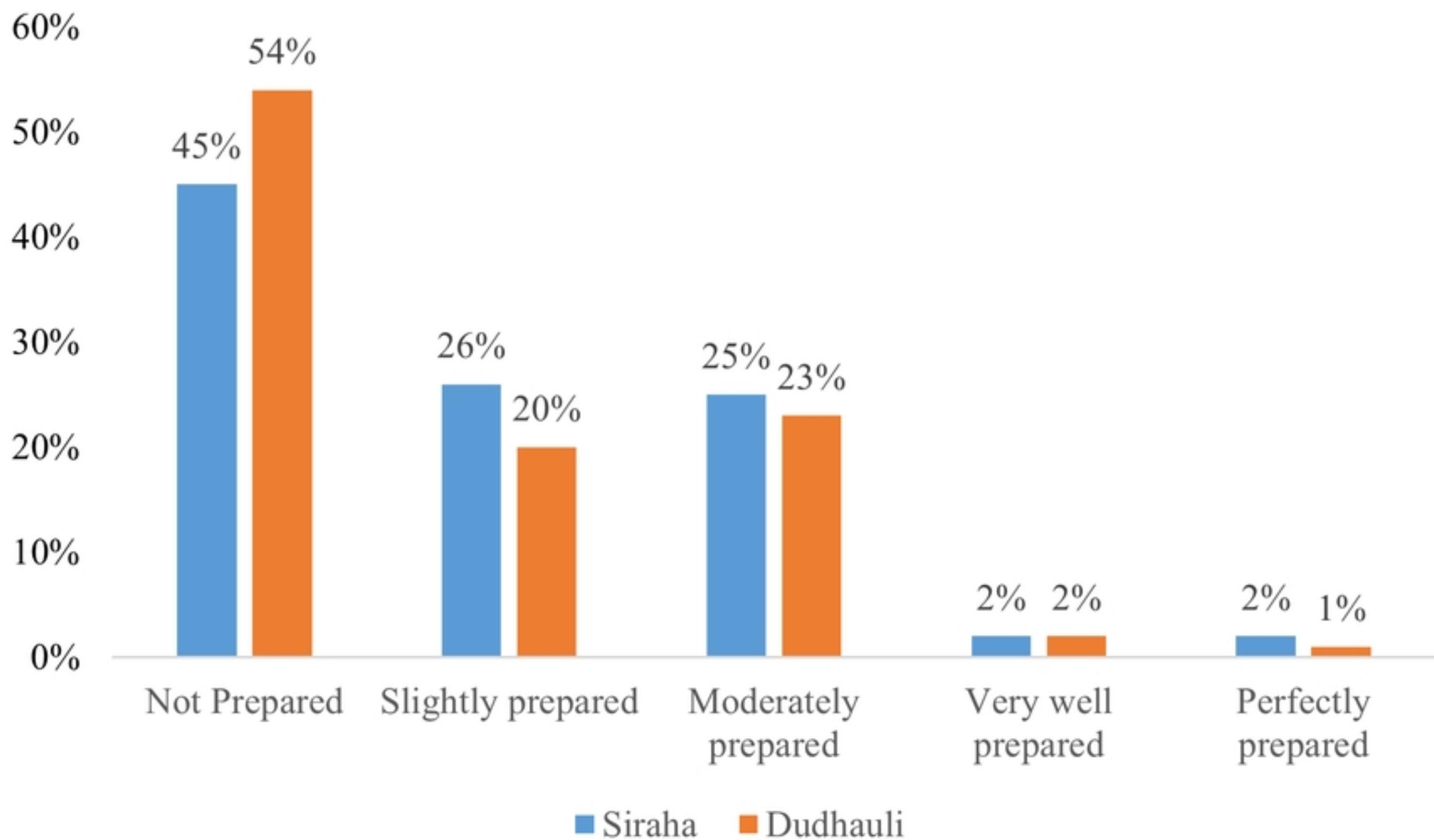


Figure 7

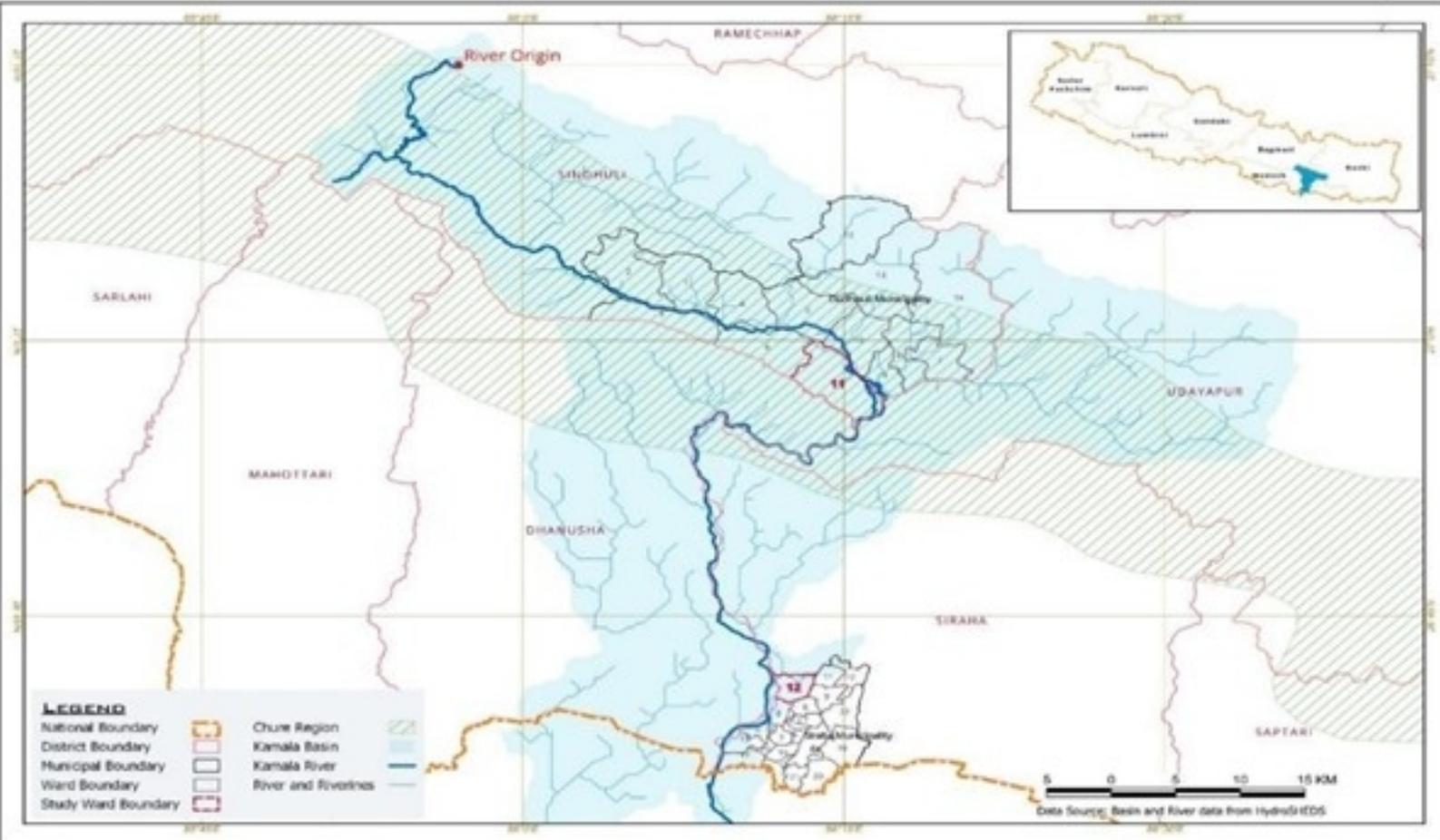


Figure 1

Trend Analysis of Max and Min Temperature (1994-2024)

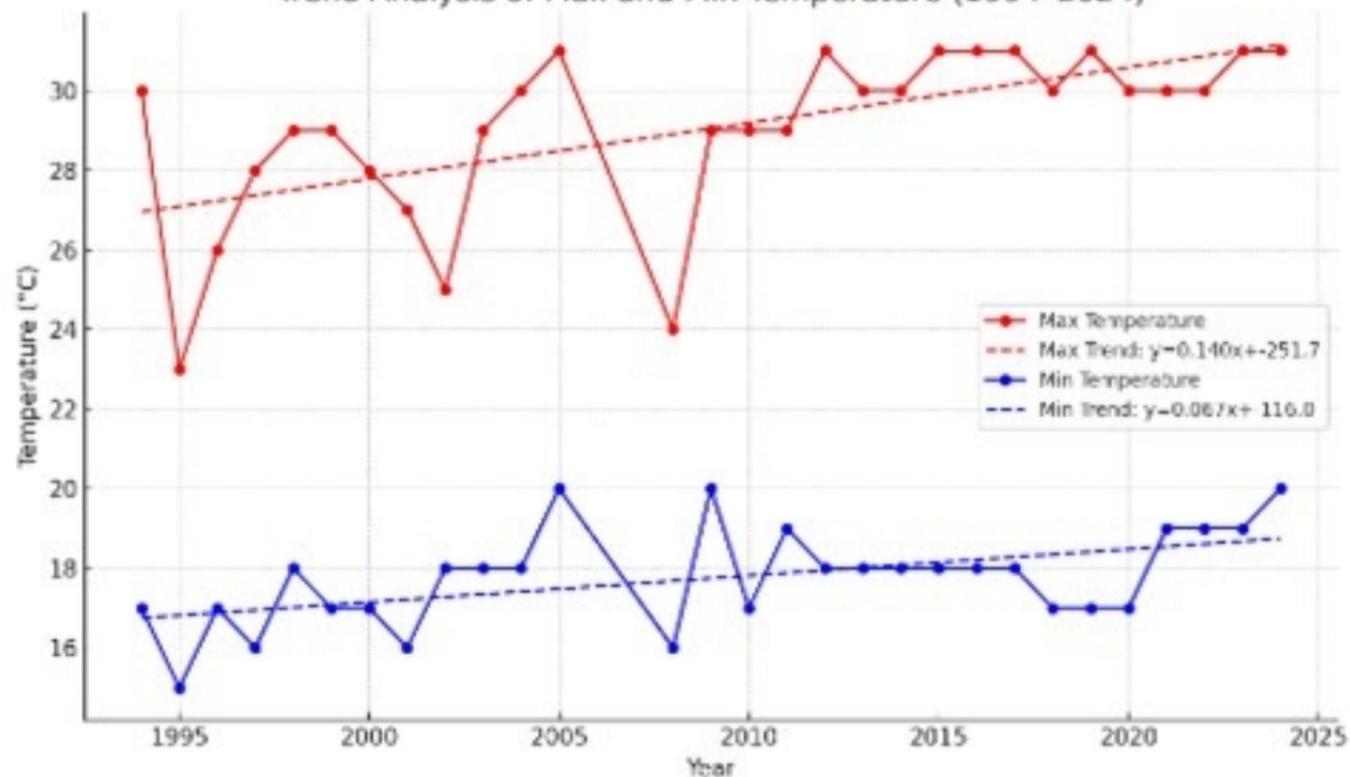


Figure 4