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Effects of Climate Change on Tourism in the Lower Mustang, Nepal

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ABSTRACT

Climate change has become a major global challenge with significant effects on many sectors, including tourism. Mustang, Nepal, located in the rain shadow of the Himalayas and known for its distinctive geography and rich cultural heritage offers an important case for examining how climate change affects tourism-dependent economies. Rising temperatures and increasingly unpredictable weather patterns are putting pressure on Mustang's fragile ecosystem, threatening both its biodiversity and the socio-economic stability of local communities that rely heavily on tourism. Despite these growing concerns, only limited research has been conducted on the impacts of climate change on the tourism sector, particularly in the Lower Mustang region. The present research aims at exploring the effects of climate change on tourism in lower Mustang, Nepal. We have formulated open-ended interview guidelines followed by purposive sampling technique to capture the first-hand and in-depth descriptions of stakeholders' perceptions. Thirty concerned stakeholders were interviewed including hotel owners, local business operators, local people and visitors followed by member checking. The qualitative data collected from study area are supported by secondary data received from the National Trust for Nature Conservation (NTNC) and the Department of Hydrology and Meterology (DHM). The result shows that average temperature and rainfall have been increasing in Mustang because of climate change. To overcome the challenges caused by rising temperature and consequences such as untimely rainfall, decreasing snowfall and increasing snowmelt on higher mountain, the government and other stakeholders should address these issues quickly for sustainable tourism in Mustang, Nepal. Furthermore, it aims to propose adaptive strategies that can mitigate these impacts and promote sustainable tourism practices in Mustang.

INTRODUCTION

Climate change has emerged as a critical global phenomenon with insightful implications for various sectors, including tourism (Phuyal *et al.*, 2020). The unique geography and cultural heritage of Mustang, Nepal, situated in the rain shadow of the Himalayas, make it a significant case study for examining the impacts of climate change on tourism-dependent economies (KC, 2017). As temperatures rise and weather patterns become increasingly unpredictable, the instable ecosystem of Mustang faces unprecedented challenges, threatening not only its biodiversity but also its socio-economic stability, particularly through tourism (K.C. & Thapa Parajuli, 2015).

The climatic condition at destination is one of the key determinants and fundamental attraction for tourists (Bhandari, 2014). United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over long period of time" (UNFCCC, 1992). Nepal is one of the least contributors to global climate change but 4th most vulnerable country in terms of climate-related disasters (Maplecroft, 2011). The global temperature, on average, has warmed by 0.850^0C over the last 100 years or more, 1880-2012 (IPCC, 2014) and its negative impacts have been seen in tourism and other aspects of livelihood in the world.

The Hindukush Himalayan region is considered as vulnerable and most climate - sensitive region followed by large climate change – led consequences (Shrestha *et al.*, 1999). Climate change affects and poses a number of threats on multiple sectors such as tourism, agricultural productivity and food security, water resources availability, biodiversity, health hazards, effects on survival of local communities (Hussain *et al.*, 2016). In 2019 (before the pandemic), Travel and Tourism accounted for 10.5 % of all jobs (334 million) and 10.4 % of global GDP, which was 10.3 trillion US dollars. International visitors spending amounted to 1.91 trillion US dollars in 2019 (WTTC, 2023).

In 2023, the Travel and Tourism sector contributed 9.1 % to the global GDP. Around 27 million new jobs were created and international visitors spending registered a 33.1 % rise in 2023 (WTTC, 2023). Despite the effects of covid pandemic, more than 6600,000 tourists visited Nepal during 2014 – 2021 (MOF, 2024). The average number of visits of foreign tourists in Nepal in is around 600,000 per year in recent decade. In FY 2023, the tourism sector contributed 1.4 % to the GDP of Nepal (MOF, 2024). Among the total tourists visit in Nepal, 62.5 % visit for holiday and entertainment, 15.9 % for trekking and mountaineering, 13.1 % for pilgrims and 9.2 % for other reasons (MOF, 2024).

This research aims to explore the multifaceted impacts

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of climate change on tourism in Mustang, focusing on both the environmental and socio-economic dimensions. By examining existing literature, conducting field surveys, and analyzing statistical data, this study seeks to elucidate how changing climatic conditions are influencing tourist behavior, local businesses, and conservation efforts in the region. Thus, the prime objective of the study is to explore the effect of climate change on tourism of Lower Mustang, Nepal. Furthermore, it aims to propose adaptive strategies that can mitigate these impacts and promote sustainable tourism practices in Mustang.

The rest of the paper is organized into different sections as follows: Second section is the review of literatures including conceptual framework designed for this study; Third section shows the Study area; Fourth section is about research methodology including materials and methods; Fifth section presents the results from interview; the Sixth section presents the discussion; The last section is about summary, conclusion, and policy recommendations.

LITERATURE REVIEW

Phuyal *et al.* (2020) conducted their study to examine the impact of climate change on tourism in Nepal and found that climate variations have a number of negative impacts on tourism activities and services provided by tourism industry. Moreover, the trend of loss and damage in tourism business is increasing since last 3 decades, which is equivalent to 987,968 U S dollar each year. The regression result shows that change in temperature and precipitation results into shrink in total number of tourists arrival. The empirical findings reveals that 1 % increase in GDP of the origin country leads to 0.19 % rise in tourist arrival in Nepal. Similarly, 1 % increase in exchange rate decreases the flow of international tourists by 0.46 %. The study further claims that tourism activities of foreign countries are sensitive to temperature and rainfall. The result of correlation shows that increase in average temperature by 0.09^0C leads to decrease in tourists flow by 1.04 % in Nepal.

Climate change and its effects on various sectors are becoming burning issues among the researchers, policy makers and governments as well as in the field of academia. It brings more risks than opportunities due to increase in temperature, decrease in snowfall, melting of snow and ice in the mountains resulting into destruction of flora and fauna (KC, 2017). Climate change has brought change in income from tourism in many developing countries like Nepal. Nepal is famous for trekking and mountaineering and they are highly climate change sensitive. Consequently, tourists change their planned holiday destinations from unpleasant weather place to fine weather place (KC, 2017). It results into decrease in number of tourists in climate sensitive regions, and thereby affecting the livelihood of people relying on tourism.

The Hindukush Himalayan region, including Nepal is climate change sensitive region in the world. Many countries in this region rely upon tourism. To explore the impact of climate change on tourism in Manaslu Conservation Area, K.C. and Thapa Parajuli (2015) conducted their study particularly focusing on tourism. The study found that temperature and rainfall are increasing in the study area due to climate change. The gradually rising temperature and decreasing snowfall resulted into adverse effects on tourism business. The visitors number of domestic tourists is increasing and that of international tourists is shrinking.

Nepal has unique natural features, highest peak in the world, biodiversity, beautiful natural landscapes including many snow-capped Himalayas. We have more potentiality of nature-based tourism, which could be one of the emerging sources of national development. Consequently, tourism sector is highly challenged by global climatic change and it's effects such as: glacial lake outburst floods, landslides, rise in temperature, unnatural and untimely rainfall, draught and effects on biodiversity, extinction of rear plants and species due to rising temperature (Nepal, 2011). Likewise, plants and animals are migrating to higher elevation to adapt to rising temperatures (Bhandari, 2014).

A study conducted by Lama (2010) on Mustang found that climate change has adversely affected on natural beauty of Mustang, reduced water availability, as well as degraded the productivity of land and thereby local crops. The study also found that shortage of water is affecting the hotel business in Lete, Marpha, Kagbeni and Muktinath region. The natural scenic beauty of the mountain was reduced due to less snowfall in winter with a thin cover of snow (Lama, 2010).

The study of Rayamajhi (2012) explored the connection between climate change and tourism business sector. The author particularly focusses on effects on lodge-owners, tourist guide, and tourists in Annapurna Trekking route. The study found that increased intensity of temperature, rainfall, landslides and floods counteract the visit of tourists in this trail (Nepal, 2011).

Subedi and Chapagain (2011) claimed that upper Mustang is a special destination for trekking tourism in Nepal since 1980s, and around 10,000 treakers are annually visiting the famous tourist's destination. However, this study has found climate change and receding glacier, abandoned agricultural field and destroyed households, increasing temperature as key concerns for sustainable tourism development. Khatri (2023) found that road construction and transportation system have increased the air pollution and sound pollution in Upper Mustang which has negatively affected to the trekking tourists in Mustang. Unpredictable change in weather pattern, the fluctuations in rainfall and snowfall damaged the tangible heritage of Upper Mustang (Khatri, 2023) due to climate change.

Tourism industry is highly sensitive to weather and climate change which affect the tourists plan for holiday and destination (Dawson & Scott, 2013; Berrittella *et al.*, (2006). What are the major factors responsible for climate change? Perhaps most of the human induced activities

such as: greenhouse gas emission, deforestation, industrial chemicals, energy products, excessive use of fossil fuels, as well as volcanic eruptions are major causes of climate change. However, Gossling *et al.* (2023) claims that tourism related business is also responsible for climate change. Tourism business was taken as "White pollution free industry" for long period of time. Since early 2000s, studies are also directed towards the calculations of pollution and greenhouse gas emission from tourism industry. Tourism is an activity by which residents and foreigners travel to domestic and international destinations. Consequently, tourism business itself is also responsible for climate change, and it adversely affects future tourism. A study of Khatib (2023) claims that patterns of future tourism and their destinations choices are likely to change due to climatic factors such as temperature and extreme weather, forced migration, degradation and disappearance of natural tourist destinations. Consequently, tourism itself is responsible for around 8 % of the world's carbon emission.

considered as one of the key determinants because particular areas are famous tourist destinations (Raihan, 2023). The decision of tourists to travel domestic and international places is determined by convenient and comfortable for them having less or no effects of climate change. To identify the effects of climate change on tourism; Pedapalli *et al.* (2022) said that climate change has adversely affected the tourism activities such as trekking and mountaineering, selection of holiday destinations and mode of enjoy. The study further suggests appropriate management practices in national and international levels to control and minimize the consequences of climate change on tourism (Kumar & Anantha, 2018).

Dube *et al.* (2023) explored the effects of climate change in Africa by examining the gaps, scholarship trends and policy issues employing the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. The study found increased tourism climate/ change risks, higher temperatures, severe droughts and floods, sea level rise, snow melting and more frequent

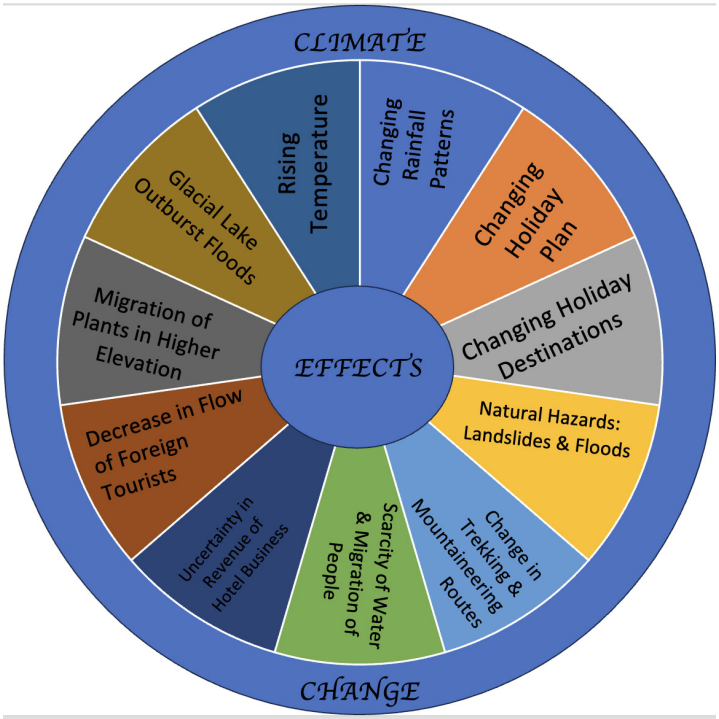


Figure 1: Conceptual Framework

Source: Author's Own Creation

Tourism is the second largest business area after information technology in the service sector of the global economy. Tourism creates direct and indirect employment opportunity. Exploring the climate change impacts on tourism in Tamil Nadu – India; Ahamed *et al.* (2022) found that climate change results into fluctuations in temperatures and rainfall pattern which damages the natural resources. It has adversely affected the tourism activities of Nilgiris and Dindigul, the hilly region of Tamil Nadu.

The tourism industry is also threatened by global warming and climate change because the weather situation is tropical cyclones; and they have adversely affected tourism industry. Connecting the effect of climate change in tourism of Indiana, USA; Day *et al.* (2021) write that Indiana is one of the famous tourist destination due to its landscapes, Michigan Lake, National Park. However, the effects of climate change are noticed as: increase in extreme hot in each summer, more rainfall, less snow fall, etc. Each of them affects tourism and recreation.

Weather and climate are key determinants for tourists in selecting their destinations as well as reduces the revenue in tourism-dependent places. Exploring the impacts of climate change on tourism in Coachella Valley of California; Yanez *et al.* (2020) found a non-

linear relationship between rising temperature and daily visitors. Chien *et al.* (2023) employed the autoregressive distributed lagged model to identify the effects of air pollution on tourism industry in the USA. The study found negative relationship between the air pollution in terms of CO_2 emission and the arrival of international tourists in the USA.

After reviewing the relevant literatures covering the international and Nepal specific studies and author's own intuition, the conceptual framework diagram is sketched in Figure 1 below.

The conceptual framework prepared for this study is presented in Figure 1. It shows that change in multiple climate induced variables bring changes in the frequency and impact level of climate induced hazards (Phuyal *et al.*, 2020). Increase in such natural hazards and disasters invite direct and indirect multiple effects on tourism business. Climate change is mostly caused by human induced activities including greenhouse gas emissions, deforestations, industrial chemicals and waste management, energy production and excessive use of fossil fuels, and natural causes like volcanic eruptions. Its effects are realized in the form of rising temperatures, precipitations, natural hazards like landslides and floods (Kinyili, 2023; Islam, 2025; Wuchu, 2024). They result into change in holiday plan and destinations of tourists. Likewise, it affects on tourism revenue, employment, income and livelihood of tourism business workers and local communities.

MATERIALS AND METHODS

Study area

This study was conducted in the Annapurna Conservation Area under NTNC, which is also popularly known as Annapurna Circuit, particularly in lower Mustang region, Nepal, as shown in Figure 2. We have covered famous tourism destinations of lower Mustang region, namely, Lete, Marpha, Jomsom, Kagbeni and Muktinath area in our study.

Mustang district is a part of Gandaki province in northern Nepal, which is situated in the rain shadow area of the Himalayas, resulting in a semi-arid climate and unique landscapes. It spans an area of around 3573 squares K.M. and it is characterized by high cliffs, barren landscapes, as well as green valley in some parts such as Marpha and Jomsom and Kagbeni. The district is divided into Upper Mustang (the northern part) and Lower Mustang (the southern part). Mustang lies in Gankaki province, a district of Dhaulagiri zone, west Nepal. Present study covers only Lower Mustang region particularly Lete, Marpha, Jomsom, Kagbeni and Muktinath temple area.

The total population of Mustang district, according to the population census report 2021, is 14,452 in which 7934 are male and 6518 are female (NSO, 2022). It is the second district after Manang in terms of lowest population with 0.69 % population growth rate per annum. Mustang

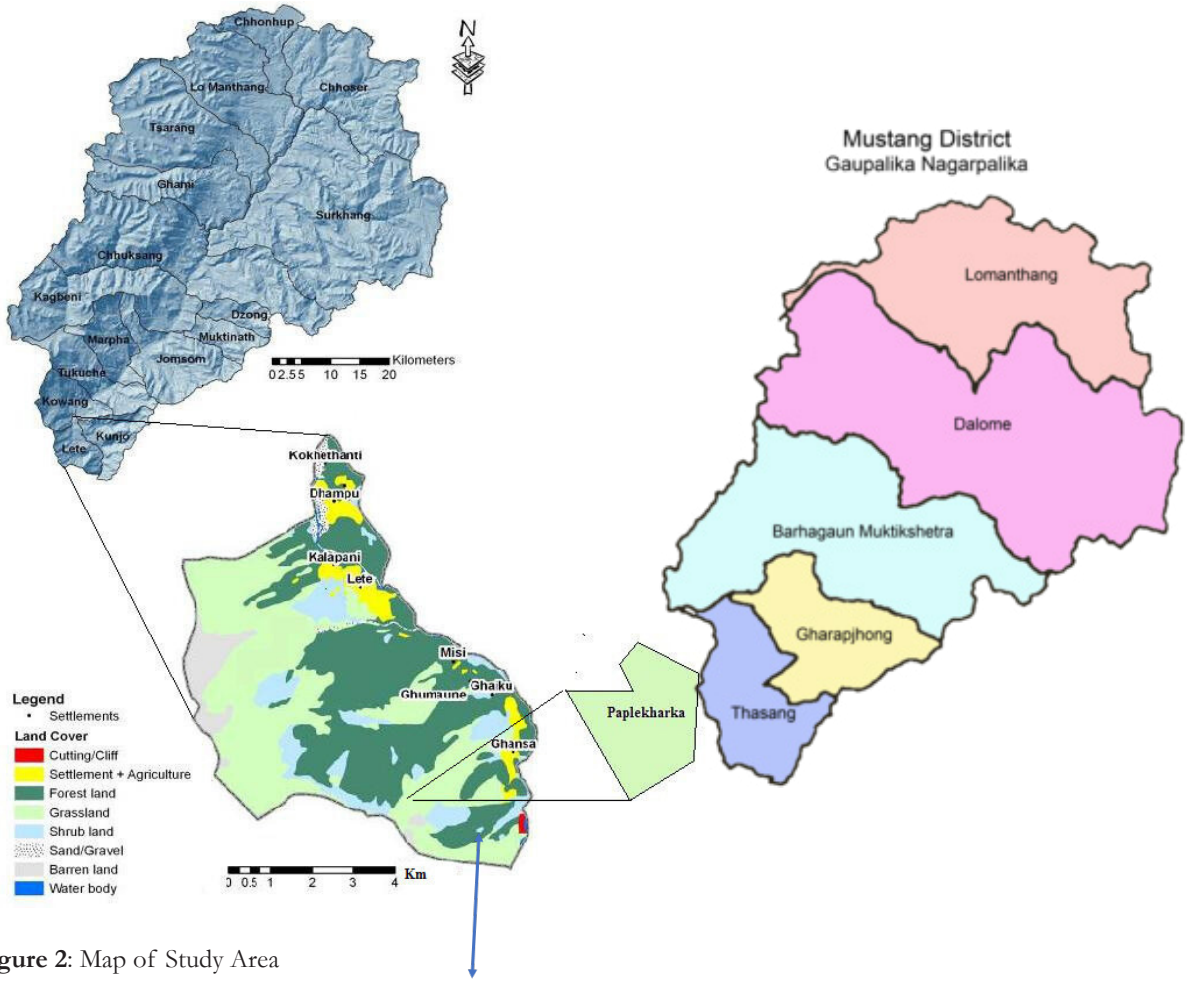
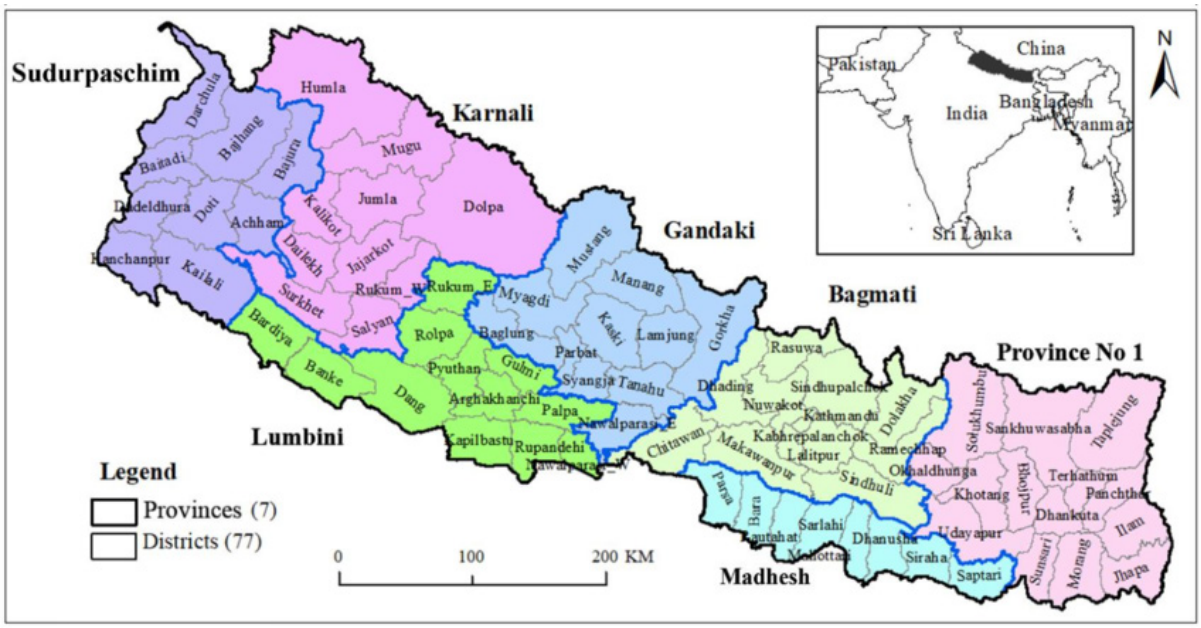


Figure 2: Map of Study Area



is connected with Tibet, the autonomous region of China, in North side; Manang district in east; Myagdi district in south and with Dopla district in the west. The elevation ranges from 2,000 meters in the lower Mustang to more than 8,000 meters in the high Himalayas. The district has trans-Himalayan climate, upper Mustang has Tibetian-like climate and lower part is more temperate. It includes world famous trekking routes and tourism places including Marpha, Jomsom, Kagbeni, Muktinath temple and Lo Manthang in upper Mustang. The ethnicity of Mustang includes mainly Thakali followed by Gurung and Tibetan communities. Thakali people are predominantly in the lower Mustang, while upper Mustang is a primarily inhabited by people of Tibetan decent. Agriculture, tourism and trade are the prime activities the region, and it famous for apple orchards. Tourism, particularly trekking play significant role in local economy. Mustang district's unique combination of rich cultural heritage, unique landscapes, distinct climate, Muktinath temple, upper Mustang make a prime tourism destination in Nepal, attracting domestic tourists as well as tourists from around the world.

In order to explore the effects of climate change on tourism business of Lower Mustang, we conducted our study on Lete, Marpha, Jomsom, Kagbeni and Muktinath temple area, Nepal. We employed qualitative research design and purposive sampling technique to collect the primary data. Semi-structured interview guidelines are used to capture the first-hand and in-depth descriptions of stakeholders' perceptions on the effects of climate change on tourism. The author held in-depth interview with 30 concerned stakeholders including hotel and lodge owners, local business operators, local people and visitors from Nepal and abroad. The qualitative data collected from research participants were thematically coded. For the trustworthiness of qualitative data, we have completed member checking with four hotel owners at our study area with most senior hotel owners as they had been experiencing nexus between climate change and tourism industry of study area since several decades. The secondary data about number of tourists visited are collected from regional office of National Trust for Nature Conservation (NTNC), Jomsom and climate data (temperature and rainfall) are collected from Department of Hydrology and Meterology (DHM), Pokhara station of Nepal government. Ethical values are well considered during our entire research work.

RESULTS AND DISCUSSION

In order to explore the effects of climate change on tourism of Lower Mustang, we have formulated open-ended interview guidelines including perception of local people on tourism business and policies practiced by the local and federal governments. The secondary data related to temperature and rainfall were available from Pokhara regional office of DHM and the number of tourists in Mustang were available from regional conservation office of NTNC located in Jomsom.

Climate Change and Tourism Observation

The annual mean temperature, average maximum temperature and minimum temperatures of Mustang since 2000 to 2023 are presented in Figure 3. As presented in Figure 3, the annual maximum temperature of Mustang has been increasing at the rate of 0.0250 Celsius per year as shown by the trending line drawn in Figure 3. The annual minimum temperature of the study area presented in Figure 3 has been decreasing by 0.06950 degree celsius per year as shown by the trending line.

The annual mean temperature of Mustang has been decreasing at the rate of 0.0210 degree celsius per year because the trending line is making a negative slope of 0.021 with yearly time scale starting from 53.96. The annual average rainfall trend in Mustang is presented in Figure 4. According to the data of DMH, Pokhara office,

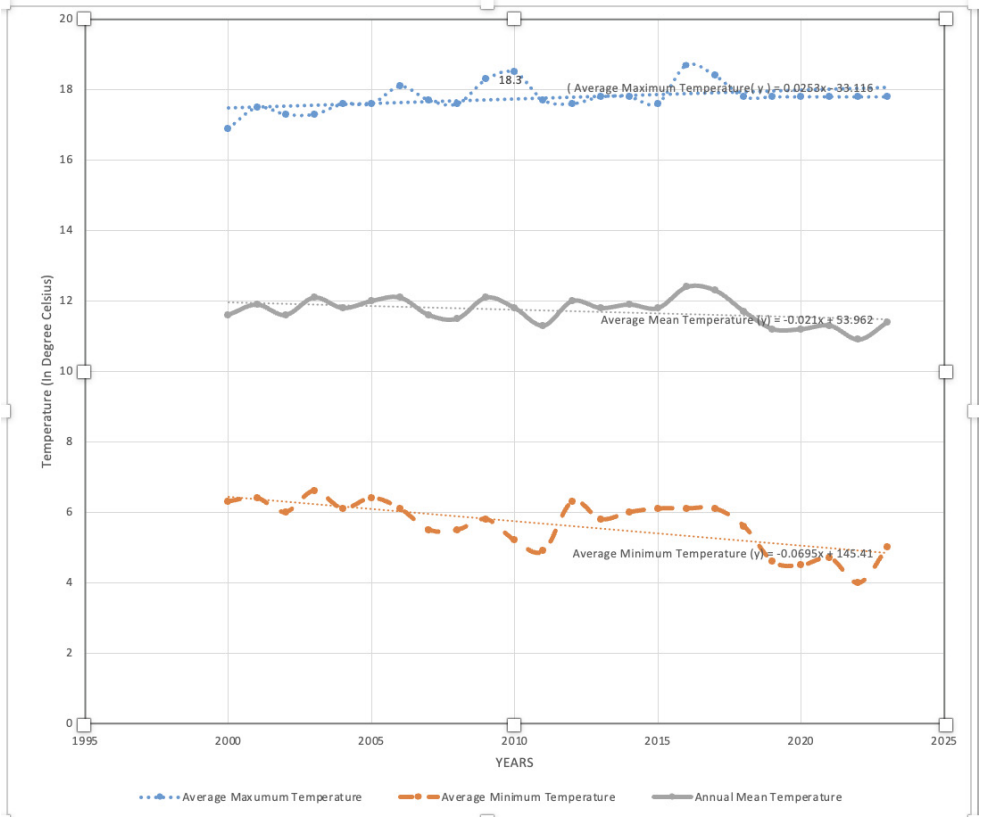


Figure 3: Average Maximum, Average Minimum and Annual Mean Temperatures.
Source: DHM, 2024.

the average annual rainfall has been increasing by 10.31 mm per year as presented in Figure 4. The trending line makes a positive slope of 10.31 with annual time scale starting from 191.48 mm per year. The annual number of visitors in Mustang since 2000 to 2023 has been presented in Figure 5. The data of visitors in Mustang are collected

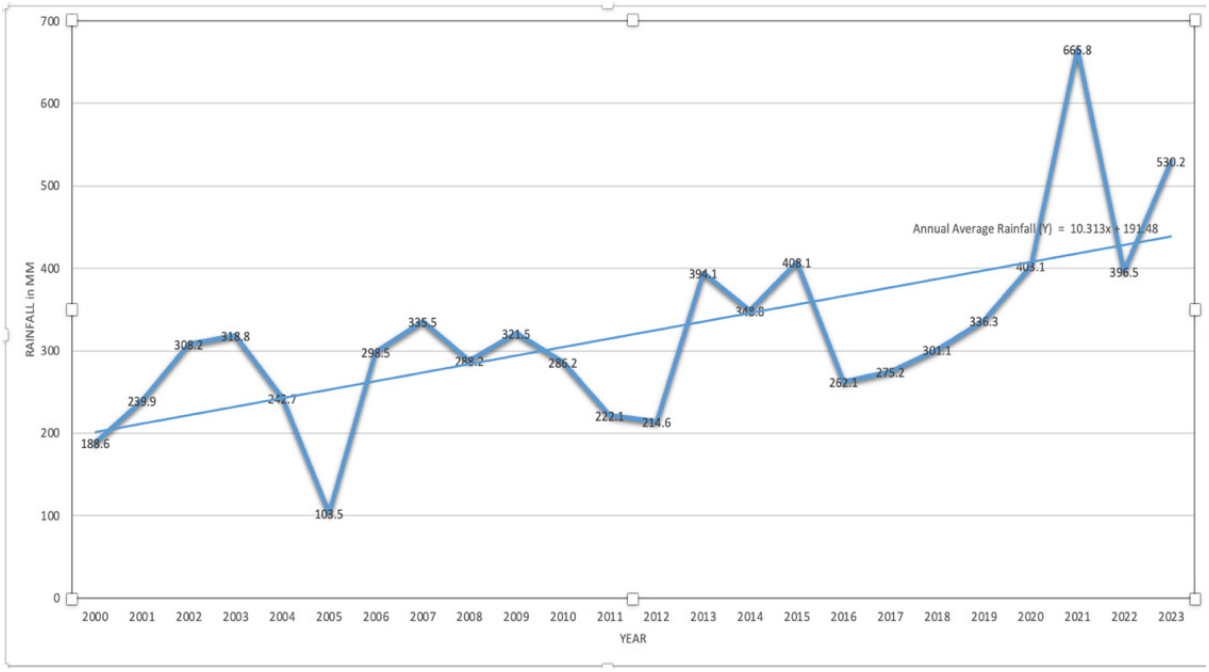


Figure 4: Average Annual Rainfall
Source: DHM, 2024.

from NTNC, Jomsom. It shows that the number of visitors in Mustang is increasing from 1995 to 2000, and remains more or less stable up to 2005. The number has increased sharply since 2000 to 2012 and then came down in 2015. The rising trend of visitors remained up to 2018 and then sharply came down in the years of 2020. The number of visitors was almost nil in the year 2021 due to effects of Covid pandemic. This minimum number has rapidly increased only after 2022 onwards, and reached at highest in the year 2023, as shown in Figure 5.

Perception on Climate Change and Tourism

We have formulated semi-structured interview guideline

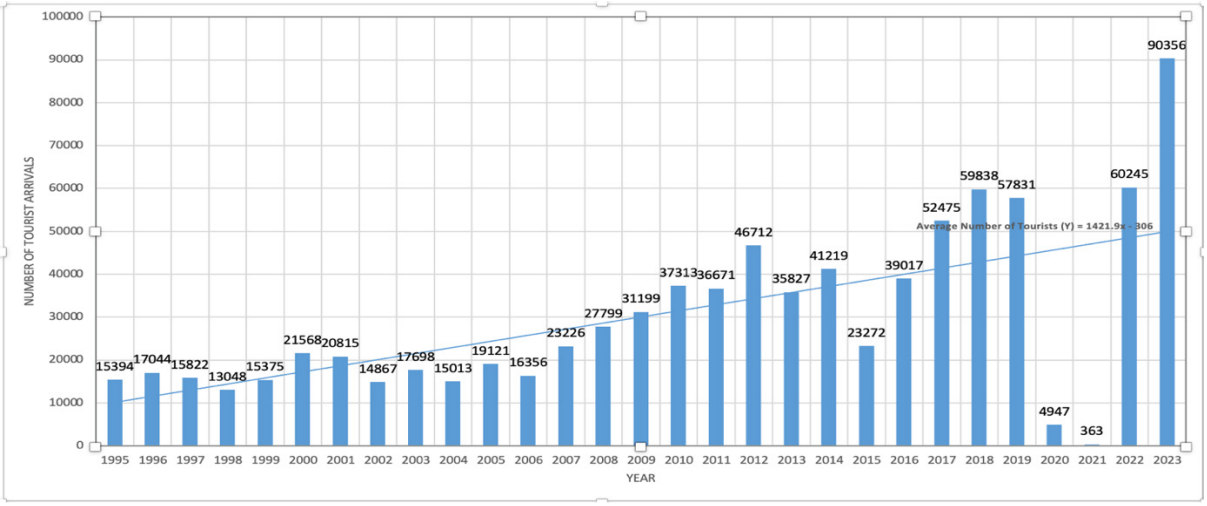


Figure 5: Number of Visitors in Mustang

Source: NTNC, 2024.

to collect the first-hand qualitative data from the tourism stakeholders including local tourism business, local people and visitors. Purposive sampling technique was employed to collect the data from research participants and key informant interview (KII). We have conducted KII with senior hotel owners, business owners, local people, farmers and visitors.

We take interview with research participants covering their perceptions of climate change on: trend of visitors in the past and recent years, tourism business, challenges faced by local business and people, policies of local government and federal government to mitigate climate change effects, long-term impact of climate change on Mustang's tourism followed by remedies to mitigate.

Relating to the perception of climate change on recent trend of visitors in Mustang; participants said that there is unexpected and unpredicted change in climate; rising temperatures, no snowfall since a couple of years in Mustang. Consequently, there is decreasing trend of international visitors except from India. However, the number of domestic and Indian visitors are increasing in recent years.

Regarding the perception of tourism business due to climate change, local business operators, including hotel and other business owners, said that their main source of revenue are international tourists. They said that "we have collected more tourism revenue especially from international tourists before a decade". But this trend has gone down in recent years due to surprising fall in number of international visitors. However, in recent years the number of visitors from own country and India is increasing, but there are no significant changes in revenue collected by hotel business.

An interview on the perception of participants on challenges faced by local business due to climate change recorded numerous challenges. Participants said that increase in temperature, untimely and unnatural rainfall, snow melting, increasing pollution due road construction, decrease in source of water, migration of local residents are some crucial challenges. Moreover, farmers are disappearing due to decrease in productivity of soil, internal and international migration of local people, fall in daily transaction of local business and hotels, decrease in income from tourism business are crucial challenges faced by local communities. Likewise, there is migration of plants in higher elevation to adapt in rising temperature, which has created thoughtful problem to the local farmers.

Regarding to the perception of local people on plans and policies formulated and practiced by local and federal governments, we could not hear any notable supportive role of government in study area. Participants said that there are no significant efforts of local government due to budgetary problem and federal government is also unable to tackle the climate change problems in Mustang.

The reply of research participants regarding to the long-term impacts of climate change on Mustang's tourism was quite noteworthy. Research participants said that Mustang was mostly famous for trekking route for international tourists in the past. Due to the construction of Myagdi – Mustang – Korala road, increase in pollution, there is radical fall in trend of international visitors as they are nature lover. In recent years, trekking business is becoming riskier due to natural hazards. Consequently, in the long-

run, there will be construction of more infrastructures, reduction in natural beauty, more pollution causes shrinkage in number of international visitors.

The views of KII are also similar with the views of research participants. They felt that climate change has noticed in rising temperatures, untimely and unnatural rainfall, decrease in snowfall in lower belt and snow melting in higher altitude, increase in landslides and floods in lower belt of Mustang. Key informants notice that climate change has increased the flow of Indian tourists in Mustang region but, it hampers the tourism business in the future.

The trend of temperature presented in Figure 3 revealed that annual average maximum temperature of Mustang is increasing at the rate of 0.02530 Degree Celsius per year and average minimum temperature is falling at the rate of 0.06950 Degree Celsius per year. It shows that summer is becoming hotter and winter is going to be cooler. The study conducted by K. C. and Thapa Parajuli (2015); and Shrestha *et al.* (1999) reported that the temperature of middle mountain and high Himalayan region is increasing by 0.060 Celsius to 0.120 Celsius per year in Nepal. The trend of snow-melting in mountain region is increasing due to rise in average annual temperature, which is similar to the study of K. C. (2017); K. C. and Thapa Parajuli (2015); Khatri (2023); Khatib (2023); Day *et al.* (2021); Dube *et al.* (2023); Phuyal *et al.* (2020); Dawson and Scott (2013).

The trend of visitors in Mustang presented in Figure 4 revealed that the number of international tourists is decreasing in study area while number of domestic and Indian visitors is increasing which is similar to Phuyal *et al.* (2020); K. C. and Thapa Parajuli; Lama (2010) on lower Mustang.

Change in climate and its extreme impacts on tourism destinations, water availability, landscapes, farming, etc have adversely affected on the tourism business of Mustang. A study conducted by Phuyal *et al.* (2020) found that changes on maximum and minimum temperatures as well as precipitation leads to fall in total number of visitors which is similar with this study in case of international tourists. The research participants and KII group observer that high snow melting due to rising temperature, less snowfall in main season, glacier melt has decreased the scenic asset of white snow-covered mountains especially for international tourists. Due to the rising temperature, the plants including fruits and vegetable are migrating towards higher elevation to adapt in climate change. It has reduced the land productivity in lower Mustang.

Unpredicted and untimely change in rainfall pattern in Mustang has resulted into change in holiday plans and holiday destinations of visitors, trekkers and mountaineering tourists which is similar to the study of Pedapalli et al. (2022); Bhandari (2014); Dube *et al.* (2023). The local community of lower Mustang is suffering from shortage of water which is similar to the study of Lama (2010). Untimely and unpredicted rainfall has resulted into floods and landslides which adversely affects the holiday plan and destination of tourists. The senior hotel owners' discourses that there is fall in overall revenue from hotel business in recent years due to multiple effects of climate change. It is similar with the study of Lama (2010); and K. C. (2020).

CONCLUSION

This study explores the impacts of climate change on tourism in Lower Mustang, Nepal, based on qualitative data from stakeholders: hotel owners, business operators, local residents, and visitors—supported by secondary sources such as NTNC and DHM. The findings indicate that climate change has significantly affected both the natural environment and tourism dynamics of the region. Rising temperatures, increased rainfall, rapid snowmelt in higher elevations, and the absence of snowfall in recent years have altered the traditional landscape and seasonal appeal of Mustang. These changes have contributed to a noticeable decline in international tourist arrivals, directly impacting the local economy. The study identifies several key findings. First, tourism activities have been disrupted, with stakeholders reporting decreased visitor numbers and shifts in tourist behavior. Second, changing climatic conditions have made weather patterns increasingly unpredictable, complicating tourism planning and reducing the reliability of peak seasons. Third, the socio-economic consequences are substantial, as communities dependent on tourism face reduced income and increased vulnerability. Tourism infrastructure is also at risk from extreme weather pattern, raising safety concerns for both residents and visitors.

To address these challenges, the study recommends the adoption of adaptive and resilience-building strategies. Strong collaboration among local communities, government bodies, and non-governmental organizations is essential to promote sustainable tourism practices. Investment in climate-resilient infrastructure and diversification of tourism products can help reduce dependency on seasonal patterns. Additionally, continuous climate monitoring and further research are necessary to better understand long-term trends and support informed decision-making. In conclusion, while climate change poses serious threats to tourism in Lower Mustang, proactive and coordinated efforts can help mitigate its impacts, protect local livelihoods, and ensure a sustainable and resilient future for the region's tourism industry.

Acknowledgements

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REFERENCES

Ahamed, M. J. B., Ravichandran, C., & Ebraheem, A. Z. M. (2022). Climate change impact on tourism. *Advances and Applications in Mathematical Sciences, 22(*6), 3407 – 3417.

Berrittella, M., Bigano, A., Rosou, R., & Tol, R. S. J. (2006). A general equilibrium analysis of climate change impact on tourism. *Tourism Management, 27*(5), 913 – 924.

Bhandari, L. N. (2014). Climate change impacts and adaptations strategies of tourism in Nepal. *International Journal of Interdisciplinary Studies, 2*(1), 113 – 126.

Chien, F., Zhang, Y. Q., Sharif, A., Sadiq, M., & Hieu, M. V. (2023). Does air pollution affect the tourism industry in the USA? Evidence from the quantile autoregressive distributed lagged approach. *Tourism Economics, 29*(5), 1164 – 1180. http://doi.org/10.1177/13548166221097021

Dawson, J., & Scott, D. (2013). Managing for climate change in the Alpine Ski Sector. *Tourism management, 35*, 244 – 254.

Day, J., Chin, N., Sydnor, S., Widhalm, M., Shah, K. U., & Dorworth, L. (2021). Implications of climate change for tourism and outdoor recreation: An Indiana, USA, case study. *Climatic Change, 169*(23), 1 – 21. https://doi.org/10.1007/s10584-021-03284-w

Dube, K., Nhamo, G., Kilungu, H., Hambira, W. L., El – Marsy, E. A., Chikodzi, D., & Molua, E. L. (2023). Tourism and climate change in Africa: Informing sector responses. *Journal of Sustainable Tourism, 1* – 21. http://doi.org/10.1080/09669582.2023.2193355

Gossling, S., Balas, M., Mayer, M., & Sun, Y. (2023). A review of tourism and climate change mitigation: The scales, scopes, stakeholders and strategies of carbon management. *Tourism management, 95*, 2 – 18. https://doi.org/10.1016/j.tourman.2022.104681.

Hussain, A., Rasul, G., Mahapatra, B., & Tuladhar, S. (2016). Household food security in the face of climate change in the Hindukush Himalayan Region. *Food Security, 8*, 921-937.https://doi.org/10.1007/s12571-016-0607-5

IPCC (2014). Climate change synthesis report: summary for policy makers. *Inter-governmental Panel on Climate Change*. http://www.ipcc.ch.

Islam, F. S. (2025). Impact of climate change and sea level rise on coastal zone of Bangladesh. *American Journal of Innovation in Science and Engineering (AJISE*). https://doi.org/10.54536/ajise.v4i1.4556

K C, A. (2017). Climate change and its impact on tourism in Nepal. *Journal of Tourism and Hospitality Education,7*, 25 – 43.

K C, A., & Thapa Parajuli, R. B. (2015). Climate change and its impact on tourism in the Manaslu Conservation Area, Nepal. *Tourism Planning and Development, 12*(2), 225 – 237. https://doi.org/10.1080/21568316.2014.933122

Khatib, A. N. (2023). Climate change and Travel: Harmonizing to Abate Impact. *Current Infections Disease Report, 25*, 77 – 85.

Khatri, M. B. (2023). The Trans-Himalayan Livelihood: opportunities and challenges in tourism development in Upper Mustang, Nepal. *Journal of Tourism and Adventure, 6*(1), 18-38. https://doi.org/10.3126/jota.v6i1.58560

Kinyili, B. M. (2023). Utilizing indigenous knowledge systems on climate change for forestry conservation in Kenya. *American Journal of Environment and Climate, 2*(3), 66-72. https://doi.org/10.54536/ajec.v2i3.1976

Kumar, S. S., & Anantha, B. V. (2018). Impacts of climate change on tourism development in India. *International Review of Business and Economics, 1*(3), 166 – 172.

Lama, A. K. (2010). Vulnerability of nature-based tourism to climate change: Stakeholders' perceptions of and response to climate change in the lower Mustang region of the Annapurna Conservation Area. *Christchurch, New Zealand: Master of parks, Recreation and Tourism Management Lincoln University.*

Maplecroft, V. (2011). *Climate change vulnerability index* 2016. Climate Change and Environmental Risk Atlas.

MoF (2024). Economic Survey. *Ministry of Finance, Singhadarbar, Kathmandu, Nepal.*

Nepal, S. K. (2011). Mountain tourism and climate change: Implications for the Nepal Himalayas. *Nepal Tourism and Development Review, 1*(1), 1 – 14.

N S O (2022). National Population Census, 2021. *Government of Nepal, Office of Prime Minister and Council of Ministers, National Statistics Office* (NSO), Thapathali, Kathmandu.

Pedapalli, S. K. S., Gupta, B., & Mahajan, P. (2022). Climate change and tourism: a paradigm for enhancing tourism resilience in small island developing states (SIDS). *Worldwide Hospitality and Tourism Themes, 14*(5), 431 – 440. https://doi.org/10.1108/WHATT-07-2022-0081

Phuyal, R. K., Bhuju, D., Devkota, T., Acharya, S., Bishwokarma, D., & Devkota, N. (2020). Impact of climate change on tourism sector in Nepal. *The Journal of Development and Administrative Studies (JODAS), 28*(1-2), 1 – 16. https://doi.org/10.3126/jodas.v28i1-2.64380

Raihan, A. (2023). A review of the global climate change impacts, adaptation strategies, and mitigation options in the socio-economic and environmental sectors. *Journal of Environmental Science and Economics, 23*, 36 – 58. https://doi.org/10.56556/jescae.v2i3.587

Rayamajhi, S. (2012). Linkage between tourism and climate change: A study of the perceptions of stakeholders along the Annapurna trekking trail. *Nepal Tourism and Development Review, 16,* 60 -75.

Shrestha, A. B., Wake, C. P., Mayewski, P. A., & Dibb, J. E. (1999). Maximum temperature trends in the Himalaya and its vicinity: An analysis based on temperature records from Nepal for the period 1971-1994. *Journal of Climate, 12,* 2775 – 2787.

Subedi, B. P., & Chapagain, P. S. (2011). Tourism development in upper Mustang valley of Annapurna Region. *Nepal Tourism and Development Review, 1*(1), 56 – 68.

UNFCCC (1992). United Nations Framework Convention on Climate Change. http:/unfccc. Int/resource/docs/convkp/conveng.pdf.

WTTC (2023). *Tourism economic research* 2023. London: World Trade and Tourism Council.

Wuchu, C. W. (2024). Adaptation of Farmers to Climate Variability in Tubah Sub-Division, North West Region of Cameroon. *International Journal of Sustainable Rural Development, 1*(1), 6-16.

Yañez, C.C., Hopkins, F.M. & Porter, W. C. (2020) Projected impacts of climate change on tourism in the Coachella Valley, California. *Climatic Change 162*, 707–721. https://doi.org/10.1007/s10584-020-02843-x