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## Developing a Tourism Opportunity Index Regarding the Prospective of Overtourism in Nepal


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**DEVELOPING A TOURISM OPPORTUNITY INDEX REGARDING THE  
PROSPECTIVE OF OVERTOURISM IN NEPAL**

A Master's Thesis

Presented to

The Graduate College of

Missouri State University

In Partial Fulfillment

Of the Requirements for the Degree

Master of Science, Geospatial Sciences

By

Susan Phuyal

December 2020

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# **DEVELOPING A TOURISM OPPORTUNITY INDEX REGARDING THE PROSPECTIVE OF OVERTOURISM IN NEPAL**

Geography, Geology and Planning

Missouri State University, December 2020

Master of Science

Susan Phuyal

## **ABSTRACT**

This research explores Nepal's overtourism scenario based on the capacity of a locality to manage sustainable tourism practices. Environmental degradation, local infrastructure degradation, negative tourist experience and local resident responses regarding visitors are the four main variables used in this study to analyze overtourism. In order to analyze the case study of overtourism, we select the three top touristic cities of Nepal, Kathmandu, Pokhara, and Chitwan based on the number of annual visitors. Nepal's case analysis of overtourism conditions reviews the overall threat of over-tourism and establishes a metric by which tourism can be viewed as potentially detrimental to sustainability. Thamel a small city that lies in Kathmandu's heart, met almost all the variables associated with the overtourism. In this location we saw an increase in resident issues due to soaring rents, apartment shortages, and the price increases for daily basic needs. Likewise, Pokhara and Chitwan also show limited aspects of overtourism. Tourism acts as a vital part of the economy for many of the countries in the world. It brings in foreign currency, improves economic conditions, and perpetuates the sharing of language, tradition, and culture between communities. The second study of this thesis explores the relationships between tourism and social and environmental vulnerability elements by creating a tourism opportunity index of the individual district based on the available amenities. The tourism opportunity index (TOIN) is accessed by analyzing a climate index, socioeconomic variables, infrastructure, and the destination's overtourism condition. Moreover, this research purposes a new way to determine the region's tourism opportunity, analyzing the climate and all the sustainable tourism development variables. A climatic index is analyzed using the synoptic meteorological data (GWTC) condition throughout Nepal with 30 years of data. Among all the districts, Kathmandu has a high TOIN score despite showing the overtourism symptoms because of its development and restoration of resources. This study and its recommendations will hopefully allow the Nepal to become a sustainable tourism destination by preserving its sources for a future generation by implementing the sustainable tourism development.

**KEYWORDS:** Overtourism, GWTC, Tourism Opportunity Index, Climate Change, Sustainable Tourism, Nepal



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December 2020

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In the interest of academic freedom and the principle of free speech, approval of this thesis indicates the format is acceptable and meets the academic criteria for the discipline as determined by the faculty that constitute the thesis committee. The content and views expressed in this thesis are those of the student-scholar and are not endorsed by Missouri State University, its Graduate College, or its employees.

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## CHAPTER-1 PERSPECTIVES OF OVERTOURISM: A CASE STUDY OF NEPAL

### Introduction

The term "overtourism" has been widely used in the last few years; however, its concept has been an item of conversation since mass tourism gained prominence after the 1960s (Mihalic, 2020). In present, it is argued that the term 'overtourism' has been greatly exaggerated by the media discourse and deemed a hypothetical issue without profound statistical analysis (Koens *et al.*, 2018). Despite some lack of theoretical and analytic support, the overtourism phenomenon is ever-present and is related to a lack of sustainability within tourism, where it has a negative impact on environmental systems and degrades local "experiences" (Azromek *et al.*, 2019). The World Tourism Organization (UNWTO) defines overtourism as "the impact of tourism on a destination, or a part thereof, that excessively influenced the perceived quality of life of the citizen and/or quality of visitors experiences in a negative way" (UNWTO, 2018). The Center for Responsible Travel (CREST) goes further by adding the tourism as wear-and-tear of the tourism resources, defined as "tourism that has moved beyond the limits of acceptable change in a destination due to quantity of visitors, resulting in degradation of the environment and infrastructure, diminished travel experience, wear and tear on built heritage, and/or negative impacts on residents" (CREST, 2018). The European Union (EU) TRAN Committee defined overtourism by relating it to an anti-tourism phenomena as "the situation in which the impact of tourism ...exceeds physical, ecological, social, economic, psychological, and or political capacity thresholds" (Peters, *et al.*, 2018). Furthermore, Milano *et al.* (2019) added overtourism as a contemporary phenomenon that relied on an excessive visitation to a tourist destination. If we review additional tourism literature in this realm, we find that overtourism has many standard



variables, which means the negative tourism consequences result from unsustainable tourism (Capocchi *et al.*, 2019).

Doxey (1975) authored one of the first papers highlighting adverse reactions by residents relating to tourists in Niagara Falls and describes the change brought by tourism. It highlights the four phases of tourism irritation known as an "Irridex": euphoria, apathy, annoyance, and antagonism. Euphoria is a stage where tourist numbers are small, and locals welcome the tourists. Apathy is a phase where the number of tourists increases, and the relationship between tourists and residents becomes strong. Annoyance is the third stage, where communities started noticing the growth of arrivals and the rising competition for the resources. In the last stage, antagonism is where tourists are responsible for much of the destination's environment's degradation.

Furthermore, Butler (1980) and Krippendorf (1987) have described the negative factors of tourism, their reaction to natural resources changes, cultural heritage, and the problem aggravated by tourism's overcrowding. In contemporary vernacular, the term "overtourism" started to evolve from the Sydney Morning Herald's reporting in 2001, which described an increasing number of tourist crowds deteriorating Pompei's residential quality of life (Peterson, 2001). Over the last decade, the amount of peer-reviewed research and the sheer number of conferences has grown noticeably, focusing on overtourism. Milano *et al.* (2019) described Barcelona's overtourism as a contemporary phenomenon related to the excessive visitation to the tourist destination where tourism shifts from tourism growth to tourism degrowth. The World Travel & Tourism Council even commissioned a research study to assess 'overcrowding' in a large number of major cities worldwide (WTTC, 2017). Thus, the evidence of the existence of

the over-tourism phenomena has a long history, and the different cities were impacted by the recent course of time.

There are numerous factors, such as low-cost travel, easy access, and social media associated with the increase in the number of tourists globally. This number exceeds one billion travelers per year (UNWTO, 2018). As such, it makes tourism one of the fastest-growing industries worldwide, significantly contributing to a proliferating world economy (Fletcher, 2011). The increasing number of mass tourists has created many housing market problems, such as increasing rents and noisy neighborhoods (Goodwin, 2019). The controversial relationship between tourism, growth, and development has created tenuous situations where an increasing number of people are compelled to share resources. The tourism stakeholder uses those resources as a short-term profit technique to achieve its target, which further proliferates the problem in the long run. Likewise, the recent success of technological development and its advancements in the travel and communication sectors have increased the visitor's flexibility and freedom. As a result, people are becoming aware of the destinations, their attraction, and the way to reach the destination (Dodds *et al.*, 2019). The technological shifts and information through social media like Instagram, Facebook, Twitter, the internet, and the joined marketing effort from the travel agents and tourism board, have further helped increase a destination's attractions.

It does not mean that the increasing number of tourists is not beneficial. The proliferating number of visitors (Bogan *et al.*, 2014) pleases many locations, cities, agencies, tourism stakeholders, and residents. Rural areas of developing countries, and urban destination that have been facing decline, and/or the destination that is receiving fewer tourists than their capacity will always be delighted with the increasing number. Therefore, over-tourism is not defined by the number of visitors but based on the number of visitors where the numbers are more significant

than their "tourism carrying capacity." The World Tourism Organization (UNWTO) defines tourism carrying capacity as "the maximum number of people that may visit a tourist destination at the same time, without causing destruction of the physical, economic, socio-cultural environment and an unacceptable decrease in the quality of visitors' satisfaction" (UNWTO, 2018).

According to UNWTO statistical Guidelines (2010), tourism is defined as the activities of persons identified as visitors. A visitor is someone who is visiting the main destination outside his/her usual environment for less than a year for any primary purpose, including holidays, leisure and recreation, business, health, education, or other purposes. Data from the World Travel and Tourism Council (WTCC) show that nine to eleven percent of the world's total GDP is generated by the travel and tourism industry. This includes GDP generated directly from the travel and tourism sector plus its indirect and induced impacts. Data shown in Figure 1 indicate that in most years, the world's direct GDP income ranges from three to four percent data and the total GDP ranges between nine to eleven percent shares out of the total GDP of the world. (WTTC, 2020).

Although the travel and tourism sector has proliferated, we should focus on the tourism industry's two sides, i.e., supply-side and demand side. According to Nelson (2017), the tourism sector's supply side is the aggregate of all businesses that directly provide goods or services to facilitate business, pleasure, and leisure activities away from the home activities (Nelson, 2017). In contrast, demand is the total number of persons who travel or wish to travel to use tourist facilities and services at places away from their places of work and residence. Understanding these two factors of tourism (Supply-demand chain) has introduced questions regarding the

limitations of tourism and how it might interface with long-term impacts associated with other natural disasters such as climate change (Grimm *et al.*, 2018).

Tourism enhances job markets, increases cash inflows, and often improves infrastructure, seasonal jobs, degradation of culture and tradition; however, degradation of the natural environment, overcrowding, high inflation on basic daily goods, and decrease on a sense of local community are some of the negative impacts of tourism. The experience we observe is always different based on the people's requirements and passion, but the adjustment to those unfamiliar sides can create a more substantial and lasting impact on the future.

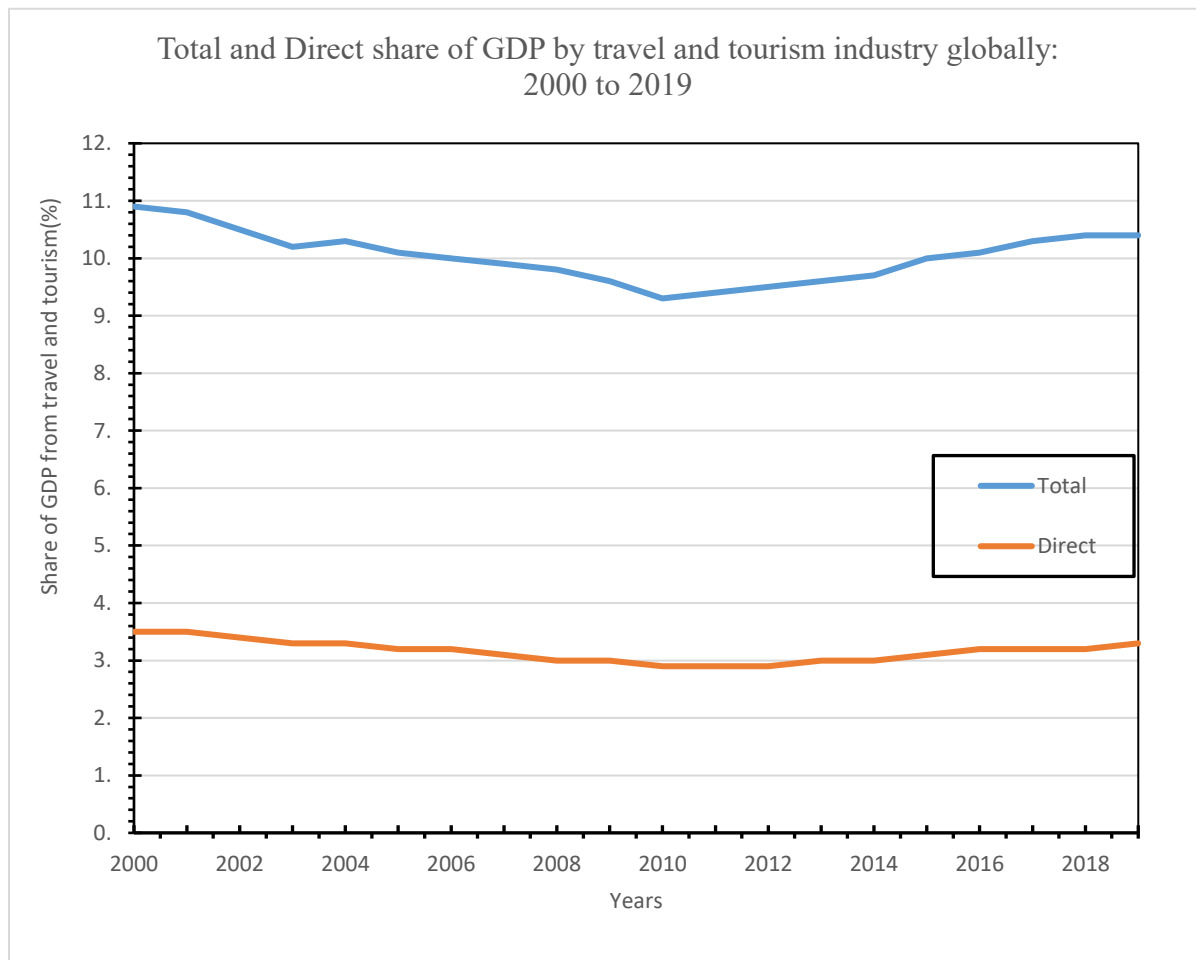


Figure 1. Direct and total share of GDP by the travel and tourism industry worldwide from 2000 to 2019 (WTTC, 2020).

**Tourism in Nepal.** Nepal is a country rich and diverse in natural and cultural resources, which has full potential for the tourism sector; however, it is in a developmental stage. Tourism had been a prime source for generating foreign revenues. Out of the ten tallest mountains globally, eight lie in Nepal, making it a prime attraction for mountaineering and adventure tourism. Nepal is also diverse in terms of language and tradition; people who have their own traditions and cultures speak 120 languages around the country. Nepal is always a hub for the Hindu philosophies and Buddhist philosophies, and a rich cultural heritage site and temple maximize Nepal's beauty.

Every year thousands of tourists visit Nepal (Figure 2) to explore its natural beauty and heritage site by roads and air flight. Due to Nepal's open border with India, it is difficult to get an exact number of tourists who visit by roadway; however, India is the leading country from where Nepal has the highest number of visitors. The trend of tourist arrivals was a net increase until 2012, but after that, political instability and devastating earthquake in 2015, tourist arrivals have significantly impacted the number of tourist arrivals (NTB, 2016). Out of total tourist arrivals, excluding Indian citizens arriving through land transport, five countries generate more than 50 percent of those visiting Nepal. The proportion of tourists from these countries are; India (16%), China (14%), Sri Lanka (8%), the USA (7%), and United Kingdom (6%) (NTB, 2018).

**Tourism Activities in Nepal.** The tourism sector has a very significant role in promoting Nepal's overall development. Realizing its role, the government of Nepal, Ministry of Culture, Tourism, and Civil Aviation (MoCTCA) has been focusing on promoting the tourism sector in order to increase the contribution of tourism in economic development. As a result, MoCTCA has been conducting various activities to promote internal and international tourism with its stakeholders' association. These stakeholders can be any of those who directly or indirectly

impact tourism planning and development like National Government, Local governments, Tourism enterprises, Tourists, Local people, Employees and Professionals, and any employees' trade union (UNWTO, 2005). The ministry has also conscientiously developed new tourist destinations expanding Nepalese tourism in the international tourist market, ensuring tourists' safety and security, and creating a tourism-friendly policy environment. To achieve these desired targets of tourism development and information on tourism, it is essential to formulate programs to promote tourism development (NTB, 2016).

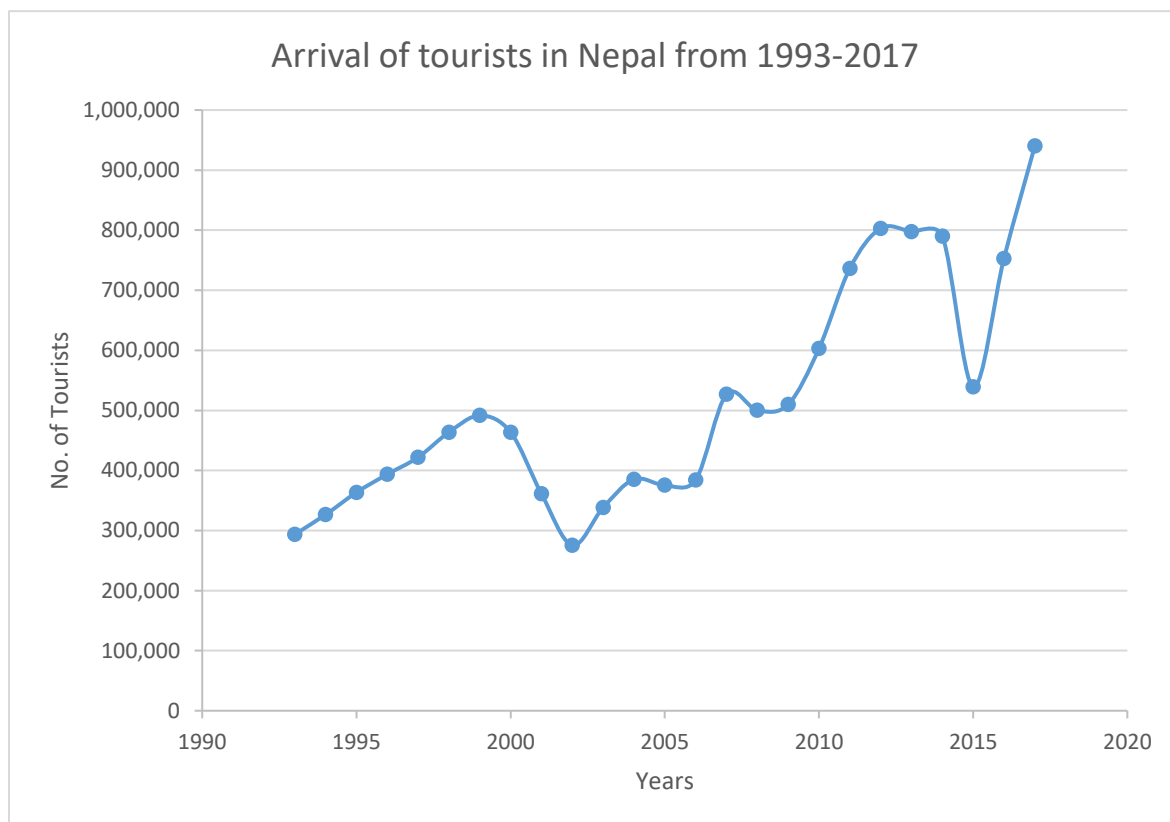


Figure 2. Annual tourist arrivals in Nepal (Data source: NTB, 2018).

In this study, we review a high degree of tourism development in Nepal's last few years. Although Nepal has generated a noticeable growth of foreign revenues, these revenues directly depend on natural and cultural resources. Reviewing the tourism resources and activities, we can summarize Nepal as a country with an abundance of tourism amenities. In addition,

mountaineering and adventure tourism have generated many visitors. To achieve an overview of the tourism situation, we choose three main cities in terms of tourism activities and tourist volume: Kathmandu (Thamel), Pokhara (Fewa Lake), and Chitwan (Chitwan National Park). This overtourism study examines the selected location's touristic condition using the overall overtourism variable like environmental degradation, local infrastructure degradation, negative touristic experience on the destination, and the local resident's negative responses result from the excessive visitors.

Kathmandu, Chitwan, and Pokhara are popular locations to visit for regional, domestic, and international tourists. Its burgeoning popularity, however, puts it in danger of experiencing negative impacts due to overtourism. Despite other areas that are frequently end-destinations for visitors in Nepal, Kathmandu's central location, availability of amenities, and location of the only international airport (Tribhuvan International airport, KTM) subjects Kathmandu to the direct inflow of most tourists that visit Nepal via air. In fact, in 2018, KTM handled nearly 12,000 passengers daily for both domestic and international flights combined. Additionally, foreign tourist arrivals at KTM exceeded one million for the first time in 2018 (NTB, 2018). This results in a very crowded Kathmandu Valley, subsequently increasing the need to manage tourism development sustainably.

Infrastructure is another critical term for the sustainable tourism development which compromised the essential devices used in transportation, communication, power, road network, etc., and buildings and service station is connected with the education, cultures, sciences, health, public administration, etc. (Panasiuk, 2007). Due to the limitation on infrastructure development and its noticeable growth, a small increase in tourists' numbers can create nuisance-levels of noise for local residents. To observe the over-tourism factor, we conducted a survey on these

three cities as our study area to elaborate on our understanding of the condition of tourism.

Considering these issues, this study will address the following objectives:

- It will address the available tourism facilities of three cities Thamel, Pokhara, and Chitwan, respectively, including their current conditions.
- It will explore the three cities' Thamel, Pokhara, and Chitwan's over-tourism condition regarding the link between tourism, growth, resident, and visitor's perception.
- It will develop the recommendation for sustainable tourism development and alternative policies to control the tourist flow by minimizing the overtourism symptoms.



## **Materials and Methods**

**Study Area.** Kathmandu is the capital and largest city of Nepal, with a population of around 1.45 million (World Population Review, 2020) and lies in the central part of Nepal's hilly region surrounded by the Himalayas. Kathmandu has been the regional center of history, art, culture, and economy for many years. Culturally, it is home to the Newars (local inhabitants), with the majority following the Hindu and Buddhist religious traditions. Nepali is the national and most spoken language in Kathmandu, though English is also widely understood throughout the country. The city was the royal capital of the Kingdom of Nepal and hosts palaces, mansions, and gardens of the Nepalese aristocracy. It has been home to the headquarters of the South Asian Association for Regional Cooperation (SAARC) since 1985. The South Asian Association for Regional Cooperation is the regional intergovernmental organization formed to promote the nation's economic development and geographical union in South Asia. Out of eight SAARC countries, India and Sri-Lanka are the most significant contributors to Nepal tourism. Tourism is an integral part of the economy; in 2013, TripAdvisor (Britton, 2019) ranked Kathmandu third among the world's top ten upcoming travel destinations. Additionally, Kathmandu and the surrounding areas make up the UNESCO cultural heritage site of Kathmandu Valley. This UNESCO site has been inscribed since 1979 (though with a recent minor boundary modification in 2006). It encompasses seven groups of monuments and buildings capturing the rich cultural heritage and diversity of this area.

The Chitwan district lies in the southern part of Nepal's Terai region; 80% of the land area is below 500m and bordered by Siwalik Hills in the south and the north's loftier Mahabharat range. It covers an area of 864.25 sq. mi, and in 2011 had a population of 579,984 (279,087 male and 300,897 female) people. Culturally, Chitwan is a home for a Tharu (local inhabitants), it is

ethnically mixed with Brahmin (29%) and Tharu (13%). Chitwan National Park (first National Park of Nepal), located on Sauraha, is the main center for this district's tourism activity. It was established in 1973 and granted the status of a World Heritage Site in 1984. In addition, this national park is home to more than 50 Mammal species, over 525 birds, and 55 amphibians and reptiles. One-horned rhino, Bengal tiger wild elephants are some of the endangered species protected in this natural site.

Pokhara is another famous touristic destination in Nepal. It is the largest metropolitan city of Nepal in terms of the area and second largest in terms of population. Pokhara is located 120 miles) west of the capital, Kathmandu, and the altitude varies from 2,713 feet in the southern part to 5,710 feet in the north. It is considered the tourism capital of Nepal and is known as the Annapurna circuit's gateway. Annapurna circuit, Phewa Lake, Shanti Stupa, Davis Fall, Sarangkot, Begnas Lake, Seti Gorge, and the International Mountain Museum are the main attraction center lies in Pokhara City. Among them, Phewa Lake is one of Nepal's most visited lakes, located in the south of the Pokhara Valley. It is situated at an altitude of 2,434 ft. from sea level and covers an area of about 1.7 sq. mi. It is the only lake in Nepal to have a temple Tal Barahi Temple at the lake's central part. This lake is important both historically and culturally. Figure 3 demonstrates the study area's district location in Nepal's map ( Note: Pokhara lies in Kaski district, Chitwan National park lies in Chitwan district, and Thamel lies Kathmandu district).

**Methods.** This study is based on survey work performed from March-20, 2019 to April-3, 2019 in Nepal's three most populated tourist destinations, i.e., Kathmandu valley, Pokhara, and Chitwan. This study aims to determine the overall condition of tourism and analyze Nepal's three cities with the variable of the overtourism. After collecting the resources, data, and the

published report from Governmental agencies, Non-governmental agencies, and social media, we determined that the three cities of Kathmandu, Pokhara, and Chitwan receive a high number of visitors compared to other cities. For this determination, we collected tourism statistics data of the last 20 years from the Nepal Tourism Board and analyzed all touristic cities' overall tourism conditions. Cities were chosen based on the amount of available tourism infrastructure, the number of visitors, and those cities which already or are most likely to face overcrowding in the near future. The purpose of this study is not only to collectively assess the state of overtourism, but it is also to ultimately inform the official authorities of how to consider this issue in tourism development policy. The study is divided into four parts:

Step 1: Collection of the primary data sources including Governmental statements, reports, and publication; Social media discourses; and different report form website

Step 2: Structure of the interview questions and organize the interview with the visitor to analyze their perspective.

Step 3: Continuation of the fieldwork, and formal and informal data collection through an interview with the residents and tourism stakeholders

Step 4: Analysis of the collected data

In this regard, we developed the qualitative approach to gain insight into overtourism with structured interview questions, as shown in Appendix A. Although we already had a predetermined question structure for determining the tourism connections with the overtourism activities, we gave priority to the respondent's open ideas and their relationships with tourism to get a healthy response, which later provides excellent insight for our research. Questions were structured to complete within five minutes, but on average, it took 10-15 minutes for participants to answer. Participants over 18 years old were approached with the objective of this research and

were begin with the introduction of verbal consent and the information about overtourism. No personally-identifying information was obtained and used during the study. The study was approved according to IRB guidelines and filed as IRB-FY2019-586 within the Missouri State University system and shown in Appendix B. To aid the research purpose, participants' approval was taken before recording the interviews, and the flexibility to stop the recording any time without any pressure to continue further increase the credibility of our research. While selecting the participants, our focus was to involve the participants who are already in the tourism industry, either tourism businesses, tourism operators, tourism officials, or the tourists themselves. Operators and the officials were contacted or approached on-site and scheduled meetings prior based on the request to discuss tourism in the area. No direct and indirect benefits were offered during the survey.

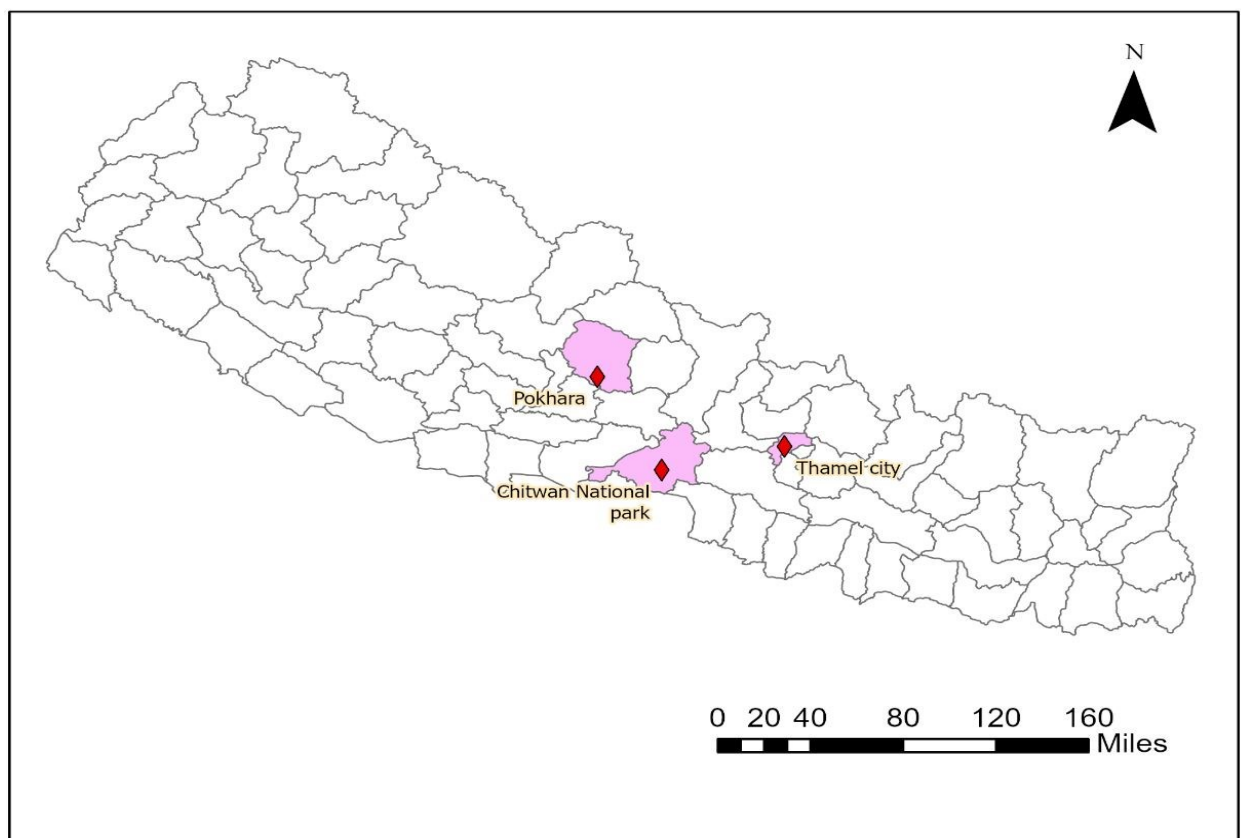


Figure 3. Study area and its location on the district map of Nepal.

Over 25 (16 male, 9 female) responses were collected between 20 March and 5 April 2019. Out of twenty-five (25) responses, ten were collected in Kathmandu (Thamel), eight were collected in Pokhara (Phewa lake), and seven were taken in Chitwan (Chitwan National Park). Data were collected in the form of verbally recorded interviews on a smartphone and field diary notes, compiled for indirect conversation. Those interviews were later transcribed. We conducted the interview either in English or Nepali during the questionnaires, depending on the participant's preferences. The participants, while taking the survey, did not encounter any language barrier.

## Results and Discussion

The survey involved ten respondents from Kathmandu; among them, five tourists, three local residents, and two tourism stakeholders who are directly engaged in the tourism field as independent tourism business owners or operators. Likewise, in Pokhara city, out of the eight respondents, four are tourists, two are local residents, and two are tourism stakeholders; Chitwan survey participants compose four tourists, two local residents, and one tourism stakeholder. Before starting the overtourism related questions, respondents were asked about the overall assessment of the respective location's tourism. The comprehensive evaluation was structured to look after the recent change they observed, either positively or negatively, by asking, "Have you observed any positive or negative impact resulting from tourism in this location?" Twenty-two (22) out of twenty-five (25) respondents (88%) marked the positive change in the place, and the others highlighted the negative consequences of tourism. All respondents (25) discussed this topic. Table 1 shows the number of participants in three cities individually and their correspondent designation on the respective location.

Table 1. Number of respondents in each city and their designation.

Location	Tourist(s)	Local Resident(s)	Tourism Stakeholder(s)
Kathamndu	5	3	2
Pokhara	4	2	2
Chitwan	4	2	1

The majority of participants bolstered their positive tourism argument by focusing on the change in infrastructure development, the rise in employment opportunities, and the rise in literacy rate. Three (3) out of twentyfive (25) (12%) respondents mentioned the negative

consequences of tourism and emphasized increasing deforestation, loss of the cultural heritage, and rising inflation rate. Overall, we found all respondents to be well informed about tourism and its consequences. Twenty-three (23) respondents out of twentyfive (25) believe that tourism can be one of the most significant sources to raise the country's economy and change people's lives significantly for the better. This overall assessment helps us understand their ideas and knowledge about tourism, which can substantially increase our research credibility.

Analyzing the participant's responses regarding the structured over-tourism questionnaire, we asked our participants, "Do you feel that there are times of the year where you may experience overtourism?" Fourteen (14) of the twenty-five (25) (56%) respondents were familiar with the overtourism topic. Furthermore, eight (8) out of ten (10) (80%) of the participants in Kathmandu believed that Thamel city (Kathmandu) had shown the overtourism symptoms, and the others (2 out of 10) believed tourism here is still controllable and capable of managing more tourists. Residents who answered affirmatively supported their answer with concerns such as soaring rent and the price inflation of basic needs. Tourists discussed overtourism symptoms in their response, focusing on noise in the city, difficulty in walking freely, increasing pollution, and slow service. However, the participants in both Pokhara {yes= 3 out of 8 (38%); No= 5 out of 8 (62%)} and Chitwan {Yes= 1 out of 7 (14%); No= 6 out of 7 (86%)}, as displayed in the Figure 4, did not feel any "overtourism" but highlighted the problem as being a lack of proper destination management. According to a respondent in Pokhara who had visited all three cities in this research, *"The Pokhara and the Chitwan both city are the natural city and being on development stage and have a better facility with little harm to the environment with the high tourism capacity but the Thamel although have a good residential facility their infrastructure pressure on the environment is way too much and totally against the environment conservation"*

*and development. There is a house everywhere without planning in Thamel city, and we can observe tourists everywhere and all the time in the street walking somewhere. This is not a good spot for the visitor and the resident who loves peace and quiet environment. At the same time, Pokhara and the Chitwan are way more peaceful and quieter, which always weight more. Still, I feel these two cities have a big potential to become one of the best destinations globally with the proper management and the planning."*

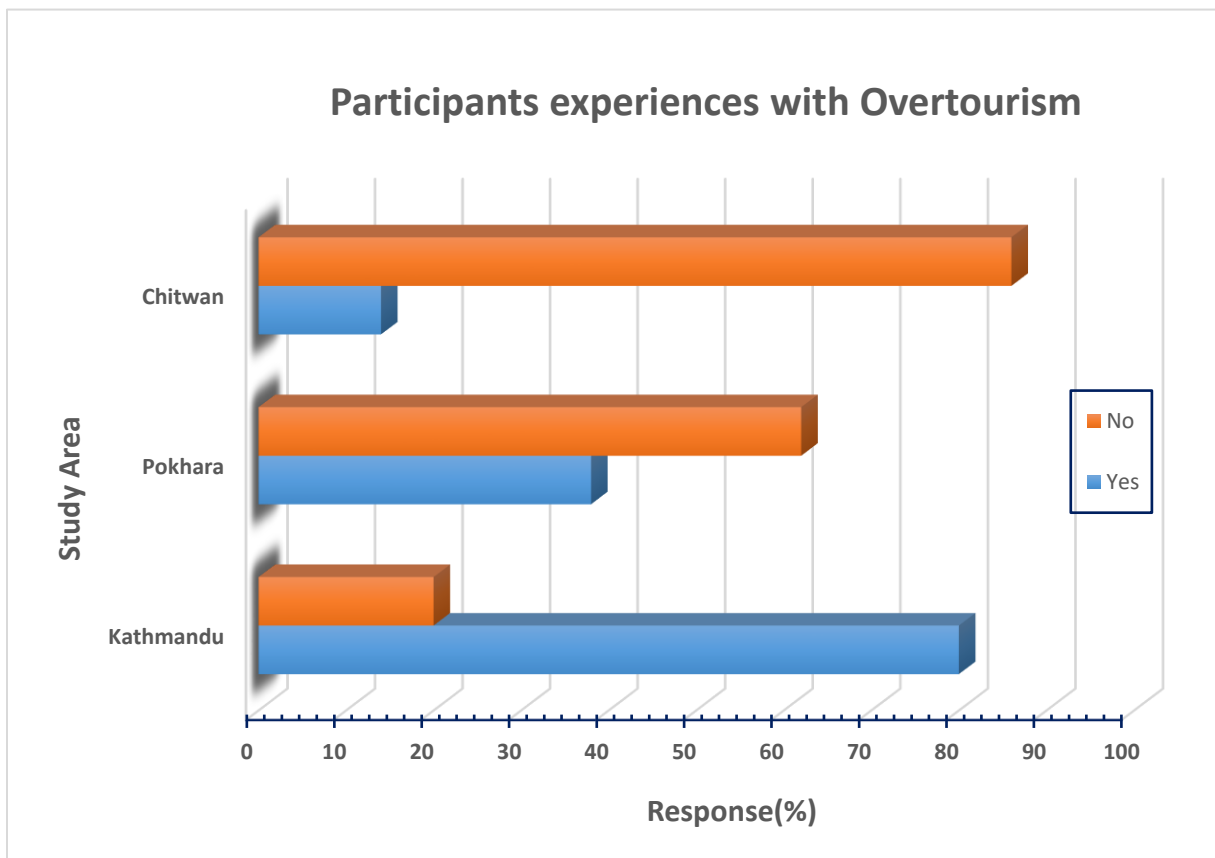


Figure 4. Participant's responses based on their experience whether they feel any overtourism symptoms in the study area.

In addition, chi-square test goodness of fit is performed to verify the distribution of the answers against our hypothesis based on that the selected cities did not show any overtourism



symptoms. The result of the chi-Square test is shown in Table 2. Thamel city was positively associated with overtourism characteristics and it was statistically significant ( $p < 0.05$ ).

The second question, "As a result of an excessive quantity of visitors (tourists), do you think this location has experienced environmental degradation?" We found that seven (7) out of ten (10) (70%) respondents felt that a large number of tourists environmentally degrade Thamel city. Only three (3) out of ten (10) (30%) felt they did not as seen in Figure 5. Further explanation was supported by the excessive use of land areas, increasing pollution, and sub-optimal natural resource utilization. Due to unplanned urbanization coupled with the substantial population density, Thamel faces challenges to save the city from pollution.

Table 2. Statistically significant test result of the overtourism consequences of each location using the Chi-Square test.

Location	Variable	Value	P-value
Chitwan	Overtourism	5.42	0.066
Pokhara	Overtourism	4.75	0.09
Kathmandu	Overtourism	10.4	0.005

As a result of these issues, there is garbage in the streets, and it is difficult to find open space. The remaining participants (3 out of 10) feel that only tourists are not only responsible for environmental degradation, they think that the lack of government enthusiasm to save the city, unplanned infrastructure development and the lack of policy implementation are the more significant cause of this degradation. According to one of the respondents (a tourist): *"Nepalese people are so lazy and undisciplined; they know that they should not throw garbage in public places and the river but throw [garbage] whenever they want."* This problem is summarized by a local store owner in Sorakhutte, Kathmandu: *"Though residents may have a larger role in*

*environmental degradation than tourists, with this poor precedent set, we see a lot of tourists throwing plastic and junk food packet in a street and river. Additionally, [this is] due to a lack of infrastructure –not having any garbage receptacles in the street".* We found that there is uncertainty regarding the proportionate negative environmental contributions between the visitor and a local resident. Still, it is apparent that Thamel city is significantly degraded in terms of environmental sustainability.

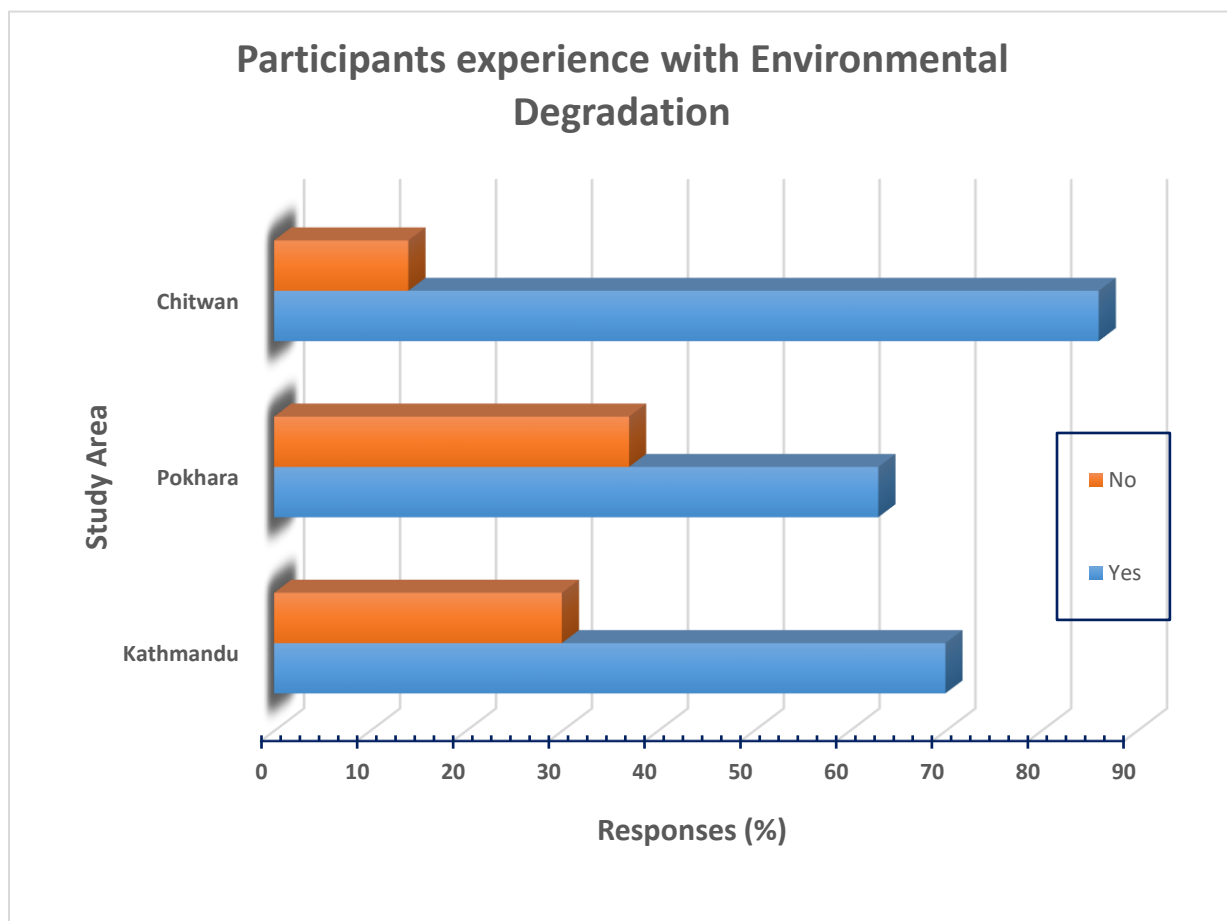


Figure 5. Participants responses based on their experience weather they feel any Environmental Degradation symptoms in the study area.

Likewise, both Pokhara {yes= 5 out of 8(63%); No= 3 out of 8(37%)}, and Chitwan {Yes= 6 out of 7(86%); No= 1 out of 7(14%)} are also in prognosis to environment degradation. Respondents from the Pokhara supplement their ideas based on the increasing pollution on the

Phewa lake result from the number of activities performed in the lake because of the excessive number of visitors. One of the respondents highlights the issues as follows: *"Pokhara is a beautiful city for those environment lovers where you can see the mountains, hills, and the beautiful lakes at the same time from one place, but the way city manages the pollution control is being a huge question. I saw many plastic bags, bottles, and overall garbage in the Phewa lake bank many times, which raised the question of saving the phewa lake. Also, I heard that in recent years, the Phewa lake area is being decreased and being occupied for the development of the touristic infrastructure, which is also a big concern regarding environmental degradation."*

Figure 6 shows the awareness painting in the Phewa lake site for the conservation of the Phewa Lake.

Likewise, the Chitwan respondents also focus on environmental conservation, however, here in terms of animal habitats and the national park conservation. Although an increasing number of visitors have created enhanced economic opportunities in recent times, it has also created pressure on national parks and natural habitats' environmental systems. The number of roads constructed, the expanded number of hotels, restaurant infrastructure, and the increasing number of touristic activities like jungle safari, jungle walking, elephant Safari inside a national park have significantly disturbed the ecological balance. Therefore, most of the respondents have affirmed their experience of environmental degradation in all these three cities.

Table 3 shows the statistical significance assessing the relationship between visitors and environmental degradation. Kathmandu and Chitwan show statistically significant relationships ( $p < 0.05$ ) indicating the observed existence of environmental degradation, Pokhara shows no statistical significance ( $p > 0.05$ ) regarding this variable.

Table 3. Statistically significant test result of the Environmental Degradation consequences of each location using the Chi-Square test.

Location	Variable	Value	P-value
Chitwan	Environmental Degradation	8.85	0.011
Pokhara	Environmental Degradation	4.75	0.093
Kathmandu	Environmental Degradation	7.4	0.024



Figure 6. Awareness Campaign painted in the wall of the road near Phewa Lake for conservation purposes.

We asked our respondents about the local infrastructure degradation, “As a result of an excessive quantity of visitors do you think this place has experienced degradation of the local infrastructure?” Eight (8) out of ten (10) (80%) respondents of the Thamel city (Kathmandu)

location found that the local infrastructure is degrading as a result of tourism activity, and two (2) out of ten (10) (20 %) did not see that to be occurring. Thamel was a relatively quiet neighborhood with a significant amount of classic local architecture and sculptures from the 17<sup>th</sup> century. Today, however, the landscape has changed, as it is now known as a commercial hub. There are restaurants and stores in nearly every house, often open for an excess of 18 hours every day. The large numbers of bars and restaurants have caused significant disruptions to a formerly quiet neighborhood. The towering urban complex is rapidly replacing the old and ancient traditional neighborhoods.

A minority of respondents in Pokhara (2 out of 8, 25%) think that the Pokhara infrastructure has been degraded due to the touristic activities, and six (6) out of eight (8) (75%) believe that there is not much pressure on the infrastructure but, instead, it is improved because of touristic activities. The majority of the Pokhara respondents experience an increase in the number of infrastructures, a number of roads, and tourism activities like bungee jumping, hiking, cycling, paragliding, and boating, on a good number in recent year because of the rising number of the visitors in a city. Therefore, most of the respondents believe that tourism development has contributed to a significant role in all this improvement. Concerning the respondents from Chitwan (Chitwan National park), we find somewhat contrasting results. Here, a majority of the respondents (71%, 5 out of 7) found that the local infrastructure is indeed degrading.

Degradation comes in many forms; however, it was observed that the landscape has deviated toward modern infrastructure and away from the traditional *Tharu* house. Because the *Tharu* house is a cultural ‘icon,’ this can impact tourism in the long run. According to a local resident respondent, *"Tharu communities have a very significant role in tourism activities because of their direct and indirect involvement in touristic development. There is a Tahru community*

*nearby the Chitwan National park, which has their own identity, tradition, culture and the language, Their housing style and the building have its significance as they were made using mostly made from the natural materials, mainly mud and the straw but the increasing number of visitor on this region has changed the housing style and the structure. Now people are deviated toward the modern infrastructure to give the tourist service, and the area has been changed as a city with towering buildings. As a result, traditional local housing is lost, which will surely impact tourism in the long run". The overall assessment of this variable is displayed in Figure 7.*

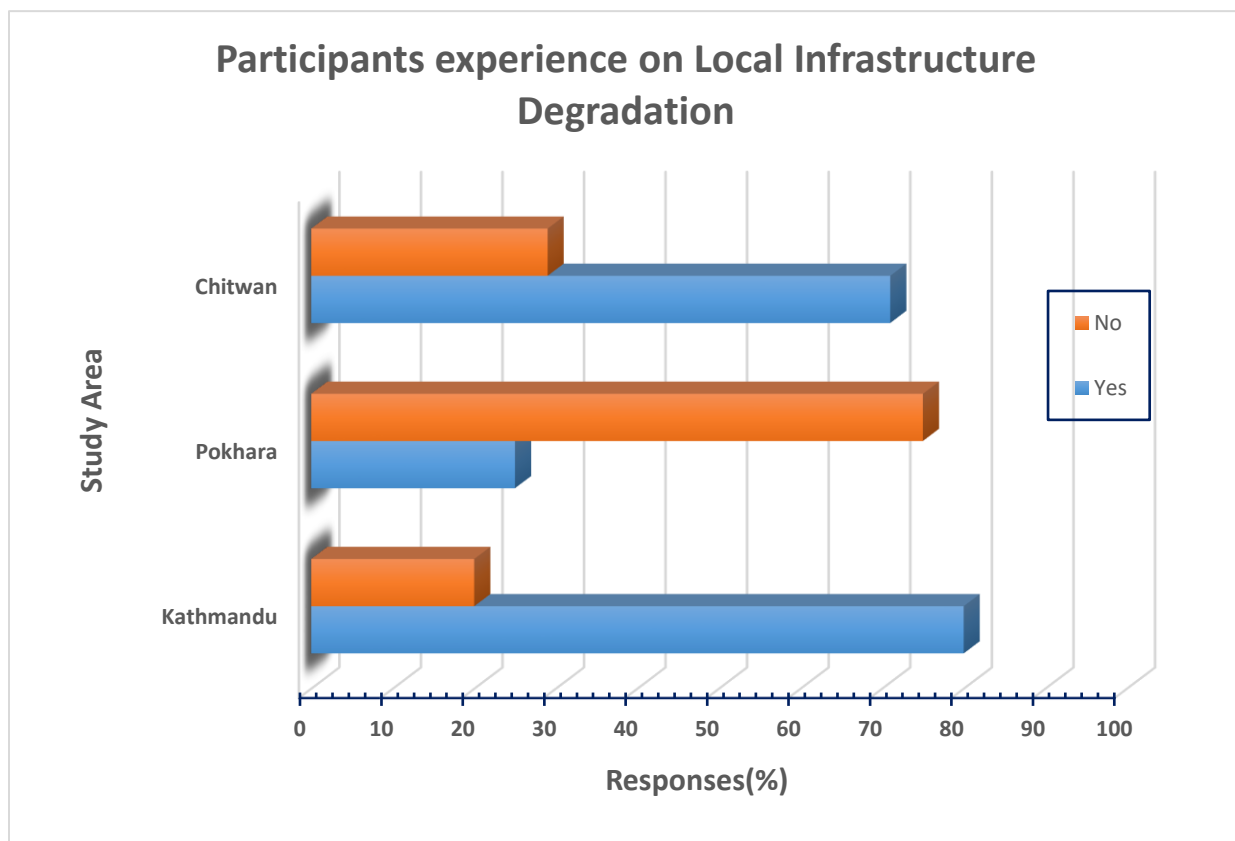


Figure 7. Participants responses based on their experience weather they feel any Local Infrastructure Degradation symptoms in the study area.

Table 4 shows the chi-square goodness of fit to check the significance of the observed data set regarding degradation of local infrastructure. Chitwan chi-square value does not show significance at the 95% level but does at the 90% confidence level that local infrastructure is

degrading, according to responses. Likewise, Kathmandu's (Thamel) statistical analysis also shows the acceptance of our idea and supports degradation, while Pokhara as well shows a significant difference.

Table 4. Statistically significant test result of the Local Infrastructure Degradation consequences of each location using the Chi-Square test.

Location	Variable	Value	P-value
Chitwan	Local Infrastructure degradation	5.42	0.066
Pokhara	Local Infrastructure degradation	7	0.03
Kathmandu	Local Infrastructure degradation	10.4	0.005

Regarding negative Tourism responses, we ask our respondents whether, as a result of an excessive quantity of visitors (tourists) do you think the tourists themselves in this place have had their 'experience' negatively affected? The respondent has a mixed review regarding each city, which is displayed in the Figure 8. Six (6) out of ten (10) (60%) in Thamel (Kathmandu) were negatively affected, and the rest of them, four (4) out of ten (10) (40%), did not have any negative experience. According to one of the visitors, he experiences the negatively with the other visitors because of an excessive number of visitors, *"As we know that Thamel is a hub for all the tourist and the people always want to visit there to do the shopping in the day time and night party or nightlife in the nights. I have a negative experience with the Chinese visitors and their discipline and respect toward tourists. The way they speak and laugh in a loud voice in a huge group and the language barrier has disturbed me many times during the visits. This not only affects me but all the tourists and the residents nearby them, which is against their fundamental right."*

While at the same time, in Pokhara, six (6) out of eight (8) (75%) of the respondents have a negative experience, and 2 out of 8 (25%) are satisfied with overall tourism activities. Chitwan also follows almost the same trajectory, where four (4) out of seven (7) (57%) are negatively influenced, and three (3) out of seven (7) (43%) as displayed in Figure 8 are happy with the overall experience. Those who are negatively influenced are concerned about the shortage of bus tickets and the flight to travel from one destination to another. Likewise, some feel price discrimination among tourists according to their country; their main concern was the different entrance and travel fees for the south-Asian tourist, other tourists, and the locals.

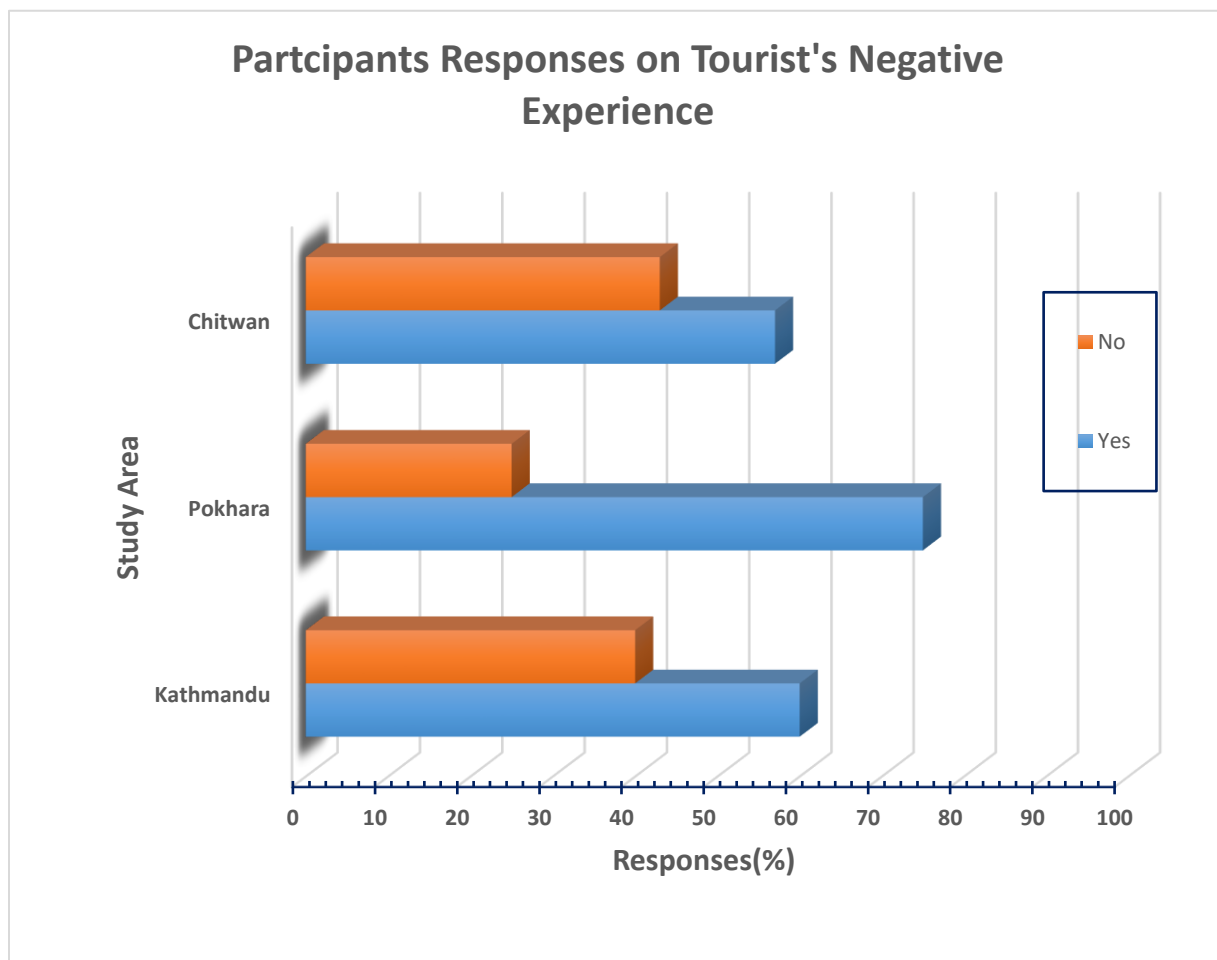


Figure 8. Participants' responses based on their experience of whether they feel any Negative experience in the study area.



Table 5 displays the significance test result from the respondent's assessment of a 'negative experience'. Compared to the other two cities, Pokhara indicates statistical significance on this ( $p < 0.05$ ), where tourists have experienced a negative experience.

Lastly, analyzing the local resident's negative consequences asks whether “As a result of an excessive quantity of visitors (tourists) do you think the local residents of this place have experienced any negative consequences?” Besides Thamel city (Kathmandu), other cities' residents are not negatively affected from the number of visitors. Six (6) out of the ten (10) (60%) respondents from the Thamel have experienced the local resident's negative consequences, while four (4) out of the ten (10) (40%) did not experience anything, as shown in Figure 9. Many of them explain the result based on their experience on religious sites. In the Hindu and Buddhist religions, monuments and temples are destinations for people to pray. These places are known for their tranquil and peaceful settings; however, the excessive number of visitors to these historical sites often disrupts a person's spiritual and sacred integrity. Some visitors spend a full day from morning to night to observe these sites exhaustively.

Table 5. Statistically significant test result of the tourist negative experience consequences of each location using the Chi-Square test.

Location	Variable	Value	P-value
Chitwan	Tourist's Negative Experience	3.71	0.156
Pokhara	Tourist's Negative Experience	7	0.03
Kathmandu	Tourist's Negative Experience	5.6	0.06

Tourists often forget or are unaware that morning and evening times are the residents' prayer times, which may cause misunderstandings and feelings of disrespect between locals, religious tourists, and sightseeing tourists. As a result, Thamel experiences structural and

environmental damage to the cultural site from the large numbers of visitors. As all of our study areas have similar responses, our p-value calculated in Table 6 below using the chi-square test is greater than the significance ( $p > 0.05$ ). This will further bolster our findings statistically.

Table 6. Statistically significant test result of the Local resident's negative experience as a consequence of excessive tourists at each location using the Chi-Square test.

Location	Variable	Value	P-value
Chitwan	Local Resident Negative Experience	3.71	0.156
Pokhara	Local Resident Negative Experience	4	0.135
Kathmandu	Local Resident Negative Experience	5.6	0.06

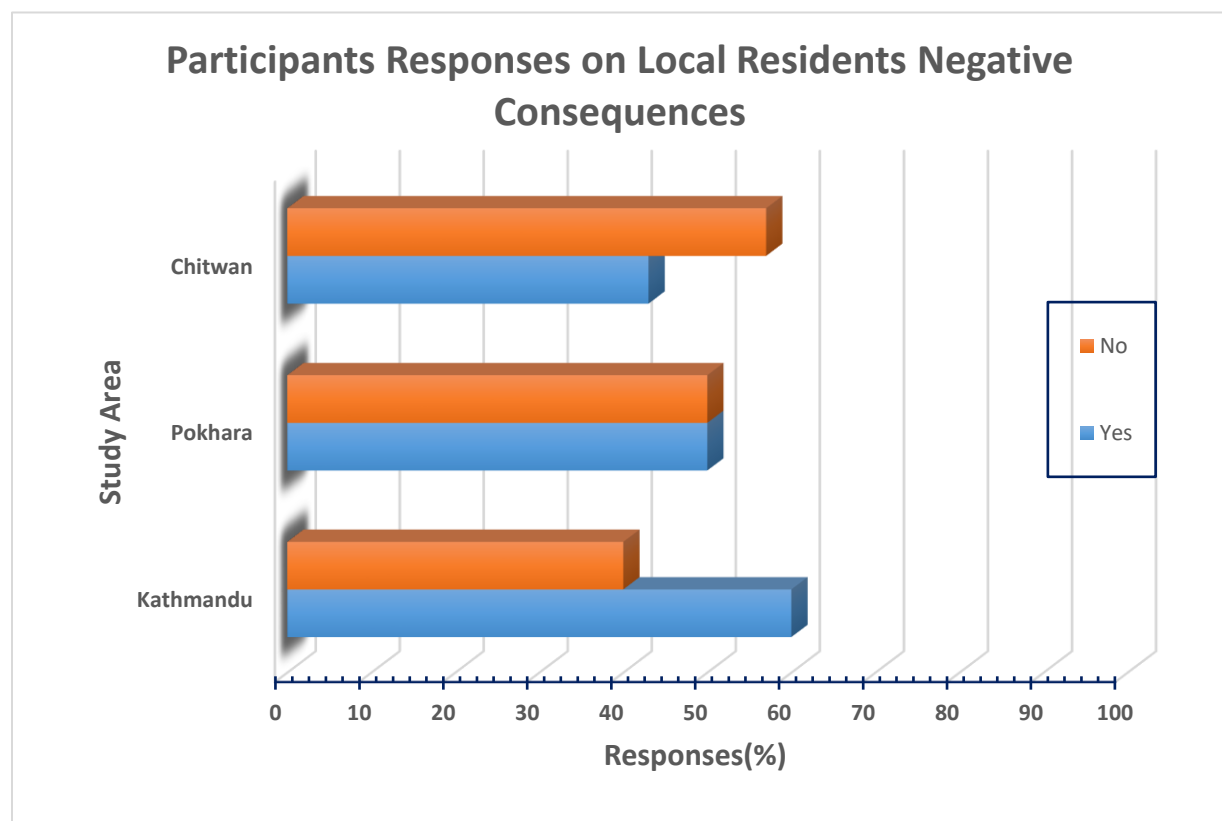


Figure 9. Participants' responses based on their experience whether they feel any local resident's negative experience from the visitors in the study area.

## Conclusion

The raw number of tourists does not define the existence of overtourism; it is contingent upon the capacity of a locality to manage sustainable tourism practices and overtourism has both natural and social dimensions in its definition and existence. It has always been a challenge for a developing country like Nepal to handle large inflows of tourists. Today, easy access to the internet worldwide and a relatively inexpensive market compared to western countries results in Nepal's receiving a higher number of tourists day by day. It is good news for a developing country to earn foreign currency; however, due to Nepal's stressed infrastructure, it is difficult for a government to manage current tourism demands—not to mention in the coming future if they receive their target of more than 2 million visitors after 2020. There is a significant implication drawn from this study. The study reveals that Thamel city shows more overtourism symptoms than the other two cities. As an excessive number of visitors, the rent inside Thamel city has increased rapidly, further impacting the whole social ecosystem inside the town.

The result of this research indicates that the Thamel City of Kathmandu is currently experiencing overtourism, results show that it has met almost all the variables associated with overtourism. Pokhara and Chitwan also show elements of overtourism, but many respondents suggest that it is not yet in concerning stages. Proper management and implementation of the plan would help mitigate the overtourism symptoms and help create sustainable tourism development. The rising environmental problem in these two cities has created concern over the quality of life and cultural heritage preservation. The widespread small development or the conversion of the local properties as a tourism facility would be a short-term solution. Still, in the long run, it will further ruin the tourism infrastructure, which is unacceptable.

The Kathmandu Valley as a whole is too crowded, and the environmental and cultural issues already under stress are exacerbated by unregulated tourism. Additionally, in seeking development, transfers to modern infrastructure to handle the influx of tourists cause this area to degrade its own historical and cultural character. The government should start to evaluate and plan sustainable tourism development strategies. In its current state, the UNESCO World Heritage site of Kathmandu Valley is experiencing harm due to the negative impacts of overtourism. In order to counteract the environment degradation impact, it is necessary to implement modern technologies to balance the city traffic, encourage the use of renewable sources, and create a walking environment for the visitors inside the city.

Furthermore, to balance overcrowding in the tourist place, Nepal can build additional infrastructure to subdue the destination's crowds. As Thamel is known as a culturally rich heritage site, it is necessary to educate the visitor by providing information about the local resident's culture, traditions, and rituals, which would help minimize the local resident and as well negative tourist experience. The displacement of the local people from Thamel city has further exaggerated the overtourism problem and shows the possible threat of cultural deportation too from the city. Thus, this study helps the tourist, tourism business operator, tourism officials, administration, and the local governments to conserve the city.

## CHAPTER-2 TOURISM OPPORTUNITY INDEX

### Introduction

**Sustainable Tourism.** The period from 1960 to 1980 showed increased promotion and modernization of tourism during particularly regarding movements from tourists of the most developed countries to the “third world” In doing so this has led to increased efforts working with the theory of sustainable development of tourism (Shakya, 2009). The rapid expansion of tourism and its negative impact on the environment create a polarized view of tourism proponents and opponents. The discussion looking for the alternative and appropriate balance between the economic goals and the environmental and socio-cultural impacts in the early 1990s created the new alternative development perspective known as sustainable tourism development. Sustainable tourism looks for the creation and development of the tourism industry without depleting the resources, and at the same time, enhancing the economic, social, and environmental capital (Shakya, 2009). Sustainable tourism is considered a form of tourism that looks for long-run profitability with collaboration at multiple levels with diverse stakeholders, the local people's direct involvement (Byrd, 2007).

Clegg (2015) identifies a conceptual framework with a principle-based scientific approach involving both developed and developing countries' environment. Such physical properties in the framework include climates, topography, and landscape, which are seen as necessary for sustainable tourism development (Clegg, 2015). In order to develop these approaches, the interaction between tourism and the environment must be analyzed with its most comprehensive meaning. Therefore, a deterministic touristic policy is needed to identify the limits of environmental factors and values and overcome the challenge associated with sustainable tourism (Boselli *et al.*, 1997).

## **Sustainable Tourism in Nepal**

Tourism has been known as a potential pathway toward Nepal's prosperity and the sector capable of changing the country's economic position. Rampant consumerism of resources without accounting for the potential degradations of environmental and socio-culture effects has created a sustainable development debate. The type of tourism resources accessible in Nepal shows that there is a substantial reliance on the natural, cultural, and environmental. An authentic lifestyle of the local population in developing countries like Nepal is a touristic asset that attracts tourists but is also often impacted more by tourism than in developed countries. To scale-up sustainable tourism, it is necessary to balance tourism demand with a full assessment of the outcomes of this demand—both positive and negative. The activities mentioned in the document's supplemental materials have attracted a large number of tourists in Nepal, while the unregulated growth and poor management leads to environmental destruction in many ways.

**Social & Economic Sustainability in tourism.** Socio-Economic sustainability refers to the long-term economic growth of a place without degrading the other aspects of the community—a focus on uplifting the standard of the local people. Social sustainability refers to people's well-being by balancing people's needs and the visitor's requirements. The Western Australia Council of Social Service (WACOSS) defines the social sustainability: “Social Sustainability occurs when the formal and informal processes; systems; structures; and relationships actively support the capacity of current and future generations to create healthy and livable communities. Socially sustainable communities are equitable, diverse, connected, and democratic and provide a good quality of life”. Moreover, the visitors traveling to and throughout Nepal represent an essential component of the national economy. With more than 1.2 million visitors in 2019 and an increasing number of visitors to the tallest peak of the world Mt.

Everest continues to serve as a nuclear core, fueling the economic development and sustainability in the country. The World's tallest peak, national parks, cultural heritage site, and historical monuments of Nepal are the service-oriented sector of the economy, which includes tourism, which has far surpassed that of the extractive industries.

Figure 10 reviews Nepal's overall economic growth rate from 2014-2019 and the forecasted growth rate for the 2020-2021 period. If we take out the 2016 GDP growth rate (significantly altered by the 2015 earthquake) in all other years, the GDP shows a rising trend. This GDP figure shows that the Nepal total monetary market values of all goods and services produced within the country have increased since 2016. This GDP includes all the private and public consumption, government investment, private inventories, paid-construction cost, and foreign balance of trade. According to the World Travel and tourism council's annual report of 2018, Nepal collected US \$2.058 billion revenue, which is 7.9 % of total GDP and supported 1.05 Million jobs directly, and indirectly.

The GDP per capita Growth rate is calculated based on a person's average revenue to the industry's total workforce and very useful. It helps in understanding both population increases and changes in GDP. However, high inflation shows that the price of goods and services has increased more than the GDP growth rate in 2015 and 2016. Comparing inflation rates with the GDP per capita indicates that inflation has been higher than GDP per capita percentage gains every year except 2018. This shows that the cost of basic needs has generally increased compared to earnings over the same period.

Although we saw a slight decrease in inflation rate compared to GDP growth rate and GDP per Capita growth rate from the 2017-2019 time period, after that, it is forecasted that the inflation rate will be higher in 2020 – 2021 time period. We saw a noticeable change during 2016

on all the parameters, resulting from the deadly earthquake in 2015, which significantly damaged the country's overall economy. However, after the slow recovery from the earthquake damage, the unexpected rise in the number of tourists helped in part to establish economic growth in the three years following. (NTB, 2019).

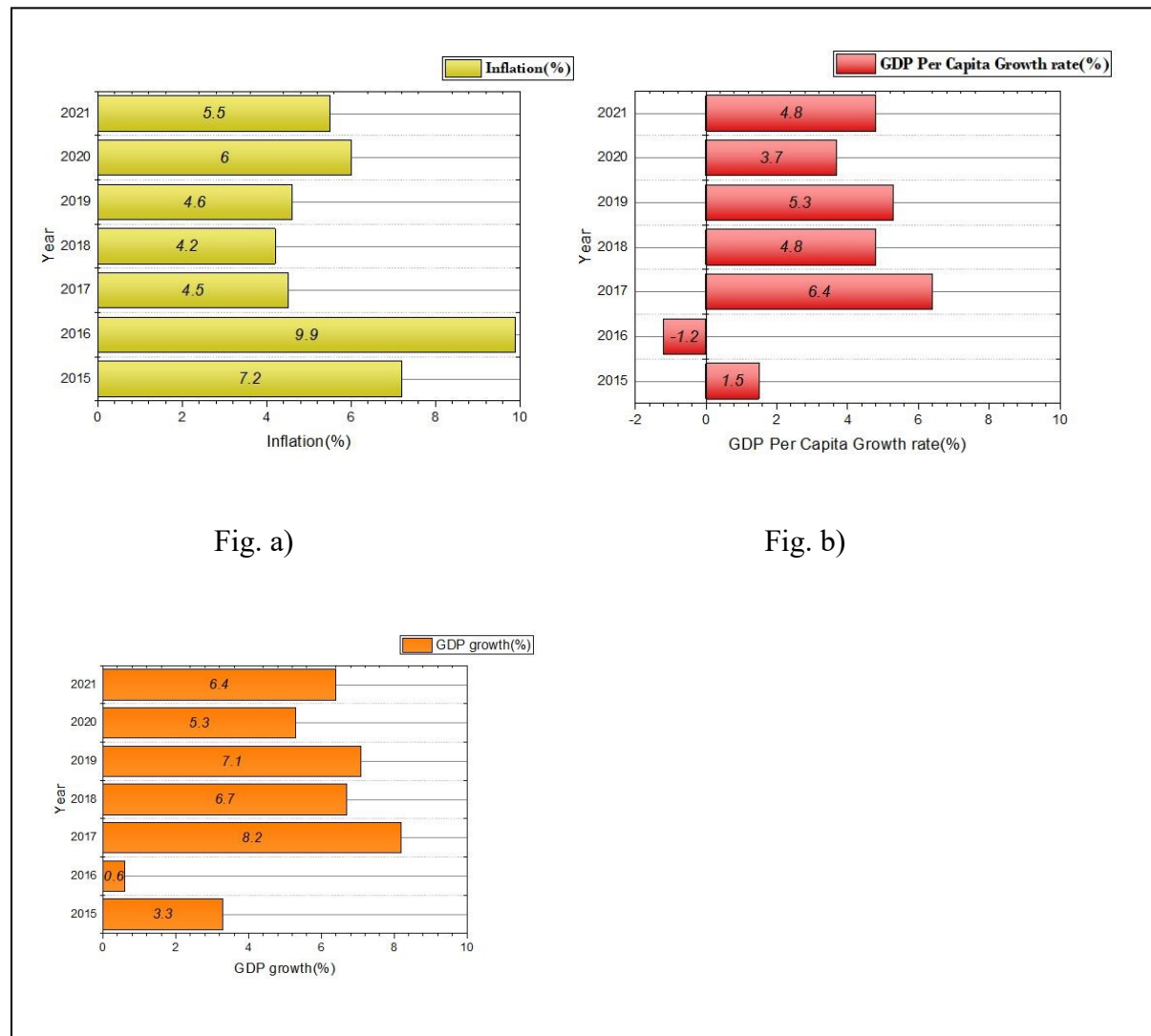


Figure 10. Economic variable compare of Nepal from 2015-2019, and forecasted 2020-2021 based on a) Inflation Rate, b) GDP Per Capita Growth Rate, c) GDP Growth Rate.

This shows that Nepal's economic parameter is on the right track to grab a maximum benefit for sustainable growth, and Figure 11 shows several economic indicators over the last five years. The opportunity created by tourism development has changed people's economic life



with a parallel increase in the job and the service. However, the change in the social behavior of the people has raised some concerns as well. Also Appendix C shows the overall tourism resources of Nepal and its future development process forwarded by Nepal government.

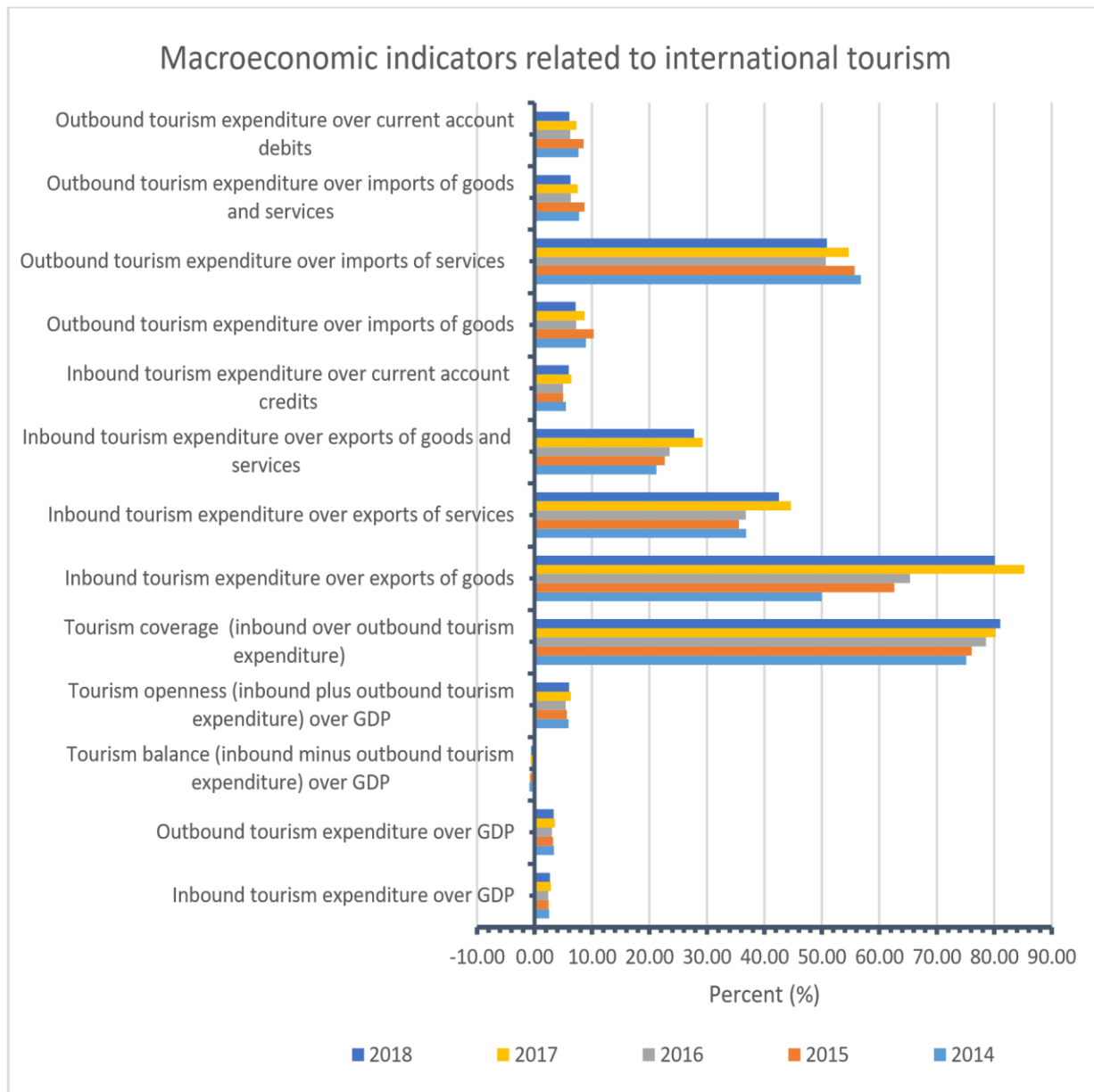


Figure 11. Macroeconomic Indicator of Nepal from 2014-2018 (NTB, 2019).

**Cultural Sustainability in tourism.** Nepalese culture has many symbols for Hindu and Buddhist sources. Tradition, religion, belief, language, and social organization are essential

aspects of culture in Nepal. Sacred pilgrimage sites, historical monuments, and memorials reflect Nepalese culture's richness and attract the tourist to Nepali Lifestyle. Hence, cultural sustainability will always play a large role in the development of tourism, which affects the number of potential tourists in the long run.

**Environmental Sustainability in tourism.** Environmental sustainability is becoming a significant concern in Nepal with rapid change and unplanned infrastructure development. People are converting the parks into resorts, unplanned road construction based on their sole profit on the hilly region's challenging topography. The mountain region results in many environmental degradation issues in a different part of Nepal. Irresponsible behavior of tourists of throwing plastic and the garbage produced from their daily activities haphazardly on the top of Himalayas is slowly becoming the big rubbish dump which can play the catalyst role for the temperature increase in mountain as a result of ongoing global temperature increase.

### **Transportation condition of Nepal**

**Air Transportation.** Since the modernization of aviation, air transportation in Nepal is the cheapest, fastest, and most accessible means of transportation. In total, there are fifty (50) airports in Nepal, and many of them are seasonal or closed due to lack of technical equipment, lack of skilled workforce, and lack of enough capital. The only international airport, Tribhuvan international airport (KTM), is the hub of all air services in Nepal and serves Kathmandu's national capital city. Out of 50 airports, only 31 have regular flights, and the remaining nineteen (19) airports are closed or not under the operation (Civil Aviation Authority of Nepal, 2020). According to flightRadar24, with the exception of Jomsom airport (JMO), all remaining twelve (12) airports connect that destination with Kathmandu airport (KTM) with at least one flight per week. Jomsom Airport (JMO) is situated at Gharapajhong Rural Municipal of the Mustang

District, Gandaki Province, at the bank of Kali Gandaki River lying in between the majestic mountains Dhaulagiri, Annapurna, Nilgiri, and other towering peaks. This airport serves the people in the Annapurna round trek route. Appendix D and Appendix E demonstrate the airports which are under operation and closed, respectively.

Tribhuvan International airport (KTM) has contributed significantly to the development of tourism in Nepal. According to Nepal Tourism Board statistics, annually, 761,000 visitors land in Tribhuvan International Airport (KTM), which is around four (4) out of every five visitors (more than 80 %) who visit Nepal yearly. This airport has been the entrance gate and hub for the tourists by connecting more than forty (40) destinations in seventeen (17) countries, as shown in Figure 12.

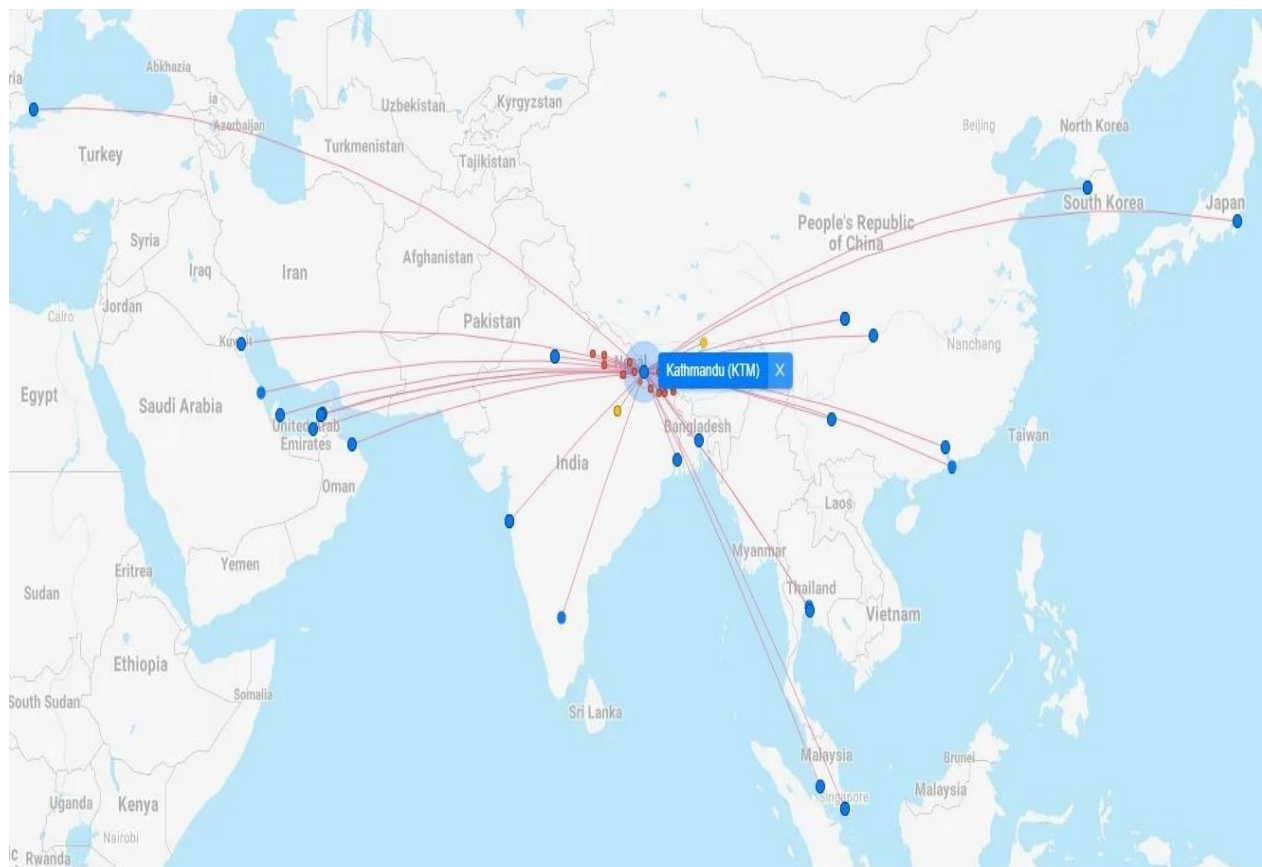


Figure 12. Airways direct connection from Kathmandu Airport to all over the world (Flight Connections, 2020).

Due to the proliferating number of flights, and passenger loads through in this airport, as, the Nepal government is expanding the KTM airport and proposing to build three other international airports to overcome crowding and shift ( as shown in Figure 13) some air service out of the capital valley (Rai, 2018). The Gautam Buddha International Airport (BWA) in Bhairahawa is likely to be ready for trial flights by the first quarter of 2020 (Sunwar, 2019), and Pokhara's new international airport is on track to begin operations by December 2020 (Dixit, 2019). Despite government initiatives to hasten the construction of the Nijgadh airport, progress is delayed due to court order and strong environmentalist opposition (Bhattarai, 2019).

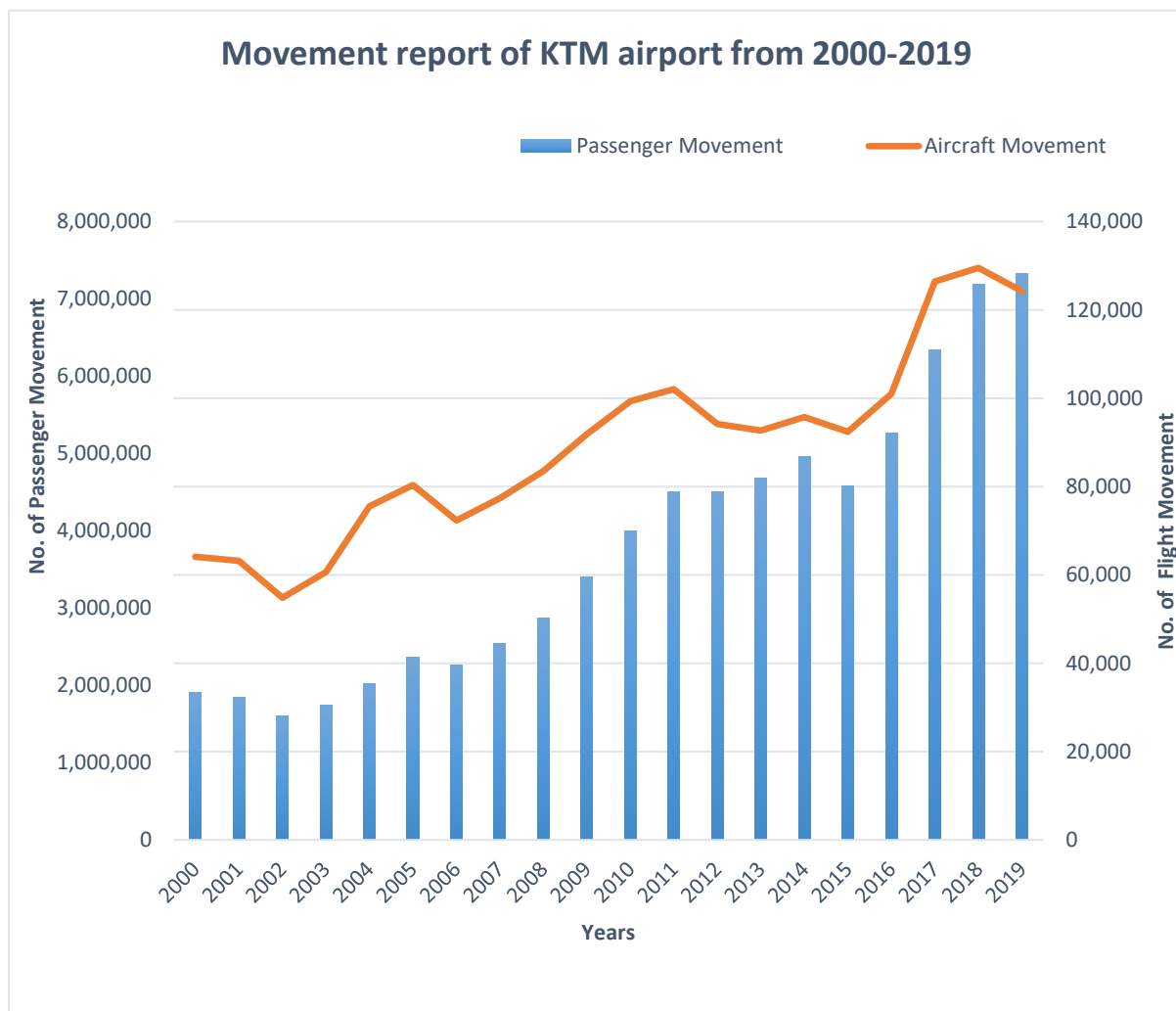


Figure 13. Statistic report of people movement and aircraft movement of Kathmandu airport from 2000-2019 (Civil Aviation Authority of Nepal, 2020).

Figure 14 shows the agreed entry route, existing outbound route, existing inbound and outbound route, future discussion entry point, and no discussion entry point of air routes of Nepal connecting to the international flight based on the agreement between Nepal and India on June 2018 (The Kathmandu Post, 2018). The red triangle shows the new entry route for the airlines agreed by the Indian government based on the Nepalese government's proposal; however, the green triangle is the existing departure and arrival route for the airlines. There are currently three inbound and outbound routes open for international flight. These all routes are open for all the airports of Nepal, while some of the points are only allowed for departure, which is shown as a deep blue triangle. Similarly, the Light blue triangles are the points the Nepal government wants to open, but the Indian government has on hold until further discussion.

After that cross-border airspace agreement of Nepal with India has gain four entry route (Kathmandu-Biratnagar-Dhaka, Kathmandu-Janakpur-Kolkata, and Kathmandu-Janakpur-Patna in the eastern part of Nepal and Kathmandu-Mahendranagar-Delhi in the west) to connect the Kathmandu airport with an international flight of other countries, which helps to cut down the air traffic as well as its holding times in the sky. As a result, it will help lower the airfare, decrease flight times, and indirectly help increase the number of tourists in Nepal.

**Road network.** The road network is one of Nepal's primary transport modes for people's movement from one place to another, particularly in a local context. Due to the Hilly and the Himalayan regions' challenging topography, roadways constructions are complicated, costly, and time-consuming affair (Bhagat, 2017). Compared to most western countries, the existing road network is poor in Nepal, and vehicle accidents are frequent as there is double the number of fatalities/injuries on roadways each year. Poor infrastructure, geological condition, equipment failure, and human error are the contributing key factors (Bhagat, 2017).

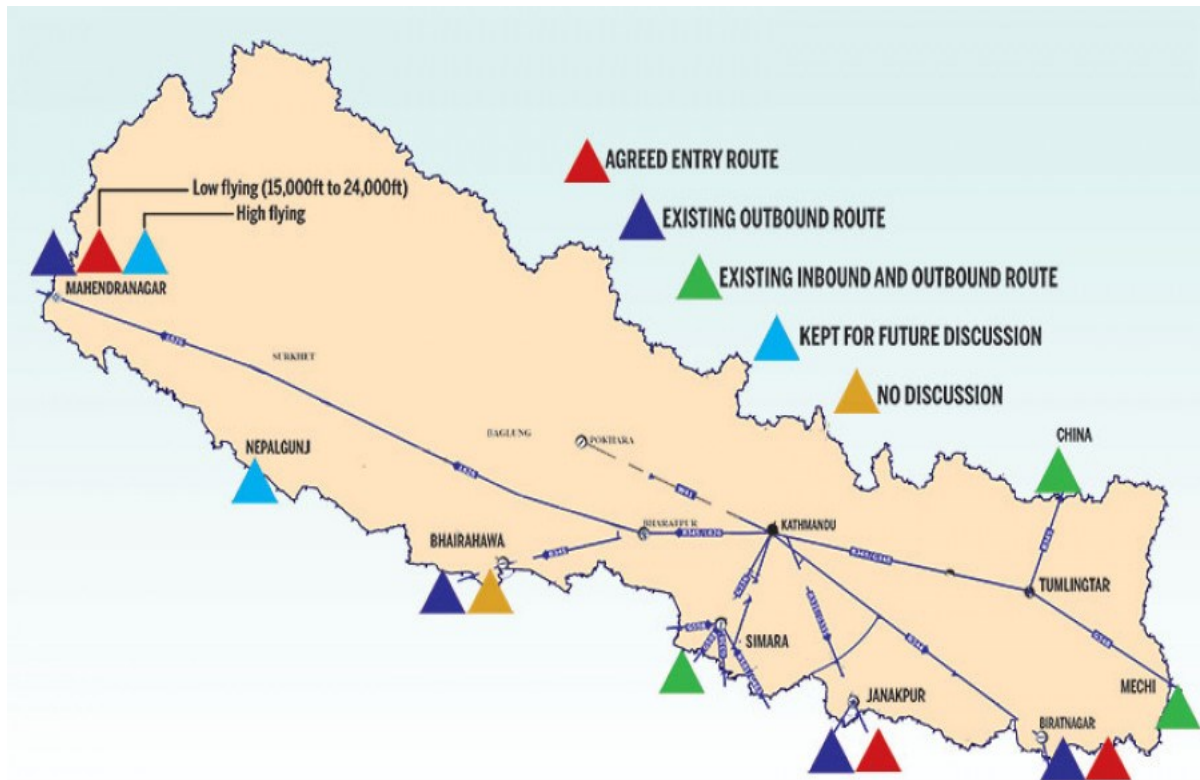


Figure 14. Existing, under construction, and proposed international air routes of Nepal (The Kathmandu Post, 2018).

Nepal's road network is primarily divided into four categories; National Highway (NH), Feeder Road National (FRN), Mid-Hill Highway (MH), and Postal Road (PR). Serving 30 million people, there is currently 3809.95 km (25%) of National Highways, 9489.56 km (62%) of Feeder Road National, 1344.00 km (9%) of Mid-hill Highways, and 741.70km (5%) of Postal Roads. However, if we look out the types of road networks, mainly there are three types of road networks, Blacktop road (BT), Gravel road (GR), and Earthen Road (ER). In total, 6979.33 km (52%) of the constructed road has been categorized as Blacktops roads, 2276.87 km (17%) are known as Graveled roads, and 4194.42 km (31%) of road track has been open and known as Earthen roads (SSRN, 2018). Individual district wise type of road and road category is shown in Appendix F. Figure 15 demonstrates the entire road network district all over Nepal (SSRN, 2018).

**Cableways.** The ropeway in Nepal was introduced in 1922 for cargo service, but the first Cable Car in Nepal was established in 1998, the Manakamana Cable Car. Cableways have changed the whole tourism market scenario with the success of connecting the mountaintop Manakamana temple with lesser shrine complexes. This cable car provided increased visitation due to a lessened climbing hassle and faster access (Khatry, 2020). The Manakamana cable car's base station is situated at 258 m above sea level in the Chitwan district, and its hill station is situated at 1302 m in the Gorkha district. This Hindu temple is famous for pilgrims/cultural tourism, where every year, thousands of domestic and international visitors (mostly from India) visit the temple annually. Each year, peak annual tourist numbers occur during the ten days of the Navaratra/Vijaya Dashami or Dashahara (in India) festival. Annapurna Himalayan range and Mt. Manaslu's scene and scenery further help draw the tourist's attention to this religious site. The other five significant cable cars in Nepal offers varieties of natural and beautiful experiences for visitors, and their location is shown in Table 7.

Table 7. Major Cable car connection of Nepal with its location.

S.N	Cable car	Location	Line Length	No. of stations
1	Chandragiri Cable Car	Kathmandu	2500m	2
2	Manakamana Cable car	Chitwan-Gorkha	2772.2m	2
3	Kalinchowk cable car	Dolakha	900m	2
4	Sarangkot Cable car	Pokhara	2300m	2
5	Kusma-Belawar Cable car	Parbat	550m	2

After the success of the Manakamana temple cable car, other cable cars have subsequently followed. For example, the Kusma -Belawar Cable car operating in Nepal's Parbat

district is a 550 m cableway serving to help both tourists and locals. Similarly, Chandragiri Cable car was established in 2016 on the south-western side of Kathmandu valley, which is 2551 m above sea level. With the establishment of this cable car, it is effortless to reach the hill's top to view the magnificent Himalayas, including the mountains of the Annapurna and Everest regions. It also helps to connect residents' cultural rituals to worship Lord Shiva at Bhaleshwor Mahadev temple, which is located on the top of Chandragiri hill. This location has been the famous touristic hub and weekend destination for the local Nepalese who reside in the Kathmandu valley. This cable car helps to reduce the travel time by more than one hour, taking only eight minutes to reach the top of the hill (Chandragiri Hills, 2020).

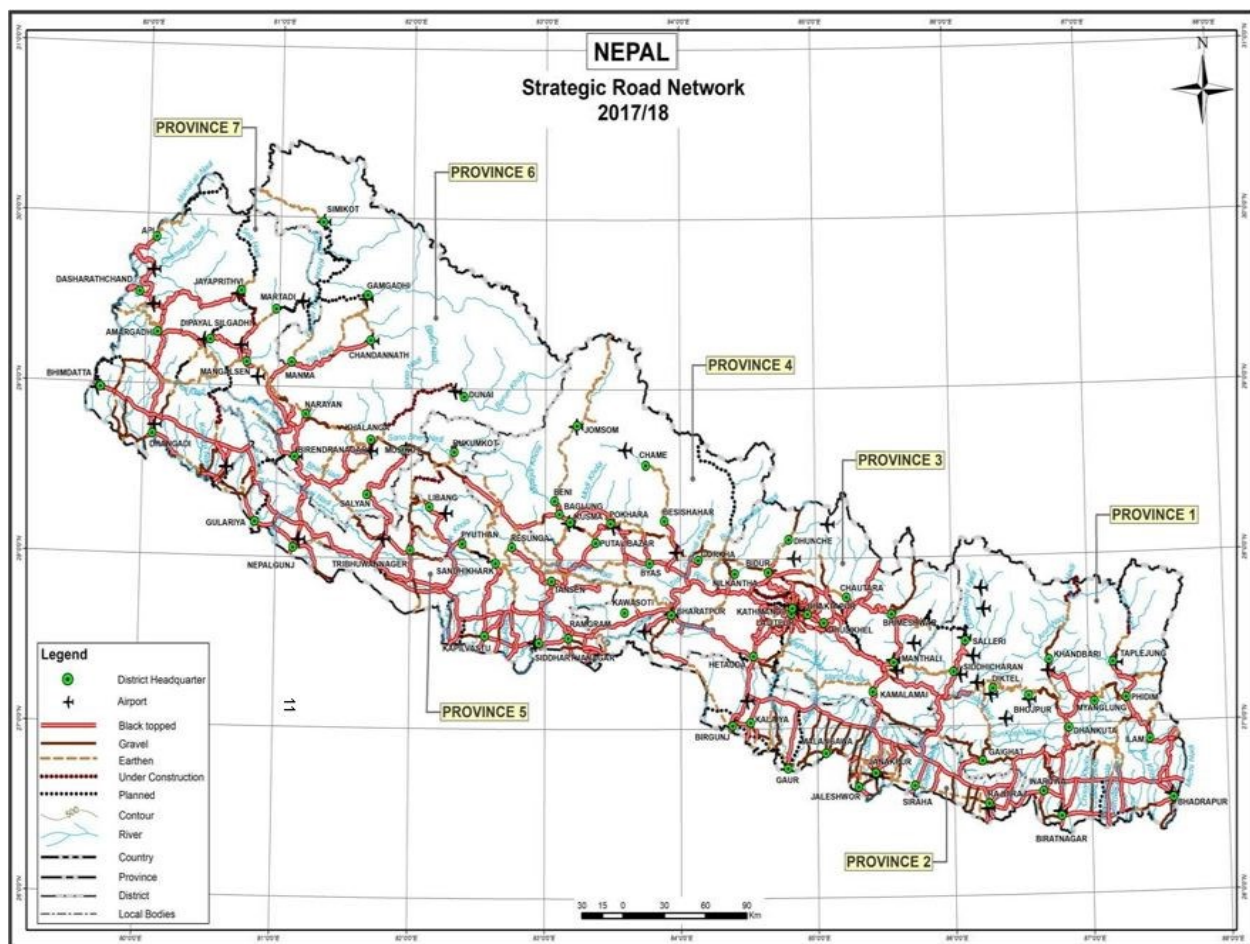


Figure 15. Strategic Road Network of Nepal, according to 2017/2018, data from the Department of road, Nepal (SSRN, 2018).



Kalinchowk cable car is another cable car operated in the Dolakha district and is located at an elevation of 3755 m above sea level, as shown in Figure 16. Kalinchowk is a famous touristic place located northeast from the Kathmandu district and takes around 6-7 hours to reach by bus. When the winter starts and snowfall begins, this area will receive the peak number of visitors, including domestic and international. This cable car connects Kuri Gaun station to Kalinchowk Bhagwati temple station along with a 900 m long cable car. It will take approximately one hour to walk from Kuri-Gaun to the top of the hill on foot, while after the construction of cable cars; it only takes around 5-7 minutes. From the peak of the Kalinchowk, we can observe a magnificent mountain range view along with Mount Langtang, Mount Ganesh, Mount Jugal, Mount Gauri Shankar, Mount Shisha Pangma, Mount Dorje Lakpa, and other mountain ranges as displayed in Figure 16. This cable car helps to increase the tourism business of this area by acting as a growth pole by which other infrastructure can develop adjacent to the cable car.

Sarankot cable car is under construction and located in the heart of Pokhara Valley. This cable car is made to improve the access network of other destinations with Sarankhot hill. This hill is famous for paragliding, bungee jumping, zip line, and other adventure activities. Moreover, this cable car also provides the opportunity for scenic views of Pokhara valley from bird-eye views along with mountain ranges located on the north side.

Overall, cable car transportation has drastically changed Nepal's transportation network and connects Nepal's remote hills faster than any other means. The investigation and construction of these cable cars have been among the most massive boons for the Nepal tourism industry. This local transportation mode has a huge potential to draw the attention of a large

number of tourists toward the remote hills of Nepal easier and faster with a mesmerizing aerial view.

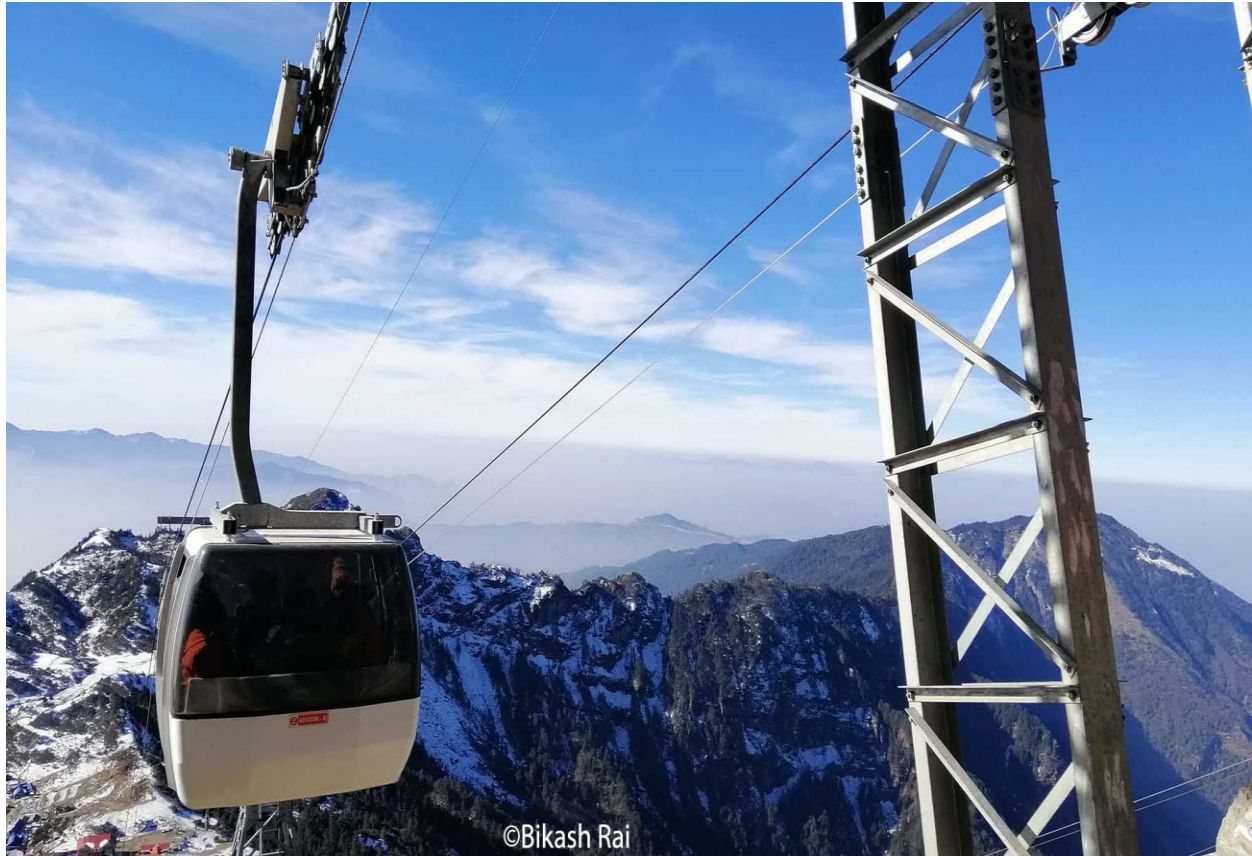


Figure 16. Kalinchowk Cable care operated in Nepal, which is located 3775m above sea level.

### **Climate Change in Nepal**

Climate change is gradually becoming a significant concern to humankind, but most vulnerable people are not aware of the real consequences of global warming. It is recognized as a significant threat to rural communities, which are more dependent on natural resources (Maharjan *et al.*, 2011). Nepal's temperature is increasing at a high rate in recent years, similar to the phenomenon observed globally. It is found that the average temperature in Nepal (Table 8) has increased consistently and continuously, at a rate of  $0.05^{\circ}\text{C}$  year from 1971 to 2005 (DHM, 2008) . Likewise, the maximum temperature increased by  $0.06^{\circ}\text{C}$  and minimum temperature

increased by  $0.03^{\circ}\text{C}/\text{year}$  between 1975 to 2005 (Marahatta *et al.*, 2009). Significant warming trends in the Himalayan and Tibetan regions, higher than the global average, are reported in the literature (Shrestha *et al.*, 1999). Such warming trend in the world's largest and highest mountain system will influence the glacier and snow dynamics, leading to changes in water resource availability, particularly during spring and autumn (Maskey *et al.*, 2011).

This seasonal variation is commonly observed worldwide as rainfall occurs as a result of the south-west monsoon, which lasts from June to September. The humid monsoon air coming from the Bay of Bengal is forced to rise as it meets the high hills and mountains in Nepal (APN, 2005). According to NCVST (Malla, 2009) Nepal's climate is influenced by the Himalayan ranges and the South Asian monsoon. Altitude affects annual temperature and precipitation patterns (DHM, 2008) and annual rainfall increases with altitude up to 1500m; after that, annual rainfall decreases with increasing altitude. The mean precipitation in Nepal is increasing annually by 13 mm (1978 to 2008), while the number of rainy days decreases by 0.8 days/year during that time period. Increases in summer river flow provide further evidence that high summer temperatures lead to fast glacier melt and retreating glaciers. A monsoon rainfall study from 1971 to 2005 shows a nearly linear increasing trend of about 2.08 mm/year with a sizeable inter-annual variation (Baidya *et al.*, 2008). There is also an increase in the number of flood days in certain rivers in Nepal.

The study showed that the adverse impacts of floods are more significant in developing countries like Nepal, which can weaken the economy. It was manifested by the intense rainfall caused by floods resulting in a massive loss of agricultural land and products in various parts of the country. The Koshi flood in 2008 in the eastern part and the West Rapti flood in 2012 in the

western part of Nepal are examples of such devastating flood events in Nepal (Sinha *et al.*, 2008).

Table 8. Projected multi-model GCM climate change variables for Nepal (NCVST, 2009).

	2030	2060	2090
Change in mean temperature annual (°C)	+1.4	+2.8	+4.7
Change in frequency of “hot days “per monsoon (%)	-	+2.5	+43
Change in monthly precipitation Annual (%)	0	+4	+8
Change in precipitation as heavy events: Monsoon (%)	+2	+7	+16

The Koppen-Grieger classification study carried out by Karki et al. (2015) Classifies four types of Koppen climate in Nepal. A (Tropical), B (Dry), C (Temperate), and E (Polar) climates occur in the Nepal territory with the temperature ranges from 26°C (in Terai region) to -12°C (at the mountaintops). However, temperate climates overall dominate Nepal's climate and which is further subdivided into Cwa (Temperate climate with dry winter and Hot Summer) and Cwb (Temperate climate with Dry winter and warm summer). Figure 17 demonstrates the overall Koppen-Geiger climatic classification of Nepal.

### **Climate Change and its Impact on Tourism**

Climate is an integral part of tourism and can attract or repel tourists (Gomez-Martin, 2005) and can directly affect the choice of recreation by limiting time and space for tourism activities. At the same time, those climate characteristics affect nature-based tourism in various ways, including the quality of a recreation/tourism experience. Comfortable and barrier-free climatic conditions attract tourists (Beniston, 2003) and changes in these factors can have a

direct impact on the quality of their trips. Climate change can also alter the environment of the tourists' origins due to its highly sensitive relationship with the environmental change, and sometimes it can change the demand side of the destination from a popular destination to a vulnerable place (Richardson *et al.*, 2004). Many islands, coastal areas, and mountains are at a high risk of climate change and can alter the tourism statistics parallel with climate change. Although the climate is not the only factor that tourists weigh, it is one of the most important considerations for a range of activities designed to satisfy tourists (Scott *et al.*, 2007).

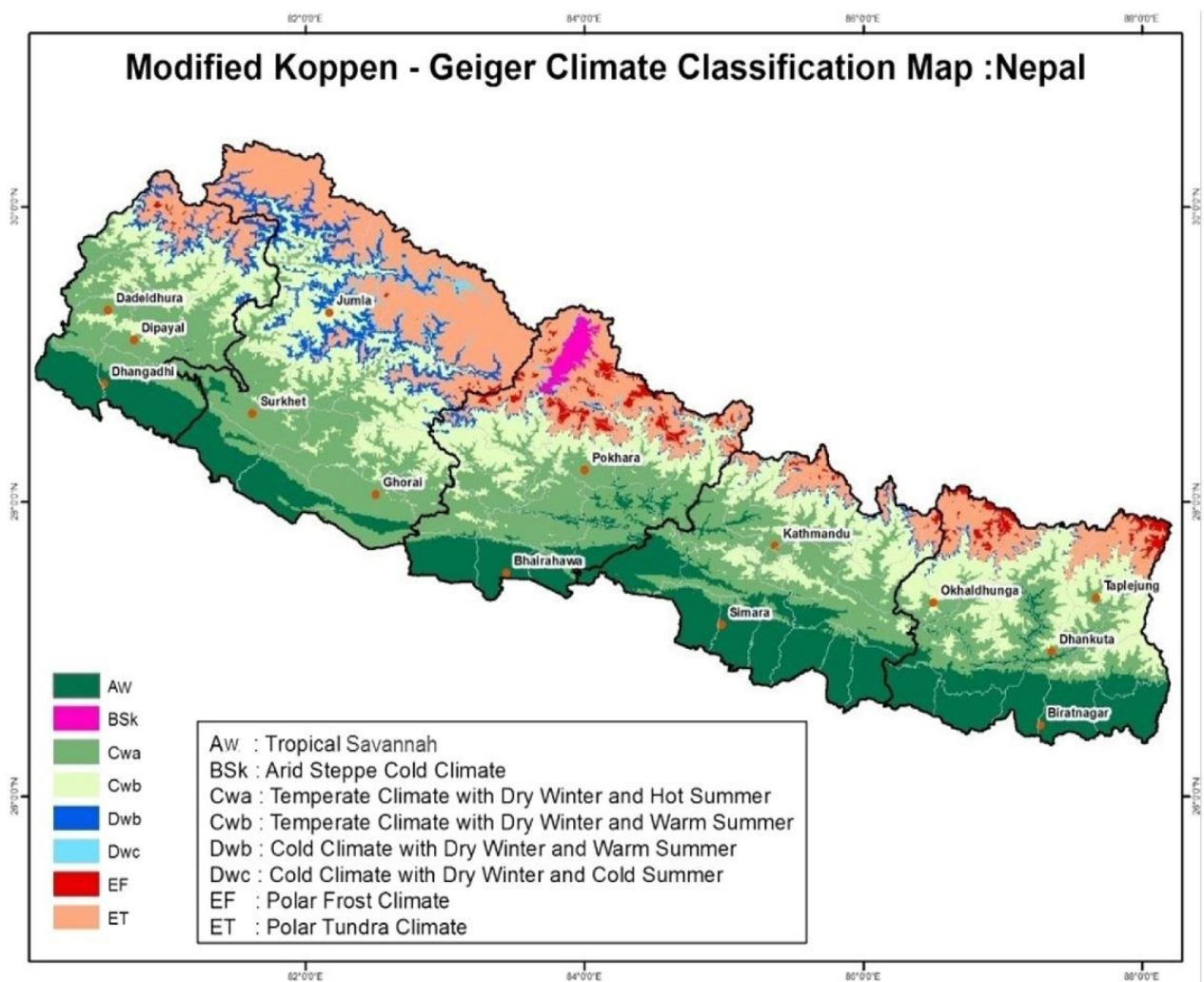


Figure 17. Koppen-Geiger's Climatic Classification of Nepal (Karki *et al.*, 2015).

Climate change affects nature-based tourism by affecting the natural resources on which tourism is based (Scott *et al.*, 2007). Any change in the Himalayas climate's characteristics could reduce the tourism flow negatively by altering the perceived attractiveness of the Himalayas environment. Unlike tourism based on built attractions, such as theme parks and shopping malls, and cultural attractions, such as historical museums, archaeological remains, historical monuments, folklore, and traditional festive celebrations, nature-based tourism is very sensitive climatic variability and change (Smith, 1993). Sometimes these changes can potentially bring out a new opportunity for the destination with the new challenge, and warmer temperatures can provide opportunities for the destination located on a higher altitude to expand the summer tourism facilities (Nelson, 2017).

The Nepalese Himalayas can be adversely affected by climate change through glacier retreat, avalanches, landslides and flooding, gradual extinction of many flora and fauna species, and damage to forest ecosystems through fire and insect infestation. Any changes in the climate's physical characteristics have the potential to negatively affect tourism industries (Nyaupane *et al.*, 2009). Many of Nepal's tourism activities are associated with the environmental factor, and any slide change on this factor can diminish the number of visitors with awful experience.

### **Research Statement**

Climate has dramatically affected Nepal's tourism due to the different natural calamities like floods, landslides, excessive rainfall, and windstorms. Nepal's entire Hindu- Kush Himalayan range has been at significant risk due to the noticeable climate change every year. Additionally, Nepal's tourism infrastructure is not sustainable due to the lack of planning and design to make it feasible and resilient for future generations. Everyone, including Nepal's government, knows the opportunity created by the tourism sector; however, there is no particular

preference to invest and protect this field in the long term. It is clear that tourism is a crucial component of Nepal's economy, and this paper will provide the investigation of each district individually, assessing all the variables regarding climate vulnerability and sustainable tourism.

In this project, using knowledge of Nepal's cultural and physical geographic diversity, we will develop a Tourism Opportunity Index (TOI) intended for identifying the different regions within Nepal that might benefit most from tourism development. The index will consider tourism resources (both current and future-development) with varying environmental and social factors that impact human vulnerability. This index aims to provide a baseline guide or tool for local governmental agencies to determine if tourism is an available and appropriate tool for local economic sustainable development. To accomplish this project, this study will address the following objectives:

- a) Address all the tourism facilities, provide a current tourism context, and evaluate future tourism development plans and sustainability.
- b) Compare the GWTC climatic classification of each decade's climate from 1979 and provide the climate change scenario all over Nepal in the last 40 years. It will provide the climatic change scenario and formulate the region, which is on the main risk and the work to carry out to overcome some changes.
- c) Develop the recommendation for sustainable tourism development and the tourism opportunity index (TOI). Based on that government can formulate their plans to benefits both the environment, local peoples, and all the stakeholders related to tourism.



## Materials and Methodology

**Geography.** Nepal is a landlocked country located in South Asia with China in the north and India in the south, east, and west, which falls between  $28^{\circ}$  N and  $84^{\circ}$  E, coordinates approximately as shown in Figure 18. The entire distance from east to west is about 800 km, while from north to south is only 150 to 250 km. Nepal has large water systems, which drain south into India. The country is divided into three central geographical regions: the Himalayan region, the Hilly region, and the Terai region.

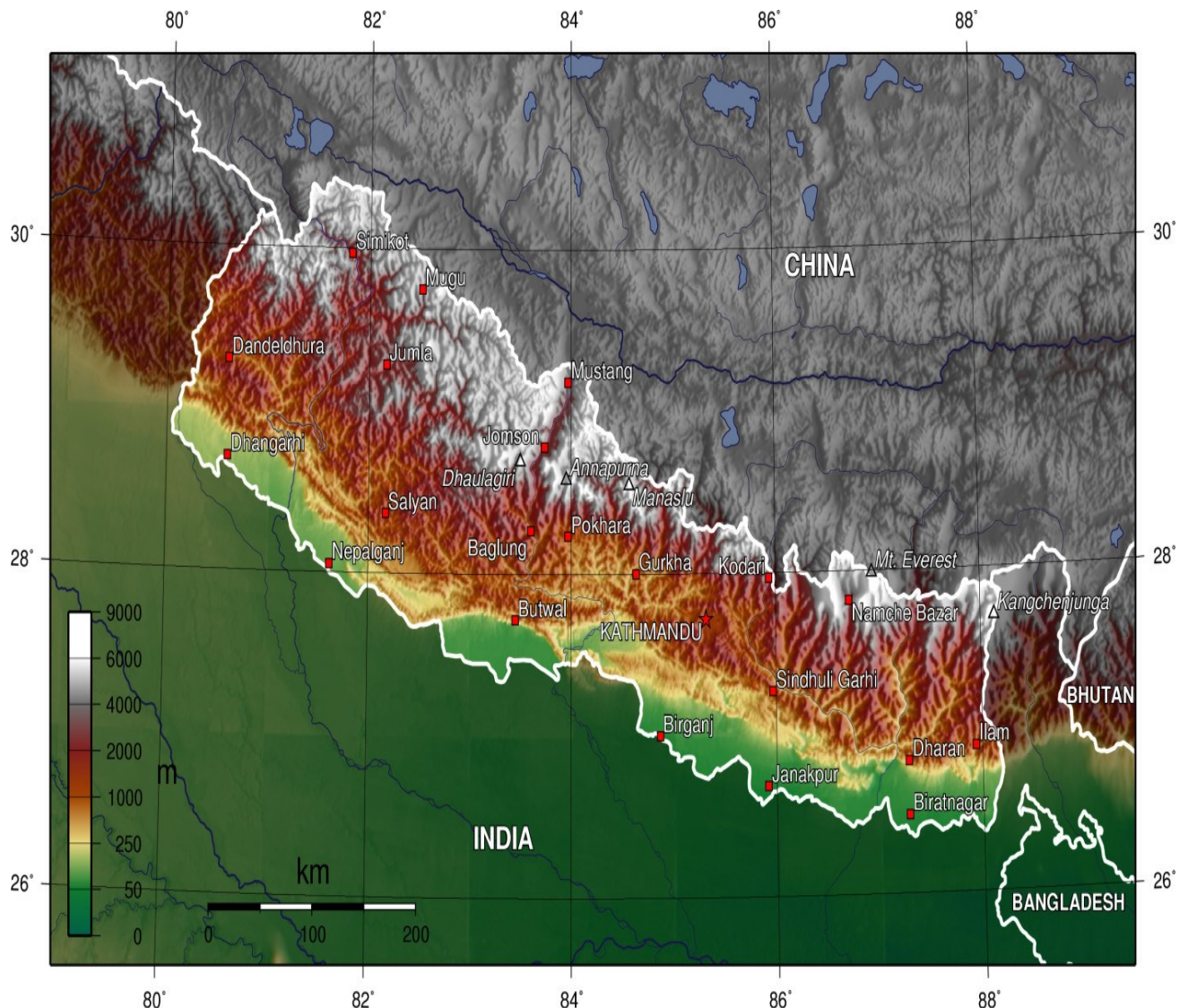


Figure 18. Elevation Map of Nepal showing its location and boundary.



The Himalayan region is a mountain region with snow located on the northern part of Nepal lies above 3000 m altitude leading into the alpine pasture. It occupies 16% of the country's total land area and is home to around 8% of the country's population. Eight of the world's highest peaks (out of fourteen) that are above 8000 m lie in Nepal, including the world tallest MT. Everest (8848 m). The Hilly region is generally a mountain region with no snow ranging the altitude from 700 m to 3000 m. This region covers around 65% of the total land area and home to around 45% of the country's population. Many lakes and valleys are located in this region, including the Kathmandu Valley and Pokhara Valley. The Terai region lies in Nepal's southern part, ranging from 26,000 m to 32,000 m wide and varies in altitude from 60 m to 700 m. It is also known as the extension of the Gangetic plains of India. It covers about 19% of the total land area, which is known for its excellent farming land.

**Climate.** Elevation mainly influences Nepal's climate and the location based on the climatic zones. There are five climatic zones in Nepal:

The Tropical Zone. The tropical zone lies below 3,300 ft, where frost occurs less than once per decade. This zone covers almost 18 % of the entire nation's areas, and the predominately Terai region experiences this type of climatic activity. This climate type is suitable for fruit and agricultural farming, making fruit like mangoes, Papaya, Banana, and citrus typical in this area. In this region, the climate is warm, with the average temperature above 18°C, and precipitation is frequent here.

The Subtropical Climatic zone. This climatic zone is active mainly in the region based on the altitude from 6,600 ft. to 9,800 ft. This region varies in climate behaviors based on the elevation, proximity to high mountains, and terrain. In this zone, we can experience the frost up to 53 days per year. Rice, maize, Millet, Wheat, potato are the conventional crops harvested in

this climatic zone. This zone is characterized by hot and humid summers and cold to mild winters with abundant precipitation.

The temperate Climate Zone. This climatic zone is active from 6,600 to 9,800 ft. elevation, covering 12% of the total land area with cool weather patterns. On average out of the entire year, this region except around average 153 days of frost with moderate mean annual rainfall and temperatures.

The subalpine zone. Nepal's subalpine zone lies from 9,800 ft. to 13,100 ft. summer high temperature reaches 24°C. This region's climate never warms, and frost is expected here, which may occur any days of the year. This region covers almost 9% of Nepal's total area and has permanent settlements in the Himalayas. Barley, Potato, Cabbage, buckwheat are the main crops harvested in this region.

The Alpine Zone. This alpine zone is located in Nepal from above 13,100 ft. to 16,400 ft. Altitude from sea level. There are virtually no plants cultivated in this region, although we can find some medicinal herbs like Yarsagumba (*Ophiocordyceps Sinensis*). This zone is known as the zone above treeline or simply called the mountain climate, where the mean temperature of every month is below 10°C, however, above 16400 ft the climates become Nival, and there is no human habitation above that.

**Seasonal Climate.** Nepal's seasonal weather is divided into pre-monsoon, monsoon, post-monsoon, and winter (DHM, 2008). Pre-monsoon season is known as the rainfall in March, April, and May; Monsoon depicts the rainfall in June, July, August, and September; Post monsoon rainfall gives the rainfall in October November; and winter season illustrate the rainfall of December, January, and February. Usually, Nepal gets 80% of rainfall in monsoon only, and the climatic pattern of the year ultimately depends on the pattern of monsoon. The average

decrease in monsoon rain or monsoon failure causes famine and drought, while above-normal rainfall causes the landslide and drought. Also, Nepal's monsoon rain depends on the distance with the Bay of Bengal; low distance is related to high rainfall, and increasing distance causes low rainfall; therefore, the eastern part of Nepal receives more rainfall than then western part. Eastern Nepal gets about 2,500 mm (100 in.) annually; the Kathmandu area about 1,400 mm (55 in.) and western Nepal about 1,000 mm (40 in.).

## **Data**

Data interpretation and collection within this project is separated into three parts:

- a) Analysis of the Tourism Opportunity index (TOI) of Nepal,
- b) Assessment of the tourism condition of Nepal, and
- c) Analysis of climatic data.

To analyze the TOI, we use secondary data published in different governmental and non-government organizations like United Nations Development Programme (UNDP), United Nations Children's Fund (UNICEF), and other governmental bodies' reports like Nepal Tourism Board (NTB), Department of Road, etc. Using this data, we analyzed the human development and economic development index of each district of Nepal. After that, we collect the tourism statistics of the last 30 years from the Statistics report published by the Nepal Tourism Board (Nepal's governmental body under the control of the Ministry of Culture, Tourism, and Civil aviation). By using this data, we separated the tourism resources and tourism flow of each district and analyzed them with the sustainable tourism development principle. Districts in Nepal are the second-level administrative division of the country, which is under the provinces.

Lastly, we use the Global Weather Type Classification (GWTC) climatological data provided by Dr. Cameron Lee (Assistant Professor, Kent State University) for the climactic

analysis. The gridded weather typing classification (GWTC) system is a geographically- and seasonally relative classification of multivariate surface weather conditions (weather types) for North America. Using six near-surface weather variables (temperature, dew point, sea-level pressure, cloudiness, wind speed, and wind direction) from the North American Regional Reanalysis (NARR; Mesinger *et al.*, 2006), the GWTC classifies every day since 1979 into one of 11 different weather types. Figure 19 shows the location used for analyzing the weather patterns all over Nepal, and during this process, we use the data set from 1979 to 2019.

### **Data Visualization and interpolation**

For data visualization and interpolation, we use the ArcMap and ArcGIS Pro software packages. An analysis is based on data availability; however, these tools allow us to represent, compile, and edit the data with the advanced data management tool. At the same time, ArcGIS allowed the process and use of the data set directly from the MS Excel and generated the maps.

**Inverse Distance Weighted (IDW).** Inverse Distance Weighting (IDW) is used to extrapolate GWTC gridded data to estimate each of Nepal's districts' weather patterns. Gridded Weather Type Classification (GWTC) uses daily data from 1979 to 2019 at a  $0.5^\circ$  by  $0.5^\circ$  resolution. In the event, the data point falls outside the political boundary of Nepal (Figure 8), it is still integrated into the IDW analysis. The deterministic and geospatial interpolation tools are important interpolation tools available to run such an analysis, but they are different based on their approach (ESRI, 2016). The unobserved location value of geospatial interpolation like kriging is computed from the linear combination of the surrounding locations based on weighting, while a deterministic approach like IDW follows the mathematical approach of the linear combination (Chen *et al.*, 2017). The challenging point of the variogram analysis and using the spatially correlated distance data of the kriging interpolation data was the reason for

choosing the IDW where the point that far away has less influences than the point closer. Kriging would be best on those data sets where we know the correlated distance or direction bias of the data. Therefore, as our data, sets are contrasted and having more weighted on the altitude, we choose the IDW for our analysis. Moreover, regarding to the projection coordinate system we use the UTM (Universal Transverse Mercator) Mercator projection known as conformal cylindrical projection. Nepal lies in the UTM zone of 44<sup>0</sup>N to 45<sup>0</sup>N, and all maps in this study are projected on UTM zone of 45<sup>0</sup>N.

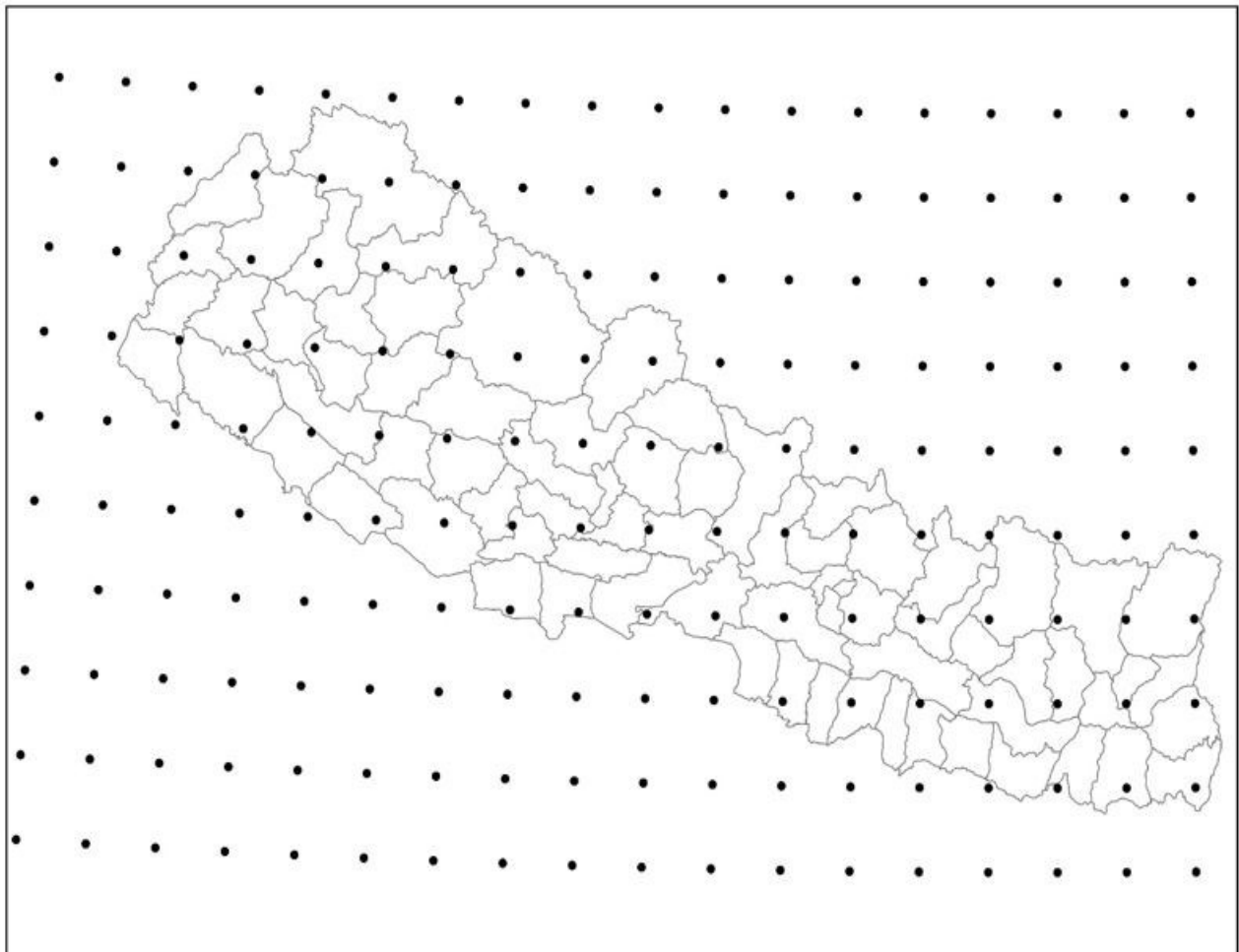


Figure 19. Map of the gridded point used for the research where we use 180 grid points.

To overcome the weighting method which treat every point equally like kriging, we use the inverse distance weighting method due to its efficiency in working on that environment,

which has a vast difference in the nearby stations' altitude and surroundings. A recent version of the approach proposed by Chang *et al.* (2005), ensuring that the sum of the weights equals one, was used. This approach considers the effect of Euclidian distances and differences in elevation (Barrios et al. 2018).

$$y_{j(m)} = \sum_{i=1}^n (h_{mi}^{-a} \cdot d_{mi}^{-k} \cdot x_{j(i)}) / \sum_{i=1}^n (h_{mi}^{-a} \cdot d_{mi}^{-k})$$

Where  $h_{mi}$  is the absolute elevation difference between the target and neighboring stations, and exponents are power parameters. Thus,  $h_{mi}$  modifies the weights of IDW, prioritizing neighboring stations that are at the same or a relative elevation of the target station, giving them higher weights during the calculations.

### **Tourism Opportunity Index (TOIN)**

Further analysis involves developing the Tourism Opportunity Index (TOI) again using the visualization tool in ArcGIS Pro. Sustainable tourism Development looks for the overall development of a society based on education, climate, per capita income, resources, and proper management. This index will give an overview of the sustainable tourism condition and its opportunities for the local people. Due to the complexity and variability of factors that determine people's socio-economics conditions, many rivaling causes besides tourism can be expected to determine the household's vulnerability. Although there is a big gap between rural tourism and urban tourism based on the visitors' choice, this study will provide the result based on the data's availability and the variable weight. Many people may argue that rural locations should score highly regarding 'opportunity' because they have more to gain as a result of lower literacy rates and the poorer infrastructure; however, this TOIN index looks more at development opportunities and less at need (though the latter is indeed an important factor for future research).

The following variables are included in the making of the tourism productivity score a) Climate Risk Index, b) Tourism Climate Index, c) Transportation Status Index d) Tourism Resource Index, e) Socioeconomic Status Index f) Overtourism Index.

**Climate Index.** Tourism and climates are the two interrelated components that can “pump and dump” the tourist industry simultaneously (Defreitas, 2005). Any change in the climate will affect tourism resources in the long run. Those countries based on natural resources are more vulnerable to the climate than the other countries based on indoor activities. It would reduce the snow cover, increase the glacier lake, create landslides, flood, and increase prolong heat waves, which would not be a good factor for tourism. Therefore, it is necessary to weigh Nepal's countries' climate aspects before conducting any sustainable tourism development program.

Firstly, we divide our climate section into two parts; Climate Risk Index (CRIN) and Tourism Climate Index (TCIN), to calculate the tourism opportunity index. We divide it into two factors because certain climate types are more productive and conducive to tourism activities despite the considerable variability. If more days are sunny and without rain, it might improve the short-term tourism quality even if the change is deleterious in the long-term to the ecological system.

The CRIN analyzes the variability for a region looking at the high variability zones from the individual location based on all the GWTC database parameters and their trend analysis of each decade from 1979 to 2019. The area with which climate varies more in each decade with its frequency receives a five score (very high risk), and where the climate is constant almost in each decade, receives a score of one (low variability/ low risk). All the 11 variables of the GWTC data set are used to calculate the CRIN. For instance, if we look in the CRIN Index, Rasuwa climatic

condition is continuously changing and get an average score of 2.7 and classify as a very high risk area and get an index score of 5. Simultaneously, if we look at Kailali CRIN map, it remains mostly unchanged in all decades, resulting in an average score of 1.6 and classify as very low risk area and get an index score of one (1). Each variable of the GWTC is evaluated individually and ranked based on their changes from each decade from five to one. After ranking all the variables, we take an average score of the individual variables and rank them using the equal interval techniques. The average thresholds of each district with their average score is shown in the Appendix G. The Equal Interval Techniques (EIQ) is based on the following equation:

$$\text{Equal interval} = (\text{highest number} - \text{lowest number}) / \text{number of intervals}$$

Here in our CRIN calculation, when we rank them our variability from five (5) to one (1), and Table 9 gives the overview of scoring thresholds.

Secondly, after calculating the CRIN, we calculate the TCIN from all variable of GWTC weather types of the places from 1979 to 2019 data period. The variable form GWTC here is not directly separated into the good variable and bad variable for tourism, however we use the location wise analysis of each variable to find out the index. The same type of weather can be good for tourism activities in one location and at the same time create a different result on the other destination. For instance, humid warm climate can adversely affect the outdoor activities in the district of the Terai region, but these humid climates can have a positive result for the outdoor activities in the cool Himalayan region. In addition, the average seasonal temperature with low humidity would create a favorable environment for the visitors, while at the same time; high humidity will likely decrease the tourism activities of the regions like Nepal, where all the resources are based on outdoor activities.



Table 9. Climate Risk index's score and its detail.

CRIN Score	Index	Details
5	Very High Risk	This score denotes the very high variability region where climates frequently change in each decade and have a high vulnerability to extreme events. Average score ranging from 2.48 to 2.7.
4	High Risk	This score denotes the considerable change in the climate where the region is vulnerable to climate change but shows relatives' characteristics with one of the decades out of the four decades. Average score ranging from 2.26 to 2.47.
3	Medium Risk	This score denotes the medium risk area where climate change occurs in one decade and shows the same climate after the decade. Average score ranging from 2.04 to 2.25.
2	Low Risk	This score denotes the climate change with less variability. The climate here is just swinging a little bit in one of the decades out of the four decades. Average score ranging from 1.82 to 2.03.
1	Very Low Risk	This score denoted the area where the climate remains the same in each of the four decades. That means there is less variability, which means less vulnerable areas related to extreme events. Average score ranging from 1.6 to 1.81.

To calculate the TCIN score, we calculate the individual score using the same CRIN technique, and the score was formulated by analyzing every district from the GWTC data set.

*“In this assessment following the humid warm weather types on Darchula or the western part of Nepal has a fewer day with above average humidity and temperature which were deemed to be good for the outdoor tourism. However at the same time if we look at the Rasuwa district or the*

*central part of Nepal, where the majority of the days in a decade have above average humidity and temperature conditions and hugely fluctuate over the decade; which indicates the poor climate for outdoor tourism and get a score of one*". Then after in this way we calculate the average score of each district and rank them from score one to five based on the equal interval technique. The average threshold score of each district and its index score is calculated and shown in Appendix H. In this section, the tourism climate is divided into five categories where five (5) to one (1), and Table 10 shows its variable score and index value.

**Transportation Status Index (TSIN).** Transportation is an important factor to consider as tourists require movement from one place to another. At the same time, the transportation facility's availability has a significant impact on the tourism industry. This also facilitates both tourists and employees' access to develop or utilize current and future tourism resources/amenities. To calculate the Transportation Status Index (TSIN), we analyze the ability of an individual (tourist or resident) to move about in each district and subsequently rank the facility of such accessibilities. First, we divide the transportation network into three sub-divisions, (1) Airport Facility Index (AFIN), (2) Road Facility Index (RFIN), and (3) Cableway Facility Index (CFIN). Based on the data from the Civil Aviation Authority of Nepal (2020), we separate the airport facility of each district into five categories No airport (1), domestic airports which are closed or not in operation (2), the domestic airport which are under operation(3), Regional airport or the airport(s) under construction (4), international airport(s) currently operating (5). By compiling these entire factors from Appendix C and Appendix D, we construct the AFIN of each district of Nepal.

The Road Facility Index (RFIN) score uses the information gathered from Strategic Road Network Nepal, Department of Road – Nepal Government. We analyzed each district based on

the type of road, Black Tops (BT), Gravel road (GR), and Earthen Road (ER) using the data shown in Appendix F. We know every kind of road has its own significant value and can help with tourism based on the different tourism amenities. Therefore, we analyze the road network of each district based on the times to reach the destination. Traveling on blacktop roads would take less time to get to the destination than the gravel roads, and the earthen roads and gravel would be quicker than the earthen but slower than the blacktops. Therefore, before analyzing the road score of individual districts, we weight the roads by the average speeds one is likely to travel on each of the roads. This results in each road category receiving a network score based on the ratio of 6 (BT):3(GR):1(ER). After weighing the road network, a district was given an ordinal score based on the road calculation score. A higher number will get a score of five (5) which means a good network, Four (4) is satisfactory, three (3) as moderate, two (2) as lower access, and one (1) as a poor roadway network. A detail of the thresholds of each index score and its average score is shown in Appendix I. Again, we rank all the districts based on their score and use the Equal Interval Technique (EIQ) to create the final score.

Lastly, we classify Nepal's cable network as cable cars that have received much attention in the last decade, connect the one top of the mountains with another, and be an easy, fast and reliable service for the tourists. There are many cable car construction projects in Nepal, but the lack of those data requires we only to analyze the presently under operation facilities. There is no guarantee that the cableway is a good factor for the lower region of Nepal. Still, they are an excellent means of transportation for the hilly areas and the mountains region where we can travel from one peak to another in a minute. Therefore due to its complex nature, we classify our CFIN based on a geographical region; Terai region districts with no cable cars would not impact the overall score, and given Zero (0), the Himalayan region and hilly region with no cable cars

get a score of negative one (-1). The districts with an operating cable car receive a score of one (1).

Table 10. Tourism Climate Index's Score and its detail description.

TCIN Score	Index	Details
5	Very good	This score denotes a perfect favorable climate for the tourism where both temperature and humidity are average. Average score ranging from 4.15 to 4.38.
4	Good	This score denotes the favorable tourism climate despite the swing any on the variable either temperature or humidity is slightly greater or lower than average. Average score ranging from 3.92 to 4.14.
3	Satisfactory	This score denotes the satisfactory condition for tourism activities but not the perfect, and the humidity and temperature where swing continuously. Average score ranging from 3.70 to 3.91.
2	Unsatisfactory	This score denotes the low favorable climate for tourism activities with the rising humidity and temperature that is not suitable for outdoor activities. Average score ranging from 3.47 to 3.69.
1	Poor	This score denotes the area with an extremely unsuitable climate for outdoor activities with high climate variability with extreme humidity and temperature. Average score ranging from 3.26 to 3.46.

After calculating AFIN, RFIN, and CFIN, we equally weight each to calculate an average index score. After this, we classify the results based on the equal interval technique from the average percentage score. Table 11 displayed the overall score ratings of TSIN from five to one with a detailed description of each score.

Table 11. Transportation Status index's Score and its detail description

TSIN Score	Index	Details
5	Very good	Overall, a very good network with a top facility in each variable. Average score ranging from 3.45 to 4.19.
4	Good	Good network connection but need to do work on any of the variables to be better. Average score ranging from 2.72 to 3.44.
3	Satisfactory	Satisfactory connection with the average facility on each variable. Average score ranging from 1.98 to 2.71.
2	Unsatisfactory	Low facility or below-average network connection. Average score ranging from 1.25 to 1.97.
1	Poor	Abysmal network connection and needing a significant improvement in all the variables. Average score ranging from 0.52 to 1.24.

**Tourism Resource Index.** The tourism resource index (TRIN) shows the available number of resources each district has based on Nepal's current and potential touristic destination generated from the Nepal Tourism Board. Resources are always a challenging part of the productivity score in developing countries like Nepal. Those resources based on the receiving end have enormous potential to drive touristic attention but not having startup capital is hurting them. (Shakya, 2009). Therefore, to develop the tourism resources index, we analyze each place district-wise and classify them based on the number of resources. To develop TRIN, we sum all the touristic destinations in each district where the number of resources ranged from one to eight. The EIQ technique gave every district a score individually and was ranked from five to one (where five denotes a higher number of resources, and one denotes a low number of resources.

**Socioeconomic Status Index (SSIN).** The SSIN reviews the socio-economic condition of the region. This index comprises the three sub-variables: per-capita income, literacy rate, and the hotel/restaurant condition of the geographical region. To calculate this index, firstly, we calculate the average score of the individual district from the per-capita income data and give a score from five (5) to one (1) using the equal interval technique where five denote the higher per-capita income, and one denotes the low per-capita income. Secondly, after per capita income, we calculate the literacy rate score from five (5) to one (1) using the same equal interval technique where five denotes the high literacy rate district, and one denotes the low literacy rate. Thirdly, we calculated the hotel and the restaurant index from the number of hotel and restaurant data and divided their score using the equal interval technique from five to one where five denotes the highest number of hotels and restaurants, and one denotes an interval of less hotel and restaurant. Finally, after the calculation of the score of each variable, we take an average score of each variable by giving equal weight to each variable and rank them from five (5) to one (1) using the equal interval technique. Here five (5) denotes very good conditions (average score from 4.2 to 5.00), four (4) denotes good condition (average score from 3.4 to 4.1), three (3) denotes the satisfactory conditions (average score from 2.6 to 3.3), two (2) denotes a unsatisfactory condition (average score from 1.8 to 2.5), and one (1) denotes very poor condition and need urgent work (average score from 1.00 to 1.7).

**Overtourism Index (OIN).** The Overtourism Index (OIN) is the continuity from Nepal's tourism perspective analysis, and it reviews tourism's negative impact. This index assesses each district tourism condition and its influence from tourism on the following variable: tourism carrying capacity based on the available infrastructure, Impact on environmental degradation, impact on the local infrastructure degradation, visitors' negative experience, and the local

resident negative experience. Based on this variable, we compute the average score of each district (Figure 20) and classify them into three categories; negative two (-2) indicated the shows the over-tourism condition and need urgent work, Negative one (-1) means that it satisfies some variable at least one but less than five, and zero (0) indicates no overtourism.

We then produced each district's Tourism Opportunity Index (TOIN) again using equal interval class technique after calculating these indices. In this index, we divide our variable into five categories, where five (5) is associated with the very good condition of the tourism, four (4) denotes the good condition of the tourism, three (3) denotes the satisfactory tourism condition, two (2) denotes the low tourism condition and one (1) denotes very weak tourism region as shown in Table 12 with its threshold in each index score. The following equation demonstrates the way of calculating the overall tourism opportunity index, and each variable weighs:

$$TOIN = TCIN - CRIN + TSIN + TRIN + SSIN + (+/- OIN$$

Table 12. Tourism Opportunity Index and Its detail description

Score	Index	Details
5	Very good	Very good condition for tourism and tourism development with a great potential for benefiting from tourism and growing having average high score. Average score ranging from 2.67 to 3.00.
4	Good	Good condition for tourism and tourism development with a slightly low score than the high score but have great potential with the resources they belong. Average score ranging from 2.33 to 2.66.
3	Satisfactory	Satisfactory tourism condition for tourism and tourism development with an average middle score in each variable. Average score ranging from 2.00 to 2.32.

2	Unsatisfactory	Unsatisfactory conditions for tourism development and need urgent work to develop as the prime tourism destination. Average score ranging from 1.66 to 1.99.
1	Poor	Very poor and weak condition for the tourism development with a very low average score and need a plenty of hard work to create the sustainable tourism environment. Average score ranging from 1.33 to 1.65.

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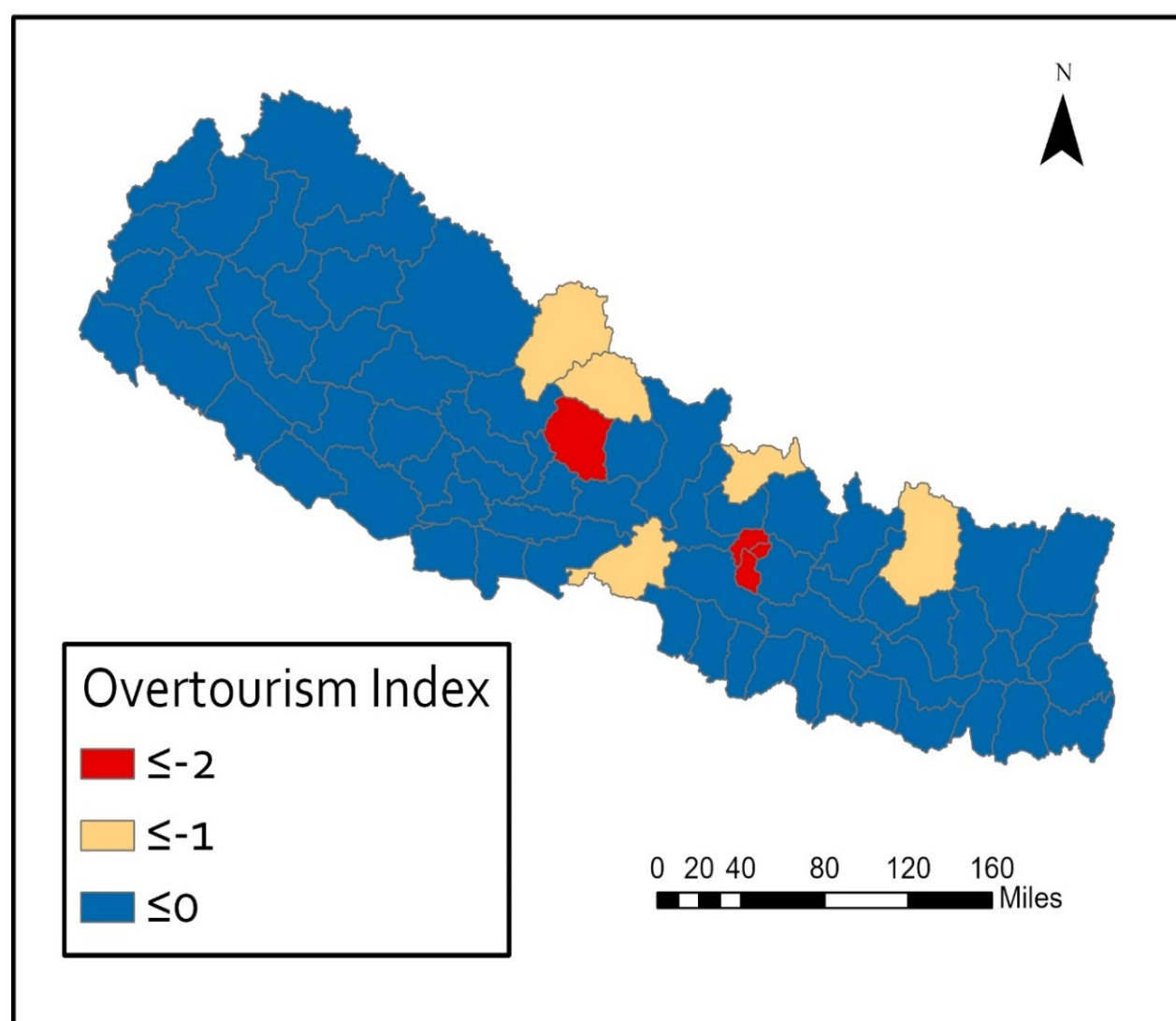


Figure 20. Overtourism index assessment of individual district of Nepal.



## Results and Discussion

**Tourism Resources.** Figure 21 demonstrates the already-established and potential tourism destinations of Nepal as of 2018 based on the Nepal tourism board presented in Appendix C. Out of 75 districts, 20 districts did not have any established destination (NTB, 2018). The Kathmandu district has the highest number of tourism locations as it contains several world heritage sites, including Kathmandu Durbar Square, Swayambhunath (religious and historical site), Pashupathinath (religious and historic site), and Boudhanath (religious and historical site). There are other tourism resources located on this valley that have great potential to draw the touristic attention but are not listed as UNESCO World Heritage Sites, i.e., Narayanhiti (old Royal Palace), Chandragiri (Natural resources), Sundarijal (historic site), and Budhanilkantha (religious site). Kaski district, which lies in the central hilly region, has four destinations: Pokhara, Sarangkot, Panchase, and Pumdikot.

The majority of established destinations like Kathmandu Valley, Pokhara Valley, and Chitwan National Park are located in Nepal's central region. The eastern Terai region districts have the lowest number of destinations compared to other parts of the country. If we compare the geographical regions of Nepal, the Himalayan region has more resources and destinations than the Terai region, this is due to the fact that the Nepalese Himalayas is a primary attraction for visitors, as they want to explore Mt. Everest, the world's tallest peak, and its surrounding areas.

The data provided in Appendix C shows the districts in Nepal, which can be a large contributor to Nepal's national tourism strategy thereby having the potential to attract tourists from all over the world. We noticed that the Nepalese government has formulated at least one potential destination for tourism development in all districts except the Dhankuta District. Again,

the central development region and Southwestern development appear to be the highest priority locations for the development of tourism resources.

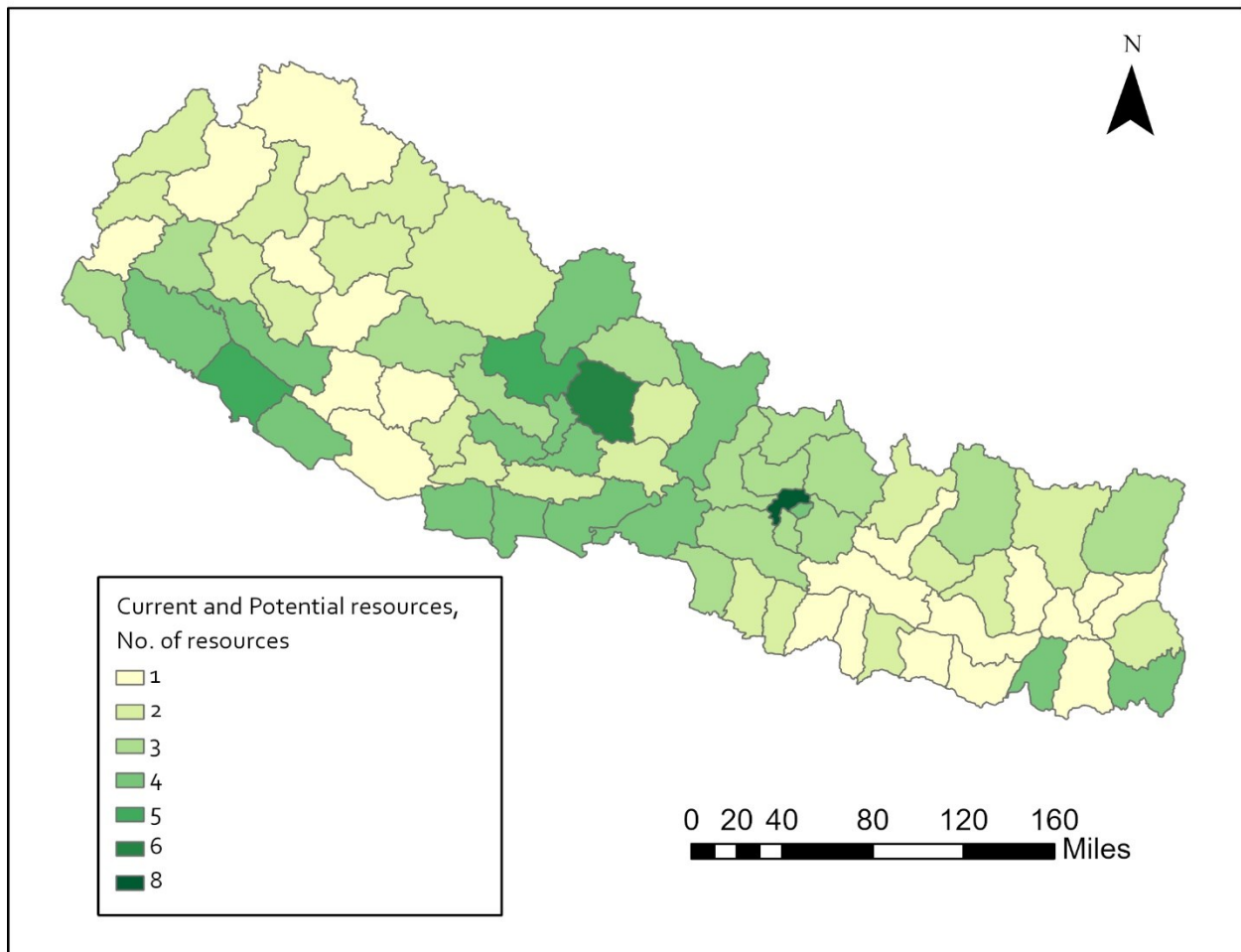


Figure 21. Showing all the resources, including both current and potential resources.

Using this resource data, we developed the TRIN, and Figure 22 displayed the results of the average TRIN score. Comparing Figure 21 and Figure 22, we have almost the same result where the Kathmandu district receives a high score as it has more than eight potential resources. On this index using the percentage of the total resources each district bear, we separate the resources index using equal interval technique where a number of resources greater than six (6) receive score five(5), no. of resources greater than five (5) receives score four (4), no of

resources greater than four receives score three(3), no. of resources greater than three(3) get a score of two(2), and the resources greater than one (1) receives the score of one(1).

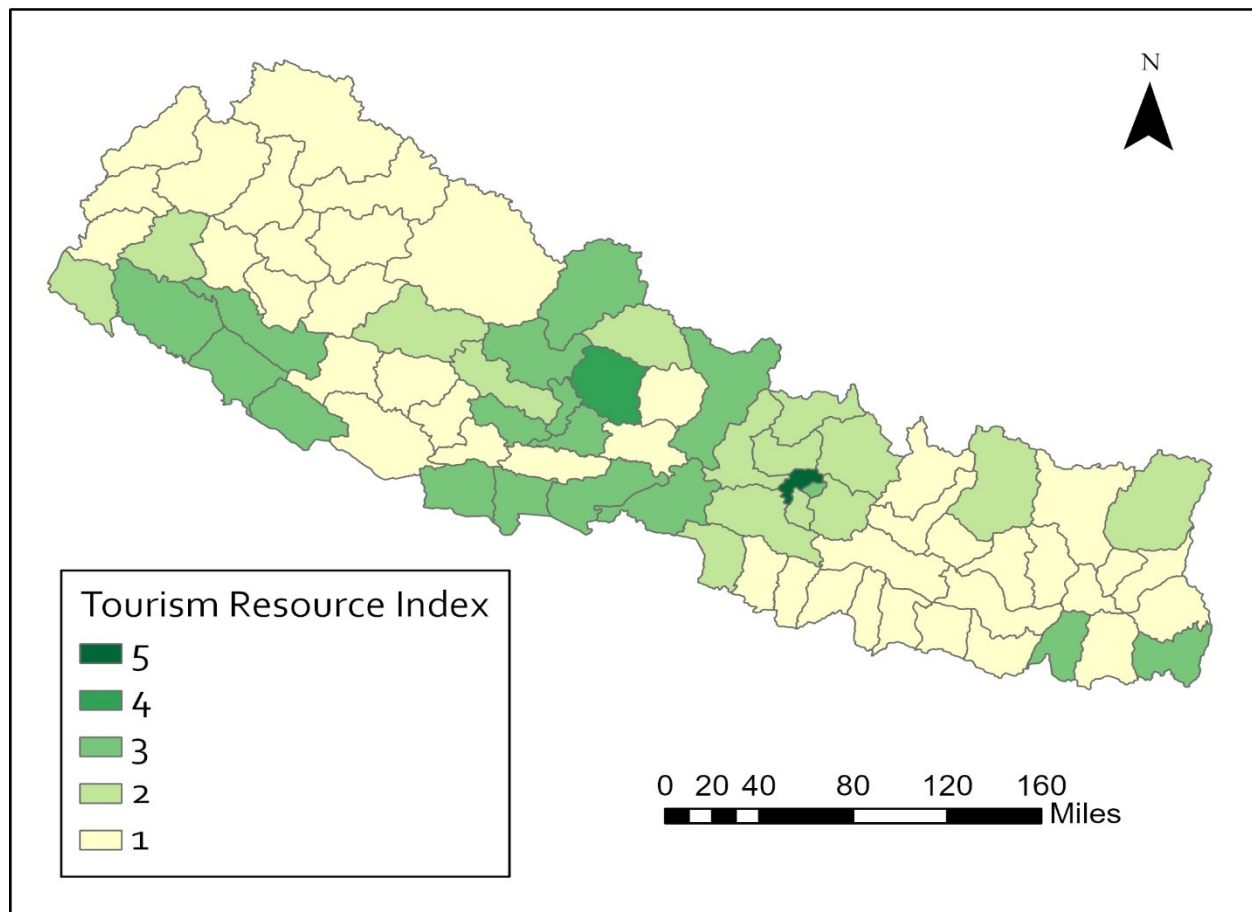


Figure 22. Map of Tourism Resources Index score of Nepal (TCIN)

## Economic drivers

**Per- Capita Income.** The per capita income map (Figure 23) illustrates the average income earned per person of Nepal's districts in 2013. It shows that a small mountainous district, Manang, has the highest per capita income in the country of \$1959, followed by the capital Kathmandu (\$1710). As we know that per capita income is based on the average income earned per person in a given area or city in a specified time, it is necessary to review the population

distribution chart shown in Table 13 before analyzing the per capita income. Although the Terai region consists of only 23% of Nepal's total land cover, population densities are higher in this region, with more than 50.27% of the total population living in this area. Likewise, the Himalayan region only accounted for 6.73% of the total population, followed by 43% in the Hilly region.

Table 13. Population Distribution and land Distribution of Nepal Based on the Geographical Region.

S.N	Geographical Region	Distribution of		
		Land area (%)	Pop (2001)	pop(2011)
1	Himalayas	35	7.3	6.73
2	Hilly	42	44.3	43
3	Terai	23	48.4	50.27

The Manang district lies in the Himalayan region, and its overall economy is profoundly grounded on tourism activities based on the trekking and mountaineering. Both Manang district and Kathmandu district are rich in tourism amenities; Kathmandu is rich in cultural heritage, whereas Manang District has abundant of mountain ranges with many trekking routes. Moreover, if we look after other districts, those districts which have abundant tourism resources in Figure 23 (e.g., Mustang, Kaski, Bhaktapur, Lalitpur), tend to have the highest per capita incomes. Based on this result, it appears that tourism may be a positive economic development sector.

Generally speaking, the Central development region districts and Himalayan districts have the highest per capita income compared to Nepal's far western region, which generally has the lowest. Regarding to the economic activities, Terai region districts are leading on economic

activities such as agriculture, real estate, construction, and manufacturing, but still, these districts are low in per capita income.

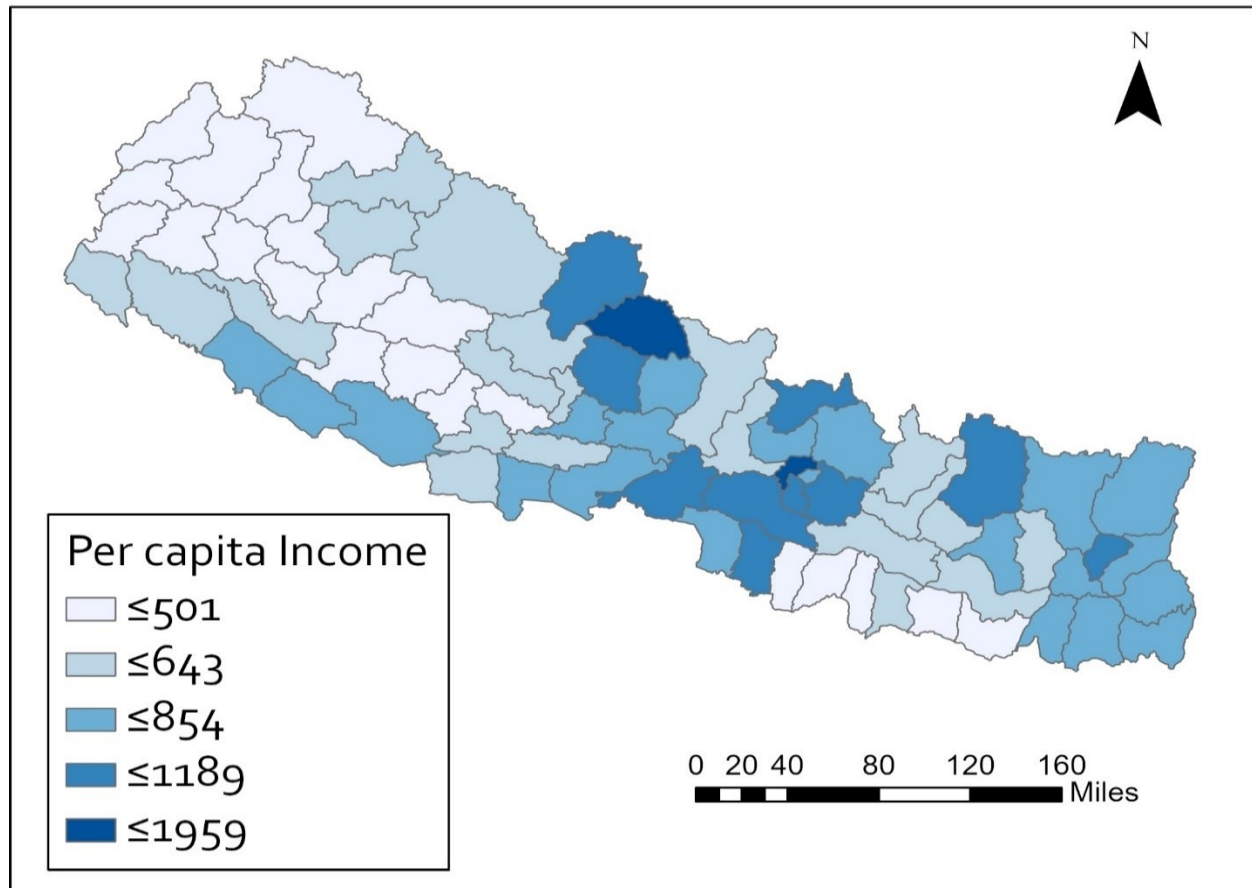


Figure 23. District wise comparison of Per capita income (\$) of Nepal.

**Literacy rate.** The history of education is not so long in Nepal. Formal education focused in the national capital city only; as a result, people who lived far from the capital have historically lacked formal education and educational facilities (Dhakal, 2018). Nepal's literacy rate is 67.9% (2018) an increase from the 59.6% average over the last ten years. Despite the improvement, this rate places Nepal in 136<sup>th</sup> position out of 159 countries globally in terms of literacy rate standing (The World Bank, 2020). The literacy rate map on Figure 24 shows that the Terai region districts are relatively illiterate compared to other regions. The Kathmandu district

tops the list where 86.3% are literate, followed by Lalitpur (82.5%), Kaski (82.4), and Bhaktapur (81.7). The lowest literacy rate is in the country's western part compared to the eastern and central parts. The eastern region districts top the list with an average literacy rate of more than 75%.

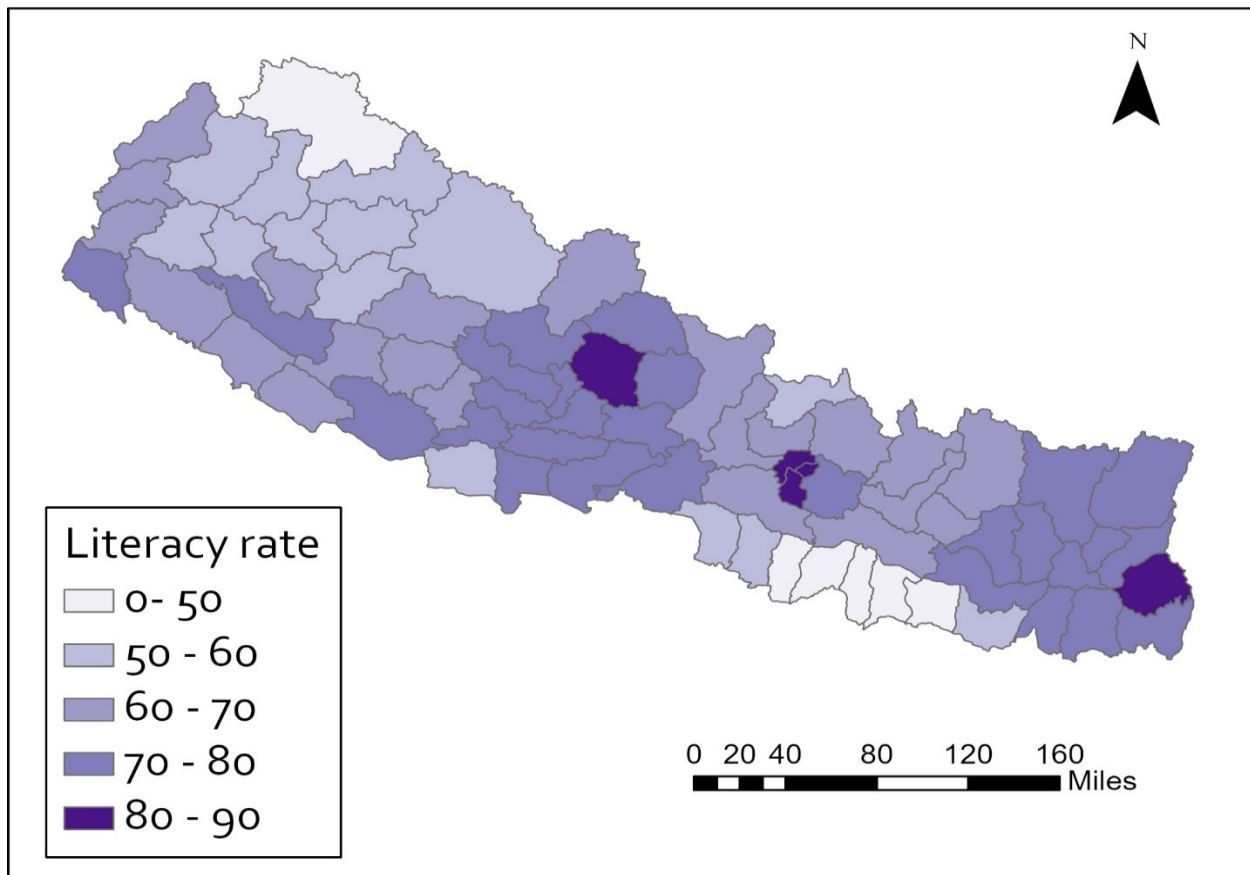


Figure 24. District wise literacy rate of Nepal in 2013.

**Hotels and restaurants.** Hotels and restaurants are other important variables of Nepal's economy. There are more than 25,000 hotels and restaurants in Nepal (Figure 25), including guesthouses, starred hotels, and homestays. There are also ever-expanding options for visitors visiting in the main touristic areas like Kathmandu, Chitwan, and Pokhara. Although the facilities and options are in fewer quantities in the Himalayan districts, one will still find

accommodation with a full range of service offerings. Compared to other geographical regions, the Terai region's districts are in the top list in the hotel's total number. Famous touristic district Kaski (1089) followed the capital Kathmandu (4,619) in terms of several other operated district-wise. Though the numbers are different, we can see plenty of hotels operated all over the country concerning the demand for the destination.

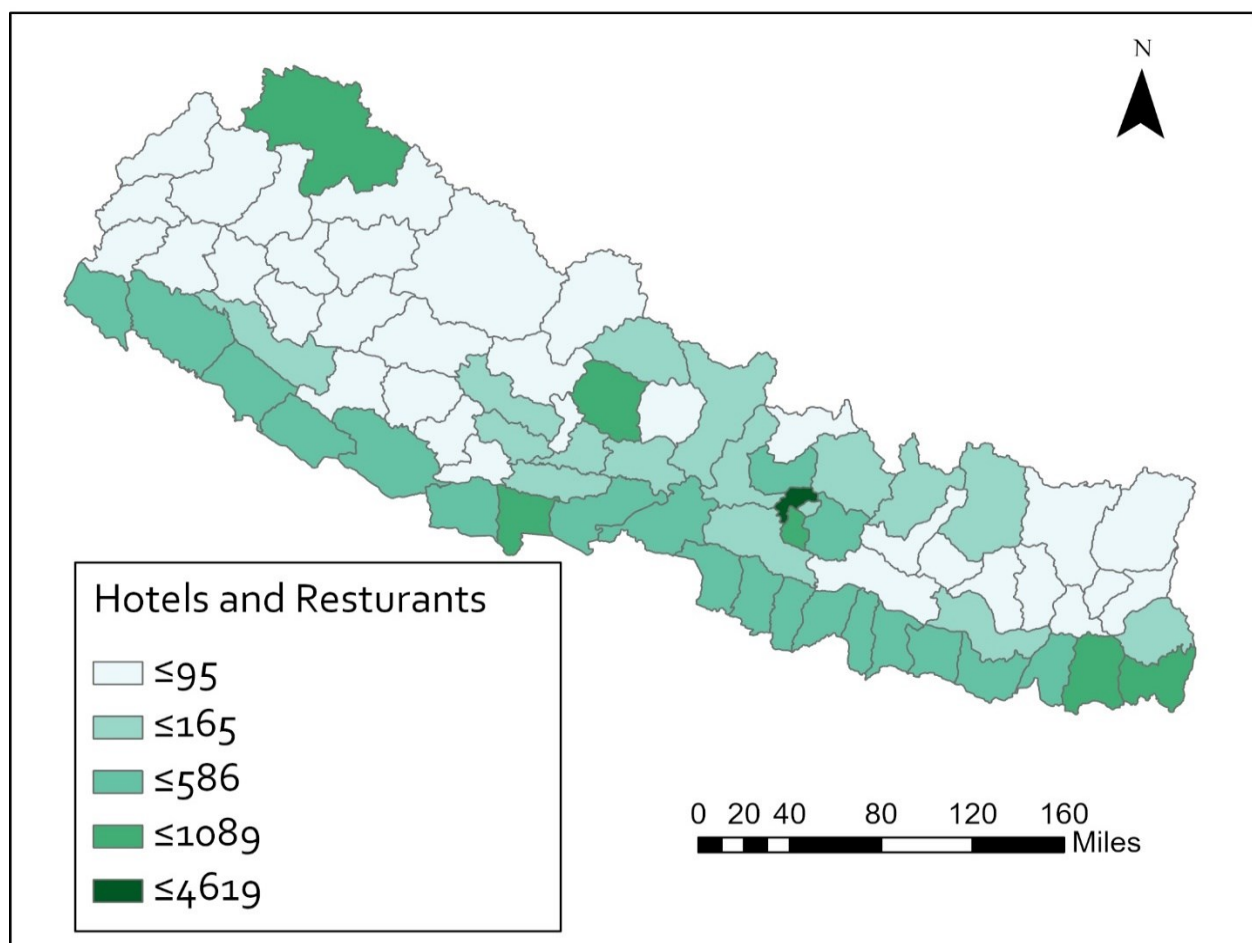


Figure 25. District wise Comparison of Hotels and restaurants operated in Nepal.

**Socioeconomic Status Index (SSIN).** Using the three-variables discussed, we derived the SSIN index, as shown in Figure 26. Kathmandu again demonstrates strong socio-economic conditions and receives a full score of five (5). Kaski and Manang follow Kathmandu with an

excellent overall socio-economic condition, getting four (4). Eastern districts and central Nepal's districts show some satisfactory socioeconomic status with three (3) scores. Dhanusha, Humla, Mahottari, Rautahat, Sarlahi and Siraha are the districts with poor socioeconomic- status and get the lowest score of one (1) and suggest a strong improvement in these factors to become a touristic district. All the remaining districts classify as unsatisfactory socioeconomic status with scores of two (2) as more than 60 % of the district lies in this class interval. Suppose the people are more educated and their living standard is high. In that case, tourist facilities will automatically increase from living to sharing the view among the communities that will positively impact visitor perspective. In the long run, a positive impact will bolster the district's overall economy and the country. In conclusion, this result suggests that Nepal has a weak socio-economic condition overall and needs significant work to improve these factors as they are directly related to the touristic activities.

### **Climatic drivers**

Climatic drivers here described the weather parameters based on the gridded weather typing classification (GWTC) system based on the geographical and seasonal classification of weather conditions in the Indian subcontinent. Using the gridded weather pattern from 1979 - 2018, we divide the weather types' frequency into four decades and compare their trend with each other. Here in this section, we define the terminology as follows: a) first decades means the climatic activities between 1979 to 1988, b) the Second decade indicates the meteorological activities during 1989 to 1989, c) the third decade represents the weather between 1999 to 2008 and d) the fourth decade indicates the climatic activities between 2009 to 2018. The seasonal climatic parameters of GWTC climate types in each decade of 11 variables are presented in this section, and all maps are produced using the help of ArcGIS pro.



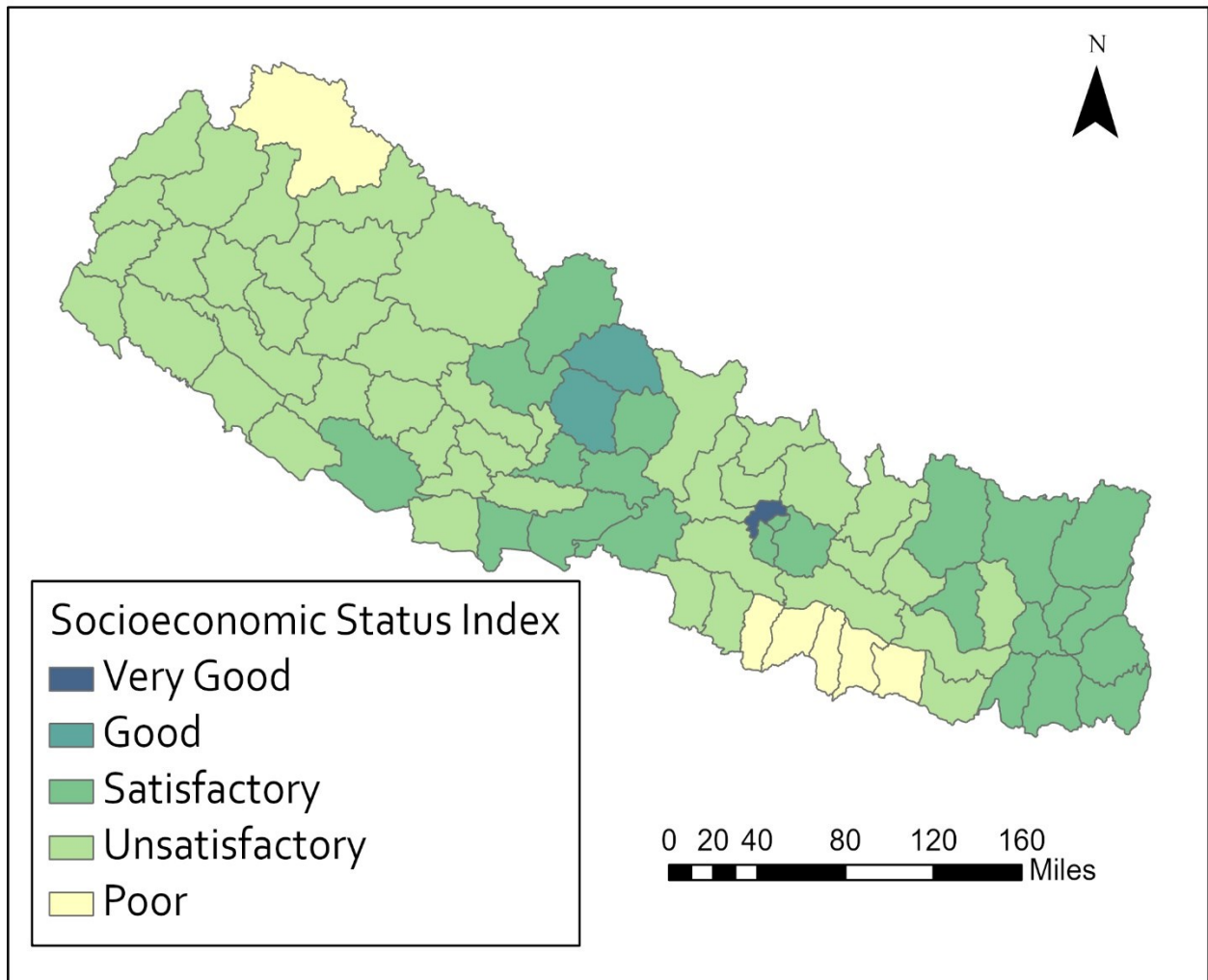


Figure 26. Map of the socioeconomic status index of Nepal district wise.

**Humid Cool (HC).** A Humid cool (HC) weather type (WT) represents the weather where fluctuation of temperature is relatively low and predominately active during the pre-monsoon season in Nepal with an above-average dew point (Lee C., 2014a). Most of the time in a year, this type of weather is frequently seen in the Terai region of Nepal as shown in Figure 27.

Humidity has a vital role in the overall weather forecast of Nepal due to its dual role. Suppose the humidity is high and the air is nearly saturated. In that case, it can produce the requisite amount of cloud cover and precipitation, which drives Nepal's overall climate. This precipitation

gradient has a considerable impact on Nepal's Himalaya's snowpack. It has the potential to create a higher rainstorm variability and increase the annual erosion that influences the people residing in the lower region.

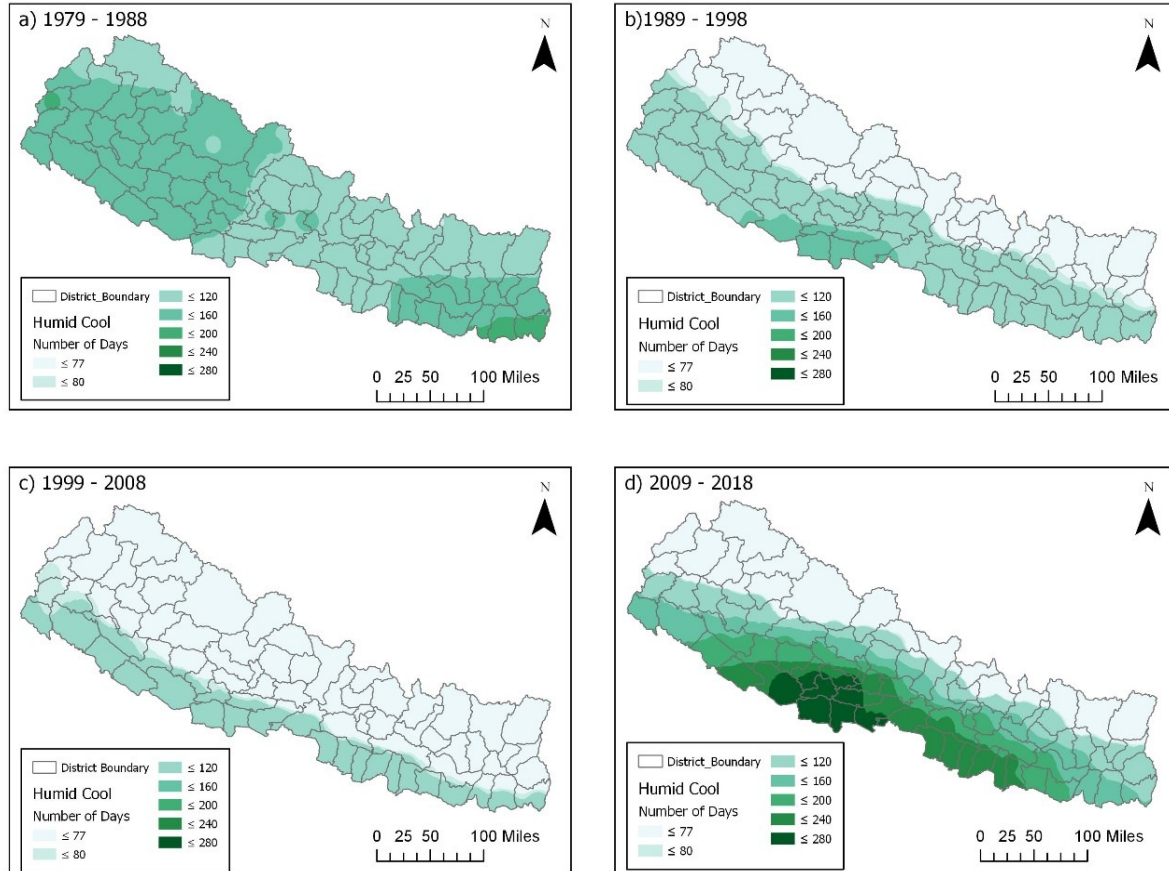


Figure 27. Synoptic Climate Classification of Humid Cool WT from 1979 to 2018.

During the first decade (1979 to 1988), HC WT occurs about 4.38 % of the time, especially in Nepal's western and eastern parts. However, we see a drastic change in the second decade (1989 to 1998) where HC WT is active in Nepal's southern region, and in the Himalayan region, it occurs about 2 % of the time. We see a further decrease in the occurrence of HC weather type in the third decade (1999 to 2008), and active more on the Terai region district compare to others. In the fourth decade (2009 to 2018), we see a drastic increase in the frequency

of occurring HC weather type of Nepal in the Terai region and Hilly region districts, where it occurs more than 7 % of the time. Overall, looking at the Terai region (all four decades), this type of weather is frequently active compared to other regions of Nepal, and the fourth decade suggests the increase of temperature activity.

**Humid (H).** The Humid weather type indicates above-normal humidity while at the same time, having a temperature index is close to average (Lee C. , 2014b). This type of weather shown in Figure 28 demonstrates that the Humid weather type is most frequently occurs during the summer months from Feb to May in Nepal, showing almost the same weather pattern as HC weather types, as both of them are active during the pre-monsoon season (summer season). During the first three-decades, humid classification days are typically low in the Himalayan region compared to the last decade and are active more in the Terai region in the first two decades, with about 11 % average occurrence a decade. However, in the fourth decade (2009 to 2018), we see increases in the humidity in the Terai region and Himalayan region, especially in the central Terai region, where it occurs more than 26 % of the time. Overall, the Terai region experiences the H-type weather most often, highlighting the importance of this region's climatic activities and its sensitivity to Nepal's overall climatic pattern. When the climatic phenomena or air mass enter Nepal from the Bay of Bengal through the eastern part of Nepal, it deviates its direction toward the west because of the blocking from the north's towering Himalayas. This will provide a time to swipe the region's characteristics with the air mass passing through it. As a result, we can see the drastic change in climatic behaviors from one location to another.

**Humid Warm (HW).** The HW weather type pattern indicates the weather pattern where humidity and temperature are both above averages (Lee C., 2014c). This type of weather pattern shows that HW is consistent throughout the first decade (1979 to 1988) and is relatively

uncommon as HW weather type occurs only 2 % of the time on average. We observed the slight increase of the frequency of occurrence for these weather types during the second decade from 2 % to 3 % of the year on average with spotty frequency on all over the country except Khaptad, Mount Langtang, and Mt. Everest regions. Furthermore, during the third decade (1999 to 2008), we see the consistent HW weather type in the Hilly region and Himalayan region and an increase in spotty frequency on some of the southern parts of the district where its occurrence time in the decade increased from 3 % to 5 % on average.

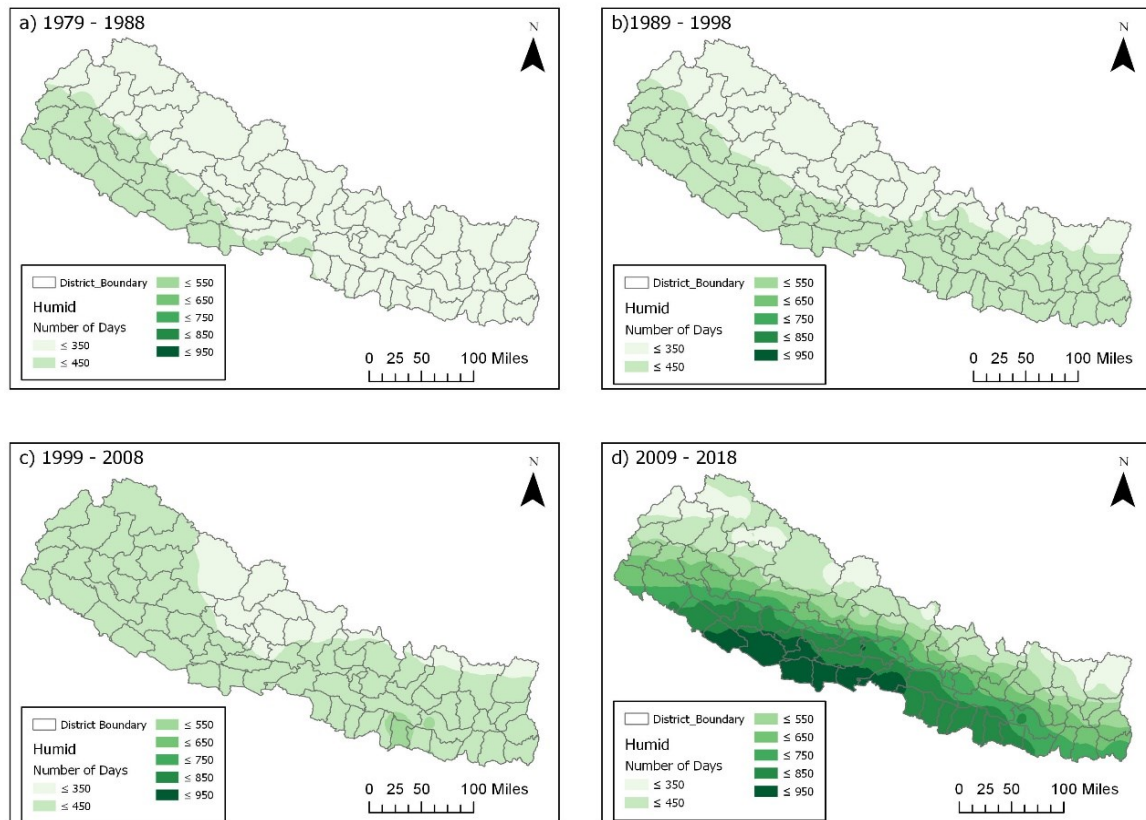


Figure 28. Synoptic Climate Classification of Humid WT from 1979 to 2018.

However, in the fourth decade (2009 to 2018), we see a dramatic rise in warm, humid days, especially in the central part of Nepal, where its frequency increased more than 5% compared to the last decade. In this decade as shown in Figure 29, the eastern and central part of

Nepal gains much temperature compare to other parts, which indicate that the warm air is rising toward the Himalayan region, which creates the biggest threat to the Nepal Himalayan region as this condition can severely alter the climatic pattern of the Himalayas. Also, many of the resources are located in the Himalayan region and directly and indirectly linked with the Himalayas.

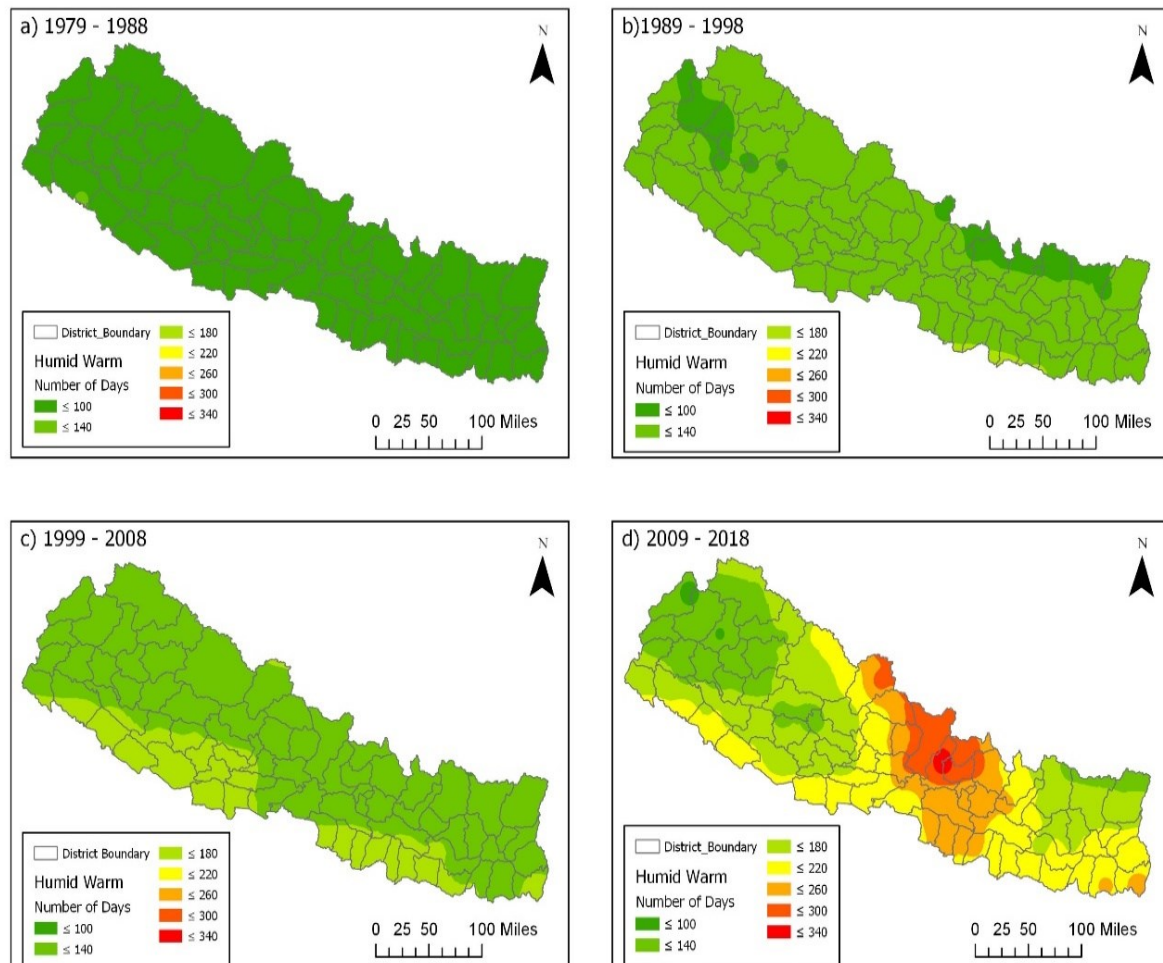


Figure 29. Synoptic Climate Classification of Humid Warm WT from 1979 to 2018.

**Cool(C).** The Cool (C) weather types (WT) indicates the average seasonal humidity below the seasonal temperature (Lee C., 2014d). Generally, in this place, the temperature is



above the freezing point ( $32^{\circ}\text{F}$ ) below and less than  $64^{\circ}\text{F}$ . This weather type is active during the winter season in Nepal (Figure 30) and is least active during the summer season. During the first decade (1979 to 1988), we noticed that it is cooler compared to the other three-decade and occurs about 20 % of the time in this decade. It also indicates that the number of winter days is long in that decade, and the western part of Nepal is cooler compare to other parts of the country. Moreover, looking at the second and third decade, there was a drastic fall in the frequency of the number of cool days from 20% to 11% in each decade.

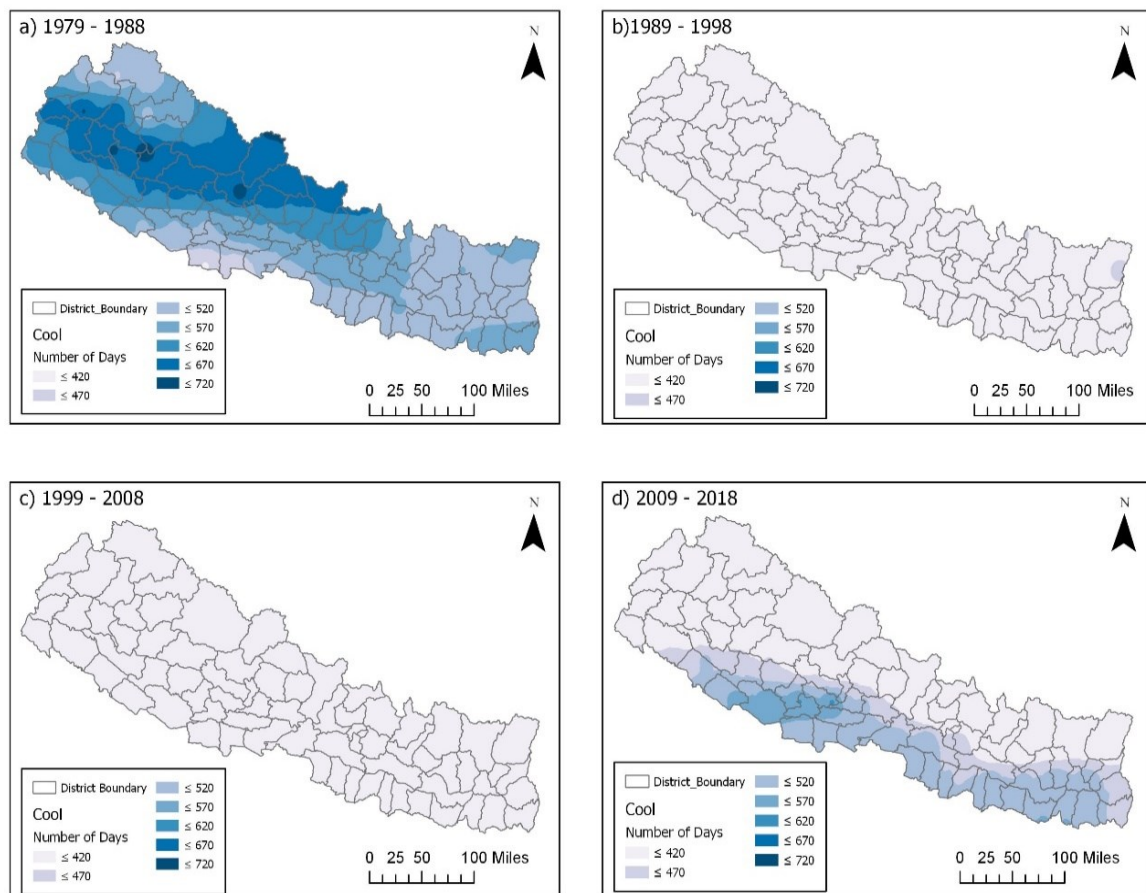


Figure 30. Synoptic Climate Classification of Cool WT from 1979 to 2018.

However, again in the fourth decade (2009 to 2018), we noticed a slight increase in the number of cooler days in the Terai region, which indicates that the Terai region is cooling more

in the winter season and concerning to warming trend from warm WT, it's warming more on summer season too. This further helps to evaluate that the Terai region is the main catalyst for the weather chain reaction with the air mass and the change in the climatic behavior according to the respective seasons.

**Seasonal (S).** The seasonal weather pattern deals with the average seasonal condition of the place regarding both temperature and humidity (Lee C., 2014e). The seasonal data analysis (Figure 31) of the last 40 years depicts that the average seasonal trend is frequently changing in each decade. Overall, the occurrence of seasonal patterns drops from 46.30 % to 36.30 % shows that the average climate of the location fluctuates with change on the overall global climatic index. With the strong and long El-Nino period in the fourth decade (2009-2018), warm WT became more frequent across the country, which creates a severe drought and weak monsoon in Nepal. This pattern overall disturbs Nepal's overall climatic pattern and results in the disturbance of all meteorological parameters. As a result, we observed that the average climatic condition is dropped, and the occurrence of seasonal WT plummeted more than 10 % of the time in a decade.

**Warm (W).** The warm WT indicates that the climatic condition of the location where the average temperature condition is relatively warm (Lee C., 2014f). During the first decade of 1979 -1988, warm WT is frequent throughout the country, with the frequency occurrence of about 11.5 % of the time in a decade. We have almost the same weather coordinates pattern, excluding 2-3 districts in the southwestern part of Nepal, where we saw a slight increase in humidity conditions. However, during the third decade (1999 to 2008), we observe a sharp rise in warm WT, where it occurs about 15.20 % of the time in a decade with an increase of more than 5% compared to the last two decades. Again, the very strong El Nino at the end of 1998 on the Pacific Ocean was the reason behind the change in climatic behaviors.

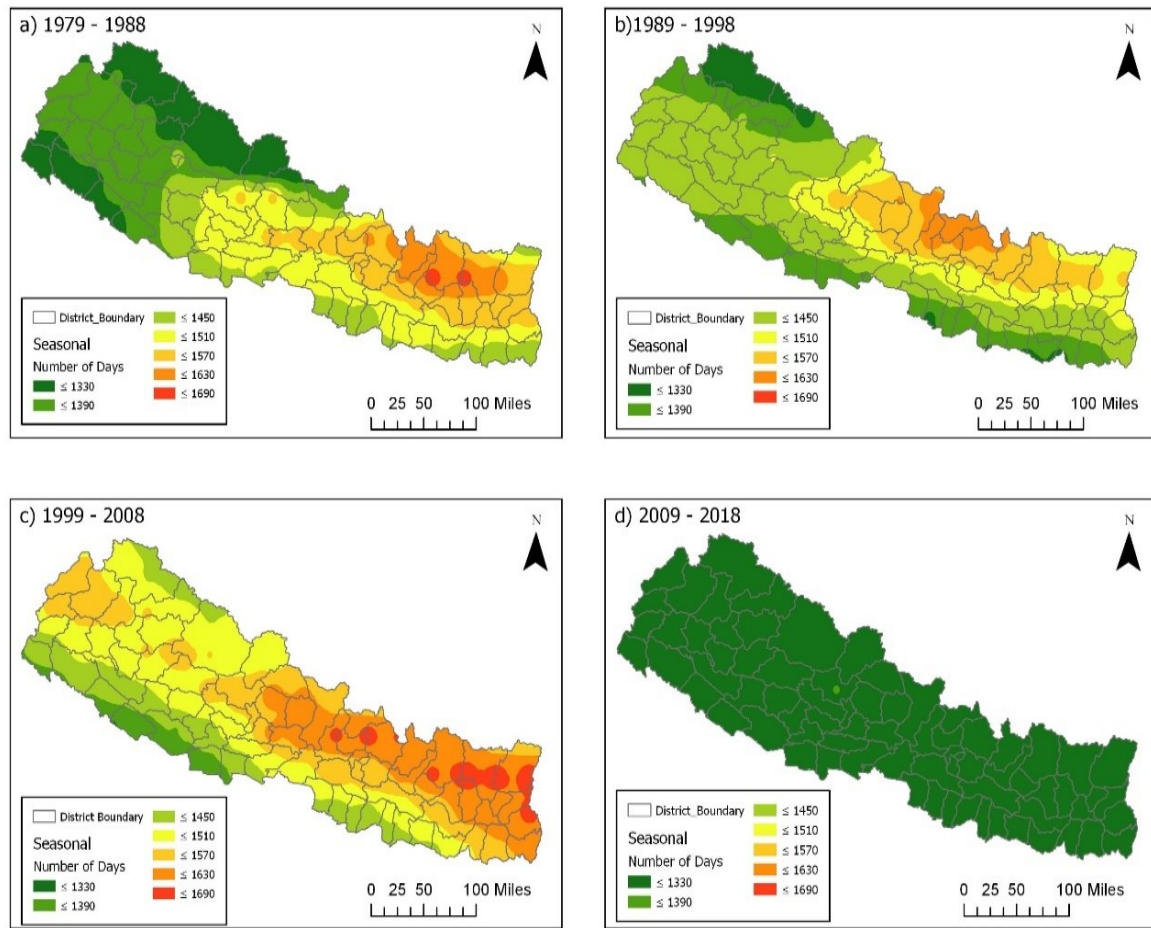


Figure 31. Synoptic Climate Classification of Seasonal WT from 1979 to 2018.

Furthermore, we observe the rise in humidity in the fourth decade (2009 to 2018) too. However, the rise is focused only on Nepal's central Himalayan region, and the rest of the part, we saw a decreasing trend of humidity compared to the third decade. This is significant, though, as this impact predominately focuses on the Mt. Annapurna region, Mt. Langtang region, and Mt. Everest region, which are the primary and famous tourist destinations of Nepal. Overall, Figure 32 shows that Nepal's average temperature is increasing in the last two decades, and the rise adversely focuses on the Himalayan region of Nepal.



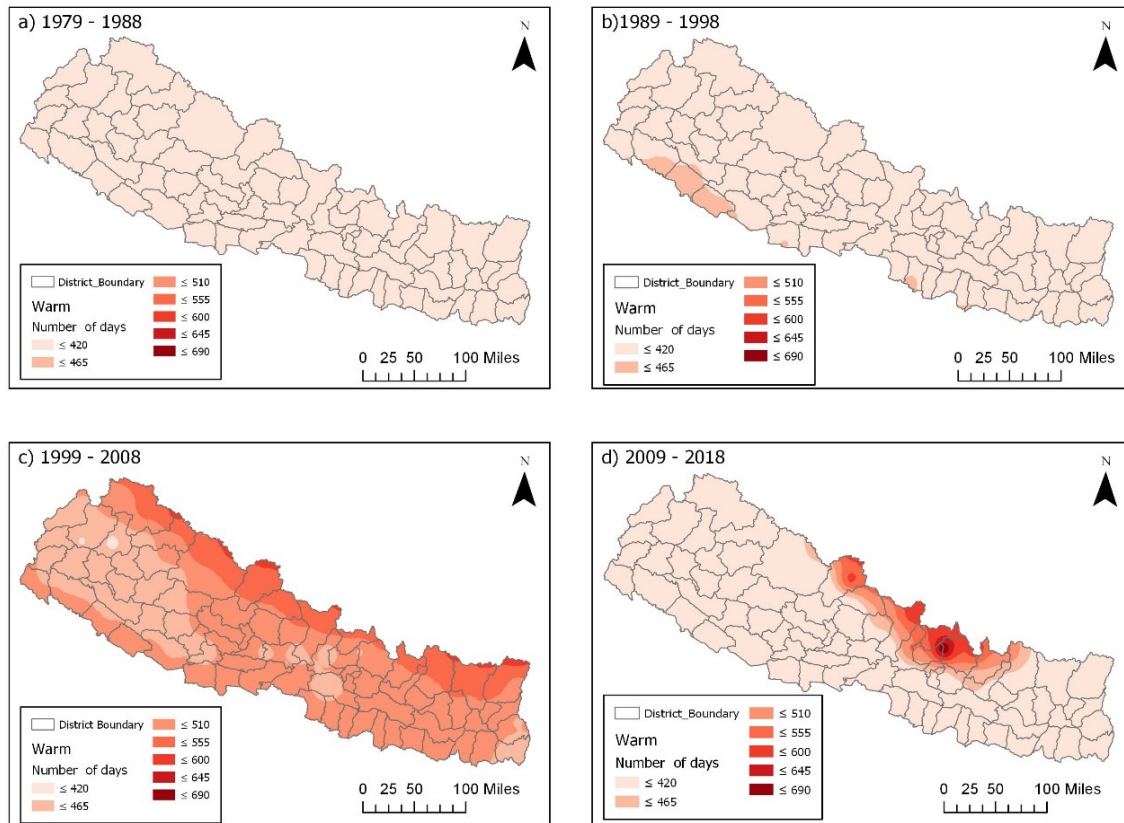


Figure 32. Synoptic Climate Classification of Warm WT from 1979 to 2018.

**Dry Cool (DC).** The Dry Cool-weather pattern represents the overall climatic pattern with low humidity and predominately occurs outside of the summer season with a peak in winter (Lee C., 2014g). During the first and second decades (1979 to 1998), we observe that dry, cool WT occurs 9% of the time in a decade. In the first decade (1979 to 1988), we saw a cool and cold winter is focused on the Himalayan region of Nepal, while in the second decade (1989 to 1998), we almost have the same pattern of weather type of weather all over the country. Likewise, in a third decade (1999 to 2008), we observe further decreasing of dry, cool days from 9 % to 3 % of the time in a decade as shown in Figure 33; which also indicate that the winter days are decreasing compared to the first and second decade due to the powerful El-Nino effect on this decade. However, during the fourth decade (2009 to 2018), we observed a drastic

increase (from 3 % to 19.89 %) in dry, cool weather patterns, especially in Nepal's western and eastern parts. Overall, this pattern shows that the dry cooler days are associated with the ENSO as well as depend on the pattern of the winter season.

**Dry (D).** Dry air is simply known as the air that has no water vapor (Lee C., 2014h). The Dry WT represents the weather types with relatively low dew points and the average temperature. This type of weather is more common during the pre-monsoon season of Nepal, and they are common in the southern Terai part of Nepal, occurring nearly 10-12 % of the time in a decade during the first decade (1979 to 1988).

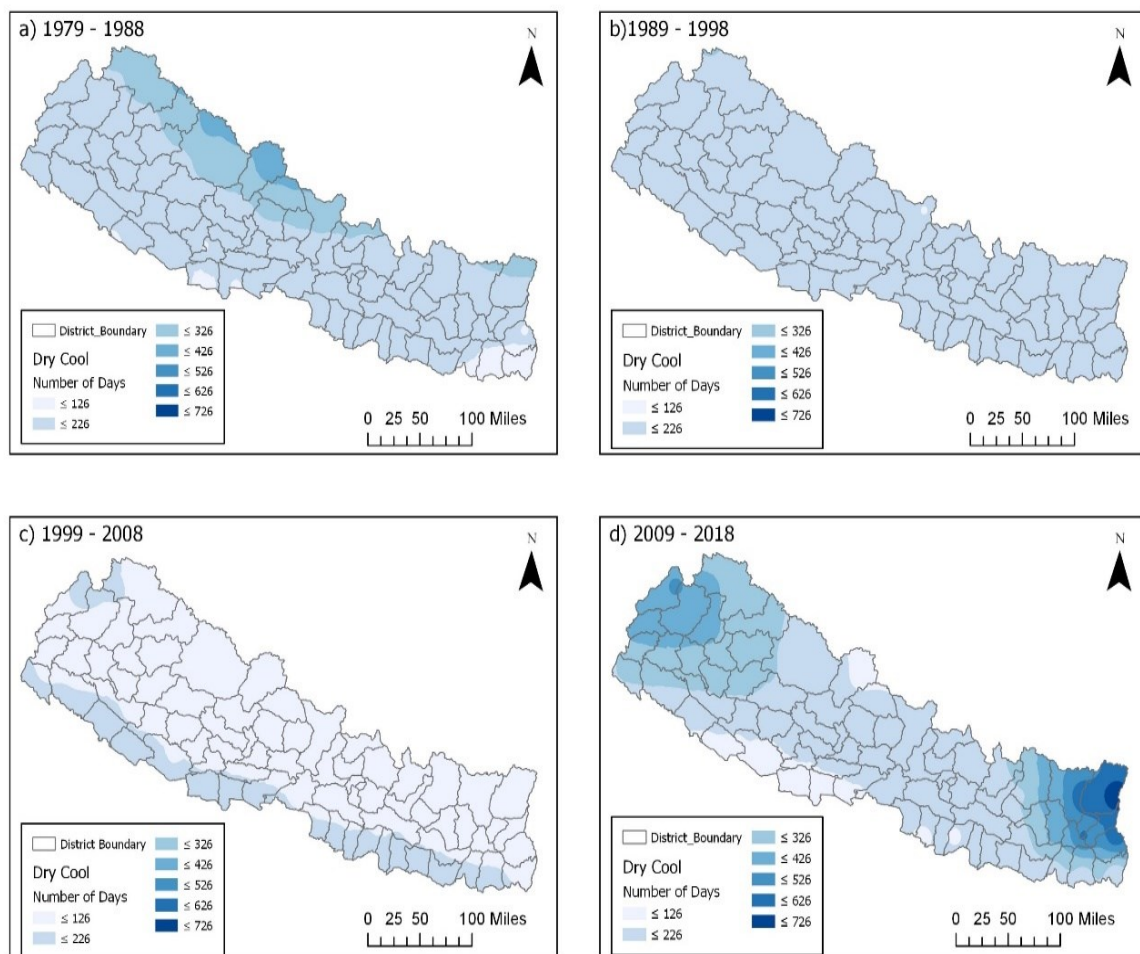


Figure 33. Synoptic Climate Classification of Dry Cool WT from 1979 to 2018.

During the second decade (1989 to 1998), we observe a massive increase in the dry days, especially in the western and eastern parts of Nepal, occurring 15-16% of times in a year in that location. In this decade, Nepal received the recorded drought in 1994, affecting more than 35 districts of the western Hilly and Terai regions. Overall, the drought in 1994 has carried the overall trend of dry days during this second decade. Over time from 1999 to 2008, we observe a slight decrease in the overall dry weather types as shown in Figure 34, but the trend is more active only in the western Terai region, with the averages closer to 12% to 15% of the time in a decade. The frequent dry spells and wet monsoon after 2002, mainly drought in 2005, 2006, and 2008 depict the third decade's overall trend.

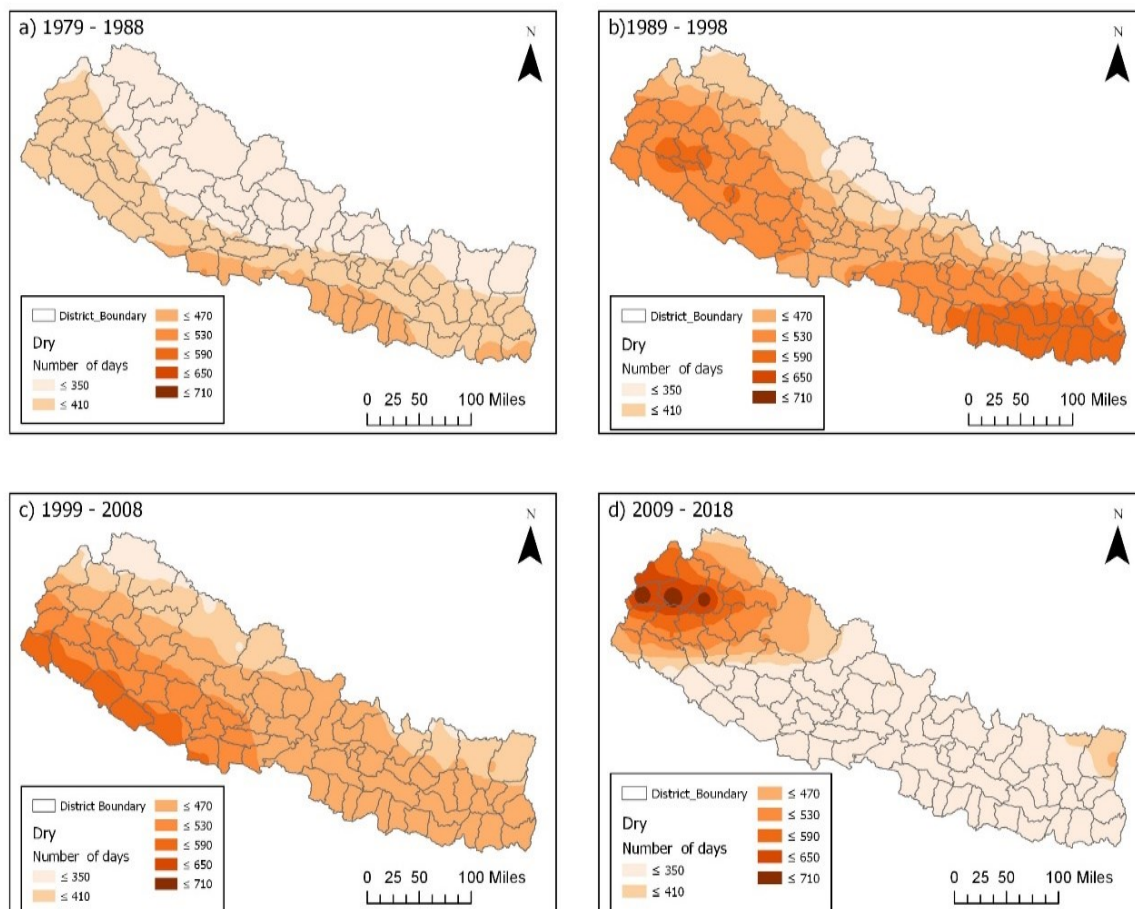


Figure 34. Synoptic Climate Classification of Dry WT from 1979 to 2018.

We see even more increase in the dry weather types during the fourth decade(2009 to 2018); however, the increase is focused only on the districts in the western hilly region and Himalayan region where they occur in between from 16% to 20% of the time in a decade which is almost double than the national average (9.58%).

**Dry Warm (DW).** The dry warm WT is the warm climatic parameters that deal with warm weather types with low humidity (Lee C. , 2014i). During the first decade (1979 to 1988), we saw that the dry, warm WT occurred more in the Terai region, with about 10 % of the times in a year of a decade. In Nepal's southern part, where the temperature is typically high than both the hilly and Himalayan regions, we observe a notorious amount of warm days in the Terai region. However, in the second decade (1989 to 1998), we see a decrease in the overall pattern of dry, warm days from 10 % to 5 % of the time in a decade. Although we see a decrease in the second decade, we see a massive increase in the frequency of dry, warm days in the third decade (1999 to 2008). The increased number of frequencies was seen more in Nepal's western part (from Figure 35), with an average occurrence of 6 % times of a year in a decade. Likewise, we observe an increase in the frequency of dry warm days during the fourth decade (2009 to 2018), where an increase was focused mainly on the Himalayan region, which shows almost the same trend as warm WT. Again, this also helps to interpret that Nepal's Himalayas are warming more than the other parts of the country during the fourth decade.

**Cold Front Passage (CFP).** Cold front passage represents the weather type where a cold air mass replaces the warm air mass and when this transitional weather becomes noticeably colder and the drier (Lee C., 2014j). During the first decade, the northern part of the Himalayas experienced 10 % to 12 % of the time in a decade. This type of weather is frequently active in the winter season and shows that the days are typically frequent in Nepal. We observe the slight

decrease in the frequency of cold front passage days in the second decade, especially in the northern Himalayan region, and the slight average increase in the frequency on the rest of the part.

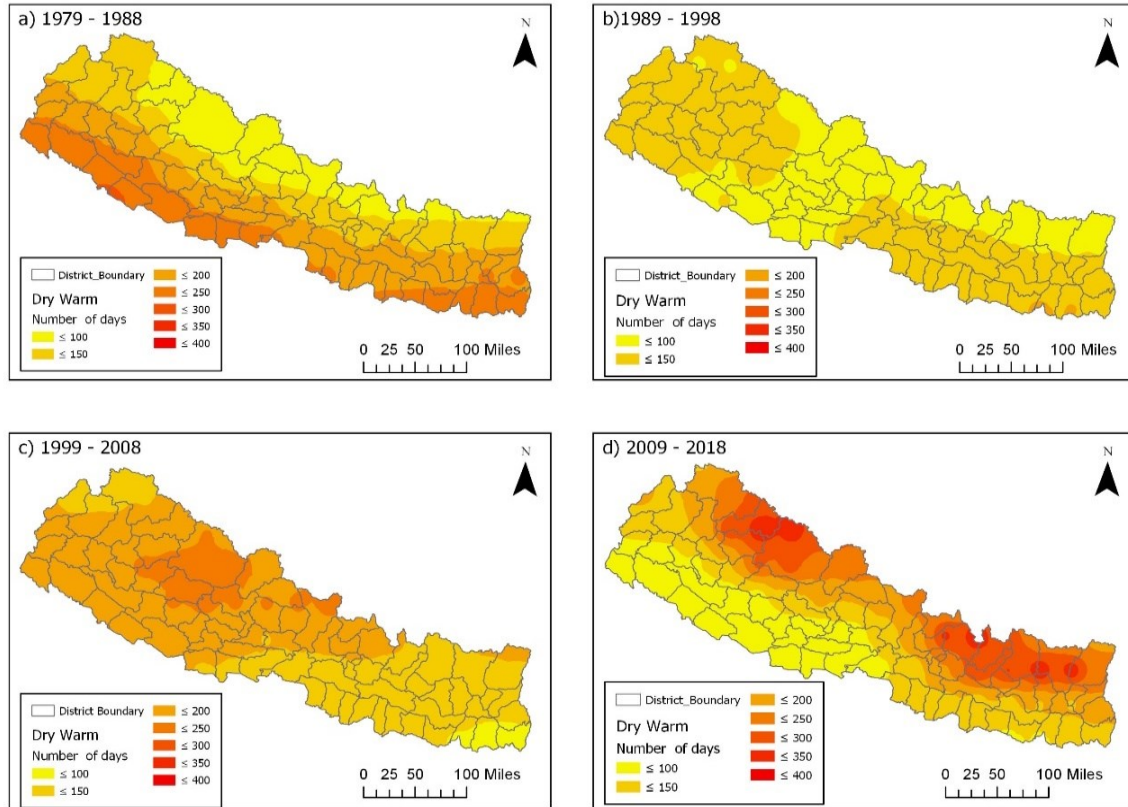


Figure 35. Synoptic Climate Classification of Dry warm WT from 1979 to 2018.

Likewise, we observe a further decrease in the west northern region in the third decade (1998 to 2008), where it's average occurrence drop to 6 % of the times in a decade. The fourth decade (2009 to 2018) almost has the same trend in the Terai region; however, we observe that the again CFP shifted toward the western and eastern Himalayan region with an average occurrence of 8% of the time in a decade as displayed in Figure 36. Overall, winter seasons weather depends on the CFP climatology, and the number of winter days directly depends on the active periods of Cold fronts.



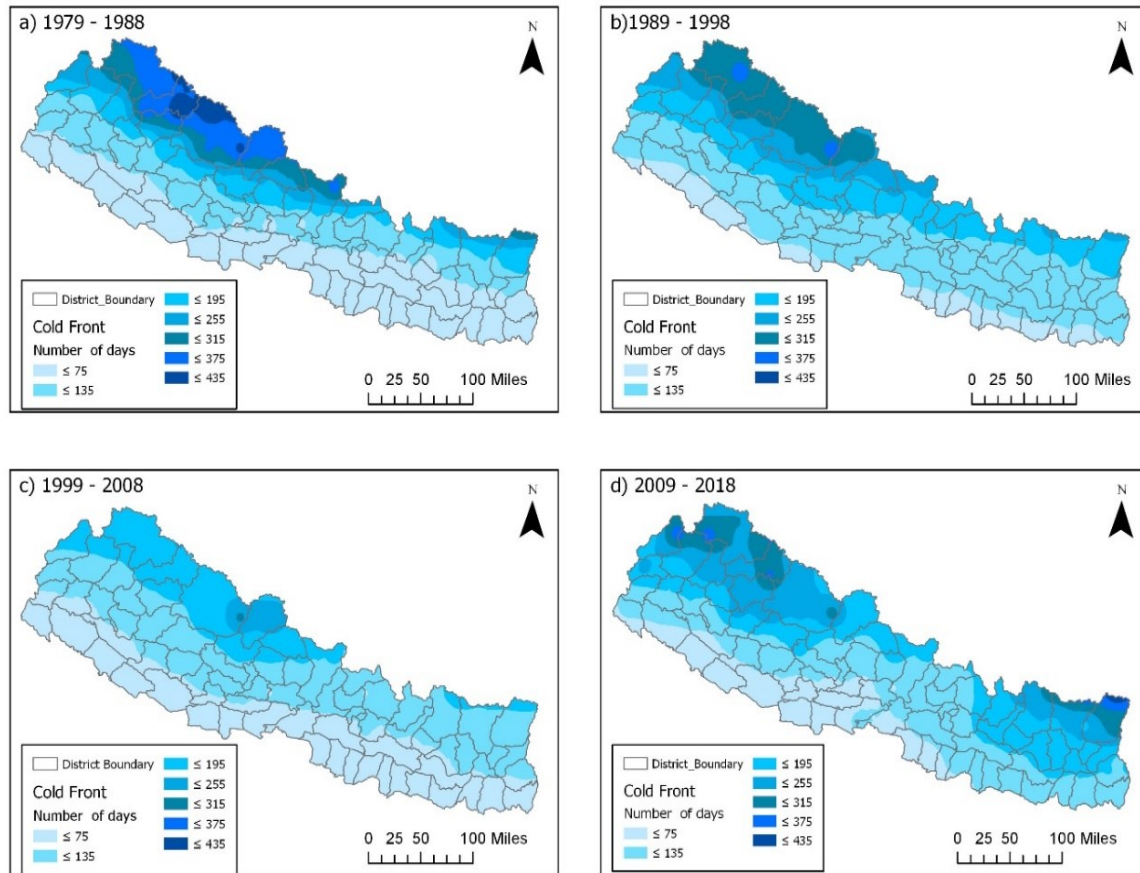


Figure 36. Synoptic Climate Classification of Cold Front Passage WT from 1979 to 2018.

**Warm Front Passage (WFP).** Warm Front passage (WFP) is a transition zone where warm air mass replaces a cold air mass, where dew points move upward, and pressure drops throughout the day (Lee C., 2014k). This type of weather event is transitional, creating warmer and more humid conditions than previously. As was the case of CFP, warm frontal passage (WFP) also has the same pattern where its frequency is more on the Himalayan region; however, its focus is in the central Himalayan region.

During the first decade (1979 to 1988), WFP is frequent in the Himalayan region, which occurs more than 10 % of the time in a year that is higher than the national average of 3 %. We almost have the same trend in the second decade (1989 to 1998) for all other parts of the country

except the Himalayan region where it slightly decreases to 9 %. Over time from 1999 to 2008 (Figure 37), we see even further decrease in the warm frontal passage all over the country and drops its frequency to about 2 % of the time in a decade. Although it plummeted in the third decade, even WFP occurs more in the Himalayan region compare to other regions. In the fourth decade (2009 to 2018), we see a slight increase, especially on Mustang and Dolpa district of the Himalayan region, while all other region has the almost same frequency. Overall, it shows that the WFP change is frequently changing in the Himalayan region in each decade, and it is hard to predict the real character of climate in these regions.

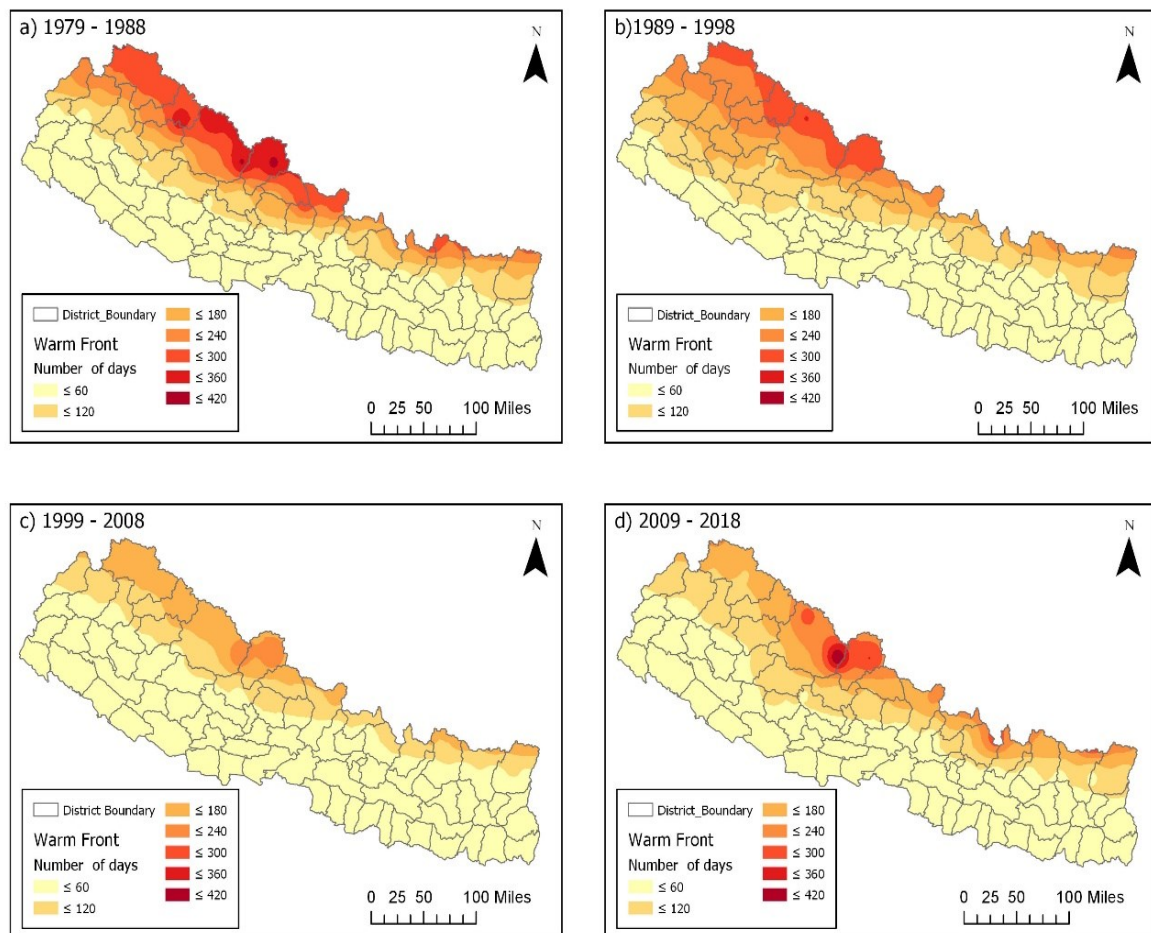


Figure 37. Synoptic Climate Classification of Warm Front Passage WT from 1979 to 2018.

**Climate discussion.** Looking at the weather map of all-weather types from 1979 to 2018 periods, we observe that the Himalayan region is mainly vulnerable to this seasonal and spatial pattern of weather, especially in the fourth decade. Although this result is limited to its GWTC classification, the frequency of occurrence is more active based on the relationship between temperature and humidity of a location. It does not mean that other factors like pressure, cloud cover, wind, etc. do not have any role in these distributions, while these spatial distributions mainly focus on the temperature and humidity. The very Strong El-Nino during 1998 and, strong and long El Nino in 2008 has brought the warming trend in the Nepal Himalayas, and the Terai region always plays a role as a playing ground of all parameters draws the overall climate of Nepal.

Although these frequency maps exhibited on Humid Warm WT, Warm WT, Dry warm WT, and WFP shows that the Himalayan region receives a more warming trend that does not mean that this area is warm and dry compared to other parts of the country. Rather, this region is the colder region of Nepal, where the dew point is more often low, and the WT frequency map shows the straightforward changing average of these parameters.

The tourism resources lie in the Himalayan region like hiking and trekking routes, mountaineering, paragliding, etc. significantly impacted by Himalayas' warming trend. The majority of Nepal's tourism resources are based on the activities in the Himalayan regions, and any change or disturbance in these regions will impact the overall number of visitors in the country. Over time from 1998 to 2018, the warming effect associated with El-Nino has significantly impacted the glacier composition of the Himalayan region, where it increased from 3,252 in 2001 to 3,808 in 2010 (ICIMOD, 2011). The potential outburst of any of this lake will affect the sustainable infrastructure that lies in the lower region of Nepal. The central mountain



region, even known as the Gandaki basin, is more affected by this warming trend where the number of glacier lakes increased from 1025 to 1337 Glacier Lake in the span of ten years. In this basin, the most famous touristic destinations like Pokhara valley, Kathamndu valley, Chitwan National Park, Mt. Annapurna range, Mt. Langtang range, Tilicho Lake, adventure activities in Mustang district are located. This spatial analysis of climatological parameters shows that these basins or destinations are most vulnerable to the recent climatical change.

To sum up, in the fourth decade (2009 to 2018), we observe an increased warming trend and high seasonal variability than the other three decades. The high season variability of temperature and precipitation creates a significant gap in the climate balance, and as a result, they have increased potential to develop natural disasters in the form of Glacier Lake out bursting, flood, landslide, and snow avalanches. Therefore, we need a more meticulous analysis of this factor while building sustainable tourism activities in this region.

## **Climate Index**

**Climate Risk Index (CRIN).** Climate Risk Index (CRIN) calculated from the GWTC data shows that the Himalayan region is a very high risk of climatic variability and gets a score of five (5) and ranks them as a very high climatic risk region. As displayed in Figure 38, Achham, Dadeldhura, Dailekh, Doti, Rolpa, Salyan, Surkhet, and Kailali are the district which is less vulnerable to the climate change and get a score of one (1) which means the very low climatic risk districts. Likewise, the Central part of Nepal, which is known for the touristic activities is highly vulnerable to climate change. Most of the eastern part of Nepal's district is classified as a very risk or the risk district's that shows that climate is more variable there and its average score is shown in Appendix G.

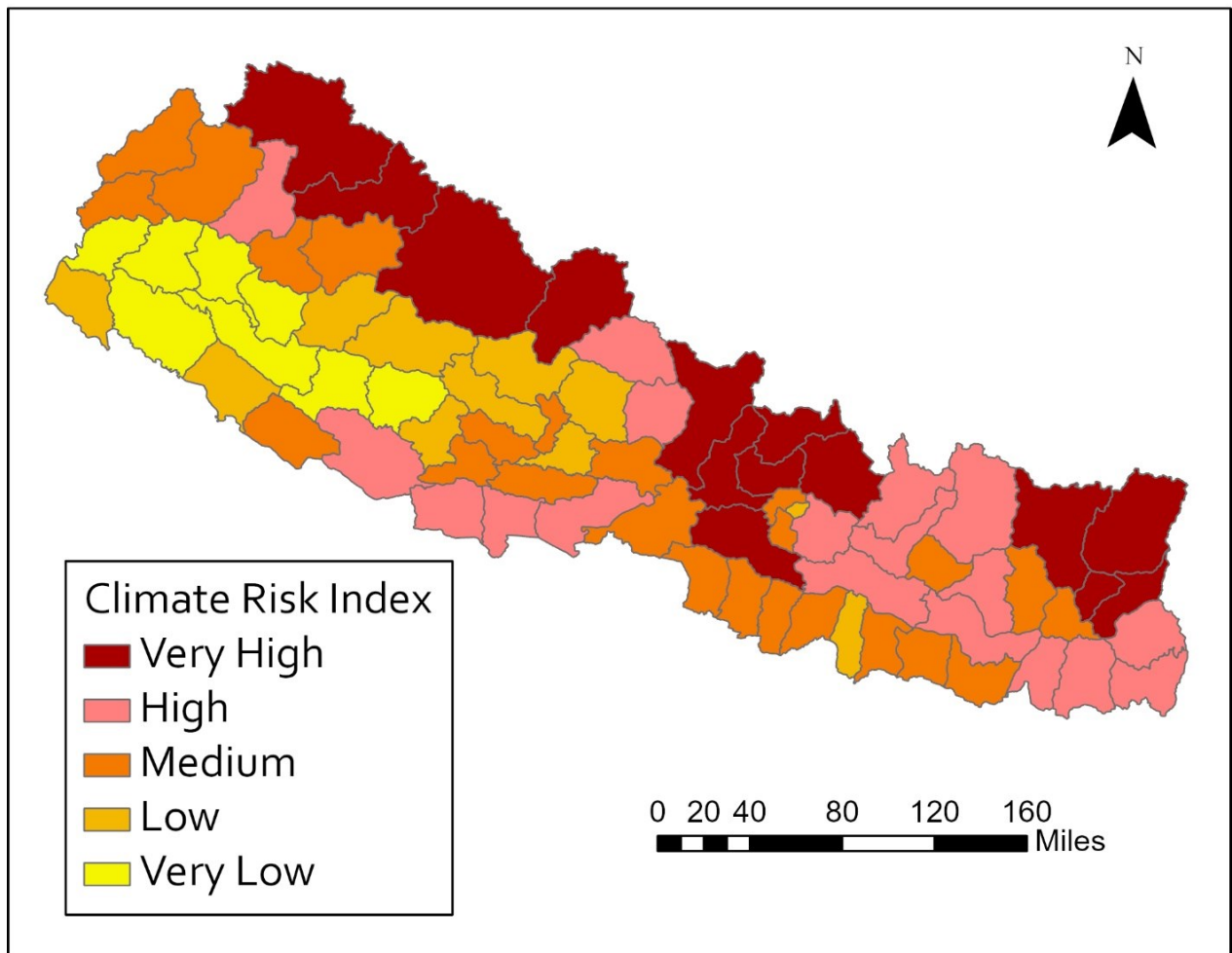


Figure 38. Map of Nepal showing the Climate Risk Index score district-wise.

**Tourism Climate Index (TCIN).** Figure 39 shows the overall TCIN score of Nepal, where 5 denotes the good score, and 1 denotes the low favorable climate for the touristic activities. Darchula, Dolakha, Dolpa, Humla, Jumla, Kalikot, Mugu, and Taplejung show some very good climatic conditions for outdoor activities like hiking trekking, and mountaineering. Overall, the Mountain regions and Hilly regions district shows the good climate condition for touristic activities. Usually, this area is known as a cold and/or cool place. The increase in the average temperature and humidity has helped increase the outside activities and create a flexible

environment for touristic behavior for the short term. Likewise, most of the Terai region displayed a very low favorable climate for tourism; as these flatlands are the hot and warm place of Nepal, the humidity and temperature rise have further worsened the problem here. The detail score calculation Table is shown in Appendix H.

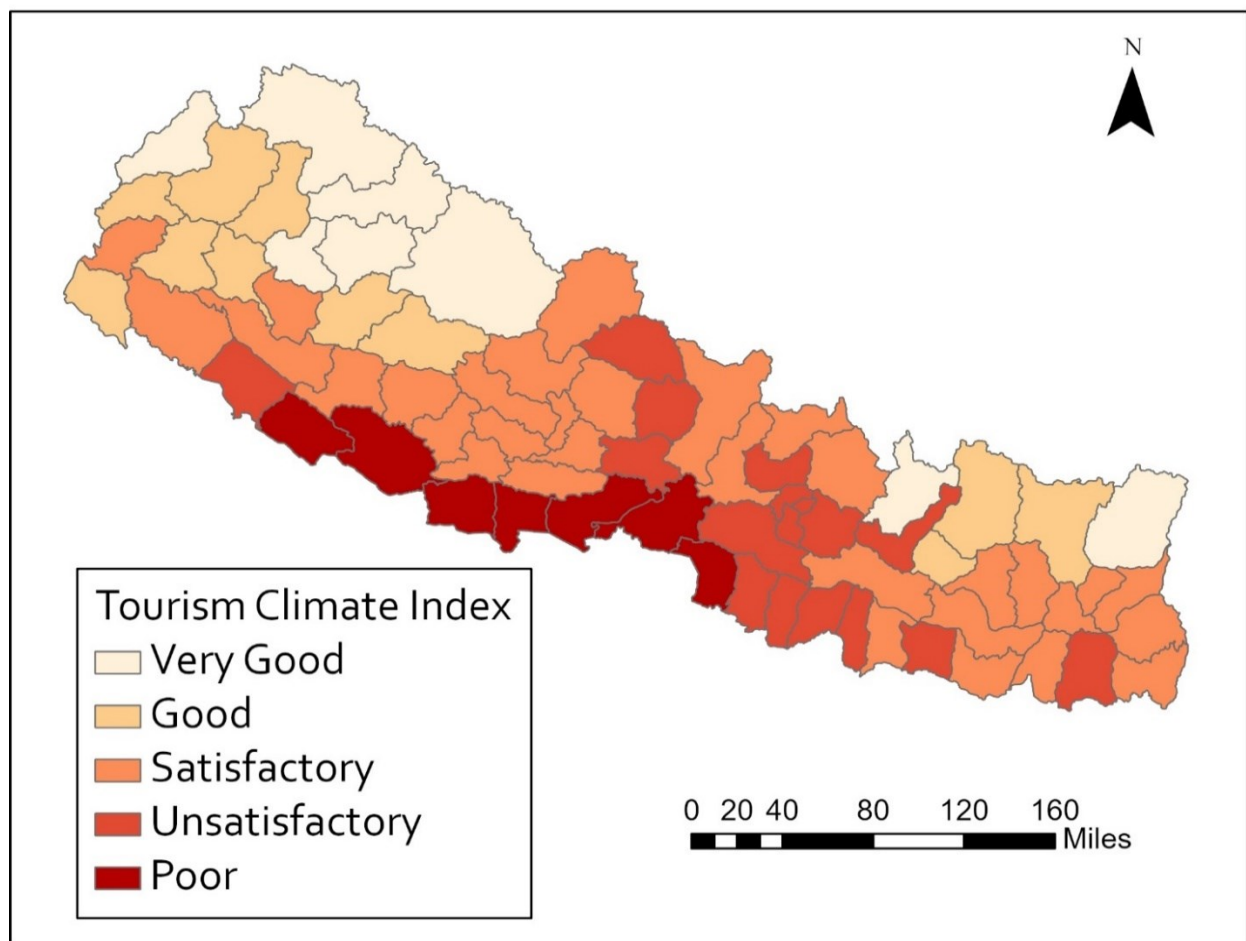


Figure 39. Map of Nepal showing the Tourism Climate Index score district-wise.

**Transportation Status Index (TSIN).** Figure 40 shows that the final transportation status index was compiled from the average score of AFIN, RFIN, and CFIN. It shows that the Kathmandu district is the capital city. It is way ahead on transportation infrastructure development compared to the other districts and receives the score five (5), known as a very

good TSIN infrastructure district. Rasuwa, Arghakhanchi, Bhaktapur, Dadeldhura, Dhankuta, Gulmi, Jajarkot, Kalikot, Lalitpur, Lamjung, Myagdi, Parsa, Pyuthan, and Tehrathum are the districts with very low transportation facility districts and receives a score of one (1).

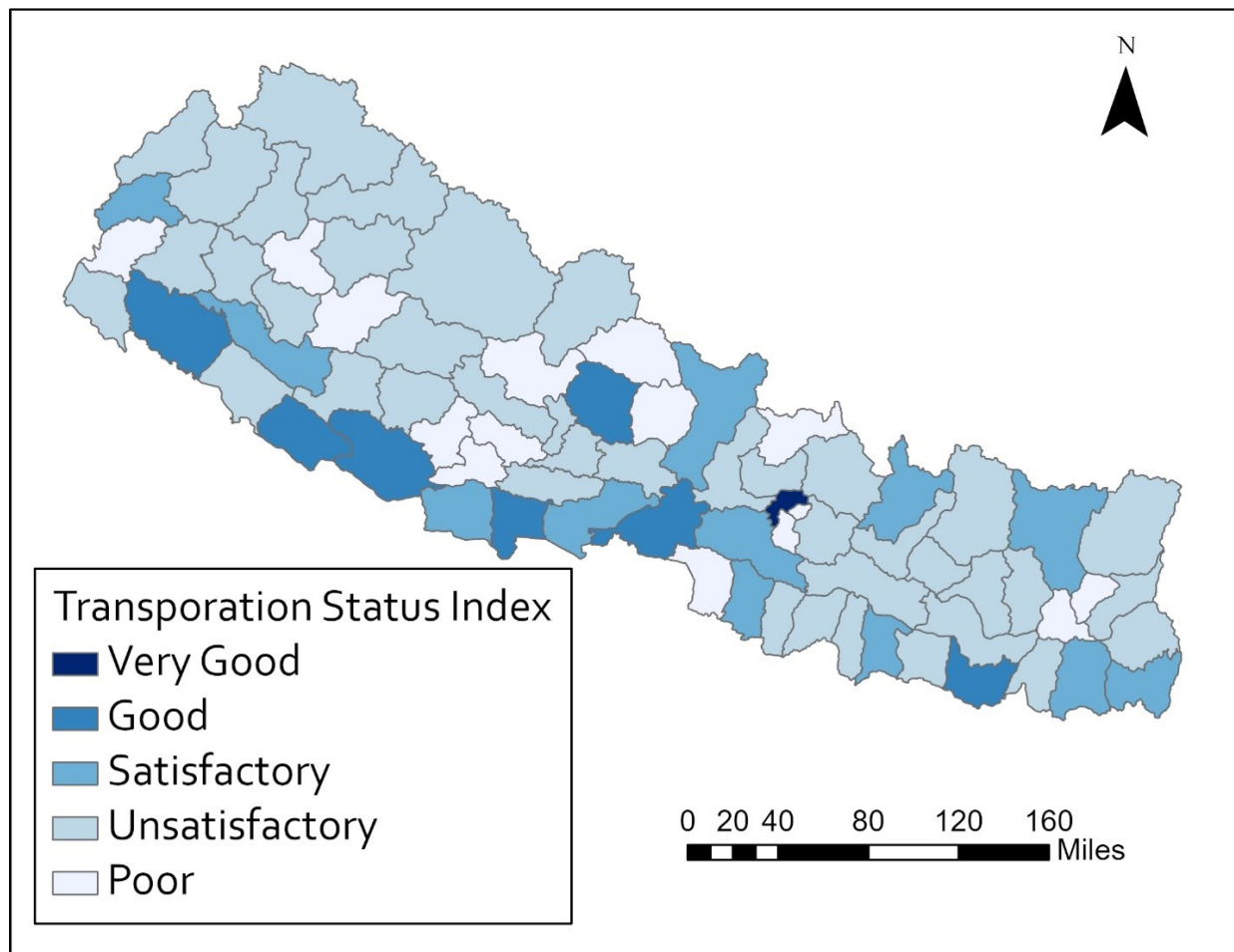


Figure 40. Map of Nepal showing the Transportation Status Index score district wise.

Overall. The majority of Nepal's districts receive a score of two (2) and one (1), which indicates that Nepal has very weak transportation facilities. To be a potential touristic destination, transportation is a big issue for tourist movement. It shows that Nepal needs to improve its entire transportation network significantly. It will be either airways or roadways or cableways.

**Tourism Opportunity Index (TOIN).** After compiling all the scores of TCIN, CRIN, SSIN, TSIN, and overtourism index (based on the variable from article one), we produce the tourism opportunity index map, as shown in Figure 41. It shows that Kathmandu is on top of the chart has many opportunities compared to other districts. Kailali, Kaski, and Surkhet are the other three districts that lie in the same column with Kathmandu, which has a high potential to develop as a prominent tourism destination. Despite showing some overtourism threat to Kathmandu's small vicinity (Thamel city), Kathmandu still has a lot of potential because of its development and the restoration of its resources. In comparison to the eastern Terai region and Hilly region districts, the western district is less threatened by climate change and environmental degradation. It, therefore, has excellent potential compare to them in the long run. Although the eastern region is more developed than the western part, the untouched natural resources and sustainable planning make it more affluent than the eastern district and and Appendix J helps to supplement the tourism information and its activities..

Achham, Doti, Jhapa, Kanchanpur, Myagdi, Rukum, and Syangja are the districts which have a good opportunity to develop as a prime touristic destination. Likewise, eastern mountain region districts, including the Mount Everest (Solukhumbu district), have shown some satisfactory tourism development. Most of the central and eastern Hilly region's districts have delivered a low potential with an unsatisfactory score index, including the culturally rich Bhaktapur district and famous trekking root of the Annapurna Mountain region of Manang and Mustang district. Lamjung, Nuwakot, Parsa, Ramechhap, Rasuwa, Rautahat, Sarlahi, Siraha, and Tehrathum are classified as the very poor and week potential destination and need a severe concern to develop the resources in this region sustainably.

In addition to higher ratings of the district of tourism opportunity index, the current famous destinations still show significant opportunity to grow more, but the concern here still will be the threat of overtourism. The lack of proper management and land use policy has significantly affected the destination potentiality. To develop as one of the world touristic destinations, Nepal bears natural resources, it is necessary to acquire the rural areas equally.

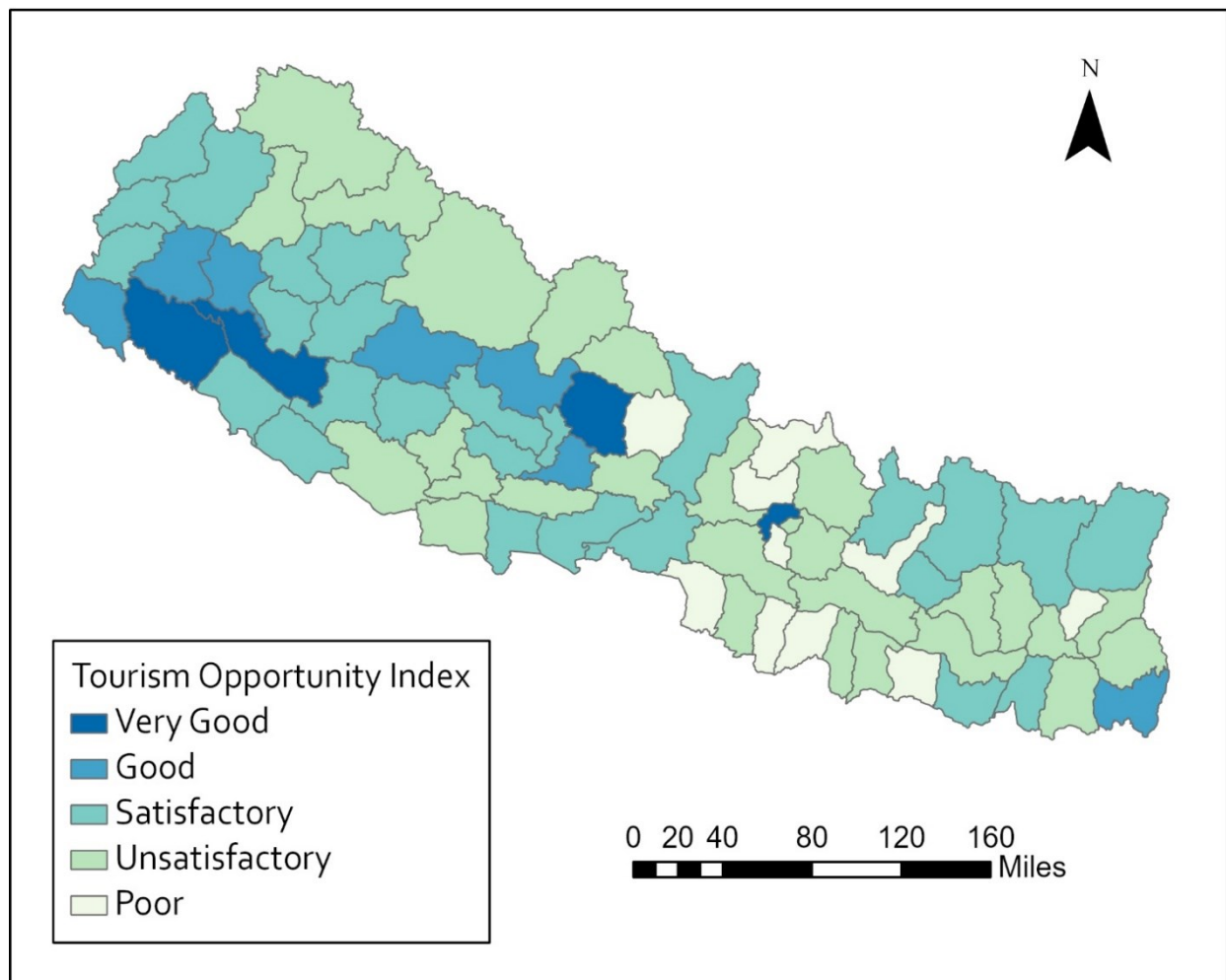


Figure 41. Map of Nepal Showing the Tourism Opportunity Index score district-wise.

## Conclusion

This study proposed the opportunity index for tourism by accessing a climate index, socioeconomic drivers, infrastructure conditions, and Nepal's overtourism condition. This index overcame the limitation of the widely used tourism climate relationship. It proposed a new way to determine Nepal's tourism opportunity by analyzing climate and sustainable tourism development variables. This paper accounts for the whole climate of the area with climate variability, and it is a wise idea to find out the positive impact of climate change on tourism. This paper helps to increase the importance of sustainable tourism in a developing country and its significance in these locations. It is vital to manage the sources and run the tourism business without impacting the environment or causing a problem to the local people. Therefore, a meticulous analysis of tourism development conditions regarding Nepal's key sustainability elements in a district-wise spatial scale would help the government to formulate its policy and plan to maximize the sources and their benefit.

With the given condition and the rising tourist numbers each year, it is necessary to shift the tourism from urban to Nepal's rural areas, which have almost the same potential to attract tourists. The robust representation of urban tourism has created a lot of negative experiences for both local residents and the tourist themselves which can adversely affect the tourism industry in the long run if it is not accounted. The prospective overtourism analysis of this research helps assess the current tourism scenario and its perceptions from the people with its growing concern worldwide. An overtourism condition can severely decrease tourism opportunities in the long run by hampering sustainable tourism development. This analysis of overtourism section helps us to find out to delete the negative factors from the tourism development and forward the education to the respective stakeholder awarding the prognosis symptoms of overtourism in the local level.

Regarding our findings, although two big touristic cities Kathmandu, and Pokhara (Kaski) have shown negative consequences in terms of management of the tourism and the locations, with the increasing number of visitors still these two cities have a lot of potential to become some of the best destinations of the world with the resources they possess. Therefore, these cities' improved conditions will significantly increase the competitiveness of the destination; thus, it will enhance the destination's economic and social situation.

An analysis of the study area was analyzed at the district level, and 75 districts were used to analyze the findings. With the recent administration division and the changes in September 2015, the importance of the district has been shifted into several provinces, and two of them, Rukum and Nawalparasi districts are split into two parts ending up into two differences provinces as a new district and the make the total number of the district to 77 in new political maps. Although we have these changes, this study treated these four districts as two districts according to the older political distribution because of the lack of separated data availability. Due to a shortened time in the field, our research regarding overtourism was only conducted in the major tourism destinations, and a low sample number has been obtained. An increase in sample size and the number of locations will further help determine a more depth understanding of the problems. In addition, our research is further limited to some older data, especially in terms of socio-economic conditions. The improvement of this limitation would further help improve this research type in the future for better analysis. Moreover, many of the tourism facilities of Nepal are based on outdoor activities, but small changes in the tourism infrastructure would help a Nepal develop more indoor tourism opportunities which may increase the overall opportunity of the tourism economy. This will help to increase the choices among the tourist and help to correct for exaggerated seasonal tourism.



In conclusion, the Tourism Opportunity Index (TOIN) and the overtourism studies indicate both the positive and negative impacts of tourism throughout Nepal's districts. The TOIN index can be useful for government and planning agencies because it pairs the destinations' tourism aspects with climate factors. The synoptic climate result using the GWTC will further the environmental analysis to protect the location and realize potential harms in troubling climate change trends. I hope that the utilization of these indices can gain widespread applicability as a result of its benefit to local people, tourism stakeholders, and the whole tourism economy. Findings and the methods used in this study are positive aspects to formulate the appropriate plans and policies to manage positive tourism development in Nepal's diverse regions.

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## APPENDICES

### Appendix A. Survey background

This chapter will examine the increase in tourism since the 1950s and the range of management practices employed, the abrupt rise in tourism over the last decade, culminating with the usage of the term "over tourism," defined by CREST as:

*"tourism that has moved beyond the limits of acceptable change in a destination due to quantity of visitors, resulting in degradation of the environment and infrastructure, diminished travel experience, wear and tear on built heritage, and/or negative impacts on residents."*

*Survey Script:*

#### **[Overall assessment of tourism]**

- What recent changes have you observed regarding tourism in [place name]?
- Have you observed any positive impacts resulting from tourism in [place name]?
  - Please explain
- Have you observed any negative impacts resulting from tourism in [place name]?
  - Please explain
- If tourism were developed or increased in [place name] in what ways do you think it would change [place name]?

#### **[Overtourism questions]**

- There is a concept called 'overtourism' and I am interested in your interpretation of it. I will define it for you and then ask you a few questions specific to [place name].
  - Over tourism is *"tourism that has moved beyond the limits of acceptable change in a destination due to quantity of visitors, resulting in degradation of the environment and infrastructure, diminished travel experience, wear and tear on built heritage, and/or negative impacts on residents."*
- Do you feel that there are times of the year where [place name] may experience overtourism?
  - Please explain
- As a result of an excessive quantity of visitors (tourists) do you think [place name] has experienced environmental degradation?
  - Please explain
- As a result of an excessive quantity of visitors (tourists) do you think [place name] has experienced degradation of the local infrastructure?
  - Please explain
- As a result of an excessive quantity of visitors (tourists) do you think the tourists themselves in [place name] have had their 'experience' negatively affected?
  - Please explain

- As a result of an excessive quantity of visitors (tourists) do you think the local residents of [place name] have experienced any negative consequences?
  - Please explain

## Appendix B. IRB Approval Form

Date: 3-12-2019

IRB #: IRB-FY2019-586

Title: Nepal Overtourism

Creation Date: 3-4-2019

End Date:

Status: **Approved**

Principal Investigator: David Perkins

Review Board: MSU Sponsor:

### Study History

Submission Type	Initial	Review Type	Exempt	Decision	<b>Exempt</b>
-----------------	---------	-------------	--------	----------	---------------

### Key Study Contacts

Member	David Perkins	Role	Primary Contact	Contact	davidperkins@missouristate.edu
Member	David Perkins	Role	Principal Investigator	Contact	davidperkins@missouristate.edu

### Initial Submission

## Investigative Team

Who is the Principal Investigator?

---

This individual will be required to certify the protocol for submission and will be 1 responsible for the overall project and MUST be a faculty or staff member.

**Name:** David Perkins

**Organization:** Geography Geology & Planning

**Address:** 901, S. National Avenue , Springfield, MO

**65897-0027 Phone:**

**Email:** davidperkins@missouristate.edu

Who is the Primary Study Contact?

---

2 This person, in addition to the Principal Investigator, will be included on all correspondence related to this project. This person may be the Principal Investigator or someone else (faculty, staff, or student).

**Name:** David Perkins

**Organization:** Geography Geology & Planning

**Address:** 901, S. National Avenue , Springfield, MO

**65897-0027 Phone:**

**Email:** davidperkins@missouristate.edu

Will there be any Co-Principal Investigators participating in this study?

---

3.

Co-Principal Investigators will also be required to certify the protocol for submission and share overall responsibility with the Principal Investigator for the study. Co-Principal Investigators MUST be faculty or staff members.

Yes

☒ No

Will there be any other individuals participating with the investigation?

---

<sup>4</sup> These individuals will be participating as part of the research team, but will not need to certify the protocol submissions, or be included in any correspondence regarding the study. Typically these individuals will be students or individuals from other institutions. Investigators may be faculty, staff, students, or unaffiliated individuals.

Yes

No

☒

## General Information

- 1 What is the full title of the research protocol?

---

An initial investigation of overtourism in Nepal

Abstract/Summary

---

- 2 Please provide a brief description of the project.

In this project people will be interviewed in Nepal and asked a variety of questions concerning tourism and the concept of 'overtourism'. Information will be used in a journalistic-style paper detailing attitudes and understanding of these topics. Individuals will be over 18 years of age and will include tourist, tourism employees, and tourism officials.

Are you requesting Single IRB Review

3

---

Single IRB Review is applicable to a study that is being reviewed by another Institution's IRB, in which you wish to rely on the external IRB for review, approval, and oversight.

Yes

☒ No

Does the study require review and oversight of the IRB?

---

4

Regardless of how these questions are answered, the determination of IRB review and oversight is made by the IRB and this study will still need to be submitted for preliminary review.

Is this study a systematic investigation, following a predetermined plan, for looking at a particular issue, testing a hypothesis or research question, or developing a new theory that includes any of the following:

- 4A Collection or analysis of quantitative or qualitative data
  - Collection of data using surveys, testing or evaluation procedures, interviews, or focus groups
  - Collection of data using experimental designs such as clinical trials
  - Observation of individual or group behavior
- 

☒ Yes

No

Will this study contribute to generalizable knowledge, in that the purpose or intent of the project is to test or to develop scientific theories or hypotheses, or to draw conclusions that are intended to be applicable and/or shared beyond the populations or situations being studied? This may include one or more of the following:

- 4B Presentation of the data at meetings, conferences, seminars, poster presentations, etc.
  - The knowledge contributes to an already established body of knowledge
  - Other investigators, scholars, and practitioners may benefit from this knowledge
  - Publications including journals, papers, dissertations, and theses
- 

☒ Yes

No

Will this study require obtaining information or biospecimens, through intervention  
4C or interaction with an individual that will be used, studied, or analyzed by the investigative team?

---

☒ Yes

☐ No

Will you be requesting an Exempt Review for this study?

---

5

In order to qualify for review via exempt procedures, the research must not be greater than minimal risk and must fall into at least one of the exempt categories defined by federal regulations.

☐ Yes

☒ No

6 Is this study receiving internal or external funding?

---

☐ Yes

☒ No

Does this study contain protected health information (PHI)?

---

7

PHI is any information in a medical record or designated record set that can be used to identify an individual and that was created, used, or disclosed in the course of providing a health care service, such as a diagnosis or treatment.

Yes

☒ No

8 Has all IRB Human Research training been taken through CITI under Missouri State University?

---

Yes

☒ No

Training Certificates

---

8A

Please upload all training certificates taken outside of CITI, or CITI certificates completed through another institution. [CITI Training Certificate.pdf](#)



Describe the proposed project in a manner that allows the IRB to gain a sense of the project including:

- The research questions and objectives,
- Key background literature (supportive and contradictory) with references, and
- The manner in which the proposed project will improve the understanding of the chosen topic.

1

---

The goal of this research is to better understand the public feelings/opinions surrounding tourism in

Nepal. In addition to an overall assessment of tourism, participants will be provided a definition of 'overtourism' after which they will be asked to comment on whether they feel 'overtourism' is happening in the respective areas.

The following is one of the most comprehensive reviews of overtourism (open access): <https://www.mdpi.com/2071-1050/10/12/4384>

This will be the first review of overtourism in Nepal, and specifically, not in the Himalaya region.

Overtourism has been a topic mostly reviewed in Europe.

2      Check all research activities that apply:

---

Audio, video, digital, or image recordings

Biohazards (e.g., rDNA, infectious agents, select agents, toxins)

Biological sampling (other than blood)

Blood drawing

- Class Protocol (or Program or Umbrella Protocol)
- Data, not publicly available
- Data, publicly available
- Deception
- Devices
- Diet, exercise, or sleep modifications
- Drugs or biologics
- Focus groups
- Internet or email data collection
- Materials that may be considered sensitive, offensive, threatening, or degrading
- Non-invasive medical procedures
- Observation of participants
- Oral history
- Placebo
- Record review
- Specimen research
- Surgical procedures
- ✓ Surveys, questionnaires, or interviews (one-on-one)
- Surveys, questionnaires, or interviews (group)
- Other

Describe the procedures and methods planned for carrying out the study. Make sure to include the following:

- Site selection,
  - The procedures used to gain permission to carry out research at the selected sites(s),
  - Data collection procedures, and
  - An overview of the manner in which data will be analyzed.
- 

Provide all information necessary for the IRB to be clear about all of the contact human participants will have with the project.

Site selection will be based on admittance and availability however it will include the following locations: Lumbini, Chitwan National Park, Kathmandu city center.

- 3 Data will be collected in the form of recorded interviews on a smartphone. These interviews will be later transcribed. Participants will be voluntary and permission will be asked prior to any recording. Depending on the participant, the survey will be conducted in either English or Nepali. Participants will be approached with the following introductory statement asking consent:

"Thank you for speaking with me, I have a few questions I would like to ask you regarding tourism in [place name]. If you don't mind, for research purposes, I would like to record this interview so I can transcribe it for later use. No personally identifying information will be obtained and you will not be identifiable through any information used. If at any point you would like to stop this interview, please let me know and I will stop. I will also provide you my contact information so you will be able to follow-up with me regarding any use and future publication of this research. Would you like to proceed?"

Data will be transferred from the recording device and stored on a university-owned computer device. All data after storage will be deleted from the recording device. Participants will all receive participant ID numbers and identifying information will not be available or used in the study. Statements such as "tourist at Lumbini" and "tourism operator in Katmandu" will be used as reference points for write-ups.

Data will be analyzed qualitatively looking for patterns in description of varying aspects of tourism in addition to the use of quotes that support findings.

- 4 Attach tests, surveys, questionnaires, and other social-behavioral measurement tools, if applicable.
- 

[overtourism questionnaire.docx](#)

- 5 Attach documentation of site permission, if applicable.
- 

## Participants

Specify the participant population(s). 1

---

Check all that apply.

☒ Adults

Children (<18 years of age)

Adults with decisional impairment

Non-English speaking

Student research pools (e.g. psychology)

Pregnant women or fetuses

Prisoners

Unknown (e.g., secondary use of data/specimens, non-targeted surveys, program/class/umbrella protocols)

2 Specify the age(s) of the individuals who may participate in the research.

---

18+

Describe the characteristics of the proposed participants, and explain how the nature of 3 the research requires/justifies their inclusion.

---

People either involved in the tourism industry (businesses, operators, officials) or consuming the product (tourists)

Provide the total number of participants (or number of participant records, specimens, 4 etc.) for whom you are seeking IRB approval.

---

The hope is for 5 or more at each site

Describe what time commitment will be required from each participant, including 5 individual interactions, total time commitment, and long-term follow-up, if any.

---

To complete this survey, it is expected to take 5 minutes.

Describe how potential participants will be identified (e.g., advertising, individuals known to investigator, record review, etc.). Explain how investigator(s) will gain access to this 6 population, as applicable.

---

Sites have been identified. Operators that advertise as working on or near the particular site will be sought prior to visiting; however, some may be approached on-site if needed.

Describe the recruitment process; including the setting in which recruitment will take place.

7

---

Participants that are either officials or operators will be contacted or approached on-site or have scheduled meetings prior based on a request to discuss tourism in the area. Tourists will be spoken to on -site as per local rules and regulations.

Attach recruitment materials (ads, flyers, website postings, recruitment letters, and oral/written scripts), if applicable .

---

Will participants receive compensation or other incentives (e.g., free services, cash  
8 payments, gift certificates, parking, classroom credit, travel reimbursement, etc.) to participate in the research study?

Yes

☒ No

Describe all reasonably expected risks, harms, and/or discomforts that may apply to the research. Discuss severity and likelihood of occurrence. 1

---

Consider the range of risks - physical, psychological, social, legal, and economic. Thinking of how tourism may be harmful to the local area could be a negative topic, however, this is minimal in its risk. Other questions ask opinions.

2 Discuss the steps that will be taken to minimize risks and the likelihood of harm.

---

Participant has been given the ability to stop the interview at any time without any cause or pressure to continue.

3 Describe the potential benefits that participants may expect as a result of this research study. State if there are no direct benefits to individual participants.

---

No direct benefits.

4 Discuss any potential indirect benefits to future subjects, science, and society.

---

No indirect benefits. Research could better inform policy decisions on a larger-scale

Describe how risks to participants are reasonable when compared to the anticipated benefits to participants (if any) and the importance of the knowledge that may reasonably be expected to result.

---

Benefits could result in positive policy action which has a much higher benefit than any negative feelings thinking of negative impacts tourism has had in the past.



From the list below, indicate how consent will be obtained for this study. 1

---

Check all that apply.

Written/signed consent by the subject

Written/signed consent (permission) for a minor by a Parent or Legal Guardian

Written/signed consent by a Legally Authorized Representative (for adults incapable of consenting)

☒ Request for waiver of documentation of consent (verbal consent, anonymous surveys, etc.) Does the research present greater than minimal risk of harm to the subjects?

---

Yes

☒ No

would the only record linking the participant and the research be the consent documentation?

---

☒ Yes

No

Waiver of parental permission

Waiver of consent (consent will not be obtained from subjects)

Describe the consent process including where and by whom the subjects will be approached, the plans to ensure the privacy of the subjects and the measures to ensure

that subjects understand the nature of the study, its procedures, risks and benefits and that they freely grant their consent.

- 
- 2 The following introduction will serve as the verbal consent and information:

Introduction: Thank you for speaking with me, I have a few questions I would like to ask you regarding tourism in [place name] it will take about 5 minutes. If you don't mind, for research purposes, I would like to record this interview so I can transcribe it for later use. No personally identifying information will be obtained and you will not be identifiable through any information used. If at any point you would like to stop this interview, please let me know and I will stop. I will also provide you my contact information so you will be able to follow-up with me regarding any use and future publication of this research. Would you like to proceed?

Attach all consent and assent documents here:

---

[overtourism questionnaire.docx](#)

Missouri State University is committed to keeping data and information secure. Please review the Missouri Ste University [Information Security Policies](#). Discuss you project with the MSU Information Security Office or your College's IT support staff if you have questions about how to handle your data appropriately.

---

Statement of Principal Investigator Responsibility for Data

- The principal investigator of this study is responsible for the storage, oversight, and
- 1 disposal of all data associated with this study. Data will not be disseminated without the explicit approval of the principal investigator, and identifying information associated with the data will not be shared.
- 

By checking this box, all personnel associated with this study understand and agree to the



Statement of Principal Investigator Responsibility for Data.

How will the data for this study be collected/stored? 2

---

Check all that apply.

☒ Electronic storage format

☐ On paper

Describe where the data will be stored (e.g., paper forms, flash drives or removable media, desktop or laptop computer, server, research storage area network, external source) and describe the plan to ensure the security and confidentiality of the records (e.g., locked office, locked file cabinet, password-protected computer or files, encrypted data files, database limited to coded data, master list stored in separate location).

---

3

At minimum, physical data should always be secured by lock and key when stored. Electronic data should be stored on University secure servers whenever possible (Office 365 or other secure campus server). If data has to be stored off campus, the file should be encrypted and the device password protected. Additionally, any data to be shared outside the University network will require a SUDERS request be filed and approved.

See <https://mis.missouristate.edu/Central/suders/create>

Data will be stored on a smartphone initially as the recording device. After returning to campus, all information will be uploaded to a MSU-owned computer and data on the recording device will be deleted. The information on the MSU-owned computer will be stored where participant identifiable information will be redacted or replaced with an ID#.

Describe how data will be disposed of and when disposal will occur.

---

4

At minimum, Federal regulations require research records to be retained for at least 3 years after the completion of the research (45 CFR 46). Research that involves identifiable health information is subject to HIPAA regulations, which require records to be retained for at least 6 years after a participant has signed an authorization. Finally, funded research projects may require longer retention periods, you may need to follow the sponsoring agency guidelines.

After the study is analyzed and published all information will be deleted. Data will be kept for at least 3 years depending on which event happens later.

Please include any additional information about the study below. 1

---

My graduate student (from Nepal) Susan Phuyal is conducting the interviews. He was not selectable on the investigative team so I had to select 'no' in order to complete this submission.

- 2      Please include any additional documents that aren't covered within the application.

## Appendix C. New proposed tourism destination by Nepal Government



पत्र संख्या :-

च. नं. :-

नेपाल सरकार

info@tourism.gov.np

संस्कृति, पर्यटन तथा नागरिक उड्डयन मन्त्रालय



www.tourism.gov.np  
E-mail : info@tourism.gov.np  
मन्त्री :- ८२९९८७९, ८२९९८०७  
फ्याक्स नं. :- ८२९९९२२  
सावित :- ८२९९८००  
फ्याक्स नं. :- ८२९९८५८ (प्रशासन)  
घ.उ.नं., मुकुटीमण्डप : ८२८७०३७  
फ्याक्स नं. :- ८२९८८९  
इन्सपेक्टर नं. :- ८२९९५२३,  
८२९९८२५, ८२९९८९९,  
८२९९८६४, ८२९९८४७,  
८२९९९०९, ८२९९८८५, ८२९९८८५

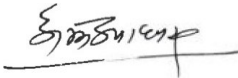
सिंहदरबार, काठमाडौं  
नेपाल

प्रेस विज्ञप्ति

प्राकृतिक, पुरातात्विक, ऐतिहासिक साँस्कृतिक तथा धार्मिक दृष्टिबाट नेपाल विश्वकै एक प्रमुख पर्यटकीय गन्तव्य हो । पर्यटन क्षेत्रको विकास तथा सोबाट प्राप्त लाभ जनस्तरमा पुर्‍याउन पर्यटकीय गन्तव्यहरुको विविधिकरण गर्दै नयाँ पर्यटकीय स्थल र उपजहरुको पहिचान, विकास तथा पर्यटकीय पूर्वाधारहरुको विकास गरी पर्यटन उद्योगलाई राष्ट्रिय अर्थतन्त्रको एक प्रमुख आधारको रुपमा विकास गर्न जरुरी छ ।

नेपाल सरकारबाट घोषित आ.व. २०७५/०७६ को बजेट वक्तव्यको बुँदा नं. ११४ मा नेपालको पर्यटन प्रवर्द्धनको लागि नयाँ गन्तव्य पहिचान तथा विकास गर्ने उल्लेख भएको छ । सोही अनुरूप चालु आ.व. मा यस मन्त्रालयको स्वीकृत वार्षिक कार्यक्रममा प्रमुख पर्यटकीय गन्तव्य स्थापित गर्न आवश्यक पूर्वाधार विकास कार्यक्रम रहेको छ । उक्त कार्यक्रम कार्यान्वयन गर्न बजेट वक्तव्यमा उल्लेख भए बमोजिम नयाँ गन्तव्य पहिचान गरी विकास गर्ने उद्देश्यले सार्वजनिक सूचना मार्फत आवेदन आव्हान गरिएकोमा सूचना मार्फत प्राप्त आवेदनहरुको अध्ययन गरी मूल्यांकन गरिएको छ । साथै विभिन्न समयमा विभिन्न निकायहरुबाट प्रकाशित जानकारी, प्राप्त विभिन्न सुझावहरु समेतको आधारमा नेपाल सरकार (मन्त्रिस्तर) को निर्णयानुसार उक्त गन्तव्यहरु पहिचान गरिएको छ ।

सूचिमा उल्लेखित नयाँ विकास गर्नुपर्ने गन्तव्यहरुमा चालु आर्थिक वर्षमा विनियोजित बजेटबाट बाँडफाँड गरिने छ । यसका अतिरिक्त थप प्रचारप्रसार गरी प्रवर्द्धन गरिने स्थापित गन्तव्यहरुको समेत संलग्न सूची रहेको जानकारी सम्बन्धित सबैमा गरिन्छ ।

  
धनराज उपाध्याय  
सं.सं. प्रका

पर्यटन प्रवर्द्धन र विकासका लागि पहिचान गरिएका गन्तव्यहरू

सि. नं.	प्रदेश	जिल्ला	स्थापित तथा प्रवर्द्धन गरिनुपर्ने गन्तव्यहरू	नयाँ तथा विकास गरिनुपर्ने गन्तव्यहरू
१	१ नं. प्रदेश	ताप्लेजुङ	<ul style="list-style-type: none"> <li>पाथीभरा</li> <li>फुङफुङे झरना, (साँवा गाँउपालिका)</li> </ul>	तिङ्बुङ पोखरी (सिदिग्बा गाँउपालिका)
२		पाँचथर		गुरु फाल्गुनानन्द सर्किट (लोब्रे कुटी- गजुरमुखी धाम-लाराम्मा-चुङ्कीनाम्बा) (फिदिम नगरपालिका)
३		इलाम		फिकल-कन्याम-श्रीअन्तु सर्किट
			सन्दकपुर-माईपोखरी (सन्दकपुर गाउँपालिका)	
४		तेह्रथुम		तीनजुरे-मिल्के-जलजले (TMJ)
५		संखुवासभा	अरुण उपत्यका	
				बालेश्वोर ऐतिहासिक गुफा
६		धनकुटा	भेडेटार नमस्ते झरना (भेडेटार गाँउपालिका)	
				हलदे पटकेडाँडा पर्यटक ट्रेल (छथरे गाउँपालिका)
७		भोजपुर		ट्याम्के डाँडा (मुन्धुम ट्रेयल)
८		खोटाङ	हलेसी महादेव	बराह पोखरी (बराह गाँउपालिका)
		सोलुखुम्बु	स्थाङबोचे	
			सगरमाथा	पाँचपोखरी (महाकुलुंगगाउँ पालिका)
१०		ओखलढुंगा	पोकली झरना	
				थोलेदम्बा डाँडा
११		उदयपुर		उदयपुरगढी
१२		झापा	बाँसबारी सिमसार पर्यटन पूर्वाधार केन्द्र	सहिद नेत्रलाल पार्क • विर्तामोड
				गौरादह कृषि पर्यटन क्षेत्र
				अर्जुनधारा पर्यटकीय क्षेत्र
१३		मोरङ		धनपालगढी पर्यटकीय क्षेत्र, बेलबारी
१४		सुनसरी	कोशिटप्पु बन्यजन्तु आरक्ष धरान	
			वराह क्षेत्र	

			(बराह गाउँपालिका)	
				पिण्डेश्वर-दन्तकाली पदमार्ग
			ताल तलैया (इटहरी उपमहानगरपालिका)	
१५	प्रदेश नं. २	सिरहा		सहलेस दरबार पर्यटन क्षेत्र (लहान, सिरहा नगरपालिका)
१६		सर्लाही		नाडी ताल (चन्द्रनगर गाउँपालिका वडा नं. ६ र ७)
१७		धनुषा	जानकी मन्दिर धनुषाधाम	
				धनेश्वर महादेव पर्यटन विकास क्षेत्र (मिथिला नगरपालिका, १०)
१८		महोत्तरी		जलेश्वर मन्दिर (जलेश्वर नगरपालिका)
१९		रौतहट		मरघर सिमसार क्षेत्र
				पतौरा पुरात्वात्विक महादेव मन्दिर पर्यटकीय क्षेत्र
२०		बारा	गढीमाई (महागढीमाई नगरपालिका)	
				सिम्रौनगढ (सिम्रौनगढ नगरपालिका)
२१		पर्सा	पर्सा रानीपोखरी	घडिअर्वा पोखरी (विरगन्ज उपमहानगरपालिका)
			पर्सा राष्ट्रिय निकुन्ज	
२२		सप्तरी		छिन्नमस्ता (छिन्नमस्ता गाउँपालिका)
२३	प्रदेश नं. ३	दोलखा	कालिञ्चोक भगवती	जिरी-शैलुङ पर्यटन पदमार्ग
२४		सिन्धुली		सिन्धुलीगढी
२५		रामेछाप		सुनकोशी न्याफिटड
२६		काभ्रेपलाञ्चोक	नमोबुद्ध	महाभारत ट्रेल (लौकुरीभन्जयाङ्ग फुल्चोकी गुर्दुमडाँडा नारायणस्थान भूमेचुली पदमार्ग)
			पलाञ्चोक भगवती	
२७		सिन्धुपाल्चोक	भोटेकोशी नदिमा न्याफिटड, बन्जीजम्पिङ	पाँचपोखरी (थाङपाल गाउँपालिका)
			हेलम्बु	
२८		नुवाकोट	नुवाकोट दरबार	
			ककनी	
				कल्चेडी-झिल्केधर-देवीघाट-भैरवी-दुप्चेधर सर्किट (बेलकोटगढी ७)



२९		रसुवा	गोसाइकुण्ड केन्जीड उपत्यका	
				तामाङ हेरिटेज ट्रेयल
३०		धादिङ	त्रिशुली नदि न्याफिटङ	
				स्काइ ट्रेयल
				रानीझरना क्यानोनिङ्ग थाके ६ धादिङ्ग
३१		चितवन	देवघाट सौरहा	
				विस हजारि ताल
				सोमेश्वोर गढी पर्यटन विकास माडी- ५ (माडी नगरपालिका, ५)
				पटियानी पर्यटकीय क्षेत्र
३२		मकवानपुर	दामन मैत्रीपार्क फर्केल-इन्द्रसरोवर	
				मकवानपुरगढी
३३		भक्तपुर	नगरकोट भक्तपुर दरबार चौगुनारायण मन्दिर	
				नीलबाराही मन्दिर/पार्क (मध्यपुर ठिमी न.पा.)
३४		काठमाण्डौ	पशुपति बौद्धनाथ स्वयम्भूनाथ नारायणहिटी चन्द्रगिरी सुन्दरीजल बुढानीलकण्ठ	दहचोक (चन्द्रागिरी नगरपालिका)
३५		ललितपुर	पाटन दरबार स्ववायर	नागदह पर्यटकीय क्षेत्र
				गोदावरी फुलचोकी हाइकिङ (गोदावरी नगरपालिका)
३६	गण्ड की प्रदेश	गोरखा	मनकामना मन्दिर गोरखा दरबार मनास्लु सर्किट ट्रेयल (आरुघाट, चुम्नुर्बी धाचे गाउँपालिका)	
				चुम्भ्याली (चुम्नुर्बी गाउँपालिका)

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३७		लमजुङ	घलेगाउँ	
				काउलेपानी
३८		तनहुँ	बन्दीपुर	तनहुँ कालिका शहीद तथा शान्ति पार्क व्यास ४
				सिद्धगुफा भिमाद
३९		कास्की	पोखरा	
			सारंगकोट	
			पञ्चासे	
			पुम्दीकोट	मौजा (होम स्टे)
				सिक्लेश पर्यटकीय क्षेत्र
४०		मनाङ	तिलिचो ताल	नार्फू ट्रेयल (सेभेन पास ट्रेयल)
			अन्नपूर्ण पदमार्ग	
४१		मुस्ताङ	मुक्तिनाथ	
			जोमसोम	
			दामोदर कुण्ड	
				लोमान्थाङ दरबार र गुफा क्षेत्र
४२		पर्वत	सालीग्राम सेतीवेणी	दुर्लुङ क्यानोनिङ्ग, केभिङ्ग र होमस्टे (कुस्मा ३)
			गुप्तेश्वर गुफा	महाशिला
४३		स्याङ्जा	सिरुवारी	
			स्वेरक मैदान प्याराग्याइडिङ (भिरकोट नगरपालिका)	सतौ-चण्डिकालिका क्षेत्र (पुतलीबजार नगरपालिका)
				आलमदेवी (कालीगण्डकी गाँउपालिका)
४४		बाग्लुङ	कालिका भगवती मन्दिर (बा.न.पा. १)	भकुण्डे भैरवस्थान गाजाको दह
				ढोरपाटन आरक्ष क्षेत्र (ढोरपाटन न.पा र निसीखोला गा.पा)
४५		नवलपरासी पूर्व	मौलाकालिका	
				दाउन्नेदेवी
४६		भ्याग्दी	पुनहिल	
			तातोपानी	
			गलेश्वर मन्दिर	घोरेपानी पर्यटकीय क्षेत्र
				रघु गंगा रुइसे डाँडा देखि धवलागिरी आईस फल सम्म पदमार्ग,
४७	प्रदेश नं. ५	नवलपरासी पश्चिम		रामग्राम
			वाल्मीकी आश्रम	
४८		रुपन्देही	लुम्बिनी	बाउन्नकोटि वनवाटिका
				सैनामैना पर्यटकीय क्षेत्र
			ग्लोबल पिस पार्क वुटवल	
४९		कपिलवस्तु	निग्लीहवा	

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		मायादेवी तिलौराकोट पैदल परिपथ	
			जगदिशपुर ताल
			सागर ताल (कपिलवस्तु न.पा.२ ठूलो बर्दगवा)
५०	पाल्पा	तानसेन (रानीमहल, श्रीनगर)	तालपोखरा रम्भादेवी मन्दिर पर्यटन क्षेत्र (रामपुर नगरपालिका)
५१	अर्घाखाँची	सुपा देउराली	पाणिनी तपोभूमी (पाणिनी गाँउपालिका)
५२	गुल्मी		रेसुङ्गा तपोभूमी (रेसुङ्गा नगरपालिका)
		सत्यवती पर्यटन तथा धार्मिक क्षेत्र	
			रुरुक्षेत्र (रुरु गाँउपालिका)
			भगवती मन्दिर पर्यटकीय क्षेत्र (रेसुङ्गा न पा १)
५३	रुकुम पूर्व	गुरिल्ला ट्रेयल	ढोरपाटन-मैकोट-सेफोकुन्डो पर्यटन मार्ग
५४	रोल्पा		जलजला
५५	प्युठान	स्वर्गद्वारी	रक गाउँन, ओखरकोट डाँडा, झिमरुक
५६	दाङ		बगरबाबा धार्मिक पर्यटकीय स्थल
५७	बाँके	वागेश्वरी मन्दिर	कम्मर शाह मजार धार्मिक पर्यटकीय क्षेत्र डडुवा गा.पा ५
		गावरभ्याली	
		बाँके राष्ट्रिय निकुञ्ज - बाघ संरक्षण र साइनेज	
५८	बर्दिया	बर्दिया राष्ट्रिय निकुञ्ज	
		डल्ला होमस्टे	
		कृष्णसार संरक्षण क्षेत्र	
			ओमकेदारेश्वर धाम धार्मिक पर्यटकीय स्थल, (वासगढी)
			शिवमन्दिर धार्मिक पर्यटकीय स्थल, जोगी गाउँ (बर्दिया नगरपालिका, २)
५९	कर्णाली प्रदेश	सल्यान	कुभिन्डे दह
६०		डोल्पा	त्रिपुरासुन्दरी धार्मिक पर्यटन क्षेत्र
६१		जुम्ला	सिंजा सभ्यता
			डुडुल चैत्य
६२		हुम्ला	लिमी उपत्यका पर्यटकीय स्थल

६३		मुगु	रारा ताल	
				रारा-से फोक्सुण्डो lake to lake trekking
६४		कालिकोट		पाचाल झरना (पाचाल झरना गाँउपालिका)
६५		जाजरकोट		खलंगा दरबार क्षेत्र (भेरी नगरपालिका)
६६		दैलेख	पञ्चकोशी धार्मिक पर्यटन विकास (पन्चकोशी ज्वाला क्षेत्र)	कोतगढी-पञ्चदेवल-वेलासपुर-महाबु पर्यटकीय विकास, नारायण न.पा.
६७		सुर्खेत	काँक्रेविहार	जाजुरा दह पञ्चपुरी न.पा. ८ र ९ (गुप्ती ताल, मादले गुफा, शिव गुफा लगायत)
			देउतीबज्यै (विरेन्द्रनगर नगरपालिका)	गिद्रेडाँडा पर्यटकीय क्षेत्र
			मदन आश्रित पार्क	
६८		रुकुम पश्चिम		बोतामकोट चित्री पाटन साहसिक पदमार्ग
६९	प्रदेश नं. ७	बाजुरा	बडिमालिका	
				कोल्टी - बुढीनन्दा - बडिमालिका पदमार्ग
७०		बझाङ		गोरखनाथ मन्दिर पैदलमार्ग (दुर्गाथैली ७)
७१		डोटी	खप्तड शैलेध्वरी	बडिकेदार धार्मिक पर्यटकीय क्षेत्र
७२		अछाम	रामारोसन	
				सुर्यकोट भस्तादेवी पर्यटन क्षेत्र (मंगलसेन नगरपालिका, ३)
७३		दार्चुला	अप्पिनाम्पा संरक्षण क्षेत्र	
				मालिकार्जुन (मालिकार्जुन गाँउपालिका)
७४		बैतडी	त्रिपुरासुन्दरी	
				सिद्धनाथ उदयदेव धार्मिक स्थल पाटन नगरपालिका ६
७५		डडेल्धुरा		अमरगढी-उग्रतारा (अमरगढी नगरपालिका)
७६		कञ्चनपुर	चाँदनी-दोधारा क्षेत्र	
				रौटेला झम्केली ब्रह्मदेवधाम धार्मिक विकास क्षेत्र
				बन्दा ताल कोटीहोम पर्यटकीय क्षेत्र (बेलौटी न.पा.)
७७		कैलाली	घोडाघोडी ताल	
			टिकापुर सर्किट	
			भादागाँउ	
				बर्दगोरिया मन्दिरधाम (बर्धगोरिया गाँउपालिका)

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**Appendix D. Name of the airport under operation (Civil Aviation Authority of Nepal, 2020)**

S.N	Airport Names	District	IATA Code	Year of Operation	Runway Dimension	Flight Movement(2019)
1	Bajura Airport	Bajura	BJU	1984	520m * 20m	756
2	Bharatpur Airport	Chitwan	BHR	1961	1200 m x 30 m	6488
3	Bhojpur Airport	Bhojpur	BHP	1978	540 m x 20 m	436
4	Chandragadhi Airport	Jhapa	BDP	1963	1500 m x 30 m	3072
5	Chaurjahari Airport	Rukum	HRJ	1973	600 m x 20 m	128
6	Dang Airport	Dang	DNP	1961	750 m x 30 m	796
7	Dhangadhi Airport	Kailali	DHI	1964	1800 m x 30 m	2768
8	Dolpa Airport	Dolpa	DOP	1975	560 m x 20 m	1496
9	Janakpur Airport	Dhanusha	JKR	1960	1306 m x 30 m	2486
10	Jomsom Airport	Mustang	JMO	1976	810 m x 20 m	4074
11	Jumla Airport	Jumla	JUM	1972	675 m x 20 m	44
12	Lamidanda Airport	Khotang	LDN	1972	520 m x 20 m	70
13	Phaplu Airport	Solukhumbhu	PPL	1976	680 m x 20 m	2749
14	Rajbiraj Airport	Rajbiraj	RJB	1960	680 m x 20 m	310
15	Ramechhap Airport	Ramechhap	RHP	1979	530 m x 20 m	6958
16	Rara Airport	Mugu		2003	570 m x 20 m	2160
17	Rumjatar Airport	Okhaldhunga	RUM	1972	581 m x 20 m	184
18	Salle Airport	Rukum	RUK	1994	580 m x 20 m	192
19	Sanfebagar Airport	Achham	FEB	1974	550 m x 20 m	138
20	Simara Airport	Bara	SIF	1958	1192 m x 30 m	5340
21	Simikot Airport	Humla	IMK	1977	650 m x 20 m	11258
22	Surkhet Airport	Surkhet	SKH	1966	1255 m x 30 m	2989
23	Tenzing-Hillary (Lukla) Airport	Solukhumbu	LUA	1971	527 m x 20 m	19680
24	Tumlingtar Airport	Sankhuwasabha	TMI	1972	1295 m x 30 m	1872
25	Taplejung Airport	Taplejung	TPJ	1976	700 m x 20 m	435
26	Thamkharka Airport	Khotang		2001	700 m x 20 m	116
27	BiratNagar Aiport	Morang	BIR	1958	1500 m x 30 m	11626
28	Gautam Buddha Airport	Rupandehi	BWA	1958	1500 m x 30 m	8390
29	NepalGunj Airport	Banke	KEP	1961	1505 m x 30 m	15698
30	Pokhara Airport	Kaski	PKR	1958	1447 m x 30 m	39920
31	Tribhuvan International Airport	Kathmandu	KTM	1951	3050 m x 46 m	91816

**Appendix E. Name of the airport, which is closed or not in operation (Civil Aviation Authority of Nepal, 2020).**

S.N	Airport Names	District	IATA Code	Year of Operation	Runway Dimension
1	Baglung Airport	Baglung	BGL	1973	608 m x 30 m
2	Baitadi Airport	Baitadi	BIT	1978	590 m x 20 m
3	Bajhang Airport	Bajhang	BJH	1976	630 m x 20 m
4	Darchula Airport	Darchula	DAP	1986	590 m x 30 m
5	Dhorpatan Airport	Baglung		1973	365 m x 30 m
6	Doti Airport	Doti	SIH	1973	490 m x 20 m
7	Gorkha Airport	Gorkha	GKH	1960	1067 m x 46 m
8	Jiri Airport	Dolakha	JIR	1976	365 m x 18 m
9	Kangeldanda Airport	Solukhumbu		2003	520 m x 26 m
10	Langtang Airport	Rasuwa	LTG		420 m x 30 m
11	Mahendranagar Airport	Kanchanpur	XMG	1973	884 m x 30 m
12	Manamaya Rai Khanidanda Airport	Khotang		2005	580 m x 25 m
13	Manang Airport	Manang	NGX	1981	900 m x 20 m
14	Masinechuar Airport	Dolpa		2014	600 m x 30 m
15	Meghauli Airport	Chitwan	MEY	1966	1067 m x 30 m
16	Rolpa Airport	Rolpa	RPA	1980	457 m x 30 m
17	Syangboche Airport	Solukhumbu	SYH		405 m x 30 m
18	Tikapur Airport	Kailali	TPU	1984	573 m x 30 m
19	Kamal Bazar Aiport	Achham			

## Appendix F. Length of SRN with its Pavement Types within Districts (in Km.)

S.N.	District	Type of Road				Road Category				Total SRN
		BT	GR	ER	Total	NH	FRN	MH	PR	
1	Taplejung	34.5	13	21	68.5	148.5	0	0	0	148.5
2	Sankhuwasabha	92	40	103	235	0	265	0	0	265
3	Solukhumbu	37.2	0	0	37.2	0	106.7	0	0	106.7
4	Okhaldhunga	69.9	0	65	134.9	0	120.9	14	0	134.9
5	Khotang	18	12	170.46	200.46	77	10.46	113	0	200.46
6	Bhojpur	0	44	63	107	0	0	107	0	107
7	Dhankuta	80.68	45	9	134.68	48.27	60.41	26	0	134.68
8	Terhathum	33.07	37	55	125.07	0	33.07	92	0	125.07
9	Panchthar	97.86	19	104	220.86	91.86	58	71	0	220.86
10	Ilam	122.95	17	110.3	250.25	94.7	155.55	0	0	250.25
11	Jhapa	152.92	38.68	5	196.6	110.75	53.85	0	48	212.6
12	Morang	153.02	39.9	23.3	216.22	54.34	162.88	0	24	241.22
13	Sunsari	127.03	68.8	10	205.83	89.03	106.8	0	31	226.83
14	Udayapur	121.31	109.3	25.9	256.51	68.86	186.65	1	0	256.51
15	Saptari	171.05	48.5	30	249.55	89.8	134.75	0	25	249.55
16	Siraha	93.93	18	33	144.93	43.27	68.66	0	33	144.93
17	Dhanusa	93.91	80.32	77.25	251.48	63.51	157.97	0	30	251.48
18	Mahottari	56.72	97.81	61.06	215.59	47.79	139.8	0	28	215.59
19	Sarlahi	32.79	153.63	2	188.42	30.23	117.19	0	41	188.42
20	Rautahat	71.83	33	33	137.83	26.39	136.94	0	33	196.33
21	Bara	109.23	26	54.35	189.58	81.26	140.12	0	25	246.38
22	Parsa	28.82	0	60	88.82	8.63	52.69	0	60	121.32
23	Dolakha	123.25	86	20.5	229.75	0	256.75	0	0	256.75
24	Sindhupalchok	144.17	17	45.5	206.67	55.93	150.74	40	0	246.67
25	Rasuwa	0	18	52.2	70.2	0	70.2	0	0	70.2
26	Dhading	121.88	59.2	45	226.08	94.38	112.7	42	0	249.08
27	Nuwakot	133.11	38	32.5	203.61	0	196.7	46	0	242.7
28	Kathmandu	221.86	7.5	20.84	250.2	82.85	238.85	0	0	321.7
29	Bhaktapur	95.56	19.5	0	115.06	36.12	100.94	0	0	137.06
30	Lalitpur	72.75	30.35	32.2	135.3	25	118.3	0	0	143.3
31	Kavrepalanchok	142.26	7.2	0	149.46	83.64	65.82	34	0	183.46
32	Ramechhap	46.6	0	68	114.6	0	151.1	39	0	190.1
33	Sindhuli	147.18	57.3	75.5	279.98	98.38	121.6	60	0	279.98
34	Makwanpur	193.67	72.87	62.8	329.34	195.97	204.37	0	0	400.34
35	Chitawan	149.25	47.5	37	233.75	88.9	83.85	0	61	233.75
36	Gorkha	31.04	43.8	138.4	213.24	0	279.24	31	0	310.24
37	Manang	0	0	30	30	0	30	0	0	30
38	Mustang	0	0	194	194	0	194	0	0	194
39	Myagdi	0	10	34	44	0	44	0	0	44
40	Kaski	92.46	5	58.5	155.96	35.4	77.56	43	0	155.96
41	Lamjung	34.34	27.5	45	106.84	0	68.84	38	0	106.84
42	Tanahu	128.49	0	51	179.49	71.25	116.24	0	0	187.49
43	Nawalpur	73.15	0	145.2	218.35	66.15	152.2	0	0	218.35
44	Syangja	117.58	0	54	171.58	77.58	97	0	0	174.58
45	Parbat	47.11	0	45	92.11	0	113.11	0	0	113.11
46	Baglung	117.13	13	98	228.13	0	102.13	130	0	232.13
47	Rukum East	0	64	49	113	0	73	64	0	137
48	Rolpa	52.41	79	39	170.41	0	207.41	0	0	207.41
49	Pyuthan	87.43	21	61	169.43	0	169.43	0	0	169.43

50	Gulmi	44.54	0	160.6	205.14	0	205.14	0	0	205.14
51	Arghakhanchi	62.24	0	110	172.24	4.12	201.12	0	0	205.24
52	Palpa	143.67	3.3	105.99	252.96	60.01	192.96	0	0	252.97
53	Parasi	124.04	29.54	3.8	157.38	32.18	130.2	0	14	176.38
54	Rupandehi	160.77	5	0	165.77	70.63	95.14	0	0	165.77
55	Kapilbastu	187.34	45.5	0	232.84	62.04	142.3	0	54.5	258.84
56	Dang	243.02	100	22	365.02	117.4	192.62	0	58	368.02
57	Banke	178.81	24.6	23	226.41	128.41	67.4	0	37	232.81
58	Bardiya	137.15	54.27	28	219.42	87.89	156.53	0	20	264.42
59	Dolpa	0	0	0	0	0	56	0	0	56
60	Mugu	0	0	28	28	0	113	0	0	113
61	Humla	0	0	90	90	0	180	0	0	180
62	Jumla	30.9	0	120.1	151	31	120	0	0	151
63	Kalikot	65	5	36	106	70	36	0	0	106
64	Dailekh	152.67	76	47.56	276.23	86	71.23	119	0	276.23
65	Jajarkot	37	13	108	158	0	134	85	0	219
66	Rukum West	31.4	61	2	94.4	31.4	2	61	0	94.4
67	Salyan	116.66	4	55	175.66	91.66	84	0	0	175.66
68	Surkhet	168.14	17	79	264.14	90.14	205	0	0	295.14
69	Bajura	15.3	0	34.7	50	0	174	0	0	174
70	Bajhang	79.08	0	29.5	108.58	0	222.08	0	0	222.08
71	Darchula	71.42	0	63	134.42	201.42	0	0	0	201.42
72	Baitadi	175.32	0	72.3	247.62	99.97	154.65	0	0	254.62
73	Dadeldhura	77.08	40	44	161.08	77.08	106	0	0	183.08
74	Doti	116.46	5	131	252.46	74.46	275	0	0	349.46
75	Achham	102	0	47	149	0	63	88	0	151
76	Kailali	239.6	47	72.5	359.1	150.78	185.12	0	57.2	393.1
77	Kanchanpur	48.32	82	28.6	158.92	57.62	60.6	0	62	180.22
Total in Nepal		6979.33	2276.87	4191.42	13447.6	3809.95	9489.56	1344	741.7	15385.21



## Appendix G. CRIN Score Table

District	Average climate risk Score	CRIN Score
Dhading	2.5	5
Dolpa	2.6	5
Gorkha	2.5	5
Humla	2.5	5
Makwanpur	2.5	5
Mugu	2.7	5
Mustang	2.5	5
Nuwakot	2.6	5
Panchthar	2.5	5
Rasuwa	2.7	5
Sankhuwasabha	2.5	5
Sindhupalchok	2.5	5
Taplejung	2.5	5
Tehrathum	2.5	5
Bajura	2.3	4
Dang	2.3	4
Dolakha	2.4	4
Ilam	2.3	4
Jhapa	2.3	4
Kapilbastu	2.3	4
Kavrepalanchok	2.4	4
Khotang	2.4	4
Lamjung	2.4	4
Manang	2.3	4
Morang	2.3	4
Nawalparasi	2.3	4
Ramechhap	2.3	4
Rupandehi	2.3	4
Sindhuli	2.3	4
Solukhumbu	2.4	4
Sunsari	2.3	4
Udayapur	2.4	4
Arghakhanchi	2.2	3
Baitadi	2.1	3
Bajhang	2.2	3
Banke	2.2	3
Bara	2.1	3
Bhojpur	2.2	3

Chitwan	2.2	3
Darchula	2.2	3
Dhankuta	2.2	3
Dhanusa	2.2	3
Gulmi	2.1	3
Jumla	2.1	3
Kalikot	2.1	3
Kathmandu	2.1	3
Lalitpur	2.2	3
Okhaldhunga	2.2	3
Palpa	2.2	3
Parbat	2.1	3
Parsa	2.1	3
Rautahat	2.1	3
Saptari	2.1	3
Sarlahi	2.1	3
Siraha	2.1	3
Tanahu	2.2	3
Baglung	2	2
Bardiya	2	2
Bhaktapur	2	2
Jajarkot	1.9	2
Kanchanpur	1.9	2
Kaski	2	2
Mahottari	2	2
Myagdi	1.9	2
Pyuthan	2	2
Rukum	1.9	2
Syangja	2	2
Achham	1.8	1
Dadeldhura	1.8	1
Dailekh	1.8	1
Doti	1.8	1
Kailali	1.6	1
Rolpa	1.8	1
Salyan	1.8	1
Surkhet	1.8	1

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## Appendix H. TCIN Score Table

District	Tourism-Climate score	TCIN Score
Jumla	4.38	5
Dolpa	4.38	5
Darchula	4.25	5
Kalikot	4.25	5
Dolakha	4.25	5
Humla	4.25	5
Mugu	4.25	5
Taplejung	4.25	5
Jajarkot	4.13	4
Sankhuwasabha	4.13	4
Achham	4.00	4
Baitadi	4.00	4
Bajhang	4.00	4
Bajura	4.00	4
Doti	4.00	4
Solukhumbu	4.00	4
Okhaldhunga	4.00	4
Rukum	4.00	4
Kanchanpur	4.00	4
Arghakhanchi	3.88	3
Baglung	3.88	3
Dadeldhura	3.88	3
Dailekh	3.88	3
Gulmi	3.88	3
Kaski	3.88	3
Khotang	3.88	3
Myagdi	3.88	3
Palpa	3.88	3
Parbat	3.88	3
Pyuthan	3.88	3
Rolpa	3.88	3
Salyan	3.88	3
Sindhuli	3.88	3
Surkhet	3.88	3
Syangja	3.88	3
Udayapur	3.88	3
Kailali	3.88	3
Sunsari	3.88	3
Bhojpur	3.75	3

Dhankuta	3.75	3
Ilam	3.75	3
Panchthar	3.75	3
Tehrathum	3.75	3
Dhanusa	3.75	3
Saptari	3.75	3
Jhapa	3.75	3
Dhading	3.75	3
Gorkha	3.75	3
Mustang	3.75	3
Rasuwa	3.75	3
Sindhupalchok	3.75	3
Bardiya	3.63	2
Mahottari	3.63	2
Siraha	3.63	2
Bhaktapur	3.63	2
Lalitpur	3.63	2
Lamjung	3.63	2
Makwanpur	3.63	2
Ramechhap	3.63	2
Tanahu	3.63	2
Morang	3.63	2
Rautahat	3.63	2
Sarlahi	3.63	2
Manang	3.63	2
Kathmandu	3.50	2
Kavrepalanchok	3.50	2
Bara	3.50	2
Nuwakot	3.50	2
Banke	3.38	1
Dang	3.38	1
Kapilbastu	3.38	1
Nawalparasi	3.38	1
Rupandehi	3.38	1
Parsa	3.38	1
Chitwan	3.25	1

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## Appendix I. RFIN Score Table

District	BT	GT	ET	Average score (6*BT+3*CGT+1*ET)/10)	RFIN Score
Dang	243.02	100.00	22.00	178.01	5
Kailali	239.60	47.00	72.50	165.11	5
Makwanpur	193.67	72.87	62.80	144.34	5
Nawalparasi	197.19	29.54	149.00	142.08	4
Kathmandu	221.86	7.50	20.84	137.45	4
Kapilbastu	187.34	45.50	0.00	126.05	4
Saptari	171.05	48.50	30.00	120.18	4
Dailekh	152.67	76.00	47.56	119.16	4
Banke	178.81	24.60	23.00	116.97	4
Surkhet	168.14	17.00	79.00	113.88	4
Sindhuli	147.18	57.30	75.50	113.05	4
Baitadi	175.32	0.00	72.30	112.42	4
Udayapur	121.31	109.30	25.90	108.17	4
Chitawan	149.25	47.50	37.00	107.50	4
Morang	153.02	39.90	23.30	106.11	3
Jhapa	152.92	38.68	5.00	103.86	3
Dolakha	123.25	86.00	20.50	101.80	3
Bardiya	137.15	54.27	28.00	101.37	3
Rupandehi	160.77	5.00	0.00	97.96	3
Sunsari	127.03	68.80	10.00	97.86	3
Palpa	143.67	3.30	105.99	97.79	3
Sindhupalchok	144.17	17.00	45.50	96.15	3
Dhading	121.88	59.20	45.00	95.39	3
Nuwakot	133.11	38.00	32.50	94.52	3
Ilam	122.95	17.00	110.30	89.90	3
Dhanusa	93.91	80.32	77.25	88.17	3
Kavrepalanchok	142.26	7.20	0.00	87.52	3
Doti	116.46	5.00	131.00	84.48	3
Baglung	117.13	13.00	98.00	83.98	3
Tanahu	128.49	0.00	51.00	82.19	3
Bara	109.23	26.00	54.35	78.77	3
Sankhuwasabha	92.00	40.00	103.00	77.50	3
Salyan	116.66	4.00	55.00	76.70	3
Syangja	117.58	0.00	54.00	75.95	3
Panchthar	97.86	19.00	104.00	74.82	3
Mahottari	56.72	97.81	61.06	69.48	2
Sarlahi	32.79	153.63	2.00	65.96	2
Achham	102.00	0.00	47.00	65.90	2
Siraha	93.93	18.00	33.00	65.06	2
Pyuthan	87.43	21.00	61.00	64.86	2

Bhaktapur	95.56	19.50	0.00	63.19	2
Kaski	92.46	5.00	58.50	62.83	2
Dhankuta	80.68	45.00	9.00	62.81	2
Dadeldhura	77.08	40.00	44.00	62.65	2
Rukum	31.40	125.00	51.00	61.44	2
Rolpa	52.41	79.00	39.00	59.05	2
Kanchanpur	48.32	82.00	28.60	56.45	2
Rautahat	71.83	33.00	33.00	56.30	2
Lalitpur	72.75	30.35	32.20	55.98	2
Bajhang	79.08	0.00	29.50	50.40	2
Darchula	71.42	0.00	63.00	49.15	2
Okhaldhunga	69.90	0.00	65.00	48.44	2
Arghakhanchi	62.24	0.00	110.00	48.34	2
Gorkha	31.04	43.80	138.40	45.60	2
Kalikot	65.00	5.00	36.00	44.10	2
Gulmi	44.54	0.00	160.60	42.78	2
Jajarkot	37.00	13.00	108.00	36.90	2
Terhathum	33.07	37.00	55.00	36.44	2
Ramechhap	46.60	0.00	68.00	34.76	1
Lamjung	34.34	27.50	45.00	33.35	1
Parbat	47.11	0.00	45.00	32.77	1
Khotang	18.00	12.00	170.46	31.45	1
Jumla	30.90	0.00	120.10	30.55	1
Taplejung	34.50	13.00	21.00	26.70	1
Parsa	28.82	0.00	60.00	23.29	1
Solukhumbu	37.20	0.00	0.00	22.32	1
Bhojpur	0.00	44.00	63.00	19.50	1
Mustang	0.00	0.00	194.00	19.40	1
Bajura	15.30	0.00	34.70	12.65	1
Rasuwa	0.00	18.00	52.20	10.62	1
Humla	0.00	0.00	90.00	9.00	1
Myagdi	0.00	10.00	34.00	6.40	1
Manang	0.00	0.00	30.00	3.00	1
Mugu	0.00	0.00	28.00	2.80	1
Dolpa	0.00	0.00	0.00	0.00	1

## Appendix J. Supplemental Materials

**Nature Tourism.** Nature Tourism is a diverse set of attractions based on a unique natural feature, landscape scenery, and the wildlife of a particular place. It is a primary tourism product protected as a form of parks and reserves, especially in the form of wildlife conservation and national parks, which allow visitors to observe its pristine forms (Nelson, 2017). These resources cater to the tourists without distributing natural habitat and environment, which involves the fragile, pristine, and relatively undisturbed natural areas (The International Ecotourism Society, 2020).

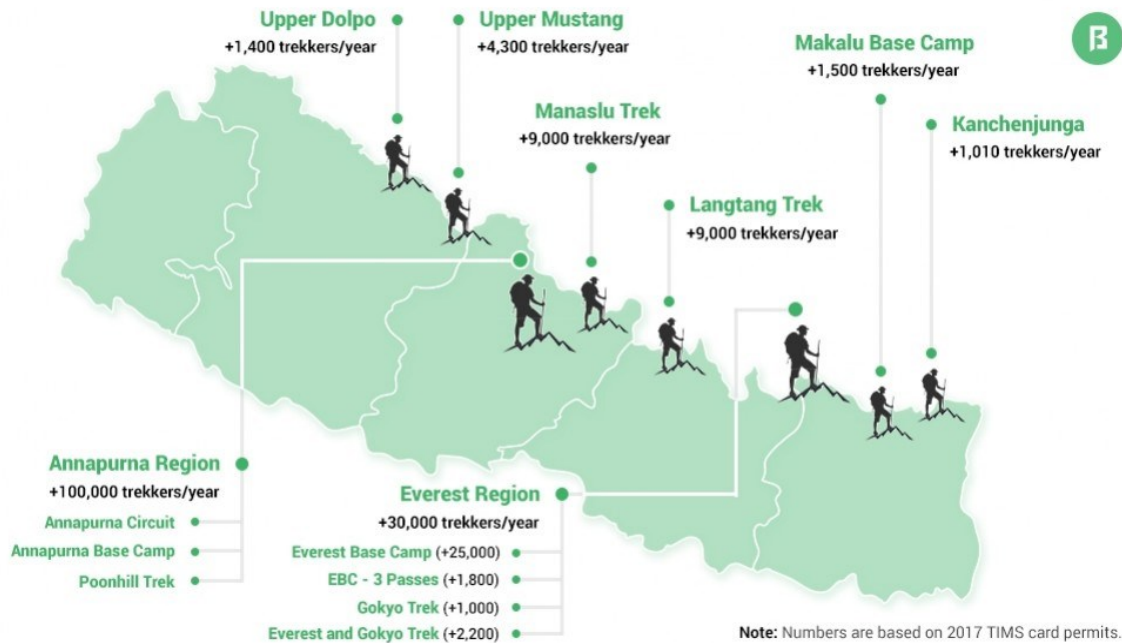
In terms of natural tourism resources, Nepal provides an opportunity for its visitors to observe the natural beauty of a country with beautiful scenery. The dramatic rise of elevation within the 94 miles from 200ft to 29028ft creates many beautiful valleys, fast-flowing white water, and lakes. Despite the small size, Nepal has ten national parks, six conservation parks, three wildlife parks, and one hunting reserve. Those national parks that lie in the lower region of Nepal are suitable for jungle safaris, jeep safaris, elephant safaris, and off-road driving in the jungle seeing animals' activities. Suklaphant National park, Bardiya national park, Chitwan National Park, and Koshi-Tappu wildlife reserves are the famous places for this activity. Moreover, visitors can enjoy the elephant ride, canoe ride, jeep safari, nature walking, bird watching excursions, or quick tours around in the jungle areas where they can find tigers, one-horned rhinos, peacocks, different types of deer, wild boar, wild bison, monkeys, bears, wild elephants, leopards, gharials, crocodiles.

**Trekking and Hiking.** Trekking and hiking are another valuable tourism resource that is based on the long, vigorous walk on the foot trails and mountains; done for fun or pleasure to reconnect with nature to calm the mind. Trekking and hiking are deferred from each other based on the duration of the days; hiking is simply known for any walking activities within a distance less than 30 miles and complete overnight, while trekking is known for the multiple-day activities, usually the distance over 30 miles (Kristina, 2020).

Trekking and hiking are other vital activities in Nepal Himalayas. There are many trekking trails throughout the country, among which some are rated easy, some medium, and some hard to trek. In addition, some of them are rated based on the trekking days, as there are many offers for tourists that start from short treks up to 5 days, medium treks up to 12 days, and long treks up to 20 days or more. Everest Base Camp, Gokyo Trek, Three Passes Trek, Annapurna Panorama Trek (Poon Hill), Annapurna Sanctuary Trek, Annapurna Circuit, Mardi Himal, The Mustang Trek, Phoksumdo Lake to Shey Gumpa Trek, Kagmara La Trek, Kanchenjunga Northern Trek, Langtang, Manaslu and Helambu, Helambu Circuit Trek, are the most popular trekking trails in Nepal ( (Hockey, 2020)

According to the Ministry of Tourism, Trekkers Information Management Systems (TIMS) card has been made mandatory for the tourist's safety, and every visitor acquires it before trekking on the Nepal Himalayas. This TIMS card helps track the number of entering and exiting trekkers in the varying trekking areas. It is designed to facilitate rescue from those areas if needed. Appendix J-1. shows the trekking areas' location and the typical number of trekkers in those areas (NTB, 2020a).





**Appendix J-1.** Number of people who trek in Nepal in 2017(source: Bookmundi, 2017)

**Mountaineering.** Mountaineering is simply the set of activities of climbing the mountains, which includes traditional outdoor climbing, skiing, and traversing (Apollo, 2017). However, Mountaineering is divided into two styles, expedition-style and alpine-style based on their routes of trips, group sizes, amount of supplies, higher exposure to the hazard, and the capital needed (Cox *et al.*, 2003). Alpine-style Mountaineering is the most common form of Mountaineering with the peaks' straightforward climbing with no backtracking of the same route. This style needs lesser supplies of the equipment suitable for the medium-sized mountain, ranging from 6600 ft. to 16400 ft., where the additional supply of oxygen is barely used. While expedition-style is a traditional climbing of the mountains with a large amount of the personal equipment supplies and the trips will be divided into several camps. These tourism styles need a part of a large team member with porters and guides, and suitable for the high mountain range above 15000 ft. This style needs more capital than the alpine style, as these styles need more

resources as they are typically longer than alpine, and an additional supplement of oxygen is frequently used.

Nepal Mountaineering is based on expedition-style climbing due to the high mountain range, and you have to backtrack on the same route because of the limited number of routes on the higher altitude. This type of Mountaineering has changed its meaning, scope, and objective over the decades and is established as a recreational sport today. With nearly a third of Nepal lying above an elevation over 15,000 ft., expedition-style climbing has attracted many visitors worldwide. Apart from the majestic “big eight mountains” based on sea-level elevation, there are 326 other mountains in Nepal open for mountaineering expeditions, and 103 are still awaiting a first documented ascent. Nepal offers the mountaineer more opportunities than any other region, and many of these opportunities can be found in the shadows of its Himalayan jewels (NTB, 2020b).

**Sky Diving.** Sky diving is simply known as parachuting from an airplane or free-falling through the air before opening a parachute. The jump can be made from the helicopter or a high enough balloon to carry out the diving. Usually, the typical height for performing sky diving ranges around 12,500 ft. with a free-fall time of 50 to 60 seconds. However, anyone can dive from more altitude to increase the free-fall time using the pressurized and bottle oxygen. Sky diving in Nepal is in a developing stage and launched in 2008 in order to attract more tourists. Since then, more than 300 people have participated in these activities to view the Nepalese Himalayas at 360 degrees, making skydiving a very exceptional experience. There are currently two-places operated over the Khumbu region for sky diving from a helicopter (23,000 ft.) either land at Syangboche Airport (12,340 ft.) or Ama Dablam Base Camp (15,00 ft.) (UpEverest, 2020). These locations make it an area with the highest commercial aerial activities in the world,

and also CNN has ranked the skydive on Everest as the number 8 best adventure event out of 50 events from throughout the Earth in 2014 (Zhang *et al.*, 2014).

**Bungee Jumping.** Bungee jumping is another adventure activity related to falling from a certain height while connected to a large elastic cord erected from the tall buildings, mountain cliff, or a bridge across a deep ravine (Kockelman & Hubbard, 2004). The thrill comes while people jump and feel the up and down free fall from the elastic cord's rebound until all the kinetic energy is dissipated.

Nepal also provides the bungee jump opportunity to its visitors looking for thrilling and adventure activities. There are currently two places, i) Bhote Koshi Gorge and ii) Hemja Pokhara, open for the visitor to experience bungee jumping. Bhote Koshi Gorge is one of the renowned bungee jumping spots located in the Sinduplachowk district and has a height of 160m. According to the CNN travel, this bungee jump location is ranked as the world ninth-best bungee jump spot out of the 15th in terms of height and the incredible view it provides to its visitors lounging toward the scary tropical gorge (Kabange, 2017). It was designed by New Zealand's top expert and is operated under the top bungee jumping experts (NTB, 2020c). Another bungee jumping spot is located on Hemja Pokhara, established after 2014 provides adventure activities in the touristic city of Pokhara, who did not have time to travel to the Bhote Koshi gorge. It is as high as 80m, and there is an artificial pond which is 20 m deep, and people jump from the steel cliff to experience the heart-throbbing water touching experience (Kaushik, 2020).

**Paragliding.** Paragliding is another adventure activity flying by the paragliders, who launch the light-weight free-flying aircraft without physical infrastructure (Whittall, 2002). It is believed that American pilot David Barish first created the paragliding for the NASA Space program to recover the space capsule. However, after the numerous researches from other

scientists during the different periods, it shifted it toward adventure sports, which will fly with the simple glide. Paragliding is mainly composed of a wing (airfoil) and the harness; the suspension lines maintain wings shape, and the pilot sits in the harness, which provides support in both the standing and sitting position. Although this paragliding flies in the air without any engine and artificial energy, they can last their flight for many hours and kilometers.

With a suitable geographical location, paragliding has attracted the visitors since early 1995, in Nepal. Currently, there are five locations opened for the visitors to experience the paraglide, i) Pokhara, ii) ChapaKharka iii) Kot Danda, iv) Godavari, and v) Phulchowki (AcrossHimalaya, 2020). Among them, Pokhara is the famous area for paragliding, where you can experience the commanding view of the world tops Himalayas. It is located at 800m altitude from sea level with a stable and eco-climate. November to February is considered as the best season to have these flights. Chapakarka, Kot Danda, Godavari, and Phulchowki are other paragliding spot located inside the Kathmandu valley above 2100m from sea level. This area is serene with green hill and provides an opportunity to view the Himalayan range located in the eastern part of the country, especially Mount Everest, Mount Langtang, and many others. With the Tandem paragliding from the experienced paraglider, Nepal is known for the best paragliding location in the world with its natural and frequently produce rising thermals (NTB, 2020d)

**Religious and Cultural Tourism.** Nepalese culture has many symbols for Hindu and Buddhist sources. These sites contain many religious stupa, monasteries, and historical monuments. As a subset of cultural tourism, religious tourism in Nepalould include Hindu and Buddhist pilgrimages, cultural events and festivals, spirituals learning and refreshment, including yoga, meditation, and spiritual teachings (Pradhan, 2014). People following Buddhism travel Nepal in high number each year since Nepal is the land where Lord Gautam Buddha was born.

Nepal has many world-famous religious sites such as Pashupati temple, Swyambhunath, Bouddha, Dakshinkali, Asura Cave, Lumbini, Bhaktapur Durbar Square, Kathmandu Durbar Square, Patan Durbar Square, Muktinath, Gosainkunda, Manakamana, Janakpur, Namo-buddha, which are the popular ones. Among these, a few are listed in the world heritage sites by UNESCO as well (Basnet, 2016).

### **Railways Condition in Nepal**

There is only one regular functioning passenger railway in Nepal near the Indian border. This 28-mile-long (45 km) track was built to carry timber from the then heavily forested areas of Janakpur in the Kingdom of Nepal to Jaynagar in British India. Many proposed railways are under construction, but none of them have progressed as visualized. Similarly, many of the proposed railways connect the Terai region districts, and China-Nepal railways are the only proposed railway that connects the Himalayan district into the Hilly and Terai region toward Indian territory (Sharma, 2019).

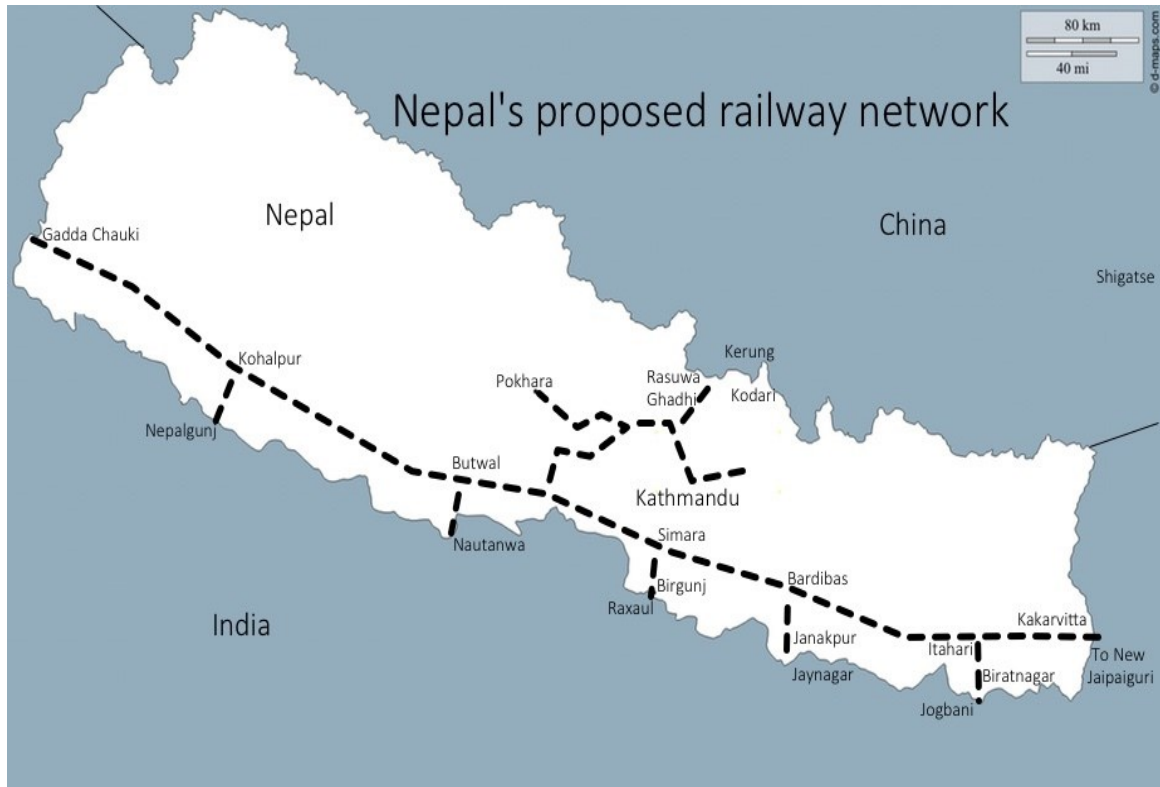
As shown in Appendix J-3 and Appendix J-4, Nepal has proposed a 7-railway network joining the Indian territory and one with China. The future proposal of the railways connecting to the Indian region will help to join a vast extent of the railway network, linking almost every city and town of Nepal in a web of fast and lower cost travel. Such travel can help to boost the tourism markets of both countries. This is particularly important regarding tourism based on religion, as both countries mostly celebrate the same religion and culture. Some of the religious sites like Kedarnath and Badrinath are located in India, and Pashupatinath, Swoyambunath, and Muktinath are located in Nepal; however, the free movement between countries helps further to connect the bonding between the citizens at the ground level, which also triggers to increase the visitors in both countries. Janaki temple, Pashupatinath temple, and Muktinath temple are some

of the prime attractions for Indian visitors based on Nepal's religious value. Moreover, this proposed network also further helps to connect Nepal with visitors who visit India, which could boost Nepal's tourism market.

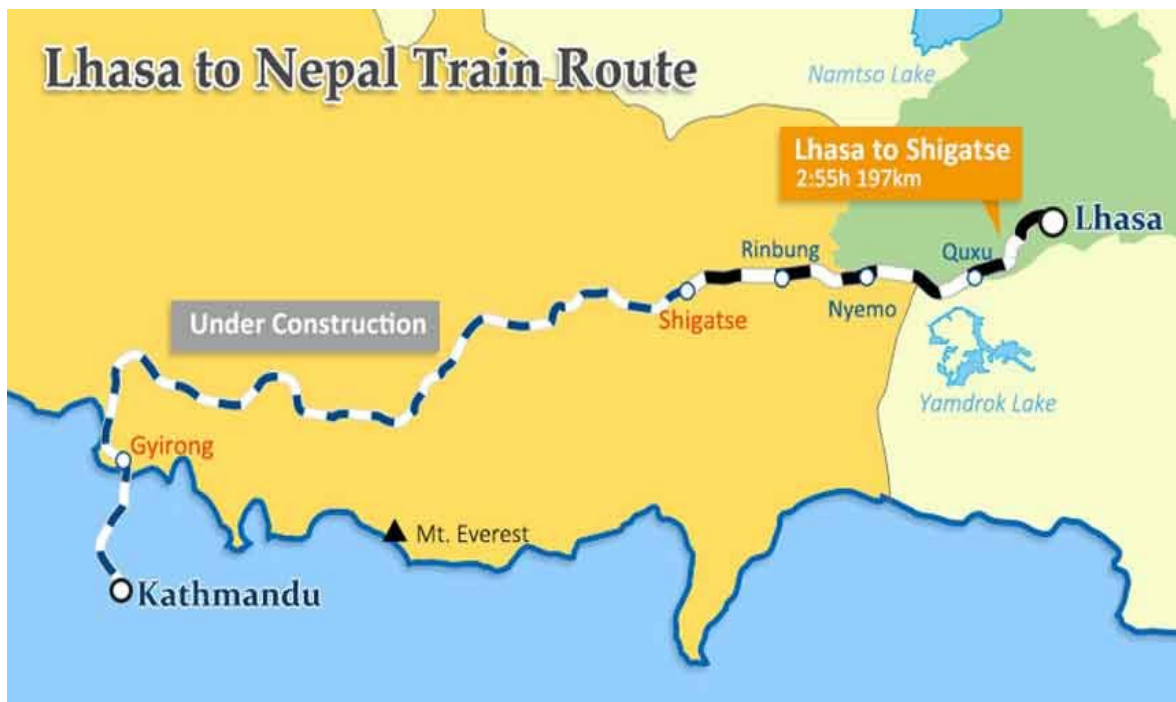
At present, there is no existing train route between Nepal and China; however, there is a route under construction. As shown in Appendix J-4, the first extension started in 2014 from Tibetan Capital Lhasa, reaching Shigatse. It is expected that this route will be constructed to Nepal's border by 2020. Once it crosses the border, this route will help to increase trade, commerce, and tourism for both Nepal and Tibet ( (Tenphel, 2019). Further expanding of the route with Pokhara and Lumbini's towns will help to join the most heavily trafficked destinations with cheaper and faster travel.



**Appendix J-2.** India-Nepal Travel map based on Ground Transportation (Tenphel, 2019).



**Appendix J-3.** Overall Proposed railway Network of Nepal (Bushal, 2017)



**Appendix J-4.** Under Construction Railway from Lhasa, Tibet to Kathmandu, Nepal (Tenphel, 2019).

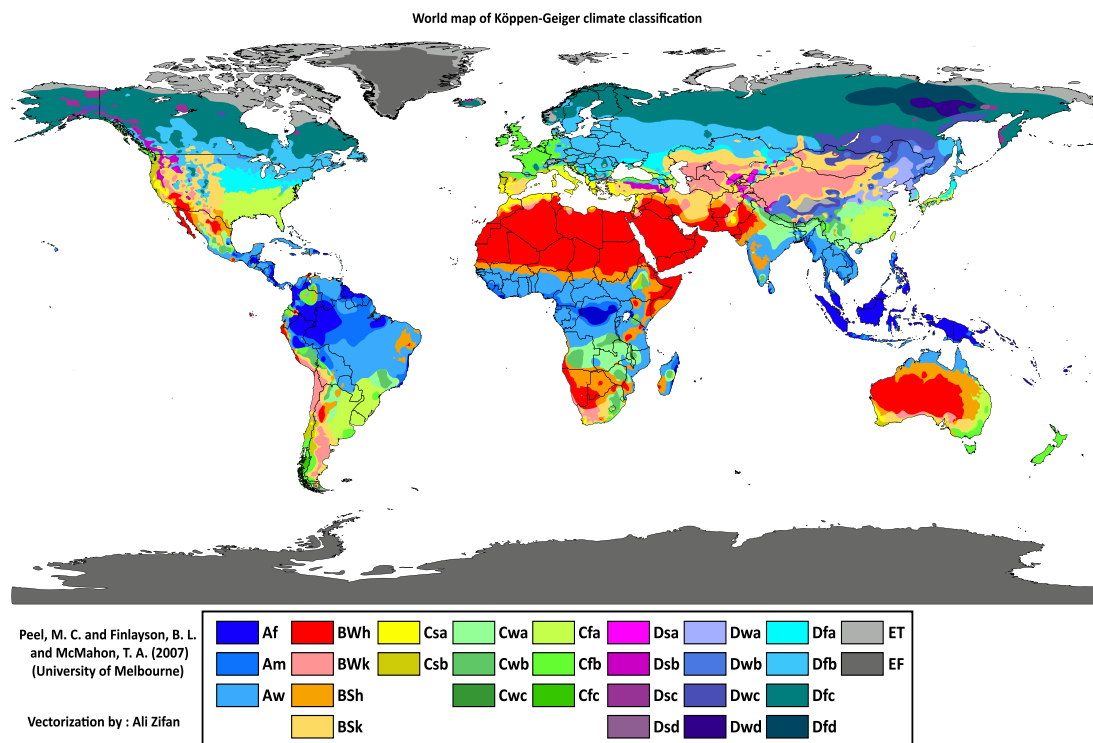
## Defining Climate Change

Climate is the character of weather over long periods. It is measured by assessing the patterns of variation in temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count, and other meteorological variables in a given region over long periods (IPCC, 2007a). Moreover, the climate in a narrow sense is usually defined as the "average weather," or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are most often surface variables such as temperature, precipitation, and wind. The climate in the broader sense is the state, including a statistical description, of the climate system (IPCC, 2007b ).

Climate change is any significant long-term change in the expected patterns of average weather of a region (or the whole Earth) over a significant period. Climate change is about abnormal variations to the climate and the effects of these variations on other parts of the Earth with the driving change in rainfall patterns, extreme weather, and the arrival of seasons, and more. The global warming trend of the temperature, sizeable human influence with the emission of greenhouse gasses, fossil fuel burning, and loss of snow cover, increased water vapor, and snow melting are the some of the global climate change (Olivier et al., 2019).

The Köppen-Geiger's climate classification recognizes the most used climatic classification, which divides climate into five main groups based on seasonal precipitation, temperature patterns, and vegetation groups. The five main groups are A(Tropical), B(Dry), C(Temperate), D(Continental), and E(polar) (Beck, *et al.*, 2018). Each of them is further divided into its subdivision, which, as shown in Appendix J-5.



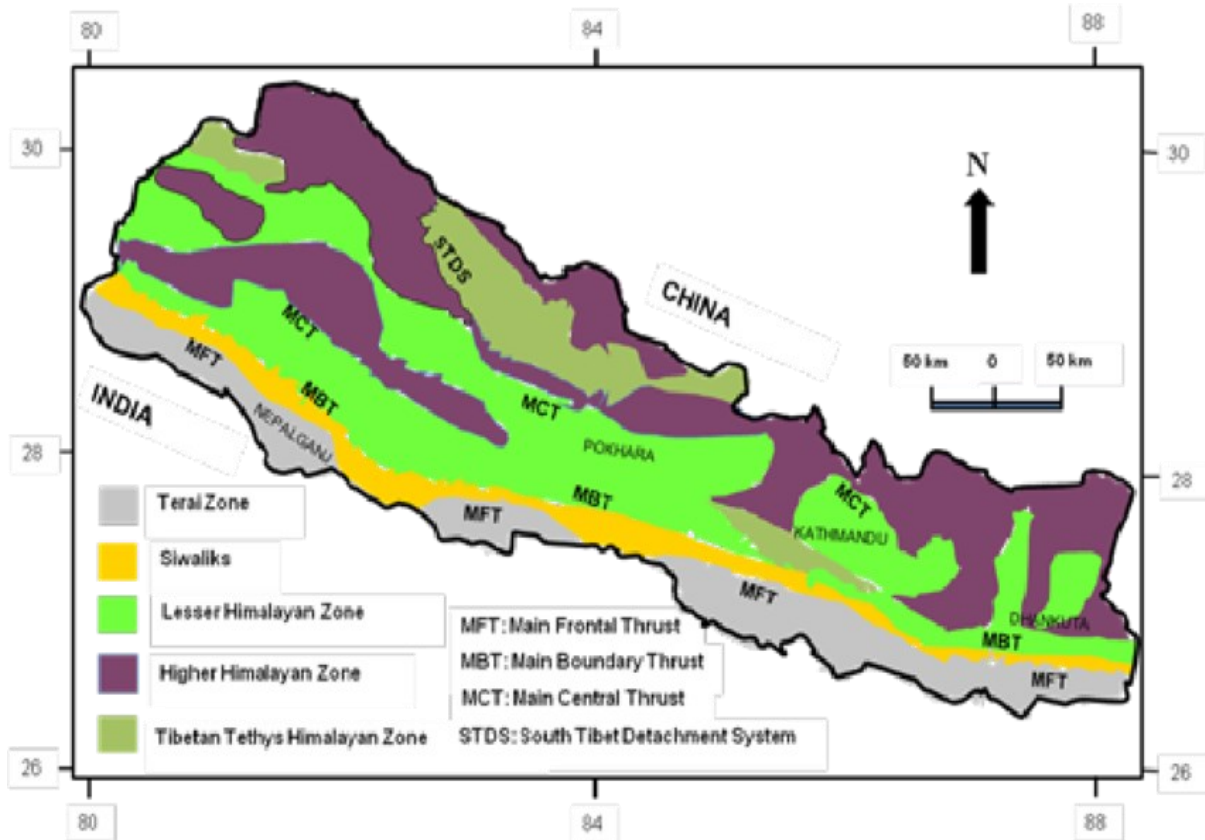


**Appendix J-5.** Köppen -Geiger’s climate classification model of the world (Beck, *et al.*, 2018)

## Geology of Nepal

The geology of Nepal is dominated by the Himalaya, which is known as the highest, youngest, and a very highly active mountain range (Upreti, 2014). The Himalayan range of the Hindu- Kush Himalayan range arc about 1500 mi from Nanga Parbat in Pakistan to Namche Barwa in eastern Tibet; however, 500 mi of this Himalayan extent lies in Nepal. It is believed that these mountain regions are formed due to active continental tectonic collision tectonics (Heim & Gansser, 1939). Gansser (1964) divided the Himalaya rocks into four tectonostratigraphic zones characterized by distinctive stratigraphy and physiography. From south to north, it can be divided into five latitudinal morpho-tectonic zones as shown in Appendix J-6, and these are:

1. The Gangetic Plain (Terai)
2. The Sub Himalayan (Chure or Siwalik)
- 3 Lesser Himalayan (Mahabharat Mountain Range),
4. Greater Himalayan, and
5. Tibetan Himalayan zones (Tethys Himalaya).



**Appendix J-6.** Five latitudinal Morpho- Tectonic Zones division of Nepal (Dhakal, 2015)