

Effect of Adventure Tourism in Nepal's environment and sustainability

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Abstract

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<p>The thesis examines the impact of adventure tourism on Nepal's ecology and sustainability, concluding with suggestions for implementing sustainable practices. It looks for patterns in the areas it affects. To achieve its goal, this study employed qualitative analysis. In order to gather data for this study, open-ended questionnaires and unstructured interviews were employed. The findings emphasize the significance of sustainability and infrastructure in relation to peak tourism activities. Creating public-private collaborations, promoting responsible travel, and reducing environmental impacts are some ways to improve adventure tourism with sustainable practices to lessen environmental concerns.</p>		
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1 Introduction

Adventure tourism is becoming more and more popular in today's world, and tourism is the industry with the fastest rate of growth worldwide. Adventure tourism stands out as the best sector for national growth and provides travelers with unique travel experiences. Adventure tourism is described by the Adventure Travel Trade Association as a travel which includes elements like enjoying with culture, nature, activity in some other country than yours. High levels of sensory stimulation are given to humans through activities utilizing these elements.

Nepal is a country located in the Himalayan foothills. Nepal's tourism sector is globally recognized. The kind of travel that is expanding the quickest worldwide is adventure tourism. Due to Nepal's many opportunities to draw tourists with its varied natural and distinctive geographical features, the country's tourism industry has hiked drastically. One source of national income in Nepal that requires little investment is tourism. Nepal's GDP has increased thanks to the growth of the tourism industry. Furthermore, because Adventure is located in a rural, undeveloped area of Nepal, tourism increases employment opportunities there, raising the standard of living for residents. The Nepalese government has updated its adventure travel goals, and have made different plan and policies in government level to explore this sector in Nepal, since Nepal is heaven for tourism industry due to its geographical structure.

People are producing adrenaline, adventure travel will continue to be popular. Around 100 different types of adventure tourist activities are available worldwide. We can increase the sharing age group and improve the variability at the same time because there is always room for development. Adventure tourism can remain current thanks to technological developments and creative approaches to the topic.

- Only a handful of adventure activities are considered in Nepal, despite the fact that over a dozen of these activities are available for families of all ages and genders. The Ministry of Culture, Tourism, and Civil Aviation (2020) reports that countries tourist arrivals and growth rate reached one million in 2018 and continuing to do so in 2019. The fall in 2015 was caused by the natural disaster and which imposed

heavily impact in Nepal. However, the flow of tourist came back after certain time which shows tourism sector in Nepal is developing.

Adventure tourism is a broad phrase because what constitutes "adventure" depends on how each traveler prefers to define their own experiences. Adventure travelers have their own comfort zones, whether they be geographical, cultural, or physical. The activities skill levels, independence, preferences, mental attitudes, and changes frequently and leads to have different owners. The sector of adventure tourism is promptly less in comparison to others due to this reason since adventure and non-adventure are not clearly distinguished. But the famous tourist activities are highly encouraged like diving, snorkeling, surfers, sailboarders, off-road drivers etc.(Buckley, 2006).

This paper will look at Nepal's adventure tourist industry and the harm it does to the Himalayan ecosystem. An assessment of relevant data demonstrating the expansion of the nation's tourism industry will open the article. The primary focus will be on adventure sports like mountain climbing and trekking in the Nepali Himalayas. The empirical results of earlier research in the literature will then be used to examine the impact of adventure tourism in environment. It will also explore on the area preserving cultural heritages and natural heritages of Nepal, the manuscript will conclude with notes that highlight the advantages of putting educational initiatives and legislative changes into place in popular adventure tourism areas.

1.2 Purpose of the Thesis

The goal of the thesis is to determine how adventure tourism affects Nepal's ecology. Further aims are:

- To focus on various aspects of adventure tourism in environment and sustainability of Nepal
- To analyze what might be the bigger problem in Nepal due to rapid growing of adventure tourism.
- To provide some solutions regarding the issue of environment and sustainability.

1.3 Research Outlines

A research problem is a query that a researcher is attempting to answer or resolve. This study will look into how adventure tourism affects Nepal's sustainability and ecology. It sets the approach, focuses on the study, and guides each stage of the inquiry, analysis, and reporting process. The researcher's investigation will center on the following questions.

The primary inquiry for the study would be:

- What are the current trends and characteristics of adventure tourism in Nepal, and how have they evolved over the past decade?
- What specific environmental challenges are associated with popular adventure activities like trekking, mountain climbing, and rafting in the Himalayas?
- How do local populations view adventure tourism's effects on their surroundings and standard of living?
- What are the potential long-term consequences of unchecked adventure tourism on the natural ecosystems in Nepal?

Sub questions would be:

- What strategies or educational programs have been implemented or could be implemented to promote sustainable adventure tourism practices?
- How effective are current policies in mitigating the adverse environmental effects of adventure tourism, and what improvements can be made?
- What role do international standards and practices play in shaping sustainable adventure tourism in Nepal?

1.4 Limitations

This research has a lot of limitations. It is difficult to poll stakeholders and travel agents because of time restrictions and the remote nature of the study. Consequently, the result was unable to encompass everything we had hoped for. Low response rates and appropriate or authentic responses may make the survey a bit difficult to complete. As a result,

this study solely looks at adventure travel in Nepal and is unable to adequately reflect the country's other varied tourism sectors. We can conclude that these constraints apply to our research since, despite its convenience and lower cost, the remote survey may not be accurate.

1.5 Theoretical Framework

Robert Pettersson's framework on the influence of tourism is used as a guide in this thesis.

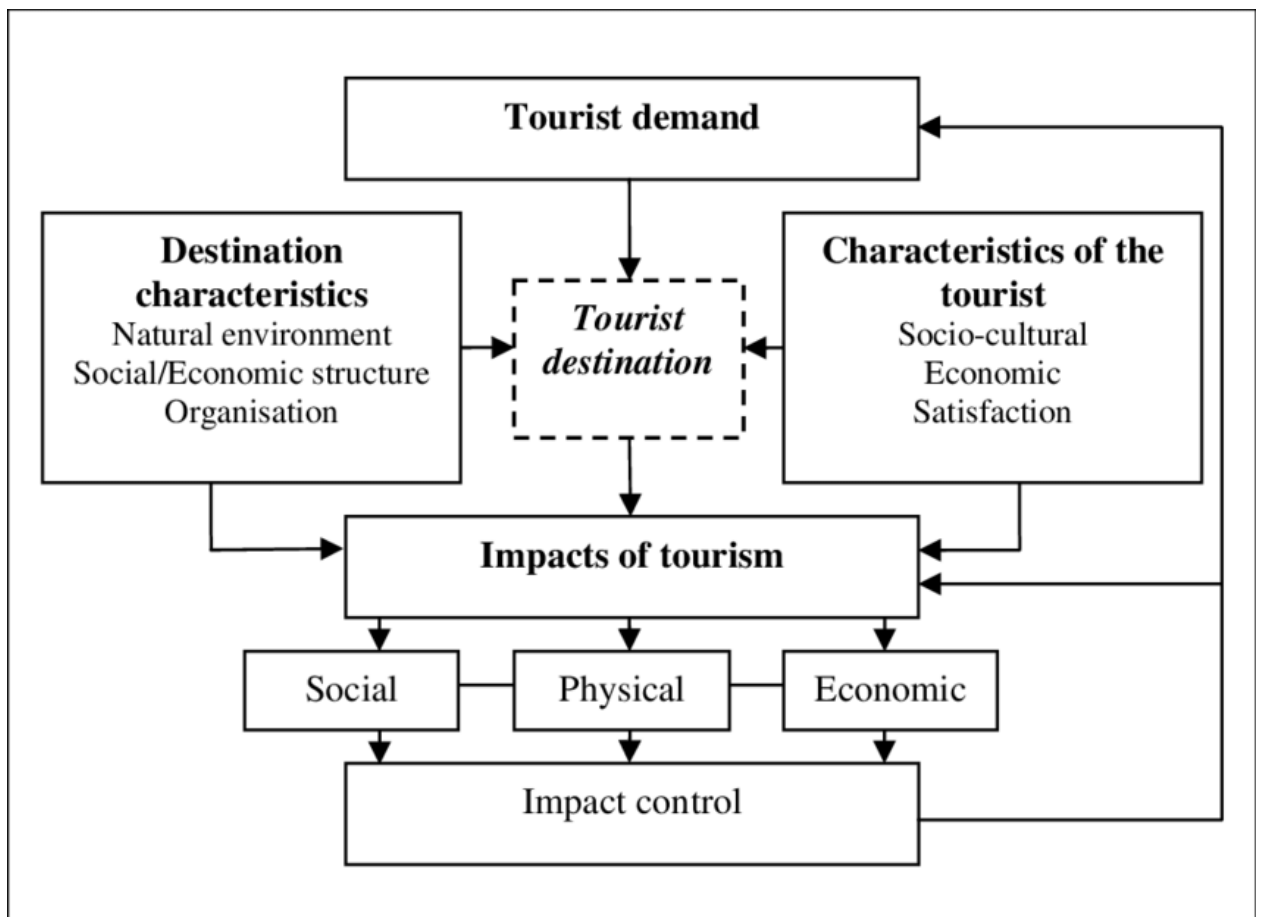


Figure 1: A framework of impact of tourism. (Robert Pettersson)

The theoretical framework illustrates the dynamic relationship between tourist demand, destination characteristics, and the characteristics of tourists, highlighting their collective influence on the impacts of tourism. Tourist demand refers to the interest or desire of visitors to experience specific destinations, shaped by preferences, economic factors, and market trends. This demand interacts with the destination characteristics, which include the natural environment, socio-economic structures, and the level of organization at the

destination. These characteristics determine the destination's ability to attract and cater to tourists while sustaining its resources. Meanwhile, Tourists' sociocultural background, economic standing, and degree of contentment are just a few of the factors that greatly influence how they behave and what they expect, which in turn affects the overall experience and the destination.

The impacts of tourism are categorized into social, physical, and economic dimensions, each requiring effective control to mitigate negative outcomes and enhance sustainability. Social impacts include changes in local culture and community dynamics, while physical impacts relate to environmental degradation or preservation efforts. Economic impacts, on the other hand, include revenue generation and income distribution. For adventure tourism, these impacts are even more pronounced, as the activities often involve high interaction with natural environments and local communities. Effective impact control measures, such as implementing regulations, promoting eco-tourism, and investing in safety infrastructure, are crucial. They ensure that while adventure tourism contributes to economic growth and cultural exchange, it does not compromise environmental sustainability or local well-being. This balance is essential to align tourism development with long-term sustainability goals.

2 Tourism

As defined by United Nations World Tourism Organization, 2008, tourism involves social, cultural or economic area which involves people or business to move outside of their normal location or surroundings. Residents or visitors, tourists or adventurers, could be among them. By this definition, tourism is not just the movement of people for different purposes (whether for business or pleasure), but a broad range of industries, services, and activities that combine to provide a unique travel experience.

International tourism had grown to be one of the most significant economic sectors in the world by the early 21st century, and its effects were being felt everywhere from the Arctic to Antarctica. As a result, the history of tourism is quite significant and fascinating. That history predates the term "tourist," which was first used at the end of the 18th century. Ancient Greece and Rome, which can claim the origins of both "heritage tourism" (which aims to celebrate and appreciate historic sites of recognized cultural importance) and beach resorts, are the places where organized travel with supporting infrastructure, sight-seeing, and an emphasis on essential destinations and experiences can be found in the Western tradition. Greeks and Romans began visiting the Seven Wonders of the World. (Smith and Jones, 1991)

2.1 The Development of Tourism in Nepal

Nepal was starting to rely on tourism as a reliable source of foreign revenue by the middle of the 1960s. The top newspapers and magazines of the day gave extensive journalistic coverage of the ascent of Everest and the other 8,000-meter peaks in Nepal. In their own unique ways, early tourism pioneers such as Toni Hagen, Jimmy Roberts, Jim Edwards, and Boris Lissanevitch helped to "advertise" Nepal. Nepal was starting to draw more and more tourists from all around the world. The "Hippy Trail" was a popular way to enter Nepal that was established in the 1950s and lasted until the late 1970s. It gave visitors lots of time to explore and gain knowledge while spending minimal money. (Purcell, 2019). There is a certain appeal and reputation among hippy tourists who want to travel to Nepal because of the accessibility and availability of hashish and other drugs through Jhochhen Tole (Freak Street) hashish shops that are governed and licensed by the Nepali government (Radeska, 2017). In search of "enlightenment and freedom," thousands of hippies sought to distance themselves from the capitalist societies of the west. Beginning in a Eu-

European center, mainly London or Amsterdam, the overland journey to Nepal often traveled through Germany, Austria, Hungary, Yugoslavia, Greece, and Turkey before arriving in the Middle East. Nepal was the ultimate target, but many

travelers were continuing on to Thailand and Vietnam, sometimes with extended stays in India. Old, ex-military vehicles that offered minimal comfort but affordable, convivial travel were typically used for these trips. Few people at the time gave much thought to the environmental, economic, or sociocultural aspects of growing tourism; the host country could only clearly envision the positive potential financial impact; any potential negative effects were never acknowledged or taken into account.

2.2 Adventure Tourism

In the travel industry, adventure tourism is a novel idea. Although adventure tourism has been embraced by the travel industry, it lacks a precise definition. Although the majority of analysts agree that adventure tourism is a niche segment of the travel business, there are numerous other niche segments of the tourist industry, such as ecotourism, activity tourism, or adventure travel, that share traits with adventure tourism.

Adventure tourism is defined by Sung et al as Adventure tourism is defined as "the culmination of the phenomena and relationships arising from the interactions of adventure touristic activities with the natural environment away from the participant's usual place of residence area and containing elements of risk in which the outcome is influenced by the organization, setting, and participation of the tourist."

According to Muller and Cleaver: The ability to offer visitors comparatively high levels of sensory stimulation is what defines adventure tourism; this is typically accomplished by incorporating physically demanding experiential elements into the visitor's journey.

According to UNWTO: Like any travel, adventure tourism must include an overnight stay but cannot go beyond a year. It can be either domestic or international. (Adventurati Outdoor, n.d.)

Adventure tourism is the migration of individuals from one place outside of their comfort zone to another for exploration or travel to isolated, exotic, and occasionally dangerous

places.((Devi and Vohra). Adventure tourism is the term used to describe travelers who engage in adventure sports such as trekking, climbing, rafting, scuba diving, and similar activities.

The thrill of adventure travel is mostly derived from letting visitors venture outside their comfort zone. This could result from going through cultural shock or from doing things that involved some level of perceived or actual risk. It also involves being physically active while establishing a connection with a new culture or environment. It's not just about taking chances and pushing yourself. In actuality, it is particularly critical to recognize and honor your boundaries when you are in a foreign environment.

Adventure travel is a leisure activity that takes place in an unusual, exotic, remote, or wilderness destination(Weber, 2001). It tends to be associated with high levels of activity by the participant, most of it outdoors. Adventure tourists expect to experience various levels of risk, excitement, and tranquillity and be personally tested. In particular, they are explorers of unspoiled, exotic parts of the planet and also seek personal challenges. The main factor distinguishing adventure tourism from all other forms of tourism is the planning and preparation involved. Adventure tourism is about connecting with a new culture or a new landscape and being physically active at the same time. It is not about being risky or pushing your boundaries. In fact, it is especially important to know and respect your limits while you are in an unfamiliar area.

2.3 Adventure Tourism Activities in Nepal

Adventure trekking, rock climbing, peak climbing, mountaineering, bungee jumping, rafting, canyoning, canyoning, jungle safari, and many other outdoor adventure sports that are more well-liked by adventure seekers may all be found in Nepal. For many years, trekking has been Nepal's distinctive offering, and adventurers from all over the world continue to choose it. Nepal is the perfect destination for hiking and exploration because of its diverse geography, abundant natural resources, and diverse and fascinating culture. Trekking in Nepal's Himalayas offers a once-in-a-lifetime chance to take in the natural beauty and witness aspects of the country's culture.

Equally popular is white water rafting on the rivers that run from the high Himalayas and cross the typical region of Nepal.((Himalayas on Foot, 2023). You can race down raging rapids or coast on clam jade waters with breathtaking views around. Rafting is unques-

tionably the greatest way to experience Nepal because it allows you to see wildlife, hamlets, canyons, and lush forests.

The best way to see the unique animal and bird species that have been protected under Nepal's national parks is to go on a jungle safari in the flat Terai. Exploring flora and animals can be accomplished by traveling across rivers and swamps in the Terai region's beautiful, green forest on an elephant's back. During your safari, you can be surprised by the frequent sightings of one-horned rhinoceroses and the spectacular Royal Bengal Tiger.

In Nepal's varied terrain of hills and mountains, mountain biking is yet another fantastic adventure sport. Exploring the country's breathtaking landscapes, lively culture and customs, and noteworthy heritage sites can be done in an economical and environmentally responsible manner with mountain bike excursions. You can see happy local faces leading simple lives in harmony and peace, practicing their own culture and speaking their own dialect, while peddling on the untrodden paths of the seldom visited rural villages.

2.4 Adventure Tourism growing influence in Nepal

Surrounded by the Himalayas, Nepal is a breathtakingly gorgeous country. The geographical location of Nepal is perfect for examining the vast possibilities of adventure tourism. Nepal has the biggest potential for adventure tourism, which is the type of tourism that is expanding the fastest out of all the others. Adventure tourism in Nepal began about fifty years ago with the first attempts to climb the world's highest mountain, Mount Everest.

Adventure tourism is particularly popular in Nepal because of the range of adventurous activities that the country offers. Numerous factors, such as the current political situation in Nepal, natural disasters, the state of the infrastructure, and global events like the COVID-19 pandemic, affect the chance of adventure tourism in the country (Shivakoti, 2021)

Nepal has a good possibility of experiencing adventure tourism in general because it is a popular destination for adventure travelers. However, the COVID-19 pandemic, earthquakes, and political instability have caused the country to experience several setbacks. (Shivakoti, 2021) Despite these challenges, Nepal has proven resilient and has been able to attract adventure travelers. In recent years, the Nepali government has made expenditures to improve the infrastructure that would support adventure tourism and has sought to promote it. For example, the government has built new roadways, airports, and tourist facilities and taken measures to ensure the safety of tourists.

Nepal's tourism industry has also been impacted by worldwide events such as the COVID-19 pandemic, which temporarily decreased foreign travel. However, once the pandemic is over, adventure travel is likely to make a resurgence in Nepal. Although adventure tourism is quite likely to occur in Nepal, a number of factors could have an impact on the industry. The country's natural beauty and diverse range of adventure activities attract adventure visitors, and government efforts to promote travel and improve infrastructure are likely to make it even more enticing in the future.

Adventure, which is a collection of heart-pounding activities, is what every modern traveler wants. Nepal has a vast array of exhilarating activities for adventure seekers. Rock climbing, peak climbing, mountaineering, bungee jumping, rafting, canyoning, jungle safari, mountain biking, hiking, trekking, paragliding, hot air ballooning, mountain flight, heli skiing, Everest sky diving, zip lining, and honey hunting are some of the most exhilarating activities that can be found in Nepal.

There are many different activities for guests to select from. As the sun rises higher into a brilliant blue sky, they might take in the breathtaking vista of the Himalayas and watch as the mountain peaks change from soft pink to glittering gold. They might also decide to experience the exhilaration of white water rafting. The opportunity to experience Nepal's tropical woods, meadows, and verdant vegetation—home to many migrating bird species, rhinoceroses, leopards, elephants, bears, and endangered Bengal Tigers—through an elephant is another opportunity the country offers.

The adventure tourism industry in Nepal is valued at billions of dollars. Globally, adventure tourism is one of the most grown sector in tourism. This activity attracts high-value customers, encourages ecologically responsible company practices, and strengthens the economy in addition to the tourism sector. The country's economy, tourism industry, indigenous population, and conservation initiatives all gain from it.

There are many possibilities in Nepal, but identifying the right advancement comes with several difficulties. In the competitive adventure travel market, Nepal trails behind. It has become difficult to inform people throughout the world about Nepal's opportunities and activities. Modernity and globalization are causing Nepal to lose its natural environment, which

provides a range of adventure options. Furthermore, Nepal cannot shield its tourists from every potential threat.

Nepal needs to take many more actions to encourage the growth of the sector because it still has a long way to go in this field. Protecting the environment, accurately promoting and describing the place online, covering the adventure potential area in the media, and other measures should all be taken to entice tourists to visit Nepal. Nepal must also provide reliable travel agencies that visitors can trust. Nepal will be able to positively affect travelers and boost adventure tourism if this is achieved. Because of its limitless potential, Nepal has a lot to offer adventurers and tourists from across the world looking for an adrenaline rush through adventure tourism. In addition to well-known tourism destinations, several unexplored regions of Nepal must be discovered in order to achieve meaningful development in this sector. If all present industry participants worked a bit harder and the government created adequate and transparent laws for adventure tourism, Nepal would receive enough exposure to the adventure world.

3 Environmental Impacts of Adventure Tourism in Nepal

In Nepal, sustainable tourism is a calculated strategy that seeks to strike a balance between environmental preservation, cultural preservation, and economic growth.(Nepal, 2022). The idea has become more popular not only in Nepal but also globally as a result of growing awareness of the negative effects that tourism has on the environment, society, and economy. Responsible hiking, eco-friendly lodging, conservation programs, cultural preservation projects, and community-based tourism are a few instances of sustainable tourism in Nepal. The methods of sustainable tourism in Nepal in 2024 will be covered in this essay.

In Nepal, eco-friendly lodging, conservation efforts, cultural preservation projects, community-based tourism, and ethical trekking are a few examples of sustainable tourism. The sustainable tourism initiatives for Nepal in 2024 will be covered in this part. Ecosystems and the environment have suffered as a result of climate change. Glaciers and polar ice caps are melting. Sea levels are rising as a result of the ice's ongoing melting, which will probably have an impact on coastal residents' quality of life.(Rogers and Aitchison)

The oceans are also warming and growing more acidic as a result of the temperature increase. Ecosystems and marine life are greatly impacted as a result. Among the effects are fish population changes and coral bleaching. The survival of many species has been jeopardized by climate change. A continual habitat change was necessary for the species because of the climate. Both marine and terrestrial species may become seriously.

3.1 Environmental Footprint of Adventure Tourism Activities

Numerous environmental problems are caused by tourism. Due to the large number of tourists visiting certain mountain regions, trekkers and mountaineers have left behind rubbish such as food cans and wrappers. These materials increase ecological stress because of disposal problems. Trail degradation brought on by an increase in hiking traffic is another adverse consequence of adventure travel. Rapid population growth and the ensuing resource exploitation worsen the loss of forests and the growth of agricultural lands.

Numerous studies have demonstrated the physical effects of trekking on hiking trails, including tread widening, incision, loss of vegetation cover over several treads, muddiness,

soil erosion on the tread surface, soil compaction, the growth of unofficial trails, and the consequences of various depreciative behaviors like littering and trail switchback cutting (Nepal, 2004). Wildlife disturbance, habitat fragmentation, forest thinning, vegetation trampling and degradation, and the introduction of exotic species are examples of biological impacts. Additionally, waste disposal along the route has the potential to contaminate groundwater and surface water. Both official and unofficial recreational routes affect tree structure and contribute to urban forest deterioration. Therefore, trail network management is crucial, particularly in regions with high conservation value.

Trail impact features can be broadly classified into five types, including structural, wetness-related, lateral, vertical, and others.(McCombes, Vanclay and Evers, 2015). Trail deterioration and visitor usage are strongly correlated. The degradation of less-traveled paths indicates that, in addition to heavy tourist use, other elements that contribute to trail degradation include altitude, gradient, vegetation, soils, landslides, and high relief (Nepal & Nepal, 2004). Mutana and Mukwada (2018) came to the conclusion that when making judgments regarding trail maintenance, one should take into account the site-specific issues, crowded areas, and areas that are critically damaged. This entails effective regulations aimed at managing trails and tourists. Alternatives for creating additional routes or closing congested routes should be investigated, For example, when rules governing tourism control the quantity of tourists and their movement within the protected area.

One of the biggest environmental threats to popular mountain tourist areas is the production and buildup of solid waste. The amount of trash from trekkers and climbers, including plastics, glass bottles, tins, foil, batteries, and tents, was so substantial that Bishop (1988) referred to the Nepalese Himalayas as the "highest junkyard on earth." An average trekking party of five to eighteen individuals produced roughly 15 kg of non- biodegradable, non-flammable garbage over the course of ten hiking days, according to a research by Lama and Sherpa (1994). Other causes that contribute to the direct disposal of human waste into rivers and streams include the use of chemical soaps, washing of dishes and clothing, and water pollution from toilets near streams and drinking water sources (Huddart & Stott, 2020). According to a study, the Sagarmatha National Park does not properly dispose of glass, metal, or plastic (Manfredi et al, 2010). Floods, especially during the rainy season, raise the risk of contaminating water by burning or disposing of waste in open dumps close to water courses.

Inadequate disposal facilities, waste management agencies, and infrastructure to hold garbage generated by adventure visitors in mountainous places contribute to the buildup

of solid waste in these areas. Both locals and tourists mostly ignore the environmental effects of the trash disposal along the paths. Since waste is sometimes concealed in holes near trails or base camps, large quantities of rubbish go undiscovered by the typical tourist. Environmental consciousness, waste management practices, and sociodemographic and travel-related characteristics can vary amongst travelers. It might be more sustainable to implement educational programs that target different tourist groups in order to increase awareness of trash issues. Research has indicated that an organized educational program may influence visitors' behavior to become more ecologically conscious (Orams, 1997). By educating visitors on the repercussions of their trash disposal habits, educational initiatives could be crucial in improving the general garbage problem in vulnerable alpine regions. Cullen (1986) suggested a number of regulations that authorities should follow in order to address the pollution caused by expedition waste. These include establishing a method of disposal for every site, monitoring garbage disposal in accordance with predetermined disposal times, adding a refundable ecological protection fee to rising payments, and giving headquarters employees permission to enforce rules.

A) Glacier Hazard in Himalayas of Nepal

In the Nepal Himalaya, there have been more than 60 avalanches since 1922, killing 372 people. In almost every high-altitude region of Nepal, avalanches are frequent. According to avalanche records going back to 1922, the Khumbu region has the highest amount of avalanche occurrences and fatalities when compared to other parts of Nepal. The recent increase in records and casualties in other regions of the country may be due to both the recording system and an increase in human (tourist) activities.

Avalanches can be brought on by precipitation, snow drifting in the wind, abrupt temperature changes, or human activity. Avalanches caused due to various reasons, like accumulation of snow on down, the bonding of snow molecules, soil erosion, earthquakes, buildings, and volcanos, among others. According to Schweizer (2003), an avalanche could be caused by three factors: (i) artificial triggering; (ii) gradual uniform loading; or (iii) place where there is no loading but which alters the characteristics of the snowpack, such as surface warming (also known as natural triggering or spontaneous release).

Avalanches are caused by intricate relationships between weather, snowpack, and geography. Slopes with an inclination higher than 30° and the unique characteristics of the terrain are the only constants that affect snow avalanches. (Corona & Stoffel, 2016). Rough-

ness in terrain roughness cause also avalanche . (Schweizer, 2003). The daily of the snowpack is also influenced by the slopes' orientation. Snow avalanching is mostly caused by factors related to the snow's strength, load, and variations over time. The four main factors that trigger the release of snow avalanches are: precipitation (snowfall), wind, temperature, and snowpack stratigraphy (Corona & Stoffel, 2016; Schweizer, 2003). Both climate change and changes in air quality should have an effect on snow and ice avalanches since they are climate-controlled phenomena.

A rock avalanche is a type of large, rapid landslide (Deline et al., 2015). Many factors influence the occurrence of rock avalanch, such as (i) natural factors (such as slope form), (ii) preemptive factors (such as climate change), (iii) precipitation events (such as earthquakes and rainstorms) (Weidinger et al., 2002), and (iv) elements that may impact mobility (Pacione, 1999). Because thawing is dependent on temperature fluctuations, it can also result in a rock avalanche, becomes ready for rock failure. Climate change and extreme weather events may also play a significant role. Earthquakes often result in avalanches, rock collapses(Fujita et al., 2016; Park & Reisinger, 2010). Observations show that earthquakes (Podolskiy et al., 2010; PérezGuillén, et al., 2014; cited in Hao et al., 2018), heavy snowfall (Conway & Wilbour, 1999; Hirashima et al., 2008), and sudden increases in temperature or precipitation (Baggi & Schweizer, 2009; Gauthier et al., 2017) are the main causes of natural avalanches. Avalanches from the 2015 earthquake leveled settlements and uprooted populations in less than a minute in the EBC and the Langtang Valley (Kunwar & Limbu, 2015).

B) Environmental impacts of River Rafting

Your fingertips go cold as the whirling water gnashes on the raft's bottom as you protect the paddle. Erosion is exciting, but underneath the exhilaration lies a concealed concern. The riverbed is being eroded by each paddle stroke and raft pass. Over time, these small disturbances could result in irreversible harm, altering the river's ecosystem and compromising its delicate balance.

Think about creating a broader, shallower channel out of a small stream. The uncontrolled rafting traffic may be the cause of this. Rafts scrape the riverbed, sending sediment downstream. This could lead to increased erosion, particularly in places where bedrock can seep through, leaving behind barren patches where aquatic life used to flourish. In severe

situations, the shifting gravel and sands can displace entire habitats, causing them to disappear.

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C) Trekking

Think about creating a broader, shallower channel out of a small stream. The uncontrolled rafting traffic may be the cause of this. Rafts scrape the riverbed, sending sediment downstream. This could lead to increased erosion, particularly in places where bedrock can seep through, leaving behind barren patches where aquatic life used to flourish. In extreme cases, entire habitats may be displaced and eventually vanished by the shifting sands and gravels.

Another source of pressure is the consumption of wild plants by certain residents. On the longer hikes, they should not be grown and consumed, even though they can be done closer to the settlements. The Himalayas are home to a wide variety of medicinal flowers and plants. Locals pick them, and sometimes hikers do as well. The higher-altitude

junipers and Brahma kamal are the most common examples of this. (Ghosh, 2017). The burden on the natural resource is not lessened by the inclusion of a caravan of mules in the group.

Trekking causes trampling, expands the trail, and produces several trails, all of which exacerbate soil erosion. (Xuemei et al., 2024). When trekking, it is advised to stay on the single track and refrain from taking detours. Trampling destroys the plantation and reduces regeneration. By damaging the stems and stopping growth, it forms a new track. But trampling also deteriorates the soil's quality and water permeability. It's better to stick to one trail.

Perhaps the most talked-about topic in the mountains. The non-biodegradable trash that trekkers and the personnel who accompany them leave behind is without a doubt the biggest environmental problem. Trekkers usually travel far and high in the highlands, where

there is no municipality to dispose of garbage. Plastic is a major contributor, in addition to tin cans and glasses.

Because they are timid, wild animals prefer to be left alone. They are disturbed when humans encroach on their domain. It affects their mating cycle and psychological well-being, for which they may have to deal with repercussions. They may become less afraid of people, which could make them more approachable and provide a stage for conflict. Conflict may also arise from the opposite. History demonstrates the impact of conflicts between humans and animals, but keep in mind that we are all related.

3.1.1 Short-Term vs. Term Environmental Effects

Adventure tourism, which attracts thousands of visitors annually to Nepal's stunning mountains, pristine rivers, dense forests, and culturally diverse villages, is a main sole for economic of country. Unmatched adventures such as paragliding, rafting, trekking, mountaineering, and jungle safaris are available to adventurers. However, the growing number of tourists has both immediate and long-term effects on Nepal's ecosystem. Addressing these impacts is essential to protecting the country's natural heritage and ensuring sustainable tourism practices.

Short-Term Effects on the Environment

1. Waste Generation and Improper Disposal

One direct environmental problem linked to adventure tourism is waste creation. Non-biodegradable things like as plastic wrappers, bottles, and camping gear are often left behind by trekkers, climbers, and other tourists, especially in popular trekking destinations like the Annapurna and Everest regions. Littering is a result of poor waste management, which contaminates ecosystems and destroys aesthetic appeal.

2. Air and Noise Pollution

In environmentally sensitive places, activities like off-road vehicle tours and helicopter rides for mountain viewing contribute to noise and air pollution. Air quality is

deteriorated and wildlife is disturbed by the noise and pollution from helicopters. For example, the pristine mountain environment is under more stress due to the large increase in flights to and from Lukla, the gateway to Everest.

3. Deforestation for Infrastructure Development

Adventure tourism often requires the construction of bridges, hotels, and trekking trails. This type of infrastructure often requires the clearing of forests. This not only decreases the amount of forest cover but also disrupts regional ecosystems. For example, the growing demand for homestays and lodges along trekking routes often leads to deforestation for building materials.

4. Soil Erosion and Trail Degradation

High foot traffic, particularly during peak seasons, causes soil compaction, erosion, and path degradation on trekking trails. Soil shifting and vegetation removal are common signs of wear on well-traveled pathways, such those in the Annapurna Circuit.

5. Disturbance to Wildlife

While visiting national parks in Nepal, it has rapidly destroyed the habitat of local animals. Animals may flee their natural habitats due to the noise and human activity, which could change their eating and behavior patterns. Activities like rafting on rivers that traverse wildlife zones further disturb aquatic ecosystems.

Long-Term Effects on the Environment

1. Climate Change Impacts

Adventure travel indirectly contributes to climate change through greenhouse gas emissions. Carbon-intensive activities like air travel and lodge electricity use have a lasting impact on Nepal's fragile ecosystem. The alarming rate at which the Himalayan glaciers are melting is a result of increased emissions, putting biodiversity and water resources at risk.

2. Loss of Biodiversity

Uncontrolled adventure tourism may eventually lead to habitat destruction and a decline in biodiversity. Forest destruction, water pollution, and disturbances brought on by humans all reduce the numbers of sensitive species. For instance, safari tourism strains places like Chitwan National Park, putting animals like the Bengal tiger and one-horned rhinoceros at risk.

3. Pressure on Water Resources

Adventure tourism puts a significant pressure on the region's water supplies. As new lodges and hotels are built, water from adjacent streams and aquifers is taken away from communities and wildlife. Prolonged over-extraction can cause springs to dry up, particularly in arid mountain regions.

4. Cultural and Environmental Degradation

Adventure tourism sometimes jeopardizes environmental integrity, despite having beneficial impacts on the local economy. Monasteries and stupas, two cultural landmarks along trekking routes, are subject to deterioration and vandalism over time. Similarly, populated places exceed sensitive settings' carrying capacity, causing irreparable environmental damage.

5. Increased Vulnerability to Natural Disasters

Together, deforestation, soil erosion, and glacier melting make Nepal more vulnerable to landslides, floods, and avalanches. For example, the Khumbu region, which is home to Mount Everest, is seeing an increase in landslides.

6. Deforestation and Land Degradation

The pedosphere provides key biological, physical, and chemical properties that are relevant to various ecological domains. For instance, the soil's thickness, structure, and texture define hydrologic characteristics that affect plant and animal populations. The soil is home to organisms that are essential to pedogenesis and biodiversity, as well as additional resources like nutrients and oxygen for the growth and development of vegetation. Land

use, soil conditions, and climate all affect how much and in which direction human activity alters the quality of the soil in mountain ecosystems. Because of the ecosystem's complexity, human pressure on mountain ecosystems has resulted in changes to land use for commercial purposes, which have unknown ecological repercussions. Ecologically sustainable land use requires the maintenance of essential soil functions such as energy partitioning, water portioning, nutrient storage and release, buffering of pollutants like acid rain, and biogeochemical cycling.

Usually done in the summer, these duties are sometimes carried out by the same operators that manage the winter maintenance and operation of ski runs (e.g., snow grooming). Their objective is to level the surface of the ski run so that less snow is required for safe and fun skiing. Additionally, less artificial snow is required when surface smoothing is employed. Additional for the management of snow supports this approach include the installation or maintenance of tree hedges for delay of snow accumulation and early in snow melt. Variations in snow density which is result of use of artificial snow have a substantial effect on the soil characteristics. Therefore, the dominating site characteristics in terms of geology, geomorphology, climate, and vegetation dictate the type and extent of soil disturbance at each site.

The expansion of adventure tourism is accompanied by serious environmental problems, particularly in light of the altered land use caused by the construction of trails and associated infrastructure. To ensure sustainability, a careful study is necessary because these changes may have a substantial influence on the environment and surrounding communities.

Land use change is the term used to describe changes in the natural landscape caused by human activity. These consequences of trail construction and related infrastructure for adventure tourism include biodiversity shifts, soil erosion, deforestation, and altered watercourses. Building trails, cabins, campgrounds, and access roads are examples of infrastructural development that frequently sacrifices natural ecosystems. Even while these developments boost tourism, they have a permanent impact on the ecosystem.

3.1.2 Trail Construction and Its Environmental Impact

Deforestation and Habitat Loss

One of the most evident consequences of route growth is deforestation. In Nepal, trails usually meander through dense forests which are places to live for flora and fauna. When vegetation is removed to create paths, it disturbs these habitats, displacing species and reducing biodiversity. In popular trekking sites like the Annapurna Circuit or the Everest Base Camp excursion, for example, the expansion of route building has led to habitat fragmentation, making it difficult for animals to thrive.

Soil Erosion

Erosion is more likely to happen because trail development changes the structure of the soil. Erosion increases as the number of hikers increases because frequent foot activity aggravates trail deterioration. This can lead to landslides that put both locals and tourists in danger, which is particularly dangerous in hilly regions like Nepal. Paths with inadequate drainage systems and poor construction raise these risks.

Watercourse Alteration

Trail development frequently necessitates rerouting watercourses or building over streams, which disrupts the natural flow of the water. Access to water for locals may be affected, and aquatic environments may suffer. Additionally, pollutants from tourism or construction may contaminate water supplies, putting people and wildlife at risk.

Infrastructure Development and Its Consequences

Accommodation Facilities

To cater to growing tourist demand, lodges, tea houses, and hotels are constructed along trekking routes. While these facilities provide comfort to tourists, they often encroach on agricultural land or natural habitats. The construction process involves clearing land, extracting resources like timber and stone, and generating waste which leads to degradation of environment.

Energy and Waste Management

The demand for energy to power tourist accommodations often leads to overexploitation of local resources, such as firewood. This not only depletes forests but also contributes to air pollution. Waste management is another significant challenge. Trails and camping sites are often littered with plastic waste and non-biodegradable materials, harming the environment and detracting from the natural beauty of the area.

Social and Cultural Impacts of Land Use Changes

Land use changes due to tourism infrastructure also have socio-cultural implications. In Nepal, many trekking routes pass through indigenous communities with unique cultures and traditions. The influx of tourists and the accompanying infrastructure development often disrupt traditional land-use patterns, such as farming or grazing.

For instance, in areas like Langtang and Manaslu, agricultural lands are increasingly being converted into tourist facilities, reducing food security for local communities. Moreover, the commercialization of trekking routes can lead to cultural dilution, as communities adapt their lifestyles to meet the demands of tourists rather than preserving their heritage.

Sustainable Practices for Minimizing Land Use Change

To balance the benefits of adventure tourism with environmental conservation, it is crucial to adopt sustainable practices. Here are some recommendations:

Environmentally Sensitive Trail Design

Trails should be designed to minimize environmental disruption. This involves conducting environmental impact assessments before construction, choosing routes that avoid sensitive habitats, and incorporating drainage systems to prevent soil erosion.

Eco-friendly Infrastructure

Tourism infrastructure should prioritize sustainability. For example, lodges and campsites can use solar power, rainwater harvesting, and biodegradable materials to reduce their ecological footprint. Building regulations should enforce limits on the size and location of structures to protect natural and agricultural land.

Waste Management Systems

Proper waste management is critical for minimizing environmental damage. Trekking routes should have designated waste disposal points, and tourists should be educated on carrying out their waste. Community-based waste recycling initiatives can also help manage the garbage generated by tourism.

Involving local communities in tourism planning and development ensures that their needs and concerns are addressed. Communities should be empowered to manage tourism activities, allowing them to benefit economically while preserving their traditional lifestyles and lands.

Policy and Regulation

Governments and tourism authorities must enforce strict regulations on land use and infrastructure development. Policies should include zoning laws, limits on tourist numbers in sensitive areas, and penalties for non-compliance. For instance, the establishment of conservation areas, such as the ACA, has been a positive step in Nepal.

Case Study: Nepal's Approach to Adventure Tourism

The experience of adventure tourism in Nepal provides important information about changes in land usage. Significant changes in land use have occurred in the nation's main trekking areas. For example, the building of numerous trails in the Annapurna and Everest regions has resulted in habitat loss, erosion, and deforestation. However, by emphasizing lesser-traveled routes and incorporating local populations in trail management, programs like the Great Himalaya Trails Project seek to encourage sustainable trekking.

Another illustration is the Sagarmatha National Park, where changes in land use brought on by tourism are closely watched. The park establishes rules for environmentally responsible tourism operations and uses a permit system to control the number of hikers. These actions show how to control tourism to reduce its negative effects on land usage. Adventure tourism will inevitably result in changes to land use as a result of infrastructure and route construction. Another illustration is the Sagarmatha National Park, where changes in land use brought on by tourism are closely watched. The park establishes rules for environmentally responsible tourism operations and uses a permit system to control the number of hikers. These actions show how to control tourism to reduce its negative effects on land usage. Adventure tourism will inevitably result in changes to land use as a result of infrastructure and route construction.

3.1.3 Impact on Forest Ecosystem and Biodiversity

Among the environmental elements most impacted by the growth of adventure tourism infrastructure and route construction are forest ecosystems and biodiversity. The quick speed of human activity upsets the delicate balance of plants and animals, which puts forest ecosystems at serious risk. With an emphasis on important concerns including deforestation, habitat fragmentation, species endangerment, and ecosystem degradation, this part examines the complex effects of adventure tourism on forests and biodiversity. Deforestation and the resulting loss of vegetation are caused by the cutting of forests for

the construction of trails, access roads, and tourism infrastructure. Popular trekking areas in Nepal, such as the Langtang Valley and Annapurna Circuit, have undergone extensive deforestation to make room for an increasing number of visitors.

Direct Impacts

Trail clearing:

The vegetation that serves as the foundation for the forest ecosystem is directly removed when trees and shrubs are cut down to create hiking trails.

Construction Materials:

Forest resources are further depleted by the need for timber to construct tea houses, lodges, and bridges.

Fuelwood Harvesting:

Deforestation is accelerated in distant tourist lodges that rely on firewood for cooking and heating, particularly in places with few other energy sources.

Indirect Impacts

Edge Effects: When forests are cleared for development, margins are formed where the interior of the forest is not as affected by factors like light, wind, and temperature. Many species find these edges less favorable, which lowers biodiversity.

Degradation of the Soil: When vegetation is removed, the soil becomes unstable, which increases its susceptibility to erosion and decreases its capacity to sustain vegetation.

When trails, roads, or other infrastructure are built, continuous forest areas become smaller, isolated portions, a phenomenon known as habitat fragmentation. The consequences for biodiversity are dire:

1. **Disruption of Wildlife Movement:** Many species require large, contiguous habitats to move freely, find mates, and access food. Fragmentation restricts these movements, leading to reduced genetic diversity and increased inbreeding.

2. **Loss of Keystone Species:** Species critical to the functioning of ecosystems, such as large carnivores or pollinators, often require extensive habitats. Their displacement or decline disrupts ecological balance.
3. **Threats to Endangered and Sensitive Species:** The risks to animals that are already endangered or vulnerable to environmental changes are increased by adventure tourism. The varied fauna of Nepal, which includes Himalayan monals, snow leopards, and red pandas, is increasingly under stress due to habitat changes brought on by tourism.
4. **Disturbance to Breeding and Nesting Sites:** The construction of trails often encroaches on critical breeding grounds, forcing species to relocate or abandon these areas.
5. **Increased Human-Wildlife Conflict:** As wildlife habitats shrink, animals are more likely to enter human-inhabited areas in search of food, leading to conflicts that often result in harm to both humans and animals.
6. **Poaching and Illegal Trade:** Increased human activity in remote areas facilitates poaching and the illegal wildlife trade, further endangering species.
7. **Biodiversity Loss:** Biodiversity refers to the variety of life forms within an ecosystem, and its loss is one of the most pressing concerns linked to tourism-related land use changes. The impacts of biodiversity loss are both ecological and economic, affecting the sustainability of ecosystems.
8. **Reduction in Species Richness:** The loss of habitats directly affects the extinction of rare species, reducing the overall species richness of the area.
9. **Invasive Species:** Increased human movement can introduce invasive plant or animal species, which compete with native species and disrupt ecological balance.
10. **Loss of Ecosystem Services:** Pollination, climate regulation are supported by biodiversity and wildlife area. These services are jeopardized by its disappearance, which has profound effects for both humans and the environment.

Degradation of Forest Ecosystem Functions

The degradation of forest ecosystems due to adventure tourism affects their ability to perform critical ecological functions:

1. **Carbon Reduction:** Forest absorbs CO₂ and balance climate change. Deforestation and degradation reduce their carbon sequestration capacity, contributing to global warming.
2. **Regulation of Water Resources:** Forest and regulation of water resources is related as it play important role by absorbing rainfall and replenishing groundwater. Their destruction disrupts this cycle, increasing the risk of droughts and floods.
3. **Soil Fertility:** Forests maintain soil fertility by providing organic matter through leaf litter and preventing erosion. Land cleared for trails or infrastructure loses this protective cover, leading to nutrient depletion.

3.1.4 Case Studies in Nepal

Sagarmatha National Park (Everest Region)

Due to tourism, the Everest region—a UNESCO World Heritage site—has seen a major decline in biodiversity. The park's delicate alpine habitat has been disturbed and animals like the Himalayan tahr have been relocated as a result of the high volume of trekkers and infrastructural development. Although efforts like waste management and reforestation have been implemented to lessen these impacts, problems still exist.

Annapurna Conservation Area

The ACA area of Nepal is the top priorities and popular trekking area, and this area is continuously losing biodiversity, experiencing habitat fragmentation, and experiencing deforestation. Nonetheless, conservation initiatives like ACAP have aided in striking a balance between environmental preservation and tourism expansion. By encouraging sustainable tourist practices that lessen ecological consequences, ACAP engages local people in conservation initiatives.

Sustainable Strategies to Protect Forest Ecosystems and Biodiversity

Protecting forest ecosystems and biodiversity in adventure tourism areas requires a multi-faceted approach:

Eco-friendly Trail Construction

Trails should be designed with minimal disruption to forests and biodiversity. This includes using existing natural paths where possible and avoiding sensitive habitats.

Community-Based Conservation

Local communities should be actively involved in conserving forests and biodiversity. Programs like ACAP demonstrate how empowering communities can lead to better environmental outcomes

Regulation and Monitoring

Governments and conservation authorities must enforce strict regulations on trail construction, infrastructure development, and tourist behavior. Regular monitoring can help identify and mitigate environmental damage.

Education and Awareness

Educating tourists about the importance of forests and biodiversity can encourage responsible behavior. For instance, trekkers can be guided to minimize their impact by staying on designated trails and avoiding littering.

Alternative Energy Sources

Promoting the use of solar energy, biogas, and other renewable sources in trekking lodges can reduce reliance on firewood, helping to conserve forests.

Adventure tourism poses a serious danger to forest ecosystems and biodiversity, two priceless natural resources. Beyond just harming the environment, deforestation, habitat fragmentation, and biodiversity loss also have an influence on local residents' livelihoods and the long-term viability of tourism. The experience of Nepal demonstrates the difficulties and possibilities in resolving these problems. It is feasible to lessen the effects on forest ecosystems and biodiversity while guaranteeing that adventure tourism continues to flourish responsibly by implementing sustainable practices, encouraging community-based conservation, and enforcing strict laws.

3.1.5 Soil Erosion and Degradation in High – Traffic Areas

In regions with high tourist foot traffic, particularly in adventure tourism destinations like Nepal, soil erosion and degradation pose serious environmental issues. The native soil structure is disturbed by the building of hiking routes, camping areas, and associated infrastructure, increasing the soil's susceptibility to erosion. These effects eventually jeopardize the land's capacity to sustain flora, retain water, and maintain the health of the ecosystem as a whole.

Mechanism of Soil Erosion and Degradation

Direct Causes of Soil Erosion

1. **Trail Construction:** Trail construction frequently entails removing plants and uprooting the soil, leaving it vulnerable to erosion by wind and water. The consequences are especially noticeable in high-altitude regions where the soil is typically thinner and less solid.
2. **Heavy Foot Traffic:** The soil's capacity to absorb water is diminished by the frequent movement of hikers and pack animals. Compacted soil is more prone to erosion and loses stability.
3. **Improper Drainage:** Adequate drainage systems are absent from many walking trails. Erosion is accelerated by rainwater flowing along the paths, which forms gullies and rills.

- ### Indirect Causes of Soil Degradation
4. **Deforestation:** The natural defense against soil erosion is eliminated when vegetation is lost as a result of path widening or the building of tourist amenities. Particularly important on steep terrain are tree roots, which hold soil particles together.
 5. **Overgrazing:** Pack animals frequently overgraze as a result of increased tourism, which reduces ground cover and worsens soil erosion.
 6. **Climate Vulnerability:** Because of increasingly frequent and strong rainstorms that worsen erosion in degraded areas, high-altitude regions are especially vulnerable to climate change.

Impacts of Soil Erosion in High-Traffic Areas

1. **Loss of Soil Fertility:** The first layer to erode is topsoil, which is high in nutrients and organic materials. Its disappearance lowers the fertility of the land, which hinders the growth of new plants. Loss of soil fertility affects local populations' agricultural output and reforestation efforts in areas like the Annapurna Conservation Area.
2. **Increased Risk of Landslides:** Particularly in hilly areas like the Himalayas, erosion destabilizes slopes, raising the possibility of landslides. By obstructing paths and destroying infrastructure, landslides not only endanger hikers and nearby communities but also cause disruptions to the tourism sector.

3. **Hydrological Impacts:** Sedimentation results from eroded soil being frequently pushed into neighboring rivers and streams. Water bodies' ability to control floods is diminished, aquatic ecosystems are changed, and water quality is impacted.
4. **Degraded Ecosystem Services:** Important ecosystem functions including carbon storage, water filtration, and vegetation growth are all impacted by soil deterioration. Both the viability of adventure tourism and the local people will be impacted in the long run by this degradation

Case Study: Soil Erosion in Nepal's Trekking Areas

With thousands of hikers each year, the Everest Base Camp trip is one of the most well-traveled treks in Nepal. Significant trail erosion has been caused by the high foot use, especially in the steeper areas. Deep gullies have been formed by poorly maintained paths and heavy monsoon rainfall, severely degrading the surrounding area.

Annapurna Conservation Area

Soil erosion has been a recurring problem in the Annapurna, particularly on trails that go through steep and wooded areas. Although some effects have been lessened by the Annapurna Conservation Area Project's efforts to install trail drainage systems and reestablish vegetation, difficulties still exist because of the steadily increasing number of visitors.

Strategies to Mitigate Soil Erosion and Degradation

Sustainable Trail Design

Use of Switchbacks: Trails on steep slopes should incorporate switchbacks to reduce water runoff velocity and minimize erosion.

Drainage Systems: Proper drainage channels and culverts can divert rainwater away from trails, preventing gully formation.

Trail Hardening: In high-traffic areas, using materials like gravel or wooden steps can reduce soil exposure and compaction.

Reforestation and Vegetation Cover: Soil stabilization and erosion reduction are achieved by replanting native vegetation along paths and damaged regions. While vegetation provide a protective layer that reduces water flow, tree roots bind the soil.

Controlled Tourism: Pressure on the land can be lessened by putting laws in place to restrict the number of hikers in sensitive regions. Sagarmatha National Park uses permit procedures to control visitor numbers and reduce environmental effects.

Community Engagement: Soil conservation initiatives should involve local populations. Building and maintaining drainage systems, replacing vegetation, and teaching visitors about ethical hiking techniques are a few examples of community-based projects.

Monitoring and Maintenance: Erosion hotspots can be found by routinely monitoring pathways and busy areas. Repairing damaged pathways and strengthening drainage systems are examples of timely maintenance that keeps minor problems from getting worse.

Benefits of Mitigation Efforts: Preservation of Natural Landscapes: Effective soil erosion control maintains the scenic beauty of trekking routes, which is a primary attraction for adventure tourists.

Enhanced Safety: Stabilized trails and reduced landslide risks improve the safety of trekking routes for both tourists and locals.

Sustainability of Tourism: By protecting soil and preventing environmental degradation, these measures ensure the long-term viability of adventure tourism in Nepal.

Improved Livelihoods: Reduced soil erosion benefits local agriculture, supports reforestation efforts, and enhances water resources, contributing to the well-being of local communities.

One of the biggest problems in adventure travel locations like Nepal is soil erosion and deterioration in high-traffic regions. The effects go beyond environmental deterioration; they also have an influence on ecosystems, local populations, and the long-term viability of the tourism sector. However, these consequences can be lessened with community cooperation, efficient erosion control techniques, and sustainable route design.

Prioritizing soil conservation as a key element of sustainable tourism practices is essential while adventure tourism keeps expanding. By doing this, places like Nepal can preserve their delicate alpine ecosystems while yet providing travelers from all over the world with life-changing experiences.

3.1.5 Water Resources and Pollution

Modeling connection between water, tourism, and ecosystems is necessary for development of ecosystem and society. The expansion and fragmentation of the areas show an uneven expansion of urban cities, which is reflected in strong economic growth.

Depleted areas and development limits can be better understood with the evaluation of ecosystem and water conservation areas. It is related to sustainable development since a sustainable economy expands without depleting natural resources. But when the population grows faster than the carrying capacity, environmental damage occurs, and further growth is reckless. Probably one of the most important underwater locations in the world, aquatic leisure tourism is a rapidly expanding global sector. Since the majority of data assess the influence on aquatic habitats, a number of them examine the consequences of recreational boating on marine environments.

The population density that the remaining natural resources in a given area can sustain is known as the environmental storage capacity. The number of people living in some area without causing environmental impact is called the total population density, sometimes referred to as carrying capacity. The species' survival depends on the availability of food, water, and habitat. When population expansion surpasses carrying capacity, the long-term risk of total resource depletion increases. Insufficient resources can lead to the demise of human societies. Environmental capacity is the ability of the environment for specific activity like release of toxins. The ecologically sustainable number of tourists that a place can safely handle while preserving the local ecology and reducing negative impacts on both tourists and residents is known as the area's tourism. While reducing unexpected consequences for visited places, sustainable tourism amplifies favorable outcomes.

Pollution is the release of materials in natural resource pool, such as the air, water, or land, with the objective of threatening ecosystem and ecology. World without pollution protects the world's ecosystems; it strengthens local economies and enhances happy

life for people; it protects historical sites. It is challenging to put a monetary value on many of the positive effects of nature. Natural environments make many things cleaner.

While studying environment carrying capacity of water, consequently, a technique for assessing critically how tourism affects these places' enjoyment has been created. Tourist attractions like historical places, picturesque locales, and natural and cultural icons are often sought after by vacationers. Tourism destination is there for the promotion of their country or state or region or city from which they can generate income. It makes logical to categorize travel to places with significant historical or natural features as environmental tourism. Destination of watershed area can serve as an opportunity for tourist to experience adventure of water tourism.

This ensures both tourists and residents are satisfied as the destination adapts to the changing needs of the market. Activities that raise residents' standards of living without endangering the environment or culture are examples of environment tourism with social responsibility. For countries that are still developing or have a developing economy, tourism may be highly helpful. By creating jobs, supporting local economies, and encouraging the building of necessary infrastructure, it reduces poverty and inequality..

This could result in shortage of water and the degrading water sources in addition to increasing the amount of wastewater generated. For example, a turtle population in a pond may eventually support an endless number of turtles. Numerous human activities, such as the expansion of towns and industry, burning of fossil fuels, changing of streams, raising livestock, can have an effect on the quality of water. The travel and leisure industry provide everything needed for these activities. Construction and upkeep of hotels, restaurants, and entertainment centers are all components of satisfying the needs of tourists. In areas with limited access to basic essentials, visitor spending may strain the local economy. In addition to the advantages it provides, the tourism sector is important since it is commercial activity that boosts and expand in other associated businesses.

In addition to increasing economic activity, the tourism sector also generates jobs, wages, and makes a substantial contribution to the development of cities. The significant impact of tourism on local land use has a number of unanticipated consequences, including soil erosion, rising pollution, ecological system degradation, invading species emergence. Traveling to locations are the main draws is known as ecology-based

tourism. Examples of responsible tourism include initiatives that support local creative integrity and lessen the negative environmental effects of traditional tourist. The primary goals of

the qualitative study are to collect data, define leisure categories, assess how tourism interacts with the environment, and pinpoint possible benefits of tourism.

3.1.6 Wildlife Disruption and Habitat Loss

One of the elements of biodiversity is wildlife. Although this document will focus on fauna primarily, the term is wide and theoretically encompasses both flora and fauna. The term "wildlife" is commonly used to describe animals found in the wild. Human activities have impacted the environment as a whole which is affecting the habitat of wild animals. Nepal is very lucky when it comes to its geographical structure. However, urbanization has impacted and occupied greater space rather than nature. Human contaminate environments. Human kill animals unlawfully. We mix nature with urbanization.

The environments that plants and animals depend on for survival are frequently altered by human. Plants and animals are extinct quicker in last 65 million years. Scientist have discovered thousand of species extinction in this century. It is difficult for plants and animals to survive due to rapid population growth.

There are many different reasons why animals went extinct in the past. In certain instances, animal competition for resources resulted in extinction; in other others, environmental changes were the culprit. Negative impacts on animals can be categorized in a variety of ways. Animal reactions (habituation, avoidance, etc.) are challenging because, although they are unquestionably significant, they are not always obvious, and animals may react in multiple ways in a single research.

As demonstrated by the travel journalist in 1999: tourists frequently fail to realize that disturbing animals could be an issue. When the boat outruns them, they plunge below the surface. We occasionally see crocodiles, which plunge swiftly into the water when we get close. Does sending wild animals running—or bounding, swimming, or flying—make a difference? When tourists have moved on, won't they immediately resume their previous activities? The response differs greatly depending on the species, life stage, habitat, and other elements.

When humans are around, animals may react in different ways. Some may run a kilometer or two before coming to a stop at the first sound, scent, or sight of people. Before returning to their initial activity, some would run to the closest 21 cover or just far enough to keep a few more meters between them and the people. Some might just remain in their current location while monitoring any approaching humans. With the correct equipment, we might be able to identify any changes in the body, such as an increase in heart rate. Some may approach the humans out of curiosity, to intimidate, or to beg for food, while others seem to pay no attention at all (though this can be misleading).

The behavior of many species makes it clear that human intervention affects them, despite the fact that spotlighting is frequently perceived as a harmless activity. Gliders occasionally glide away from a food tree, possums reduce their social or foraging activities, owls routinely turn their gaze sideways and downward after staring into the light, and even the somewhat sedentary koala frequently moves to trees (pers. obs.). The intervention is thought to impair wildlife's capacity to see at night (Lindenmayer and Press 1989).

According to studies conducted in Victoria, larger gliders and yellow-bellied gliders have taken longer to emerge as a result of frequent spotlighting efforts (ibid). Spotlighting actions are thought to increase the risk of predation and injury, diminish foraging capacity, decrease individual density (Wilson 1999). Animals that must see obstacles and landing spots, such as flying and gliding creatures (even diurnal birds accidentally awakened by lights), may suffer grave repercussions from temporary vision loss. When frightened by a spotlight beam, a yellow-bellied glider has been observed by Daryl Moncrieff (pers. comm.) changing direction, losing speed, and falling to the forest.

As advised by NEAP, many tour operators now use red filters to reduce light intensity after locating an animal. At least one, Wildscapes Safaris' Alberto Vale, also applies red filters to the tour vehicle's headlights when it is on a road with locked gates, which is obviously unsafe on public roads. It affects animals while we use light beam. Reduced light levels may also improve the experience of visitors by giving them a greater sense of what nighttime in a forest is like, in addition to a better view of the animal going about its daily business. By shutting off lights and listening for rustles, guides can also try to locate certain species. Infrared binoculars and nightscopes are also helpful but costly.

Numerous government policies and initiatives in Nepal have acknowledged nature tourism for conservation of biodiversity. For instance, nature-based tourism has been recognized as a possible strategy for supporting biodiversity conservation in the Nepal Biodiversity Strategy and Action Plan 2014-2020 (Government of Nepal, 2014). In a similar vein, Nepal's tourist Policy 2073 acknowledges the significance of biodiversity preservation and sustainable tourist growth (Government of Nepal, 2017). By putting regulations into place, impacts upon environment are declined and the integrity and vitality of the tourist destination are preserved. Nowadays, it is crucial and concerning to control resource extraction and raise awareness about protecting the area's natural resources and environment (Butler and Boyd, 2000). The current situation is unbalanced, nevertheless, because there is disagreement about how to define sustainability and how it relates to nature-based tourism (Sharpley, 2000; Tao & Wall, 2008; Wall, 1995). Although nature-based tourism has enormous potential to raise biodiversity values and encourage conservation in Nepal, the growth of the tourism industry is also fraught with difficulties.

Wildlife disturbance, habitat destruction, and environmental degradation can result from unregulated tourism. Trekking and mountaineering are two examples of tourism activities that may negatively affect efforts to conserve biodiversity. Currently, it is essential to control resource extraction and raise awareness about the protection of the area's natural resources, particularly in relation to the environment (Butler and Boyd, 2000). There is disagreement and discord in the current situation, nevertheless, because it is difficult to define sustainability and how it relates to tourism (Sharpley, 2000; Tao & Wall, 2008; Wall, 1995). In order to fully utilize potential in tourism sector to enlighten the conservation of biodiversity, it is imperative to comprehend the opportunities and difficulties related to its development in Nepal.

It was believed that the limited administration which is caused due to inadequate law would cause problem to local community, as observed, there are many trekking sector like ABC trail, EBC which should get international recognition by now. Furthermore, there was worry that nature base tourism would focus protecting animals above its development.

Following a review of the available possibilities, classification of "conservation area" was suggested, which would permit hunting and the use of visiting fees to fund local development. ABC has given its special management zone which works solely for preservation of bio-diversity and work to develop localities and make everybody's life

easy. In ABC trail, there are lots of bamboos plant in the way, and wild animals like bear is prominently found in this area. The local management community has restricted the visitors to do trekking after 6 pm for the protection of wildlife and to create balance between wildlife preservation and ecosystem right there. (Wells, 1994a).

The Conservation Area of Annapurna The Annapurna Conservation Area (ACA), which spans roughly 7,629 km², is situated in Nepal's middle Himalayas. Established in 1986, it is one of Nepal's largest protected areas (Pokharel et al., 2016). A diverse range of plants and animals can be found in the ACA, including 1,226 plant species, including numerous endemic species, 450 bird species, and more than 100 mammal species. Snow leopards, Himalayan tahr, and musk deer are a few of the ACA's most recognizable animal species (Karki et al., 2015). Because it is home to numerous ethnic populations with distinct cultures and traditions, including the Gurung, Thakali, and Manange, the area also has cultural value. Ecotourism, community forestry, and alternative energy production are just a few of the conservation and sustainable development initiatives that the ACA has put into action. These initiatives seek to enhance local communities' quality of life, encourage sustainable resource usage, and lessen reliance on natural resources (Sherpa et al., 2020). Wildlife populations have grown and ecosystem health has improved as a result of the ACA's conservation initiatives. Increased community involvement and participation in conservation initiatives has also resulted from the effective execution of these programs (Chhetri et al., 2018). The effects of climate change, illegal wildlife trafficking are just a few of the issues the ACA still has to deal with. The region's biodiversity and local inhabitants' means of subsistence are being impacted by the warming temperatures that are altering the region's ecosystems, including the melting of glaciers and modifications to precipitation patterns (Pokharel et al., 2016). The region's delicate ecology has been negatively impacted by pollution, environmental degradation, and other issues brought on by the growing number of tourists. The ACA has taken a number of actions to address these issues, such as encouraging alternative livelihoods for local populations, developing eco-friendly tourism practices, and implementing community-based conservation programs (Sherpa et al., 2020).

3.2 Sustainability Practices in Adventure Tourism

In Nepal, a country known for its natural beauty and rich cultural legacy, sustainable tourism development offers a vibrant nexus of sociocultural preservation, environmental conservation, and economic expansion. Nepal is well-positioned to take advantage

of its distinctive tourism resources while tackling the problems brought on by rapid development as knowledge of sustainable practices spreads throughout the world. Nevertheless, the literature shows notable gaps in knowledge and application that call for targeted research and calculated interventions, even in the face of enormous efforts and attempts. The goals and research issues of the literature currently available on Nepal's sustainable tourism development are unclear. Important topics including socioeconomic effects on local populations, maintaining cultural legacy in the face of tourism, and incorporating sustainable practices into tourism policy are not sufficiently examined. Furthermore, there are very few thorough studies evaluating how well the policies and programs in place now are accomplishing the objectives of sustainable tourism.

Numerous studies have examined Nepal's complex sustainable tourism development scenario in recent years, providing insightful information about both its prospects and problems. A thorough investigation of the environmental, sociological, and economic aspects of Nepali tourism was carried out by Sharma and Niroula in 2023. Their efforts highlight the importance of careful planning for sustainable tourism as well as the vital role that stakeholder participation plays in negotiating the complexity of the industry. Building on this framework, Gurung and Thapa (2022) focus in urgent problem of excessive tourism, especially in locations, EBC and Kathmandu Valley. Their study highlights the significance of minimizing negative impacts on local populations and fragile ecosystems while outlining measures for sustainable destination management. It is required to empower local tourism un rural area (Rai and Tamang (2024). They demonstrate CBT's ability to promote socioeconomic growth, strengthen underprivileged groups, and preserve cultural heritage through extensive case studies.

3.2.1 Policy Framework

To promote sustainable development in Nepal's tourist sector, a strong legislative framework and efficient institutional assistance are essential. These components guarantee benefits to everyone in addition to improving the competitiveness of the destination. Comprehensive policies and institutional procedures are necessary since tourism presents a wide range of opportunities and constraints.

National Tourism Policy: This areas will certainly look into policy for tourism which will specifically work for guiding Nepal's tourist growth. In this plan, it will include vision,

strategies, objectives of government sector for the promotion of sustainability in tourism sector. It will also look into management of tourism destination, distribution and allocation of budget for preserving tourist areas, development of resources, conservation of environment and others.

Legal and Regulatory Framework: This areas will certainly look into favourable legal framework to protect legal rights of stakeholders. Law can govern different areas in tourism sector. The protection of environment with sustainable practice can be achieved with international standards. Unambiguous legal framework can help to foster adventure tourism without much risk

Institutional Framework: The coordination and execution of tourist policies and initiatives depend heavily on efficient institutional arrangements on national, regional, and local levels. The primary government organization in charge of creating and carrying out tourism-related laws, rules, and development strategies in Nepal is MoCTCA. Furthermore, federal, provincial, and local tourist boards, agencies, and committees are essential in advancing destination management. (Adeyinka-Ojo and associates (2014))

Public-Private Partnership: PPP models are widely acknowledged for risk, raising funds as a whole investment. (Cui et al. (2018)). Tourist area need financial assistant to make flourish more. For all market promotion, capacity building, many governmental and non-governmental agencies need to cooperate to make it happen. PPPs can address difficult issues and take advantage of new opportunities in the tourism industry with assistance of public as well as private partnership.

Training and Capacity Building: To improve the abilities, expertise of Nepal's tourism sector, investments in human resource development are crucial. Tourism personnel are empowered to provide guests with top-notch services and experiences on different areas. Additionally, local communities can actively engage in tourist development and take advantage of opportunities thanks to capacity building programs that are aimed at them (Pandey, 2011).

Tourism Marketing and Promotion: To increase awareness, draw visitors, and improve Nepal's reputation as a travel destination, efficient marketing and promotion techniques are crucial. Targeting important market segments, utilizing digital technologies, and creating and executing integrated marketing campaigns all depend on cooperation

with different stakeholders. Additionally, attending international trade exhibits, roadshows, and promotional events aids in introducing prospective tourists from around the world to Nepal's variety of attractions and distinctive experiences. Bogan (2014). This entails creating thorough tourism policies, fortifying legal frameworks, encouraging public-private collaborations, allocating funds for capacity building, and putting successful marketing plans into action.

However, achieving Nepal's objectives for sustainable tourism depends on the efficient application, oversight, and assessment of these regulations.

Possibilities for the growth of sustainable tourism Nepal offers a wealth of chances for the development of sustainable tourism, leveraging its varied landscapes, distinctive cultural customs, and rich natural and cultural heritage. For long-term sustainability of tourist sites, sustainable tourism policies seek to maximize socioeconomic benefits while limiting detrimental environmental and sociocultural effects.

Ecotourism and Nature-Based Tourism: Nepal offers major prospects for ecotourism and nature-based tourism due to its unmatched natural beauty. There are different activities that encourage conservation and environmental care while giving tourists a chance to explore the nation's magnificent natural settings. Different sustainable practices should support the preservation of delicate ecosystems and biodiversity hotspots.

Community-Based tourist: By enabling locals to get engaged in and gain profit from tourism, community-based tourism projects foster inclusive and equitable development. In addition to providing tourists with immersive and genuine experiences, it help rural communities make a living. Community-based tourism promotes economic empowerment, cultural preservation, and social cohesion by incorporating locals in the planning, administration, and revenue-sharing processes of the tourism industry.

Cultural Tourism and Heritage Conservation: Nepal's rich cultural past, which includes UNESCO World Heritage Sites, presents outstanding prospect for cultural tourism. Tourist can promote intercultural communication and understanding by learning about the country's numerous religious practices, architectural marvels, and cultural traditions. Sustainable tourism activities not only encourage tourists to travel ethically but also help to save Nepal's cultural heritage for future generations.

Nepal's rough terrain, high mountains, and swift-moving rivers make it the perfect destination for anyone who enjoy adventure travel and adventure sports. Adventure sports like paragliding, bungee jumping, white-water rafting, trekking, and mountaineering

draw tourists from all over the world, boosting the economy and creating jobs. In addition to protecting natural landscapes and ecosystems, sustainable adventure tourism practices including safety rules, risk management, and environmental conservation guarantee the security and welfare of both visitors and local populations.

Pilgrimage Tourism and Spiritual trips: Nepal offers chances for pilgrimage tourism and spiritual trips due to its significance as Nepal offers religious belief for buddhism and those who follow hinduism. The origin of these religion has great importance with Nepal since the borthplace of Buddha is Nepal and Pashupati Temple lies in Nepal. In addition to encouraging spiritual refreshment and personal development, sustainable practices are highly encouraged.

Niche Tourism Markets: To get big number of interest of tourirts, Nepal may be able to access niche tourism markets such as agrotourism, culinary, and educational tourism. The niche tourism can provide some genuine and different experience for travelers. Nepal can maximize economic gains and minimize sociocultural and environmental drawbacks by expanding its tourism offerings to appeal to specialized market segments and extend visitor stays.

Nepal offers various areas for the development of sustainable tourism. Nepal as a country is very rich in natural resources as well as culturally also, nepal is very rich. Sustainable tourist practice can attract many tourist while environment will also be taken care of with this approach. Whole world is turning towards the practice of sustainability to protect this mother Earth. In this timeframe, it is very necessary to look around tourism sector, specifically adventure tourism in sustainability angle if we truly want to develop and generate income from this sector for country. Nepal, lying in lapse of himalaya and full of natural resources can truly foster tourism sector and leverage economy from this sector. To achieve, sustainable practice in the sector of adventure tourism, all the stakeholders like governmental agencies, private organizations, local communities and others is required to make this possible in the larger scale.

4 Research Methodology

4.1 Research Methods and Data Collection

A thesis's research methodology section describes the procedures and technique used to carry out the investigation. Technique for data collection, analysis, and interviews are frequently used in the research process. The importance of social or human circumstances for people and organizations is investigated in qualitative research. The design, tools, population, procedure, and analysis of data collection are all covered in this chapter of qualitative research methodology. The analysis of Nepal's expanding adventure tourism industry and its effect on environment is the main goal of this study. We have conducted unstructured interviews using open-ended questionnaire with entrepreneurs, tourist guide, tour operators, and government officials. Unstructured interviews prevent misrepresentations and misunderstandings of the participant's responses and give interviewer more opportunity to probe and analyse the participants comment (Bihu 2020).

We interviewed the local homestay owners who provide homestay experiences to tourists on context of adventure tourism in Nepal. To learn more about the respondent's reasons, difficulties, and the effects of adventure tourism on the neighborhood and the harm it has caused, we conducted unstructured interviews with them. Due to the rise in adventure tourism and the effects it has had to homestay and wild ecosystems, the questions examine before and after scenes. This interview took place during a trekking trial at Annapurna Base Camp. Travel agencies in Nepal make up the second group of responders. The goal is to learn more about how adventure travel has impacted Nepal's tourism industry. The tour guides were then interviewed and asked about their experiences dealing with both high and low tourist volumes. Finally, we were able to set up an interview with government representatives to talk about the strategies to mitigate the effects on the environment and advance sustainability in adventure travel. Additionally, all of the interviews were done remotely via phone conversations, emails, and social media. Genuine information was requested from the interviewees. To find patterns, themes, and narratives, the recorded interview is transcribed and conceptually analyzed. Qualitative information from unstructured interviews contributes to a comprehensive picture of how the government and locals view the environment's increasing influence and how they plan to address this problem and encourage sustainable practices in the adventure tourism industry.

The study is conducted using qualitative research, which entails gathering and analyzing nonnumerical data in order to comprehend thoughts, viewpoints, or experiences that can be utilized to obtain in depth knowledge about an issue and produce fresh research notions. Because the survey is conducted online, the most information possible may be obtained in the allotted period and obtained the appropriate outcome after analyzing the data.

4.2 Qualitative Research Methods

The research techniques listed below entail the use of one or more data collection techniques. These are some of the most popular qualitative techniques that we shall employ in our research (Bhandari 2020):

- Observations: Taking thorough field notes on what we have seen, heard, or come across or another research paper.
- Interviews: In my experience posing questions to individuals in one on one interaction via emails or various social media platforms.
- Focus groups: Posing queries and fostering conversation among a group of individuals who either live in or have visited the area.
- Surveys: Utilizing online platforms to distribute surveys with open ended questions.
- Secondary research: Gathering pre-existing material in the form of recordings, pictures, audio, or video

4.3 Implementation of Research

A research methodology serves to validate the study and ensures that results are adequately backed by science. It offers a comprehensive strategy that guides researchers and ensures a straightforward, efficient, and well-run process. The methodology of a researcher aids readers or products in comprehending the techniques and strategies employed to produce outcomes.(Bahati 2021). This study used a quantitative approach, gathering data via an online survey.

The purpose of this research, which will be conducted using a qualitative research approach, is to gather information about the adventure tourism sector in Nepal, including its causes, effects, difficulties, and solutions. Through the internet, we provided google links

and questionnaire to the travel industry, which includes tour operator's, guides, visitors. Data collection and study goals were analyzed using the qualitative technique.

Unstructured interviews were used to collect data, and several unstructured interview questions were employed in the study to gather primary data for the investigation. Numerous websites and social media pages were available to gather the data. Guesthouse owners, local handicraft vendors, tour operators, and local tour guides in the Annapurna region and other adventure tourist destinations were interviewed via various social media platforms, such as WhatsApp and Messenger, to gain insight into the tourism sector and its issues.

Between October 2024 and the second week of November 2024, an interview was conducted. Numerous surveys regarding the experience of visitors, challenges faced by the business, and suggestions for enhancement were distributed. We conducted research with diversity as in we involved different group of people for interviewing locals. The participant's availability determined how the interview was set up. In several instances, follow up questions were posed to responders in order to get more details or clarification. This guarantees that the researcher comprehends the perspective, view of them in this research. The interview responses were recorded in a systematic manner.

To guarantee dependability and reliability, the researcher carefully examined and condensed the collected data. The response are given accurately. The purpose of the thematic analysis was to find recurring themes, trends, and unique ideas. The results of the interviews are arranged according to related subjects. The goals of the study were considered when evaluating findings. The results of the study were compiled into a thorough report. This strategy will help us to get knowledge from survey conducted internal guests, Ghandruk region tour guides, travel agencies, and guesthouse.

Homestay owners, tour guides, travel companies, government representatives, and tour operators participated in qualitative research. The duration of the interviews varied between 10 and 25 minutes. Since there was only a 3-hour, 45-minute time difference between Nepal and Finland, the data was gathered at an appropriate time. The interview time and date were set by the interviewers and interviewees. The interview time was purposefully selected to have as little impact as possible on the travel and tourism sector. A study using thematic analysis was carried out. Thematic content analysis makes data analysis simpler and finds recurring themes and patterns in interview interactions.

4.3.1 Preparing Codes

The researcher arranged and became acquainted with all of the unstructured interview material after obtaining it. The researcher conducted a comprehensive coding process as the first stage of qualitative data analysis in order to find and classify important themes and patterns. The complexities and nuances of the material were carefully considered throughout the rigorous coding process. Notwithstanding the comprehensive nature of the study, which comprised participants, a number of limitations were discovered during the data collection procedure. These limitations, which included respondent availability the scheduling constraints, restricted the extent to which data could be gathered as first intended.

To make sure that all pertinent trends and insights were observed and recorded, the researcher meticulously went over the transcripts numerous times. The Annapurna Region interviews raised a number of topics, including tour operators, local perspectives, homestay owner's experiences, and the opinion of tour guides. These trends offered a nice perspective in regard of adventure tourism in Nepal, notwithstanding constraints encountered during data collecting.

4.3.2 Classification of codes

While classifying, codes were separated and comparable and dissimilar groups by the researcher. They made certain that every code was distinct from the others. They were able to create data- driven themes thanks to these accurate classifications.

4.3.3 Finalizing codes

When the codes are finalized, the researcher carefully reviews them, classifies them, and looks for recurrent patterns to create themes. Based on the collected codes, researchers provide a fitting label for each theme. In order to cover the meaning insights, this entails carefully examining the interview transcripts and analyzing the information.

5 Findings

5.1 Demographic Factors

There were 25 respondents who were tour guides, tour operators, homestay owners, travel agencies, government representatives who were interviewed. In interview, audio was used and video conversations to record and share their queries and remarks. Through tourism, researchers can gain a deeper understanding of the behavior, preferences, and pleasure levels of their subjects, which aids in the development of travel plans for the entire year. We used both English as well as Nepali language while interviewing these individuals, where Nepali was transcribed into English recorded for analysis. All individuals who gave interview were Nepali. Technical part of this study is based on objective nature of research issue and literature review of this paper. We have selected most qualified candidate for our interviews, which are detailed below.

Gender of Respondents	Homestay / Lodge Owner	Tourist Guide	Tour Operator	Government officials	Total
Men	5	1	4	3	15
Women	4	2	1	2	10
Sum	9	3	5	1	25

By table we can say that, 25 participants in total were involved in this survey among which 15 were male and 10 of them were female. We took interviews with people from homestays, travel agencies, tourist guides, government officials, and others. The people with whom we took the interview from homestay were 9 people in total. Additionally, there were two women from travel agencies and 1 male. We interviewed them who guided us as an agency during the trek to the Annapurna Region. Also, there was 1 female and 4 male as tourist guides. We also took interviews of the tour organizers, a team of 2 females and 3 males. Moreover, in government officials as well, there were 1 female and 2 male. When we analyze the number, we can clearly see there are more men than women in this field which shows the proportion of men and women in different areas varies differently. Recognizing all of the data we collected, in the tourism sector, it is quite evident to say that be it male or female everyone is equally and fairly treated. The number of female were less than male which made less female participation in our survey for our demographic result.

5.2 Environmental Effect Due to Adventure Tourism

Adventure tourism in Nepal has both positive and negative effects on the environment as the study showed. When we conducted a survey and asked the local owner of Annapurna Trekking Trail, they responded how the overflow of tourists has impacted the natural habitat of animals and the wildlife has been disturbed due to a lack of sustainable management.

Interview Insights

We took several interview with different personalities. The local government officer named, **Prakash Dhakal** said,

— Annapurna Region of Nepal became very famous worldwide for it's trekking trail. According to him, there have been massive flow of tourists in this area and they are using speakers during trek. Annapurna Region contains many wild animals like Bear, Tiger and Leopard too. He told, due to overflow of people in the area, animals are scared to come out which has affected their livelihood, their food habits and their way of living. Not only this, plastic pollution also have increased tremendously in the area and it is high time for government to look after it and suggest some sustainable mitigation measures to address the issue”.

Based on the study, adventure tourism has had varying impacts on Nepal's environment, influenced by adventure tourist activities. The effects are particularly visible in popular destinations like the Annapurna Circuit, Everest Base Camp, and Chitwan National Park. These impacts range from soil erosion and waste management issues to long-term environmental degradation.

Santosh Lamichhane, a 29-year old trek guide said,

"The growing number of trekkers on popular trails is causing severe trail degradation and soil erosion," He said trails grow congested during the busiest hiking season, and he said it has caused harm to the surrounding environment. Similar to this, garbage management is frequently a problem in high-altitude areas like Everest, where visitors leave behind non-biodegradable waste that is difficult for local authorities to properly handle.

A 36-year-old female homestay owner named **Manmaya Tamang** told,

“The environmental impact is more pronounced during the spring and autumn seasons when the tourist flow is highest. Our village experiences more waste generation during these times, and managing it becomes a challenge for us locals.”

According to 42-year-old **Nirjala Bista**,

Habitat damage has also been exacerbated by deforestation for the construction of hiking lodges, paths, and other tourism-related infrastructure, biodiversity is being lost as a result of the high-altitude regions' need for wooden structures. Local ecosystems are seriously threatened by this and the rising demand for firewood in off-grid locations.

5.3 Challenges in Sustainable Resources Management

The seasonal variation in tourist arrivals significantly impacts the utilization of resources in Nepal's adventure tourism hotspots. During the high season, food resources, energy resources are overused, and during low season, underutilization becomes a major issue.

A 34-year-old male entrepreneur, **Amrit Kharel** stated:

In peak season, we often struggle to meet the demand for locally sourced food and lodging. During the off-season, the lack of tourists means a sharp decline in income, and maintaining the workforce becomes challenging.” He further noted that this fluctuation directly affects the livelihood of local communities dependent on tourism.

Waste management was another commonly cited issue. A 40-year-old female government official, **Shruti Kharel** working in tourism development mentioned,

“Tourists, especially during their adventure activities, leave behind a significant amount of waste. Although there are waste collection systems in place in popular trekking regions, remote areas still face a major challenge in handling the waste effectively.”

A 37-year-old local conservationist **Laxmi Aryal**;

“In regions like Chitwan, the influx of visitors during peak safari seasons puts immense pressure on the infrastructure. Overcrowding in the park affects wildlife, causing animals to migrate away from their natural habitats.”

5.4 Environmental Degradation in Adventure Tourism Areas

One of the most urgent problems facing Nepal's adventure tourist industry is environmental degradation. Uncontrolled tourism is causing deforestation, water pollution, and biodiversity loss in popular trekking areas.

*In my years of guiding, I have observed a decrease in the natural beauty of several trekking areas," a **38-year-old mountain guide** remarked. Over time, more forests have been cut down to make way for new lodges and trails, and some areas are already experiencing water shortages.*

Furthermore, overcrowding in popular areas like Gosaikunda and the Everest region has led to visible environmental strain. **A 35-year-old local lodge owner** in the Langtang region highlighted, *"During peak season, the carrying capacity of our village is exceeded. This results in improper waste disposal, leading to water pollution and health risks for the locals."*

Exploitation of natural resources is another consequence of the growing desire for adventure tourism. *"We encourage eco-friendly alternatives, but enforcement is still weak in remote areas, and many tourists demand firewood for heating during their stays," a **47-year-old government official** said.*

5.5 Community Perspectives on Environmental Sustainability

Stakeholders and local communities stress the importance of striking a balance between environmental sustainability and tourism.

According to a **50-year-old woman** who runs a homestay in the Annapurna region, *"Our village's cultural heritage draws tourists, but maintaining it amid the expanding tourism activities is a challenge."* Although it takes teamwork, we are attempting to teach guests about sustainable practices.

To lessen the seasonal differences in tourism, a **45-year-old man** who works for a trekking firm proposed holding eco-friendly events and festivals during the off-season. *"We*

can increase tourism and spread the impact throughout the year by holding cultural festivals during slower months. Additionally, this will ease the strain on busy times of the year and promote our culture.

"The rivers we use for rafting are affected by pollution from both tourists and locals," a **30-year-old rafting guide** continued. We run the risk of losing the inherent appeal that draws adventure travelers in the first place if we don't enact stronger regulations.

In order to guarantee improved resource use and waste management, local stakeholders also demanded government action. "If we praise locals living in such areas in planning and give them resources, we can preserve our natural and cultural heritage for future generations," said a **41-year-old conservationist**, emphasizing the value of awareness campaigns.

5.6 Environmental Challenges Highlighted by Government Officials

According to government authorities that participated in the study, adventure tourism in Nepal has resulted in serious environmental problems. *"Standard trekking destinations like Annapurna and Everest regions face extensive waste management issues, especially during the peak season,"* said a **42-year-old male Ministry of Tourism representative**. Tourists frequently leave behind non-biodegradable things, plastic debris, and abandoned hiking gear, which causes long-term environmental issues. Similarly, in vulnerable high-altitude areas, unregulated tourism practices like off-trail walking and campsite expansions have led to deforestation and soil erosion.

The Department of **Environment's 38-year-old female official** underlined that Nepal's *natural resources are under tremendous strain due to the country's rapidly growing adventure tourism industry. High-altitude biodiversity and river ecosystems are being impacted by activities like rafting and mountaineering. Because of habitat destruction and greater human meddling, rare species populations are declining.* The issue is made worse by the lax implementation of environmental laws, which results in congestion in protected areas and excessive usage of trekking routes.

For reducing environmental impact of adventure tourism in Nepal, our findings highlight the urgent need for sustainable tourism practices, such as more stringent trash disposal regulations and controlled visitor numbers.

5.7 Sustainable Practices to Mitigate Environmental Challenges

In order to solve the environmental issues brought on by adventure tourism in Nepal, government representatives, travel industry leaders, and local stakeholders stress the significance of implementing sustainable practices. Strict waste management regulations must be put in place in well-known hiking destinations like Everest and Annapurna, according to a 45-year-old male officer at the Ministry of Forests and Environment. We must advocate for the "carry-in, carry-out" concept, which holds agencies and hikers accountable for disposing of their waste. Littering can also be decreased by putting eco-friendly garbage collection and disposal facilities in popular tourist locations.

Promoting alternative energy sources is another aspect of sustainable tourism. *"Encouraging the use of solar energy and clean cooking stoves can reduce the reliance on firewood, which is a leading cause of deforestation in high-altitude regions,"* said a **38-year-old woman guesthouse** entrepreneur in the Langtang region. These techniques are being progressively adopted by local communities and tourism enterprises, but wider adoption calls for more robust government and non-governmental organization support.

Another important tactic is to control the quantity of visitors. According to a 42-year-old conservationist, *"Trekking and mountaineering can avoid crowding and lessen the burden on natural resources by implementing a quota system or seasonal permits."* Authorities can protect delicate ecosystems by regulating visitor flow to make sure that the environment's carrying capacity is not exceeded.

Additionally, promoting a culture of responsible tourism requires education and awareness initiatives. *"We are holding workshops for local communities and trekking guides to teach them about environmental conservation,"* a **40-year-old tourism development officer** stressed. In a similar vein, visitors should receive instruction on how to minimize their environmental impact and respect local ecosystems.

Additionally, cooperation between local communities, the commercial sector, and the government is being investigated. *"Public-private partnerships can play a vital role in funding and implementing sustainable tourism projects,"* emphasized a **37-year-old policy advisor** from the Ministry of Tourism. For instance, we are developing eco-trails that assist the local economy while also promoting conservation.

6 Conclusion

Nepal, with its diverse geography and breathtaking landscapes, holds immense potential for adventure tourism. From the towering Himalayas to the vast plains of the Terai, the country offers a range of thrilling activities such as trekking, mountaineering, paragliding, rafting, and jungle safaris. The natural beauty, combined with a rich cultural heritage and warm hospitality, makes Nepal a prime destination for adventure seekers worldwide. Tourists flock to Nepal not only for adrenaline-fueled experiences but also to immerse themselves in unique cultural traditions and connect with its serene environment. Despite the challenges of rugged terrain and unpredictable weather, the allure of pristine trails and unexplored regions continues to captivate travelers. Furthermore, the government and private sectors have been making concerted efforts to develop infrastructure, promote tourism, and ensure safety, which are critical for expanding adventure tourism. With responsible planning and management, Nepal has the potential to cement its position as a global hub for adventure tourism while simultaneously uplifting local economies and fostering community engagement.

However, the rapid growth of adventure tourism is not without consequences. One of the most pressing concerns is the environmental degradation caused by increased human activity in fragile ecosystems. Trails littered with waste, deforestation for tourism infrastructure, and the depletion of natural resources are becoming prevalent issues in popular tourist areas such as the Everest and Annapurna regions. The influx of visitors often strains local resources, leading to challenges in waste management and water pollution. Additionally, over-tourism in certain regions disrupts wildlife habitats, causing long-term ecological imbalances. The carbon footprint of transportation and activities such as helicopter tours also contributes to global warming, directly impacting the glaciers and water systems that define Nepal's landscape. While tourism generates significant revenue, the environmental cost cannot be ignored, as it risks diminishing the very resources that attract adventurers. This calls for a balanced approach, where economic gains from tourism do not come at the expense of environmental sustainability.

This study emphasizes how adventure tourism in Nepal has a major negative influence on the ecosystem, especially in well-known trekking and mountaineering locations. Despite being essential to Nepal's economy and international prominence, adventure tourism presents problems such as waste management, soil erosion, deforestation, and dangers to biodiversity because of habitat degradation and increased human activity. These problems

are made worse by seasonal fluctuations, which put strain on delicate ecosystems and lead to unequal resource use.

In order to address these environmental issues, sustainable practices are desperately needed, according to interviews with local stakeholders, tourism business owners, and government representatives. Important tactics include enforcing more stringent waste management regulations, encouraging the use of alternative energy sources, controlling the number of visitors, and launching educational initiatives to encourage ethical travel practices. To develop long-term, sustainable tourism models, cooperation between public and private entities as well as local communities is crucial.

The results highlight how important it is for Nepal's sustainability to balance environment and tourism as tourism if not handled effectively, can impose various threat to environment. Nepal can maintain its position as a top adventure travel destination while preserving its distinctive natural legacy for future generations by implementing eco-friendly practices, upholding laws, and promoting active involvement from all stakeholders. To address these challenges, adopting sustainable practices in adventure tourism is essential. First and foremost, eco-friendly policies and regulations must be enforced to manage waste, limit over-tourism, and protect biodiversity. Initiatives like eco-trekking routes, biodegradable products, and renewable energy-powered accommodations can significantly reduce environmental impact. Furthermore, educating tourists and local communities about conservation and responsible tourism is crucial in fostering a culture of environmental stewardship.

Collaboration among stakeholders, including the government, local businesses, and international organizations, can promote sustainable tourism through innovation and funding for green projects. For instance, incentives for sustainable travel operators and certification programs for eco-friendly practices can encourage compliance. Lastly, involving local communities in decision-making ensures that tourism benefits them economically while preserving their environment and culture. Through such holistic approaches, Nepal can achieve a harmonious balance between tourism development and environmental preservation, securing a thriving future for its adventure tourism sector.

Hence, Nepal stands at a critical juncture where the promise of adventure tourism must be carefully balanced with its environmental and social responsibilities. The unparalleled potential for adventure tourism, rooted in its diverse landscapes and cultural richness, can drive significant economic and community development. However, unchecked growth poses a grave risk to the fragile ecosystems that make this tourism possible. It is impera-

tive to embrace sustainable practices that minimize environmental degradation and ensure long-term viability. Through collaboration, innovation, and a shared commitment to preservation, Nepal can not only thrive as a global adventure tourism destination but also serve as a model for balancing economic ambition with ecological integrity.

7 Recommendations

To mitigate the environmental challenges posed by adventure tourism in Nepal, a comprehensive and sustainable approach must be adopted.

- Firstly, the implementation of effective waste management systems is crucial. Stricter policies, such as the "carry-in, carry-out" principle, should be enforced, requiring tourists and trekking agencies to take responsibility for waste disposal. The establishment of eco-friendly waste collection and recycling facilities at major trekking hubs, combined with regular clean-up drives, can significantly reduce littering in pristine natural areas.
- Promoting electricity, heater in tourist accommodations is another critical measure. Solar panels and clean cooking stoves can replace firewood, which is a leading cause of deforestation in high-altitude regions.
- The government should introduce subsidies and incentives to make renewable energy systems accessible and affordable for local communities. This step not only reduces environmental degradation but also promotes energy independence among rural households.
- Regulating tourist numbers is essential to protect the carrying capacity of fragile ecosystems. Implementing a quota system or seasonal permits for high-traffic activities, such as trekking and mountaineering, can prevent overcrowding and overuse of natural resources.
- The development of alternative trekking routes and promotion of lesser-known destinations can help distribute tourist flow more evenly across the country, reducing pressure on popular areas like Everest Base Camp and Annapurna Circuit.
- Community participation in tourism management and conservation efforts is vwey important for development of sustainable practice in adventure tourism sector. The local community must also be actively participate in decision making process which can make them believe they are leading something for their community.
- Training programs should be provided to equip locals with the skills and knowledge needed to implement eco-friendly tourism practices. This includes workshops on waste management, energy conservation, and biodiversity protection. Additionally,

profits from tourism activities should be shared equitably with local communities to incentivize sustainable practices.

- Raising awareness among tourists about the environmental impacts of their activities is equally important. Pre-trek orientations, informational campaigns, and on-site signage can educate visitors on responsible tourism behavior. Tourists should be encouraged to minimize their ecological footprint by respecting local ecosystems, following designated trails, and refraining from activities that harm wildlife or habitats.
- Public-private partnership can play a transformative value in promoting sustainable tourism. Collaboration between government agencies, private enterprises, and NGOs can mobilize resources for eco-tourism projects, such as building eco-trails, restoring degraded habitats, and promoting conservation-friendly activities.
- Regular monitoring and evaluation of environmental impacts is very crucial at this point for sustainable practice in adventure tourism. Environmental impact assessments should be conducted periodically in popular destinations, and the findings should inform policy updates and enforcement mechanisms. This adaptive approach will enable stakeholders to address emerging challenges effectively and preserve Nepal's unique natural heritage for future generations

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