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Journal of Tourism and Himalayan Adventures is purely an official publication. NMA has planned to publish an academic journal annually focusing on tourism, adventure tourism, mountaineering, and mountain sciences. It aims at promoting research and tourism activities among the college faculties, researchers, university professors and graduate and undergraduate students, and personnel in administrative positions involved in research ventures, academic or professional, however, academic researchers are prioritized. As it is obvious from the title of the journal, mainly research articles of qualitative and quantitative in nature but exclusively from the field of tourism, adventure tourism, mountaineering, and mountain sciences are accepted for publication.

The articles published in this journal are from mountain sciences, mountaineering, adventure tourism, trekking and general tourism. The articles were assigned for blind peer review to professors and practitioners in their respective fields; amendments recommended by the reviewers were made by the authors; and afterwards editing and corrections were done to ensure article quality before they were processed for publication.

However, the editorial team does not bear any responsibility for any incongruences in thematic contents and patterns presented in the articles as they are purely the products of their authors, and hence, the authors are subject to ethical interrogations in the circumstances that are marked to violate ethical parameters applicable in the field or academics and research.

The articles have been arranged in alphabetical order of the authors' names. Researchers and readers are welcome for any kind of scholarly inquiries and suggestions.

Thank you.

Prof. Ramesh Kumar Bajracharya, PhD
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Ecological Restoration in Gautam Buddha's Birthplace Lumbini

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Abstract

The historical information about natural vegetation of Lumbini is not clearly known. Modern day human colonization around Mayadevi temple could have been intensified after Khadga Samsher's visit to Lumbini in 1896, followed by the eradication of Malaria in the Tarai of Nepal around the 1950s. The dense human settlements around the Mayadevi temple (place where Buddha was born) was gradually shifted outside the area of Lumbini Development Trust (LDT) (16 x 4 km2 area), and the area was planted with a huge number of plant species. Hence, the forest within LDT is essentially a secondary forest without a scientific method of forest management (only plantation), as a result some species were not able to get naturally established and disappeared gradually. Studies indicated that there were around 354 species of plants species in LDT (Siwakoti, 2008) however, a recent vegetation survey (Tiwari, 1919) recorded only about 250 species including 39 tree species and other herbs and shrubs (the data is being produced, and needs second round survey to confirm). Some very common plant species have not been found from the region, indicating the heavy anthropogenic pressure including construction activities, grazing, fire, and plantation of trees without knowing microhabitat have taken the toll, and also by the encroachment of alien and invasive plant species both in terrestrial and aquatic environment. It is quite important to update the biodiversity, study regeneration of plant and animal species and management of invasive species in order to restore the natural ecosystems of Lumbini to develop it as both a sacred pilgrimage site and nature reserve. Ecosystem conservation and reintroduction at LDT could be done by following the strong reliance of Gautam Buddha's teaching about nature and life.

Keywords: Lumbini, ecosystem, restoration, heritage, biodiversity, conservation

Introduction

The exact environmental condition of Lumbini during the Buddha's time is still largely unknown and has remained mysterious although the archaeological sequences remain well preserved and present a history stretching back to C.1300 BCE. It is of great interest to know how the surrounding environment might have motivated Siddahrtha to become Gautam Buddha. Various historical annals have mentioned that Siddartha was born in a green lush, quiet and sacred garden of Lumbini (27029'47.8" N & 83016'59.8" E) which lies in the Rupandehi district of central Nepal's Tarai lowland (approx. 150 m asl) region with a typical tropical type of climate and vegetation. The mean maximum temperature in the area is 360 C during May, mean minimum temperature is 80 C during January and the annual precipitation is about 1700 mm.

The Lumbini Garden is located some 13 km west from Bhairahawa city, the headquarters of Rupandehi district. It is a birthplace of the Buddha, a holy site of pilgrimage for the Buddhists and peace loving people of the world and also recognized as a World Heritage Site in 1997.

Buddhist literatures mention that the newly born prince Siddhartha (Buddha) had taken seven steps and uttered some precious words as an epoch-making message to the suffering humanity. It happened in the beautiful *Sal* (Shorea robusta) grove of lush green trees where queen Maya Devi gave birth to the Buddha in 623 BC during that time she took support of the branch of a tree (Brochure, Lumbini Development Trust). There are different views about the identification of the birth tree; some authorities claimed it as an *Asokha tree* (Saraca asoca), whereas others as *Sal tree* (Shorea robusta), Mango tree (Mangifera indica), *Pipal tree* (Ficus religiosa), Banyan tree (Ficus benghalensis), Black berry (Syzygium cumini), etc. (Bidari, 1995). The ancient monuments and records are the witness to glorify the Lumbini as a birthplace of the Lord Buddha. The history of the area between the 15th to 19th centuries is not clear. It had remained neglected and the surrounding vicinity had changed the beautiful garden into cultivated land. Until about 3 decades ago, the area was occupied by cultivated lands and settlements but after the initiation of Lumbini Development Project in 1970 the settlements have been shifted and developed greenery by planting over 3,71,182 tree saplings (Khan & Yoshino, 1995). *Dalbergia sissoo* is the major planted species (about 295,000 saplings) followed by *Shorea robusta, Syzygium cumini, Acacia catechu, Azadirachta indica, Tectonia grandis, Eucalyptus citridora, Callistemon citrinus, Anthocephalus sinensis, Albizia spp., Magnifera indica*, etc.

Figure 1: *Beautiful view of Mayadevi temple, Mayadevi pond & Ashoka pillar at Lumbini (Photo collection: A. Tiwari, January 2019)*

Materials and methods

Field data were collected from the Lumbini Development Trust (LDT) zone. We recorded and collected all naturalized plants during the transect walk which was carried out along the forested as well as non-forested areas within the LDT area. For the practical purpose, we divided the transect survey in three zones, Lumbini sacred garden zone, Monastery zone and Crane Sanctuary zone. The collected herbarium specimens of all the plant species (excluding

the very common plants) were identified and reconfirmed with the help of standard literature Hooker (1872-1897), Hara et al. (1978), Hara and Williams (1979), Hara et al. (1982), Flora of Bhutan (Grierson & Long, 1983-2001; Noltie, 1994-2000; Pearce & Cribb 2002), Stainton (1972), Polunin and Stainton (1984), Stainton (1988), Wu et al. (1994-2008). We have also observed different ecosystems within the LDT area and reviewed their ecological environment.

Further, we reviewed published and unpublished literature dealing with issues related to Lumbini. Literature was searched by using some key words like Lumbini, the Buddha, history of Lumbini, and history of Nepal. In this study literature published (also conference proceeding, abstract, thesis, projects) up to the end of August 2018 is incorporated. Similarly, for ongoing research, those studies which were recently carried out with LDT are also included.

Discussion and results

Plant diversity in Lumbini

We identified and enumerated all plant species scientifically mentioning their correct scientific name, local name, genus and family. Our study (Tiwari, 2019) enumerated 255 species of flowering plants. Previous study indicated that there were around 354 species of plant species in LDT (Siwakoti, 2008), the reduction in number could be due to the study in a single season. We emphasize that the flora studies should be carried out in different seasons in order to have a complete study of Lumbini flora. Interestingly some very common plant species of the ecological belt have not been found in LDT area, indicating the heavy anthropogenic pressure (construction activities, grazing, fire, and plantation of trees without knowing microhabitat have caused the disappearance or annihilation of these floras; and also by the encroachment of alien and invasive plant species both in terrestrial and aquatic environment. Hence it is quite critical to manage the natural ecosystems of Lumbini to develop it as both a sacred pilgrimage site and nature reserve. Ecosystem conservation and reintroduction at LDT could be done by following the strong reliance of Gautam Buddha's teaching about nature and human life.

The invasion of plant species is also one of the key factors for threatening plant diversity of Lumbini among different disturbing factors. We reported more than 23 invasive plant species in Lumbini. The number of invasive and alien plant species (IAPS) that we reported in LDT is very close to the total number of IAPS (26 species) reported in Nepal (Shrestha, 2019) showing that the plant invasion in tropical region of Nepal is growing in the recent years and Lumbini is not an exception. Fourteen species of invasive and alien plants were reported from Parsa National Park (627.39 km2) in central Nepal (Chaudhary et al., 2020), similarly, Bhatta et al. (2020) reported 12 IAPS from Bardiya National Park (968 km2) in Nepal which is bigger than Parsa National Park. In this context, 23 IAPS reported from LDT (64.5 km2) is a very high number in terms of plant invasion. We can clearly see the higher impact of IAPS to the natural ecosystem of the LDT region in the future; hence, it is critically important to address the issues of invasive plant management in the region.

Nature and Buddhism

Lumbini is one of the most sacred places in the world, and people around the globe have developed different visions over centuries about the place where Gautam Buddha was born. However, there are some common understanding in certain attributes and characteristics

regarding Lumbini. The Gautam Buddha is not only the Light of Asia but also the light of modern human civilization. Buddhism philosophy talks much about nature and life; however, there still exists antagonistic approaches within Buddhism. 'Pro-Civilization Strand' sees nature as something disagreeable and full of danger and wilder for comfortable living and, hence, developed cities with ideal living conditions, whereas 'Hermit Strand' (full compliance to nature) advocates time in solitude in nature where every living creature is valued as an important component of ecosystem, and is preserved and restored (Schmithausen, 1991). Hence the 'Hermit Strand' concept in association with Buddhist ethos of not killing any living creature and of compassion and benevolence has been described as the main crux of Buddhism and nature.

Figure 2: *A panoramic view of Sun set in Lumbini*
(Photo collection: A. Tiwari, January 2019)

Buddhism and the Lord Buddha's teaching can be regarded as a science of human living since long ago. As modern science deals with proof or evidence-based studies, Buddhist eternal teaching requires 'proving before believing' by an individual and hence understanding the basic rationale of Buddhism enables one to not only understand the basics of many scientific explanations but also many social science theories in politics and economics. The understanding of both Buddhism and science is complementary in order to enable any individual to live a full and meaningful human life in today's market economy driven world which is full of competition, chaos and conflicts.

The Lord Buddha's teachings are more relevant in today's world than they were about 2500 years back. The economic developments all over the world are increasingly dictating the direction of development at the cost of rampant environmental degradation and loss of

biological diversity. However, few Buddhist countries have followed the teaching of the Lord Buddha on leading life along the middle path or the 'noble eightfold path' is a teaching on making choices in life for sufficiency and moderate living, choices which will produce sustainable use of our natural resources that are depleting at an alarming rate. Modern biologists (Prof. Andy Purvis at the Natural History Museum in London, Peter H. Raven at Missouri Botanical Garden, St. Louis and many) have already warned of 6th mass extinction of species due to modern climatic and land use changes, here the Buddhist teaching and modern realization converge; we can no longer senselessly overexploit our resources without sustaining them for the future generations.

The current environmental problems at global or local level are mainly due to anthropogenic causes associated with over-exploitation of resources and excessive emission of noxious gases and effluents. These activities are basically guided by people's making choices based on desire and greed for maximization of return of benefits and excessiveness in one way or another. In this context, the understanding of the Buddhist teaching could greatly help to redirect these trends towards sustainable development for the benefit of humanity as a whole. It has already been evident from the ecological footprints of Buddhist countries, being distinctly modest as they are several fold less than those of developed countries of the world. Most of Buddhist nations do not even use the full ecological capacity available to them despite their poverty, when their counterparts are exceedingly ecologically overshot as a percentage of sustainable level. In the backdrop of growing consumerism and capitalism fuelled by highly developed economics in the post-globalization era, the Buddhist philosophy about nature conservation and right to live for all provides immense inspiration for conserving nature and biodiversity for the sustained future on earth.

Ecological restoration in Lumbini

Lumbini is a Buddhist pilgrimage centre, where the archaeological remains associated with the birth of the Lord Buddha forms a central feature. Lumbini has been inscribed as a World Heritage Site since 1997, and is declared as "Fountain of World Peace" by World Buddhist Federation (1988 December) because of its immense historical and archeological importance (Bhatt, 2006). The restoration of ecology of the Lumbini region is essentially a complicated task because it has to be managed both as a pilgrimage destination and touristic site (Karki, 2005). People of various dimensions of human life and religion are very much interested to visit Lumbini, ranging from adherent Buddhist monks and people of various religions just for recreation purposes. LDT official resources indicated that a large number of visitors of very young age visit Lumbini every year. It is indeed a great opportunity for Lumbini to teach the visitors about humanity and nature as described by Buddhism; so that the visitors would feel eternal peace, tranquility and great reverence to Mother Nature which supports our living on the Earth.

Ecological restoration in Lumbini is essentially important for its sustainability. We can see the greater interest of national and international bodies for the sustained development of Lumbini as the birthplace of Lord Gautam Buddha. It is clear that the problems on development of Lumbini have already been identified, and we only need commitment for its development. Sometimes, the Kenzo Tange Master Plan (Kenzo Tange is a Japanese architect who was hired to draw up the master plan for LDT is stigmatized as the epitome of moratorium in action in Nepali management system (Rai, 2007). However, it is good news that the remaining development as per the master plant is going to be completed very soon.

Figure 3: *Students collecting plant specimens during plant documentation (Photo collection: A. Tiwari, January 2019)*

Lumbini has to be developed both as a sacred pilgrimage site for Buddhist practitioners from all over the world and as a learning place for every human about the Buddha's philosophy on nature and life. Hence, the ideal environment of Lumbini requires it to be clean, green, and spiritual. Further, people come to Lumbini to see nature, forests, wetland, birds, animals, butterflies living in close harmony of nature where life of every individual is secured (Rai, 2006). The Buddha's life and enlightenment are closely related to plants and animals. There are stories on which tree he was born, he meditated for such a long time, he got enlightened. Sarus Crane is the tallest flying bird on earth, which is very closely related to the Buddha's enlightenment and his first teaching about right to live, and Lumbini is one of key habitats of Saras Crane (Aryal, 2004; Dahal, 1995). Hence, ecological restoration is of immense importance in Lumbini to teach people about nature and to develop Lumbini as an important destination to visit, stay and for getting enlightenment.

Conservation challenges in Lumbini

Many people may not know that the area of LDT now was dense human settlements with many villages until late 80s, they were gradually evacuated to outer areas of LDT and LDT started ecological restoration in Lumbini. After Kenzo Tange's master plan was implemented in Lumbini after the 1980s, ecological restoration began, and the chunk of forests as we see inside LDT today is essentially a secondary forest planted for restoration of at least 60 % green zone as described in Kenzo Tange's plan. One should not forget that planting trees does

not work for scientific ecological restoration, this can clearly be seen in the case of Lumbini. The data showed that millions of seedlings and saplings were planted in the LDT area, without prior adequate knowledge of the climate, microhabitat, plant physiology and rapidly changing climate in the region. In the name of restoration, only plating trees went on rather than managing forests and trees. Large number of planted tree species can no longer be seen in Lumbini, because they were not planted scientifically and they were not given adequate attention after plantation.

Figure 4: *Forest fire in Lumbini 8th January 2019*
(Photo collection: A. Tiwari, January 2019)

As has been observed in the recent visit to Lumbini (January 1-10, 2019) during plant survey in the LDT area, we have seen various ecological problems of ecological restoration. Wrong preferences of tree species for plantation, lack of proper care for planted trees, grazing of livestock, illegal collection (firewood, grasses), forest fire in winter and pre-monsoon season, plastic pollution, dumping of fungicides and increased vehicular movement inside LDT (even in brick paved footpath) all are posing greater threats to ecological restoration.

There are of course other challenges associated with livelihood of local people in Lumbini as it is fully surrounded by villages, and most villagers still rely on forests of LDT for their survival, because most of them used to be the residents of villages within LDT before they were resettled outside. Hence, more attention is needed to train local people if Lumbini is to be developed, they will be definitely privileged in the other way rather than from the limited resources from the small forest patches of Lumbini.

Figure 5: *Invasive plant species Michania Micrantha challenging the growth of teak (Tectona grandis) tree in Lumbini*
(Photo collection: A. Tiwari, January 2019)

Figure 6: *A lady taking firewood and grass from Lumbini, and the wetland full of water hyacinth invasion*
(Photo collection: A. Tiwari, January 2019)

Conclusion and recommendation

It is very important to recognize that plant diversity is a key foundation for supporting natural ecosystems. Maintenance of plant diversity is the cornerstone of developing Lumbini as per Kenzo Tange's master plan. It is also equally important to recognize the threatened ecosystems around Lumbini due to habitat loss and degradation, unsustainable development works, pollution, alien plant species invasion, and climate change. The current state of the art has been able to prevent the extinction of any plant and animal species, In situ conservation in protected areas and other sustainably managed habitats, and through seed banks, cryopreservation and live plant collection, Ex situ conservation to protect all known rare and endangered species in Lumbini. It should be strictly monitored and implemented that the destruction causing extinction of any known plant species is unforgivable at least within the premises of Lumbini Development Trust. The LDT region as it stands today has all the possibilities to be developed as a unique nature sanctuary that integrates expertise, experience and skills, and resources into effective plant and animal protection, and enables effective integration between scientific research, landscape gardening, conservation, and public education. For example, thousands of waterfowls, eagles, storks, and cranes fly down from Mongolia and Siberia to the wetlands of the Tarai in Nepal; many land in the wetlands of Lumbini garden and enhance the ecological value of the region. The rampant disposal of solid wastes should be strictly prohibited as they have largely impacted natural ecosystems in the region. We could initiate the planting of local plants within the LDT area, and also could introduce tree species which could help restoration of birds, insect pollinators and other life forms. The wetlands of Lumbini are extremely important for bird and aquatic life; hence the invasive plant species should be controlled in order to save ecosystem health.

The regular monitoring of biodiversity (flora and fauna) of Lumbini is very important for proper management. The reference materials (posters, brochures, hooding boards) could be used to educate visitors about the local biodiversity in the region. We could initiate the campaign of restoration of natural ecosystems in Lumbini including forests, grasslands, wetlands which ensure the conservation of biodiversity in the region. Moreover, the Buddha's philosophy of life should be highlighted through wise management of biodiversity in the region so that the visitors could take home a message about loving and caring Mother Nature.

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Boris Lissanevitch and Nepali Tourism: History Revisited

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Abstract

In the transitional phase of Nepal, attaining peoples' democracy in the 1950, the tourism and hospitality sector witnessed dynamism. The isolated Nepal was on the way of opening for tourism. This paper tries to frame a picture of the era of 1950s in Nepal when commercial tourism was introduced. An overlooked pioneer, Boris Lissanevitch, who established the international-standard Royal Hotel in Kathmandu in 1954, assisted in making key changes in the progression of tourism as visa issuance, hospitality modernization, management of royal events, sightseeing activities, accomplishing inter-continental land cruise, and introduction of European vegetables and dishes. His vision of tourism as an economic sector led Nepal attaining its golden age (of tourism) thus paving the way for other tourism and hospitality enthusiasts to establish similar businesses. This paper aims at interpreting and appreciating the efforts Boris made in the development of tourism in Nepal among tourism scholars and stakeholders.

Keywords: the era of 1950s, commercial tourism, Boris Lissanevitch, Royal Hotel, golden age of tourism

Boris Lissanevitch and Nepali Tourism: History Revisited

Nepal, a land-linked Himalayan territory in south-east Asia, is recognized as the sanctum of nature, culture and adventure (Musa et al., 2004). In historical progression (before the 1950s), Nepal was visited, linked via published sources, and talked about its peculiarity by many visitors and scholars, to name a few, Joao Cabral, a Portuguese Jesuit missionary who visited Nepal in the spring of 1628 (Nunciature, 2017), Kirk Patric, the author of *An Account of the Kingdom of Nepal*, 1792 (Adhikari, 2012), and Sylvain Lévi, a French orientalist and author of the 3-volume book, *Le Népal: Étude historique d'un royaume hindou* (Translated as, Nepal: Historical Study of a Hindu Kingdom), who have had a detailed look-up into the Nepali Kingdom through his travels from 1905-1908 (Britannica, 2021). Nepal, since Junga Bahadur Rana, had organized large scale hunting parties, and especially in 1911 had hosted exquisite tiger shooting for the British Royals; King George V and his party trophied 18 one-horned rhinos, 39 tigers and 4 sloth bears followed by the hunts of Edward VIII, the Prince of Wales and successor of George V (Rookmaaker et al., 2005). Edward VIII also named himself the first person to land a car (on mens' back) in Nepal in 1922 (Hatuwali, 2015).

The world's first ascent of an Eight-Thousander, Annapurna, on 3rd July 1950 led Nepal into the limelight of the world and Nepal rose into fame as the hub of Himalayan mega-mountaineering followed by iconic ascents of Sagarmatha (Mt. Everest) in 1953, Kanchenjunga in 1955, Lhotse in 1956 and so on (Harper, 1999; NTB, 2011; MoCTCA, 2019). The Himalayan kingdom since the first of mountain ascents witnessed progressive growth of visitors from the western world and big names are accredited in the progression of

what latterly was known as tourism. History, however, has not duly accredited one of the major the then pioneers of commercial Nepali tourism (in the 1950s), Boris Lissanevitch, a Russian ballet dancer turned hotelier who through his incredibly adventurous journey made into the isolated Kathmandu and hosted the world-famous[1] Royal Hotel (current Election Commission building, Kantipath) (Peissel, 1966), thus paving a way for commercial tourism in Nepal. This paper tries to highlight the tourism potential Boris saw in Kathmandu (Nepal) and his contributions in projecting Nepal, through both promotion and paperwork, to the world out, simultaneously being a constituting figure of the kindling days of Nepali "Golden Age of Tourism"[2] (Beedie 2003, p. 216, cited in Liechty, 2017).

Kathmandu was indeed an isolated wonderland to all the foreigners till the Rana sovereignty. It was in 1950 when Nepal aptly opened its doors to the world and a land restricted throughout the history, and even strictly during the 105 years Rana regime (Liechty, 1997), suddenly became the enchanted heaven of Himalayan mountaineering, cultural sanctity and ecstasy of the war-worried youths (Liechty, 2017).

Mentioned previously, Nepal had permitted and entertained majorly notables (royals, diplomats and writers) before the 1950s. In a sense, Nepal's formal tourism, considering the previous visits to be much of royal endeavours, was induced after the then King Tribhuvan and Nepali Congress's (Nepal's one of the leading political parties) combined efforts led to a revolution overthrowing the 105-year Rana regime (Liechty, 2017, p. 29). Boris Lissanevitch visited Nepal as a guest (much more of a confidant) of King Tribhuvan in 1951. He had met Tribhuvan via the exiled General Mahabir Samsher JBR in the Club 300 (Kolkata), one of Boris's luxurious and premium establishments. Nepal's fate of tourism with Boris's visit was about to take a radical transformation.

Boris Lissanevitch was born as the youngest of 3 children in 1905 in Odessa. In times of tumultuous Russian politics, his career as an army recruit for the Bolsheviks was inevitable, to add, born to a Czarist army officer. At the age of nine, he was sent off to the cadet school in Odessa and so began Boris's unenthusiastic military life. In 1917 when the revolution raged, the 13-year old Boris was enlisted in the Imperial Navy and started his military career. The war quickly came out tragic to the Lissanevitch family, losing 2nd son Mikhail and lives of the remaining were still at stake as Odessa had fallen and barred. With countless struggles, Boris finally made it to Paris to pursue a new life but as something he'd not anticipated. He took help from his aunt who was a ballet mistress and teacher at Odessa Opera House. The idea was cut and dried, Boris, if needs to get out of the struggling Russia, must train as a ballet dancer and get certified as a member of *corps de ballet* opera. Attending the ballet school not only saved Boris's life but started a career for him- one of his many careers- that was to take him around the world in remarkable adventures (Peissel, 1966, p. 73).

With ballet performances from Moscow to Berlin to Paris, Boris had achieved the fame of a young talent in ballet. It eventually led him to Sergei Diaghilev (1872-1929), an impresario and a respected figure of ballet in Europe. From 1925 until Diaghilev's death, Boris flourished and amazed the European ballet under the shade of such finest artistic genius. *Le Carnaval, La Boutique fantasque, Prince Igor, The Three-Concerned Hat, Petrouchka, Mercure, Parade, The Firebird* were some of the hits Boris starred in Diaghilev's creation (Peissel, 1966, p. 88), His fame grew amongst all crew and audience as a tall, muscular, and witty

*1 on the claim **"Boris is the number two attraction in Nepal after Everest"** made by an American paper, cited in the novel Tiger for Breakfast by Michel Peissel.*

2 The era 1950-65 is considered as the "Golden Age of Tourism" in Nepal.

man. This evidences the larger-than-life character in his latter life as the central figure of both Club 300 and Royal Hotel, seed of what must have been Diaghilev's Ballets Russes. Eskelund, (1960), cited in Liechty (2017), states, "A visitor (of Royal Hotel) in 1957 noted that tourists arriving in Kathmandu wished to be photographed with three things: in order of preference,

1. Mt. Everest (which they were told was too far away to see),
2. the Abominable Snowman (which they were told was too shy), and
3. Boris, "the famous ballet dancer and night-club king who goes hunting with film stars and maharajas".

Diaghilev's death trembled the Russo-European ballet and Boris had now been in sheer absence of Diaghilev's guardianship. After a few months, he tied up the situation and re-pursued the ballet career, now on more of international stages. Boris in the ballet career pursuit met Kira Stcherbatcheva in the early 1930s and married her soon after. The "Kira and Boris" group performed in upscale colonial hotels, nightclubs, and concert halls from Shanghai and Hong Kong, to French Indo-China and Singapore, to Calcutta and Bombay. This ballet adventure brought Boris to the lights of Asia, especially India (Liechty, 2017). After his dancing career almost came to an end with quivering marriage in 1936, he crystallized the idea of creating an all-day-open mixed club[3] in Calcutta; the brainchild of Boris, Club 300, was established in December 1936 hosting India's elites, the princes, Maharajas, corporate magnates, and foreigners (Liechty, 2017).

Club 300 rose as a venerable social club in Calcutta, fame spreading as far as Europe and Boris, if his exquisiteness looked upon today, is one of the few individuals who is even larger attraction than his establishment. His connections from the club led him to big game, Tiger Hunting. Big game hunting was sport of the elites in India, while Nepal's approach was slightly slant; the Ranas had used Tiger Shooting as a diplomatic tool, mostly for the East India Company's bigwigs and British royals (Rookmaaker et al., 2005). Now the rallying point of young, wealthy, and brilliant men in the city, Club 300 had led Boris to intimate relations with major rajas and maharajas, the notable for us, General Mahabir Shamsher Rana who was residing in Calcutta as an exile from Nepal and had joined 300 soon after its opening. General Mahabir Shamsher was also the sole reason why Tribhuvan met Boris, and a financer for the liberation movement (via Nepali Congress party) against the tyrannical Ranas (Peissel, 1966, p. 180).

While the tiers of revolution were unfolding in Nepal, Boris was busy in his unusual endeavours, and in airlines this time. The service refurbishment of Cathy Pacific Airlines[4], incepted at 300, had Boris and de Kantzow plan the flights of surplus airplanes left by the US Army Air Force. Peissel (1966) estimates that these flights brought profits of almost a million dollars in matter of weeks. With this immensely successful flight renovation, Boris inspired General Mahabir to buy a surplus plane that Boudzikowski (Boris's Russian friend) would pilot. General Mahabir bought the small chartered DC3 plane and converted it into a luxury plane and having earned quite handsomely, he kept on adding aircrafts, leading to the establishment of Himalayan Aviation (estd. 1955), Nepal's first airlines operator. A small airstrip built in Gaucharan (now Tribhuvan International Airport) in 1950 saw Nepal's first

3 India then had extravagant clubs but only open to European lords with fewer or no recognition to Indians. Boris had felt a mix club was Calcutta's necessity, and a precise target market he had waiting for the club.

4 Started with residual planes by Roy Farrell and Sydney de Kantzow (Boris's friend) during the post-war China, 1946, Cathy Pacific is now a popular airlines operator in the Pacific area.

commercial airplane (the DC3 aircraft), visibly breaking the extensive isolation for the first time in history. In a sense, Boris had contributed to the commencement of the tourism of Nepal before he even realized, and before anyone had attempted. It is plausible that many travel and tourism professionals believe, Boris was and is to be considered as Nepal's 'Father of Commercial Tourism'.

Inger Lissanevitch, Boris's second wife, according to Rai (2005), immediately fell in love with Nepal in the very first visit and wanted to live here. Boris was more than captivated by Nepal, the moment he landed. Explaining to a friend, according to Liechty (2017) Boris expressed his charm for Nepal as "Where can I breathe fresh air like this? Where can I find open space like this? If I live in Nepal, I'll live fifteen years longer!" As we explain the major pulling factors of Nepali tourism now, fresh air, resembling pristine natural environment, the breeze of the Himalayas is at the prime. Open space resembling unspoiled and immune to unmanaged concrete infestation as another competitive advantage while fifteen years longer life portrays the spiritual haven Nepal is. Boris's first statement on Nepal illustrates one of the prime reasons he fell for Nepal and a man of such splendid personality, he saw the unprecedented tourism potentiality.

It is tough digging out the exact reason Boris wanted to build a hotel in Nepal. Based on his establishment of Club 300, he could possibly have been figuring a way to drink after 2:00 am in Kathmandu, considering the times, Kathmandu was flooded only with home-grown fermented liquor (*Raksi*) at local levels; royals and elites had privilege of imported drinks apparently. Or until Boris opened the Royal in 1954, there were not many standard lodging hotels in Kathmandu, which could have possibly had him struck with the opportunities of instituting one. Liechty (2017) explores the hotels existent in Kathmandu before the Royal, which were, Himalayan Hotel, Paras Hotel, in the 1940s, neither of which served meals or had proper bathrooms. Kathmandu also saw the first of its standard eateries, notably, Rangana Café and Rendezvous Restaurant, New road, in 1950s, basically Indian hangouts they were (Dammann, 1995, p. 81; Chand, 2000, p. 51). Nepal Hotel, Jawalakhel, Patan, changed the existing scene of hospitality in Nepal. Established in 1951, the first "quality hotel", provided meals and had improved bathrooms with faucet and Asian-style toilets (Dammann, 1995, p. 51). Unfortunately, in just one year of establishment, the hotel became obsolete and bolted forever. Hotel Snow View, Lazimpat, emerged as the first successful foreign-class hotel in 1952 (Adhikari, 2005). Thomas Mendes, an Anglo-Indian and a Christian Missionary, ran the hotel well compared to existing ones with dining halls, clean rooms, kitchen staffs, but retaining from selling alcohol and cigarettes (Morris 1963, p. 52). These were the major players in Nepal hospitality before the Royal opened.

Picking up on the motive behind establishment, Boris might as well have been looking for a good place to rest his head in the nostalgia of his flamboyant Calcutta endeavour. Peissel (1966) contends that Boris, who had gone weary explaining tourism from Prime Minister to governmental desk-jockeys, had the idea of reviving Club 300's flavour in a place his heart dreamt of dwelling. How? A hotel.

It, however, is evident that Boris was not really a money-driven businessperson. According to Choegyal (2020), Boris times-a-while went into financial distress and sought loan from Jim Edwards[5]. 'He was a terrible businessman, he didn't think about money at all,' bemoaned

5 Jim Edwards is a gargantuan figure in tourism of Nepal. He is famously known for renovating the Tiger Tops, a famous jungle lodge, now, Tiger Mountain, chain of eco-resorts. Edwards is also credited to establishing Elephant Polo, a sport introduced by Nepal to the world.

Inger. Boris himself said: 'I always spent just about a little bit more than I made' (Choegyal, 2020). It thus is evident that Boris was never unto money solely. For him, money was just an operational asset to get things running. Managing and monetary activities for Boris was a necessary chore and socializing the real reward (Shelby, 2008). It also could be deducted that, had Boris operated the Royal only as a profit-making hotel, he possibly would not have been remembered as the larger-than-life character by those who met him and Nepal's tourism would not have had taken the pace he raced at based on the Royal.

The Royal Hotel came into existence in 1954. Boris with financing from and in partnership with prince Basundhara (younger brother of King Mahendra), leased a large section of the Bahadur Bhawan (current Election Commission Building, Kantipath, as of 2021) and went on operating the hotel, a sector he was relatively new to. Examining all of Boris's doings, it is obvious that he was eccentric and able to look into things the way others could not, extravagantly most of the times. The Royal in that sense was destined to open as a hotel but stand as something larger aligned with Boris sophistication. As mentioned earlier, Nepali officials were totally unknown to 'tourism' and mocked those who suggested Nepal should open for it. A hotel he dreamt of establishing and the hotel he established, but apart from the large empty halls and ghostly rooms, the building would never be a hotel. Had he thought of a restaurant, setting up would have been much easier but for an international, tourist-grade hotel, everything from forks and knives to bed and beddings to sink and flush-toilet needed to be set; the latter was something Kathmandu till the date had never seen. Boris had to import his own belongings, from Club 300, Calcutta to Kathmandu, Nepal. With no proper roads and vehicles in Kathmandu and India in Monsoon, his journey with 140 crates of hotel items turned out to be as harrowing as it could get (Peissel, 1966, p. 48). After a week, he managed to get the logistics in Kathmandu. Another take on tourism progression, now the logistics, for clarity let's imagine, a flush (commode) toilet that modern day tourism (even basic) hotels use, and something so common that no one thinks about, were alien to Nepal till 1954 and Boris was the first one to get them. Tourism modernization in Nepal owes a lot to the Russian émigré.

Bahadur Bhawan in its refurbishment took a huge capital and time, and with the crew of Indian and Nepali craftsmen, was ready to lodge and serve by February 1955. Boris was still struggling to persuade Nepal to issue tourist visas and at a moment, he gambled that Nepal could relax the visa restrictions if tourists enjoyed their stay in Nepal (Liechty, 2017, p. 39). To enlighten the context, Boris was very keen to receive guests for the Royal (hotel). According to Satyal (1999), cited in Liechty, 2017, the mass travel pioneer Thomas Cook in October 1954 asked Boris to manage and accommodate 20 of his clients, who were in a cruise tour to India, to Kathmandu, Nepal. The 20 tourists, mostly elderly and extremely rich, fell in crazy love with Kathmandu, buying all the local arts and crafts from the hotel display[6]. Who were the 20 ladies? Tourism history acknowledges them as the first tourists who visited Nepal, considering the 'tourist' identity they belonged to.

Nepal's tourist visa issuance also had noteworthy efforts of Boris as he had put himself in enlightening the prospects of tourism Nepal could offer. In one of the cardinal visits of the

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6 Royal Hotel alongside being the first standard hotel in Nepal was the first boutique hotel as well. Peissel (1996) in Tiger for Breakfast explains he witnessed local merchants rushing every morning to the large glass displays in the hallway of Royal Hotel to exhibit their arts and crafts (gold, brass ornaments, bamboo crafts, wood carvings etc.). Tourists in the hotel could experience and purchase Nepali souvenirs. The hallway alone contributed in a section of Kathmandu's local merchants' economy.

hotel, he arranged that the King himself should attend a reception for the newcomers. Mr. and Mrs. Alexander of the Ford Foundation, who had arrived a few months earlier and were the first clients of the Royal Hotel, scanned Patan's artisans' shops for intricate and beautiful Nepali jewellery and handicrafts. They felt these might interest visitors and could be a new source of foreign exchange for the country. On the day of the reception, before the surprised King Mahendra and his royal ministers, the tourists rushed on the handicraft exhibits, fighting with each other to buy up everything. So popular were the bejewelled copper boxes, the masks and other artefacts that there were not enough to go around and more had to be ordered. King Mahendra was so impressed by the evident enthusiasm of the tourists for his country and its crafts that he gave orders to his ministers then and there, on the terrace of the Royal Hotel that in the future visas should be issued to all tourists on sight. Thus Nepal, with the King's aspiration and Boris's assistance, was procedurally opened to the world (Klenov, 2000, p. 14).

Now that Royal Hotel was successfully installed and even enjoyed its first clients, visa issuance in the operational pipeline and Nepal as the haven for adventure and mountaineering (especially after the Annapurna Expedition, 1950 and majorly, Sagarmatha Expedition, 1953), Kathmandu rose as the ultimate oriental world, a Farout the world looked as if it were another planet, a must go for the west, a must be for the west. The hype of Kathmandu could also be expressed in lights of the visitors Royal welcomed; because for foreigners, there simply was not a place except the Royal to reside in stay, and Boris, with his ebullient personality, was even larger charm than the hotel itself. Ed Hillary, Father Marshal Moran, Elizabeth Hawley, Desmund Doig, Han Suyin, Werner Schultess, Toni Hagen, Peter Aufschneider were frequent visitors of the Royal Hotel. Some iconic personages had visited Nepal back then, to name a few, Valentina Tereshkova (first and youngest woman to have flown in space) and her husband Andriyan Nikolayev (Russian Cosmonaut), who stayed in the Royal on her honeymoon, American billionaire John D. Rockefeller III, Spanish Prince and later King Juan Carlos, on his honeymoon in Royal and many politicians, diplomats, Hollywood celebrities, and celebrated authors. Not to mention the Nepali royals, to whom the Royal served as a hangout. The kind-hearted Boris had let youngsters without money to dwell in their camps on the vast open lush-green gardens of the hotel. Mountaineers dwelt all around. As the inside overwhelmed with extravagance of the aristocrats, the outside was equally colourful with music and youthful ecstasy.

On the unwavering foundation of the Royal Hotel accompanied by Boris's corresponding charisma, and larger than that, the magnificence of nature-cultural wonders, Nepal's tourism debuted as a sensation to the world media. The media coverage and western perception of Kathmandu in the golden years is richly compiled by Liechty (2017), a few are attempted to reword here. New York Times and Chicago Daily Tribune in 1955 infatuatedly covered the tourists' trip to Nepal, stressing over how such few visits happened before. The Los Angeles Times claimed Kathmandu "the new million-dollar world in travel," destined to join Bali and Tahiti "in every around-the-world-folder" (Hemphill, 1956). Kathmandu enchanted the US's public imagination, virally as of now, with Life (1955) magazine's 4-page photo-article on the lavish visitors of the Royal Hotel and sites to visit. People believing Kathmandu was somewhere on another world now realized they could with enough money and peripheral hobbies (sightseeing, trekking or mountaineering) make it to Nepal. Public image of Kathmandu before was justified as with the above-mentioned names in the place, one would simply believe it was the place for the chosen ones. Now that the tourists' numbers kept on

increasing, and Royal Hotel, being the first encounter and choice of stay of the tourists, was synonymous with Kathmandu. A London newspaper ranked it second among "the most interesting hotels in the world" (Stephens, 1979).

The number of tourists steadily grew in Nepal. The reason Boris saw the tourism potentiality in Nepal were indeed the major pulling factors. Peissel (1966) compares Patan with Venice, that not a single structure that built them were out of the places. A city so alive, so architectural, every minor component of the city exhibits its aesthetic beauty and the glorious hands that carved them; 'a dream city' in Peissel's language. Bhaktapur and Kathmandu were similar in terms of authenticity. He was amongst the non-native pioneers who added vibrance to the city[7], a desire the world wished to experience. Unsaturated as Calcutta, Kathmandu was free from all sort of noise, pollution, dust and the ever-deepening crater of rich-poor visible encounter. The valley roads despite being narrow, passed through the melting smile and humility of the Nepali people. The roads of Kathmandu, as found in literary sources are described as an experience on themselves. Aligned with beautiful flowering trees: Persian lilacs, silky oak, bottlebrush, and jacaranda (Fleming & Fleming, 1990), and the grand view of majestic Himalayan chain, Kathmandu had a magnetic effect on tourists in only a few minutes of arrival. Boris was very accurate in recognizing that Kathmandu could be the definition of tourism when he landed in Nepal. It now was. Royal Hotel was well set in operation. Boris had hired and instructed required staffs to meet the demands of the tourists and was involved himself as he was the sole bridge between the guests' expectation and the Nepal experience. Inger, Boris's wife, had employed herself to receiving the guests at the airport.

In the swift operations, an issue arose, however. The tourists wanted to explore, understand Kathmandu, see the temples, monasteries, hills, valley and all that it has to offer, but how? Boris could hardly get free managing the logistics as he had to supervise the airlifts of majorly liquors and other requisites from Calcutta to Kathmandu. And a few even if he could manage, not quite compatible with the growing numbers every day. Nepali townsfolks, rich in warm smile though, only communicated with the tourists in sign language, that wouldn't work for the over-enthusiastic westerners. Boris had realized the situation and came up with an idea of hiring English-speaking hotel managers from India which would work for the in-hotel encounters. But what on the outside, where the real deal was? In the early 1950s, the only place where he could find English-speaking Nepali was at the St. Xavier's School run by American Jesuits. Boris met with Ashok Sharma, a local English-speaking boy of St. Xaviers whom he proposed to guide the groups of westerners. Liechty (2017) has illustrated a section of the interview with Sharma where he recalls his first guiding as, just being able to speak English Boris hired him and instructed to take them from airport to Pashupatinath and Boudhanath, then to hotel, a bit of shopping and dinner. More sightseeing on the next day or next days to and from the hotel. Sharma who didn't know much of temples, anyhow managed to guide the tourists to Kathmandu's marvels. Boris, in 2 minutes chat with Sharma on being able to speak English as all that required, had trained Nepal's first tourist guide; a vocation now that takes 4 months to complete, requiring minimum bachelor's degree to enrol, has its history emerged this way.

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7 Kathmandu, excluding westerners, had several colorful and enigmatic adored internationally. Almost every western visitor of Kathmandu was intrigued by the royal family, especially King Tribhuvan, Prince Mahendra, Prince Basundhara, Field Marshal Kaiser Shamsher Rana, their sex-life as the major drunk gossip, illustrates Murphy (1967, p. 80)

While operating the Royal, Boris had introduced Kathmandu to many things it was unknown to, that the Nepali in the valley did not know they existed. On the large lush grounds of the Royal, he raised European vegetables unheard, unseen and unavailable in the local market such as mushrooms, strawberries, artichokes, carrots, and beets (Liechty, 2017, p. 70). Such common vegetables now were completely alien till the 1950s. Another supposedly noteworthy Boris's contribution to Nepali society was the introduction of Yorkshire Whites to Nepal whose transformation to *Bangur* is incredible. Nepali pigs (*Sungurs*) were considered impure, only to be eaten by lower caste but wild boar (*Bandels*) were considered dainty dishes, often hunted for and by the elites. While the hotel needed fresh ham, Boris cooked stupendous idea of breeding pigs in Nepal and imported 43 large Yorkshire Whites from India (Peissel, 1966, p. 61) which were deemed edible by the elites (Liechty, 2017, p. 70). To distinguish the Yorkshires, a new identity was required for the hogs. It is believed either Boris or Jimmy Roberts was the architect behind the term *Bangur*, combining *Bandel* and *Sungur*. It is very likely that the ancestral roots of Nepali *Bangurs* if researched, would lead to Boris's hogs. He had also been a pioneer of introducing several European (Russian majorly) dishes to Nepal. One of the noted dishes, as mentioned by Peissel (1966), was the Genoa fruit cake which used to be the summit treat of nearly every Himalayan mountaineering expedition. Boris was very warm with the mountaineering fraternity which privileged him to be accounted on their after-expedition publications while many mountaineers brought him pieces of rocks from the summit of the highest peaks (Peissel, 1966, p. 225). In the reign of the Royal, 1954 to 1969, Boris had played a major part in assisting, feeding, lodging and entertaining number of largest and famous expeditions. It is with these multiple accounts and mentions of him in several publications, the western media crowned him with 'the number two attraction in Nepal after Everest.'

The Royal, along with providing food and accommodating the visitors, via the Yak and Yeti bar, served as the primal spot of socialization. Founded on the 2nd floor of the hotel, the bar was the clubhouse where all Kathmandu gossip trickled (Murphy, 1967, p. 22). From Hillary to royals, Yak and Yeti entertained all colourful personas. The problem was however liquor, which ran short every once-a-while as there was no distillery in Nepal that could produce liquor of the par, thus was to be airlifted, causing delays. Seeing the guests and royals helpless, Boris planned another of his astounding endeavour, setting up a distillery in the eastern Nepal (Biratnagar). He arranged the legalities with the authorities and indeed set up the thing, for his calculations were simple. There were none in whole Nepal, guarantees a success. Boris thus set the very first factory in Nepal (Peissel, 1966, p. 199) and in Biratnagar, the city that would later develop as the country's largest industrial center. The factory produced 3 categories of fine fruit flavoured alcohol, which unfortunately would not sell at high prices. Loss for him it was, although, Nepal witnessed the very first factory and the enthusiasm of industrial commencement. A win, calculating all accounts.

In 1956, Boris had played a significant role in the hospitality management of the coronation of King Mahendra. With the epitomal royal event, he attempted changing the nature of managing events, performing at an unprecedented standards and methods. Boris, having assigned with the accommodation of the royal guests from several countries and the management of the event, did it so splendidly that major royal and elite events afterwards required him to execute. The detailed account of King Mahendra's coronation is described in the 1958 Han Suyin novel, *The Mountain is Young*. Peissel (1966) describes a thorough version from Boris's standpoint. For logistics, he had chartered three DC3 aircrafts for three

days, airlifting six thousand live chicken, one thousand guinea fowl, two thousand ducks, five hundred turkeys, one hundred geese, one and a half ton of fish, two tons of vegetables and even a couple of tons of ice (Peissel, 1966, p. 210). This airlift was a gamechanger in Nepal due the fact that all coronations before were hosted on and with entirely local logistics, for which the citizens were subjected to high taxation and even property cuts. It changed with Boris's idea of airlifting the logistics from India. King Mahendra's coronation brought Nepal to even grander fame in eyes of the west and the elites from around the world. The guests of the event, who enjoyed their stay at Royal and explored virgin Kathmandu, came repeatedly what later advanced as diplomatic tourism.

What genuinely separates Boris from anyone of that era and even as of now it seems was his courage and enthusiasm to explore things, some of which never previously undertaken. Analyzing his past as a soldier at the age of 13 to world tours to an opium addict at some point, a big game hunter and the center of social clubs and gatherings, it is logical that only the person whose character and doings resonate as of an adventurer can think in levels of the unprecedented. In 1957, Boris attempted and succeeded in an endeavour possibly not many of that time would try. He became the first person to drive the full distance from Solihull, London to Kathmandu on 3 long-wheel based Land Rovers (Peissel, 1966, p. 237), a pioneering journey that he completed in 42 days, odometer reading 12,380 kilometers, as the monster vehicles parked in the Royal, Kathmandu (Liechty, 2017, p. 130). He pulled off this grand cruise as a pilot to develop an overland-cruise-package with 20 luxury house trailers. The cruise was to last for 3 months at a cost of $100 per day. The spacious house trailers were loaded on costume-designed powerful Land Rovers, each trailer having a Nepali valet, Nepali chauffeurs and in-built bathroom facilities. Two giant kitchen trucks were part of the crew with 5 cooks and local chefs to be picked up on the arrival of specific countries for the nation's specialities (Peissel, 1966, p. 239). Such was his vision and operated the package for a few years. Owing to poor quality roads and high maintenance costs, he had to take the idea down but recollecting the concept now, how a man pulled off such a gargantuan cruise alone, inspires the tourism associates to pull off similar endeavours on tourism innovation and product diversification. On the bright side, Boris's travel attracted a wide media coverage (Peissel, 1966, p. 272) which in turn inspired the latter travellers (majorly hippies) to undertake long overland travels from Europe to Kathmandu.

By 1961, Boris's fame was glowing around the world. The Royal, hosting a wide range of visitors from royals and elites to diplomats and researchers to hippies, had Boris featured in almost every literature the visitors published. During Queen Elizabeth's state visit to Nepal, Prince Philip is said to have scanned the room at a reception, approached with hand outstretched, and asked, "Are you Boris?" (Simpson, 1976, p. 65). Boris was assigned by King Mahendra to manage the royal state visit, and that he did, utilizing the moment to display his extravagance of organization. Welcoming the royal couple at Meghauli, Chitawan (the hunting camp), Boris lined up no fewer than 376 elephants, lavishly decorated and painted with gold and silver, into one immense, breathing wall, stretching miles long (MacDonald, 2005, p. 80). A heated criticism the tiger shooting of the British royals brought from over the west as an issue of animal cruelty and heavy taxation on the poor citizens for the royal appeasement. It however for Nepal and Boris was possibly the biggest and grandiose event that ever happened. Being among the last of the tiger shoots around the world, King Mahendra's spectacle was truly magnificent. Nepal army was mobilized to set the camps on the banks of Rapti river, Meghauli, Chitawan. A road was bulldozed through the deep Terai

jungle and an airstrip of 1200 yards long was built (Peissel, 1966, p. 254). Boris at the event managed and executed flawlessly all that he was capable of doing, banquets, picnics, tent camps, in both Kathmandu and Meghauli, and a model of Mount Everest at the center of the hunting camp (McDonald, 2005, p. 80). Kathmandu, unfamiliar with any of the westernized receptions, galas, balls, banquets, and other sophisticated event managements, was introduced and pioneered with Boris, a take, Nepali tourism history should acknowledge.

Conclusion

Boris, who through his adventurous journey, made it to Nepal in 1951 and falling in love with Kathmandu, he established the Royal Hotel in 1954 and the Yak and Yeti Bar. His establishments were modern and of international standards at the time and enjoyed global recognition. But apart from just operating a hospitality business in a candid economic mode, Boris succeeded in changing the nature of tourism in Nepal via events like visa issuance, King Mahendra's coronation, Queen Elizabeth's state visit to Nepal, and maintained a warm relation with guests that privileged him and the Royal hotel to be synonymous with Kathmandu. As Morris (1963) has pointed out, "nobody in their senses" visited Nepal for great food or lodging. Nepal was not seen as any whereabout, but an oriental world and Boris was the catalyst who channelized Nepal into the lights of commercial tourism, an unseen experience then, that would later develop as the nation's one of the pillars of national economy. Owing to his carefree business attitude and reluctance to keep pace with the expanding tourism industry, the Royal Hotel was shut down in 1969 but on the bright side, Boris was the inspiration behind those later generation of Nepali tourism and hospitality. The rise of Mountain Travel Nepal (estd. 1964), Hotel Annapurna (estd. 1965), The Soaltee Hotel (founded 1965; inaugurated in 1966) (Soaltee Hotel Limited, 2021), Hotel Association of Nepal (estd. 1966), Kathmandu Guest House (estd. 1968) contributed to further evolution of tourism, succeeding the Boris-pioneered 1950s, thus the end of an era.

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Mountaineering Risk, Safety and Security

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Abstract

The purpose of this paper is to explore some of the underlying mountaineering risks, safety and security issues found in the traditional activity known as mountaineering. The paper also highlights some of the commonly known and distinguished terms of mountaineering.

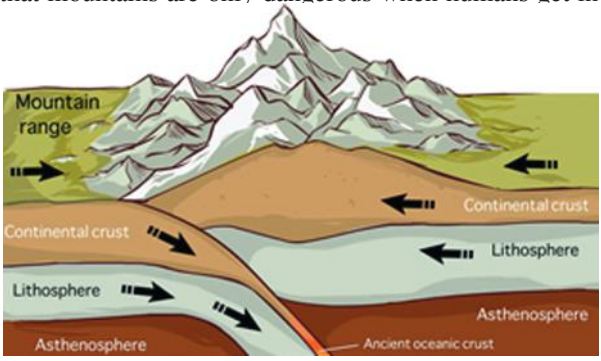
Mountaineering is the art of moving through the mountains using a set of technical 'mountaineering' skills. In Europe, it is often called alpinism when done in the Alps, apart from known as trekking, hiking or even fell walking. It includes traditional outdoor rock climbing in a mountain setting, multi-day rock climbing, skiing, snow-shoeing, a multi-day journey in the mountains, whether camping or in lodges. Mountaineering is not necessarily restricted to the greater mountain ranges as many countries with low altitude mountains have many citizens that go 'mountaineering' inside their borders.

There are no predetermined heights at which a hill becomes a mountain; many geographers state that a mountain is greater than 300m (1,000 feet) above sea level, but the Oxford English Dictionary puts the hill limit at 600m asl. Another consideration is the latitude of the 'hills'. For example, the hills of Scotland, although the highest being Ben Nevis at 1345m asl, are considerably further north than the Pyrenees with its highest mountain, Pic Aneto, at 3404m asl. The arctic winds, the northern European winds and the south-westerly gales are as harsh as any found in the higher ranges.

Keywords: Art of mountaineering, risk, safety, security

Introduction

Many people would agree with the statement that mountains are inherently dangerous. However, I would disagree, or add that mountains are only dangerous when humans get in the way. From a safe distance, when the natural movement of the mountainous environment occurs, people will gaze on in amazement; however, if people or communities are in danger of being engulfed by the mountainside, then the emotion is often one of fear, panic and empathy for those in the path of nature. Mountains are formed basically by three different forces of nature.

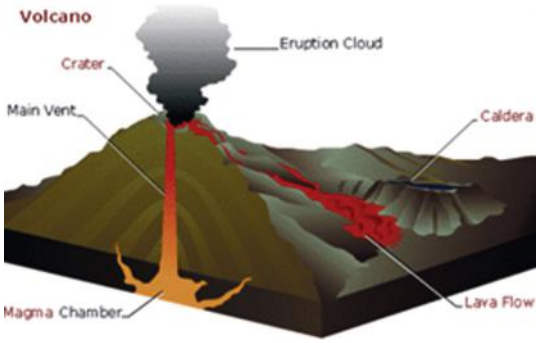


Fold mountains – HYPERLINK "http://www.Geoengineer.org" www.Geoengineer.org illustrating the Indian tectonic plate sliding under the Euroasian plate resulting in the deep surface layer of the Earth's crust being scrapped up to form the Himalaya

Fold mountains occur when the

movement of the tectonic plates collide, forcing one plate to buckle under the strain of the collision and consequently forcing the top section of the Earth's crust to either be lifted or forced down, lifting the opposing plate, thus creating fold mountains. The Himalaya is a good example with the Earth's crust initially staying intact and only folding

Rolwaling - Ian Wall collection - Looking east up the Rolwaling Valley and glacier, a valley formed in the folding of the earth's crust as the Indian tectonic Plate to the south slide under the Euroasian Plate to the north



Kilimanjaro - Ian Wall collection - Kilimanjaro, the highest point on the African Plate and the largest freestanding volcano in the world

Volcanic mountains form when molten rock from deep inside the Earth erupts through the crust and piles upon itself. Undersea volcanoes formed the islands of Hawaii, and the islands seen above the water today are the remaining volcano tops. Well-known volcanoes on land include Mount St. Helens in Washington State and Mount Fuji in Japan. Kilimanjaro, one of the seven summits, the highest mountain on each of the continents is a volcano'

Fault-block mountains form when stresses within and between the tectonic plates lead to cracking and faulting of the Earth's surface, which forces blocks of rock up and down.

The Sierra Nevada in California and Nevada, the Tetons in Wyoming, and the Harz Mountains in Germany are good examples of this type of formation. The mountains of Yosemite are also a good example of Block Mountains with the mighty granite walls still standing proudly above the valley.

It takes millions of years for mountains to form, except volcanic mountains that can form over a matter of days and weeks. During the evolution of mountain ranges, the raising or valleys, the lowering of the Earth's crust is subjected to millions of years of erosion by the elements. This erosion slowly breaks the surface of the landscape down into the jagged shape of mountains that we are more familiar with today.

Mountaineering activities occur in the regions of the Earth's surface (crust) that is subjected to movement. So it should not come as any surprise that any activity in these mountain ranges will be

Block mountains and rift valley: HYPERLINK "http://www.Geoengineer.org" www.Geoengineer.org These formations are created when the Earth's crust either drops or is raised between two parallel fault lines.

Yosemite Valley - Yosemite National Park Collection HYPERLINK "https://www.nps.gov/yose/index.htm/images" https://www.nps.gov/yose/index.htm/images Illustrating how a 'block' in the Earth's crust had dropped between two fault lines creating a vertically sided valley.

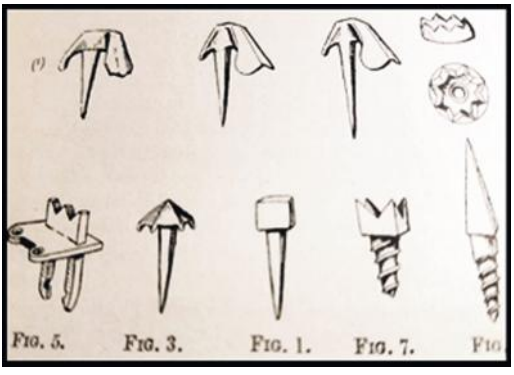
susceptible to further movement of the Earth's crust thus creating a scenario of potential risk which requires skills in mountaineering safety and security to enable mountaineers to make a safe passage through them.

Impact of mountains on habitats and geopolitics

Mountains often serve as geographic features that define the natural borders of countries. Their heights can influence weather patterns, stalling storms that roll off the oceans and squeezing water from the clouds. The other side is often much drier; the rain-shadow formed by the Himalaya of northern Nepal causes the Tibetan Plateau to remain relatively free from precipitation. The rugged landscapes even provide refuge, and protection, for fleeing and invading armies, the European Alps in World War-II.

Mountaineering, risk, safety and security

If we look back into the history of mountaineering, it can easily be seen that humans have always perceived that there was a risk associated with the mountains. From the earliest of times, the sound of avalanches, roaring winds, echoing thunder and lightning all built up



Boot nails and boot nail pattern - American Alpine Club collection HYPERLINK "https://americanalpineclub.org/library-blog/2017/12/18/the-evolution-of-mountaineering-boots" https://americanalpineclub.org/library-blog/2017/12/18/the-evolution-of-mountaineering-boots Boots were 'nailed' with different varieties / designs of 'nails' depending on the types of conditions expected to be encountered, in general there were different patterns for snow and ice as opposed to rock.

images of possible devils, demons and deities living in the high mountains and those theories were backed up by traders who tried crossing high European alpine passes only to witness the anger of the demons; goats and ibex falling from high cliffs reportedly at the hands of those living in these high places who had been upset by 'visitors'. There were tales of misadventure, of getting lost and witnessing unexplained images, possibly broken-specters and of winds roaring like dragons down from the glaciated peaks. Fear and the concept of risk are significant safety factors, and for mortal man, these emotions keep most people safe.

Artist impression of the first ascent of the Matterhorn, Gustave Dore /Wikimedia - HYPERLINK "https://www.wikiwand.com/en/First_ascent_of_the_Matterhorn" https://www.wikiwand.com/en/First_ascent_of_the_Matterhorn

The first people who exhibited the most adventurous awareness of mountaineering risk, safety and security were the early crystal hunters; they developed a 'mountain awareness' and as Guides became the first piece of 'essential equipment' used mainly by the British alpinist leading up to the Golden Age of Mountaineering (1854 – 1865) (Engel, 1950). Although rudimentary long-shafted alpine stocks, clinker nailed boots and rather unsafe hemp ropes were used there were little technical skills as to how these could be employed other than for pulling on or pushing on to surmount difficulties. Victorian mountaineers developed different nail patterns using various nail designs for their boots, depending on the sort of terrain they would likely encounter during their mountaineering exploits.

During the Golden Age of Mountaineering, the understanding and perception of risk were vastly different from today. The safety rules of the day were not to fall off and to be able to climb down anything you climbed up! The use of rudimentary equipment did not allow the level of security that we insist on today. However, the early explorers and mountaineers realized that by taking a guide, a rope, an alpine-stock and wearing boots they could considerably reduce the risks of the activities that they undertook (Engel, 1950).

In 1865 on the descent from the first ascent of the Matterhorn by Edward Whymper and team, there was a fatal accident in which Douglas, Hudson, Hadow and Croz were killed. As a result of that accident, Whymper came under not only close scrutiny but also a public outcry for assumed acts of self-preservation; he was accused of cutting the rope between himself and those who fell to their deaths. This has been disproved as the ends of the rope frayed, they would have been clean cut marks should a knife have been used (Whymper, 1871).

Although there had been other deaths in the mountains before this incident Whymper had a complete novice, Hadow, on his team and part of the scrutiny was related as to whether this person actually understood the risks he was taking and whether Whymper should have

actually allowed him to go with the team on the trip that was, at the time, to a mountain that had a 'last great problem of the Alps' label attached to it (Bennet, 1922, 1950).

This episode in mountaineering history, although many decades before the modern approach to risk analysis in the mountains existed, was certainly a foretaste of what was to come over a century later.

Once the major alpine peaks had been climbed, many ambitious alpinists turned their attention to more distant and often loftier ranges, such as the Caucasus, the Andes, the Rockies and, latterly, the Himalaya. Those prominent alpinists and their European guides of the period included Christian Almer, Melchior Anderegg, Hermann Von Barth, Alexander Burgener, W. A. B. Coolidge, Henri Cordier, Clinton Thomas Dent, James Eccles, D. W. Freshfield, Pierre Gaspard, Paul Grohmann, Paul Güssfeldt, John Oakley Maund, Thomas Middlemore, A. W. Moore, Albert F. Mummery, Julius Payer and William Penhall (Mason, 1987)

Those with a heightened sense of adventure, fortitude and a passion for exploration ventured further afield and into the Himalaya not only taking their guides with them but also their developing technical skill base.

In Victorian times there was a definite ladder of experience required to 'enable' a potential alpinist to gain progression within the mountaineering world. Initially many aspiring mountaineers gained experience in the mountain regions of the UK; North Wales and Scotland and in particular in winter conditions. This was regarded as good and essential skill training for a safer expedition to the Alps and in turn for the Himalaya (Hansen, July 1995).

By the 1900s there were mountaineers venturing into the Indian Himalaya and the lessons they learned and subsequently wrote up in their expedition reports were the foundations for future Himalaya expeditions. Using these expedition reports to gain additional knowledge and thus minimize the risk and adding an additional level of safety to their expeditions a new generation of mountaineers ventured forth with the confidence in the knowledge gained from previous expeditions. Along with this literary support, equipment was also being developed as was the mental approach to mountaineering. Today there is a proliferation of guide-books, maps and the internet all providing an added level of safety for the modern mountaineer.

The early Himalayan expeditions, especially those mounted by the Germans on Nanga Parbat and the British on Everest were masterminded by people who had survived trench warfare in the 1914-18 world war. They had faced death in the most inhumane of circumstances that to a certain extent numbed their view of 'sacrifice' for the greater cause, thus getting to the summit was a matter of national pride and never mind the cost. Little, at that time, was understood about altitude sickness and mountaineers simply fort their way through it or died in the process but in the knowledge that they had the best and most advanced equipment at the time.

The European mountain guides were certainly considered as the key factor in reducing risks on mountaineering trips, possibly right up to the turn of the 1900s. But, then World War-I put an end to many European relationships, guides and their British clients more often than not finding themselves in opposing armies, the comradery of the rope was broken (Forbes, 1900).

Mountain ranges often dictate national borders. As a result of the World War-II 1939- 1945 a rapid advancement in equipment design and mountaineering techniques was made to basically provide armies, especially the 'special forces' with the equipment and skills to fight

and move over hostile mountainous terrain and rocky sea-cliffs, this in turn increased the development of new materials, nylon rope, alloy karabiners, nylon material, silk base layer clothing, down jackets, the design of tents, Vibram soled boots, all were eventually incorporated into the development of mountaineering equipment. These developments allowed technical mountaineering skills to be pushed to the limit, the Italians were developing artificial climbing and the use of pitons, etriers (short rope ladders) and the mechanics of the use of the rope, endurance improved and mountaineers were prepared to go further, go higher and to push the risks to, and beyond, the levels of safety so far experienced in the mountains (National Army Museum, n.d.).

Evans & Bourdillon back at Camp VIII after ascent of the south summit of Everest HYPERLINK "https://www.rgsprint-store.com /products/evans-and-bourdillon-back-at-camp-vi-ii-on-the-south-col-after-ascent-of-south-summit-of-everest" https://www.rgsprintstore.com /products/evans-and-bour-dillon-back-at-camp-viii-on-the-south-col-after-ascent-of-south-summit-of-everest

The Outward Bound (OB) international network of outdoor education organizations was founded in the United Kingdom by Lawrence Holt and Kurt Hahn in 1941. Initially, in America, its aim was to help shape the U.S. Peace Corps but' in the UK, it was to develop outdoor adventure programs and to foster the personal growth and social skills of participants by using challenging expeditions in the outdoors. These expeditions were generally conducted in the mountain regions. In 1950 Plas-y-Brenin was founded in the UK as a major training establishment for developing mountaineering skills (King, 2006).

With the development of these 'outdoor training centers' more people were taking on the responsibility of 'leading' groups in the mountains and in some cases into unrealized danger. At the beginning of this new 'educational' era, there were many very experienced mountaineers with no qualifications, then as colleges and universities introduced training courses, the balance changed to one where there were many qualified outdoor instructors with little experience. Over the next twenty years, the balance was restored.

Early wrought iron 10-point crampons designed by Oscar Eckenstein: HYPERLINK "http://www.1stdibs.com" www.1stdibs.com/-equipment-memorabilia/vintage-mountaineering-crampons-design-oscar-eckenstein/id-f_14310651/

Up to 1950, risk, safety and security in the mountains had basically been a 'test of moral fiber', mountaineers were empowered by the new and the best

of equipment for their era, they had knowledge gained from previous expeditions and from maybe their service in national armies and they felt at the peak of physical and mental fitness.

The summits were at hand!

In 1950, the French ventured into the unknown extremes of 8000m asl and survived basically using a supplementary oxygen system tried, tested and modified from the Mallory era on Everest and the development of down clothing and other equipment as a result of world war two. Nailed boots had been surpassed by highly insulated boots and an early design of 10-point crampons. This oxygen system had been originally tested in the mountains of Snowdonia, in Wales, UK (Norton, 1925).

The 1950- 1960s was the golden age of Himalayan climbing, all the 8000m asl peaks had been climbed, reports written, equipment failures had been rectified, new designs were produced, and confidences were inspired. More was understood of the science of mountains and mountaineering, snow conditions were scientifically investigated, and a lot of research was done on human physiology and the effects of altitude on the human body (Mason, 1987).

Mountaineering risks were being reduced and the awareness of safety and security were increasing. In the drive to do steeper and harder ascents mountaineers were taking equipment design into their own hands and many subsequently established retail outlets.

The basic design changes that have come into the market over the last three decades have greatly increased the safety and security margins of mountaineers as well as reducing the risk factors. This applies to other mountain-based sports as well.

Petzel, Ergo Ice Tool *Cassin Alpinist Crampons* *DMM Mithril harness*
Illustrations from the brand on-line catalogue

DMM wire torque nuts, Wild Country Technical Friends, Sportiva Olympic Mon high altitude boots, Mountain Hardwear Ravi Everest Down Suit, A selection of mountain dome tents Illustrations from the brand on-line catalogues

However, another issue was surfacing in the Himalayan climbing especially in Nepal- a lack of trained human resources. The mountain people of Nepal, specifically the Sherpa

community, took the place of the Victorian Age Mountain Guides of Europe although they were not mountain guides; they certainly knew the valleys and many possible approach routes. It is a well-known fact that all the formative expeditions would not have succeeded if it were not for the mountain workers but being equipped with all the new technology, equipment and mountaineering skills and techniques foreign mountaineers were taking on more challenging and riskier routes. To raise the safety margins of the Nepalese mountain workers and to enable expedition members to continue to use them to support foreign expeditions a greater level of training was required. One of the first people to recognize this was Aleš Kunaver in the early 1970s and he embarked on a massive, state-supported project (Slovenia was still part of Yugoslavia in 1970) and built the first mountaineering training school in Manang in the Annapurna range in 1979 (Slovenian Climbing Portal, 2020).

The profession of a mountain guide was by now well established in Europe and other mountainous regions of the world but the guides all operated at different standards and with different skill sets, meaning that there was no 'guiding' standard regarding safety and security, not only for the guides but also for their clients.

IFMGA badge - The Union Internationale des Associations de Guides de Montagnes is the International Federation of Mountain Guides Associations, known alternatively by its French, German and English abbreviations: in Nepal the NNMGA HYPERLINK "http://www.FMGA.com" www.FMGA.com

In the UK, there was an increased interest in using the outdoors for developing life-skills for school children. However, in 1971 a fatal situation occurred in the Cairngorm Mountains of Scotland, now known as the Cairngorm Plateau Disaster. This occurred in November 1971 when six fifteen-year-old school students and their two leaders were on a navigational expedition in a remote area, the weather deteriorated and the group adopted their emergency plan and headed for a mountain shelter, but they failed to reach it and became stranded for two nights on the high plateau in a blizzard. Five children and the leader's assistant died of exposure. A sixth student and the group's leader survived the ordeal with severe hypothermia and frostbite. The tragedy is regarded as Britain's worst mountaineering accident (UK Parliament, 1972).

A 'fatal accident' inquiry led to formal requirements being placed on leaders for school expeditions and a national training program was devised and made compulsory for all leaders who wanted to take groups into the UK mountains (UK Parliament, 1972).

In 1973, the Nepal Mountaineering Association was formed with the goal of, among other activities, to provide safety awareness and mountaineering skills to Nepali mountaineers.

The International Federation of Mountain Guides Associations (IFMGA), was founded in 1965 by guides from Austria, France, Switzerland and Italy. The aim of the Association is to:

- regulate the mountain guide profession at a global scale;
- represent the interests of the mountain guiding profession to governments;

- support standardized laws and regulations for the mountain guide profession;
- determine mandatory international training standards;
- implement reciprocal acceptance of IFMGA qualification;
- support free professional activity for mountain guides;
- support existing national mountain guides associations and develop new ones; and
- provide services and assistance for mountain guides (IFMGA administration, 2018).

With the development of training and qualification schemes in mountaineering and the concern that trained leaders and guides would be held responsible for the safety of their charges the areas of safety and security are continually being redefined to provide legal protection for both the 'client' and the 'guide' (IFMGA administration, 2018).

Modern mountaineer modern equipment - Nirmal Purja Magar collection HYPERLINK "http://www.Nimsdai.com" www.Nimsdai.com

Over the last two or three decades the development in technical equipment has surpassed such development of the last century, not only has the equipment developed but so have the skills required to use it, including rescue techniques. All this new and technical equipment is not only backed up by a myriad of training programs on how to use it but there are also many technical manuals and of course the internet giving advice.

In 1990 the first commercial expeditions took place on Everest and slowly over the years the number of people attempting the mountain has increased dramatically. These people have access to all the modern technology, they are supported by well trained and qualified guides and leaders but what many don't necessarily have is on the ground experience that will enable them to meet risk, safety and security situations intuitively (Crockett, 2020).

The development of modern mountaineering equipment provides many inexperienced mountaineers with a false sense of security, basic steps in safety protocol are ignored and the presumed level of risk is disproportional with the actual risk that may be encountered during the intended activity. There is no guarantee that with all the latest and most up to date equipment that a mountaineer today will be any safer than Whymper in 1865 if the practitioner does not have experience of physically challenging situations and using the appropriate equipment correctly under pressure. Training is key to success. Today not only can the extreme mountaineer use the latest equipment but he/she can have a personal diet plan, a training plan and even in low countries there are now high-altitude training chambers meaning a mountaineer can reduce the time he or she spends passing through dangerous environments.

In January 2021, the world witnessed an historic event in mountaineering that has eluded many top mountaineers for two and a half decades, reaching the summit of K2 in winter, the last of the 8000m asl peaks to have such an ascent.

This was achieved with a well-organized plan, a very fit, well trained and unified team of Nepali mountaineers. They had the latest equipment, a determined spirit, they worked as a team plus they also had an extraordinary amount of good luck by having a perfect weather window.

This paper has now virtually joined the loop with the issue that was probably first recognized by the public back in 1865 with Whymper and the accident on the Matterhorn.

There is a real risk of going into the mountains with inexperienced people. What are the safety and security issues that should be considered?

Conclusion

In terms of mountaineering activities risk can be identified in three ways:

Objective risk– these are risks that are inherent in mountaineering, rock fall, avalanches, lightning strikes, earthquakes etc. Although mountaineers are not capable of controlling such events it is possible through thorough training and experience to learn to minimize some of the risks in certain situations. The development of the appropriate skills is paramount to being a good safe mountaineer both in understanding the potential risk and recognizing the conditions that could result in such natural events (with the exception of earthquakes) and then the skill in being able to deal with the fallout from such events. For example, recognizing the snow conditions and a mountain side that might be a potential avalanche risk and then being trained and aware of how to use an avalanche transceiver and what to do if caught in an avalanche.

Subjective risk – risks that a mountaineer has direct control over, human-caused incidents. To follow the line of the example given above. A mountaineer goes into an area where they fully recognize that there is a high risk of an avalanche, but the individual is prepared to take that risk, as opposed to finding a different route.

Legal risk – this sector is a newly encountered risk where professional guides and leaders are taken to court with a legal issue pending against them. This could be as a result of a ski guide taking a client 'off-piste' when the client falls and breaks a leg as a result of not listening to the guide or as the result of the client's technical ability not being as high as maybe they claimed. The risk is that the client might sue the guide for negligence.

Risk vs comfort zones

Mortlock C. 1984. Four stages of adventure

Everybody has a level of acceptable risk and this places them in a specific comfort zone, these zones vary from person to person and usually depends on the level of experience an individual has in certain adventure situations.

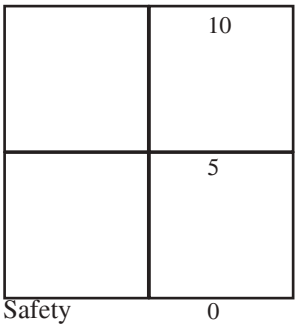
1. **Play zone –** there is no technical challenge and the client is happy with the risks they are faced with.
2. **Adventure zone –** the client is moving towards their skill limit but is still just within their risk acceptability area.

3. Frontier adventure – the client is now on the verge of being out of control and at the limit of their skill set.
4. Misadventure – the client is completely outside their skill set and beyond their level of acceptable risk

Risks never stay static, for example, what essentially begins as a low-risk activity can quickly change into a high-risk situation as a result of unforeseen circumstances. For example, trekking below a glacial lake on a nice sunny day when all of a sudden, the dam bursts.

On the other hand, a guide or leader who does not fully understand their client's expectations runs 'the risk' of having a dissatisfied client. Although it might not result in any injury it could damage the guide's or leader's reputation and work prospects.

The leader's/ guide's ability to quickly and decisively complete a risk assessment is critical to the safety of the party.



5

Assessment of RISK – what are the chances of something happening during this specific activity – for example crossing a bridge on a scale of 1 : 10?

Assessing the safety situation of a group is a skill that comes out of performing a good risk assessment. For example, if the risk facing a group appears to be accepted by the group then the guide or leader should still put a safety plan in place, just in case. For example, a group has to do a river crossing; all clients are within their comfort zone A. However, there is always the 'what if' question. Safety measures should be put in place just in case; all rucksack straps should be released in case the situation develops into one where the rucksack has to be shed, a small rescue team should be placed downstream ready to collect any items of equipment or even a client that floats downstream, cameras should be stored correctly 'just in case'. Obviously, there are degrees of safety measures that can/ can't be put in place and these impacts on the risk. If there is a big waterfall downstream from the assumed safe crossing point and if there are not the staff to provide a back-up rescue plan, then the risk goes into the zone of too dangerous B.

Security

Security also comes out of a good risk assessment. This is the skill that after identifying a potential risk the guide or leader puts in place a system to 'secure' a client 'just in case'. For

example, if a client is walking along the edge of a crevasse it might not be possible to have a back-up rescue team below the client, 'just in case', so to secure the client the guide or leader might attach a rope just to provide additional security for the client.

A lot has been documented in the Journals of the Himalayan Database covering the deaths on Everest and the circumstances surrounding the events. Mark Horrell (September 2020) considered the executive summary of an investigation into the recent history of fatalities on Everest. He concluded:

Overcrowding does not have a significant effect on either success or death rate?

This is perhaps the most surprising finding from this study, and a strong argument against much of the media rage about Everest expeditions, which has focused on overcrowding more recently.

Are photographs of climbers queuing on the Hillary Step evidence that Everest is becoming more dangerous?

It's certainly true that spending an additional hour or two in queuing traffic over 8,000m increases the risk of altitude sickness and frostbite. It's therefore reasonable to assume that crowding like this, increases death rates and lowers success rates.

However, the data suggest that it doesn't?

In 2019, 65.9% of all summit bids were made in just two days, 22 and 23 May. Neither the probability of summiting (92.4% on these two days vs. 90.5% on less crowded days) nor the probability of dying (1% on these two days vs. 1.2% on less crowded days) was significantly different.

It was a similar story in 2018. In that year, 58.2% of all summit bids were made on four days, 16–19 May. In this case the probability of summiting was slightly less on these four more-crowded days (91.1% vs. 95.3% on less crowded days) but not significantly so. In 2018 there were no deaths during summit bids on either crowded or uncrowded days.

This may seem counter-intuitive, but what this tells us is that although Everest is becoming more crowded, it is not yet so crowded that climbing Everest is becoming more dangerous. If you think about it another way, there's a reason everybody climbs on these more crowded days – because the weather is much better, and the mountain is consequently safer (Horrell, September, 2020).

The critical point

On Everest, weather still poses a much greater risk than people, and as long as operators are able to manage the risk, such as by taking more oxygen and preparing climbers for a longer day, then it's still better to climb during more crowded days than during marginal weather windows.

Taking more oxygen will also require an increase in human sources (cost), an increase in oxygen (cost), an increase in technical guides to manage exhausted and possibly stressed clients (cost) and possibly additional training at altitude pre-Everest for clients (cost). The questions are, are the Everest operators prepared to take the risk to operate as they are now,

with possible consequences of additional deaths, are they prepared to take the risk of increasing client support at the cost of losing clients due to expeditions becoming more expensive and are clients prepared to pay the extra for a less risky option?

Whenever I do a risk assessment, I always add a postscript – What would I tell a board of inquiry if something happened!

Recommendation

- Develop a good risk assessment strategy, base it on practical personal experience developed over years not months.
- If leading a group of inexperienced clients never works to your limitations, if something happens you always need to think the problem through without having to worry about your own safety and security.
- If you are working with more experienced people and you are all at your limitations, accept the risk that you might have to sort your own situation out without the support of others if something goes wrong.
- Do not cut safety margins for the sake of profit.
- If you are getting paid to do the guiding or leading, remember one of the clients' expectations is to be looked after and that is your responsibility that is what you are getting paid for.
- Do not over-extend your limitations but rather extend your limitations with appropriate skill-based training.
- It should also be part of your risk management skills to develop a good working knowledge of the most important downloadable smartphone applications that are relevant to the mountaineering sector in which you operate.
- Continual Professional Development (CPD) will become increasingly important and so it is important to keep a record of all training programs that you attend to prove you are up to date with all the new methods and skills required to be a safe guide and leader.

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Assessment of Tourism in Nepal with Reference to Regional Countries: Trend Analysis and ARIMA Approach

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Abstract

Tourism (either domestic or international or both) is an internationally flourished business or industry all over the world. The economic foundations of tourism are essentially the cultural assets, the cultural property and the nature of the travel location. So, it has a greater contribution to the country's balance of payments. Simple trend analysis was carried out using a set of line graphs along simple linear regression. For forecasting of international tourist arrivals of period: 1962-2020, and real per capita international tourist receipts of period: 1995-2018, the suitable Auto-Regressive Integrated Moving Average (ARIMA) models were developed using Akaike Information Criterion along with method of autocorrelation function and partial autocorrelation function.

Nepal has a significant growth rate of 1.372 of the international tourist arrivals. It has the eighth position for international tourist arrivals among nine counties. Likewise, Nepal has a significant growth rate of 1.315 of real per capita international tourist receipts. It has the fourth position for real per capita international tourist receipts among nine counties.

Nepal has been receiving its international tourist arrivals, growth as well as real per capita international tourist receipts. Forecasts of international tourist arrivals of Nepal are 879638.3 in 2018, 860459.0 in 2019, 875824.1 in 2020, 891189.3 in 2021, and 906554.4 in 2022. Forecasts of real per capita international receipts in dollars are 687000000 in 2019, 727000000 in 2020, 807000000 in 2021, and 845000000 in 2022.

Keywords: Trend analysis, Akaike Information Criterion, autoregressive integrated moving average, autocorrelation function, partial autocorrelation function

Introduction

Tourism is an internationally flourished business and industry all over the world. It has a greater contribution to the country's balance of payments. Tourism, that may be either domestic or international or both, is travel for pleasure or business or both. It is an art of science in the business for attracting, accommodating, and entertaining tourists and the business of operating tours (Oxford English Dictionary, 2005).

The economic foundations of tourism are essentially the cultural assets, the cultural property and the nature of the travel location. The World Heritage Sites are particularly worth mentioning today because they are real tourism magnets.

In the context of Nepal, the Rana ruler had isolated Nepal from external influences for a hundred and four years. During that period, Nepal was a 'forbidden land' for foreigners. It is found that tourism in Nepal was promoted after the establishment of democracy in 1951. The international tourists are found to visit Nepal as they are attracted by various natural and cultural heritages of Nepal, its diverse topography, varied climate, diverse flora and fauna,

different shrines and temples, jungle safari and trekking. The past thirty years beginning from 1962 show that Nepal has experienced an unprecedented rise in the tourist arrivals and its contribution to 20% of the foreign exchange (MoCTCA, 2001). But, this arrival saw steadlly declent due to the heightened political instability and the war on terrorism within the country, the region and beyond (Thapa, 2003). However, Nepal started enyoing once again the up market trend in the 2010s.

The scenario of international tourist arrival is presented in Figure 1 for the period of 1994-2019 in Nepal. Ministry of Culture, Tourism and Civil Aviation (MoCTCA), tourist arrivals show a steady trend during 1994-2019 in Nepal (Government of Nepal, 2020) on average. This is depicted by the upward trend-line.

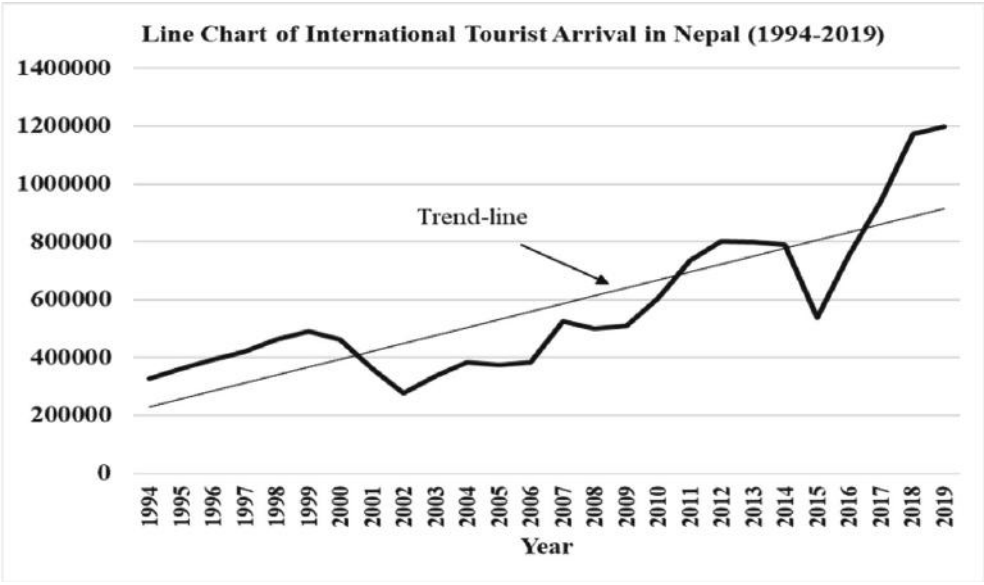

Figure 1: *Line chart of actual number of international tourist arrival during 1994-2019 along with trend-line*

The recent trend of tourist arrival in Nepal seems satisfactory (Dhakal, 2014) from 1994 to 2014. However, there is a sudden decline in the tourist arrival in 2015. This is because of the impact of the 7.6 magnitude earthquake that hit a large part of central Nepal. It heavily affected the tourism business and livelihoods based on tourism. The overall economic loss due to the earthquake was equivalent to US$ 7 billion. The disaster effect on the tourism sector was estimated at 81241 million, 11.5 percent of total (Rijal, 2016). The data on arrivals of tourists are ever changing in years to come in Nepal. In other words, that may not be steady forever. So, it is necessary to assess the pattern of the tourist arrivals in Nepal. However, the sudden decline is seen in 2015. This is because of Earthquake and aftershocks in Nepal

The economic development of the world as well as regional levels has been linked increasingly to tourism development and particularly to the volumes of tourist arrivals (Song & Witt, 2000, Song et al., 2009). Furthermore, global international tourism has become one of the major economic exports and a significant contributor to many national economic development strategies. International tourism as an export income provides employment opportunities and affects living standards through external economic benefits that flow into many sectors of a national economy. Thus, the tourism industry becomes a very important economic activity

contributing to the growth of the Gross Domestic Product (GDP) of all the countries in this world.

In the changing world over the year to year, there were many consequences experienced by the world how the number of tourists has been declined. History has said that there was a decrease in tourism numbers because of a strong economic slowdown due to the late-2000s recession during 2008-2009, and in the consequence of the outbreaks of the 2009 H1N1 influenza virus, but later slowly recovered (WTO, 2009). Recently (in 2019-2020), the pandemic of coronavirus (COVID-19) has been negatively affecting the tourism industries all over the world.

According to the United Nations specialized agency (UNWTO, 2020), the crisis could lead to an annual decline of between 60% and 80% when compared with 2019 Figures. This places millions of livelihoods at risk and threatens to roll back progress made in advancing the Sustainable Development Goals (SDGs).

The latest data from the UNWTO has shown that the COVID-19 pandemic has caused a 22% fall in international tourist arrivals during the first quarter of 2020. It could decline by 60-80% over the whole year. Further, it is assumed that 67 million fewer international tourists up to March translates into US$ 80 billion in lost exports (UNWTO, 2020). However, several countries have been fighting against this pandemic to revive the tourism business. Therefore, the business may take improvement and ultimately normal stage in years to come. Nepal has also faced the same problems in all sectors of the business including tourism.

Despite the natural or manmade consequences, tourism is also changing with the capacity of destinations as there should be a greater skill to manage larger volumes of internationally diverse tourist populations, with new markets opening for tourists.

As such, the forecasting of International Tourist Arrivals (ITA) and Real Per Capita International Tourist Receipts (RPCITR) has become a more pressing issue in recent years for governments at all levels including Nepal, in order to reliably estimate tourism growth and the economic benefits generated by expanding tourism activities.

This paper, therefore, aims at filling this gap by providing a graphical as well as simple regression analysis of ITA (by means of all transportation in Nepal) and RPCITR at regional levels.

Hence, this study has taken following two objectives.

Objective

Increasingly, international tourism arrival sizes and hence receipts, have impacted on regions within countries including Nepal. Tourism growth can no longer be simply measured at a country or national level, as regional governments seek regional forecast information for economic, transport and infrastructure planning for their regions, to enable a greater share of the growing world tourism receipts to be earned in their regions.

Based on the scenarios of international tourism arrival sizes and receipts, this study aims:

- to assess simple trend analysis of international tourist arrivals and real per capita international tourism receipts for nine Asian countries including Nepal, and
- to develop an ARIMA model to forecast international tourist arrivals and real per

capita international tourism receipts in Nepal (this study will develop the ARIMA models under this objective for forecasting purposes).

Literature review (Empirical)

The study has carried out the time-series analysis of international tourist's arrivals and receipts. Several literatures are found to review the time-series of the two variables of interest, international tourist arrivals and receipts on the behalf of the world, Americas, Africa, Europe, Asia-Pacific, Middle East and Nepal.

According to UNWTO (2013), international tourist arrivals increased to 1.035 billion in 2012, which was the highest over the past three years. In the late-2000s recession, tourism arrivals declined to negative in the second half of 2008 after an increase of 5% in the first half of 2008. The international tourist arrivals then increased in diminishing rate and ended up only 2% for the year, compared to 7% increase in 2007. Only in 2011 and 2012, the international travel demand continued to recover from the losses of the recession (UNWTO, 2009). There was no improvement in the negative trend of tourism arrival during 2009. The situation further aggravated in some countries because of the outbreak of the H1N1 influenza virus, resulting in a worldwide decline of 4.2% in 2009 to 880 million international tourists' arrivals, and a 5.7% decline in international tourism receipts (UNWTO, 2010).

In 2020, international tourism had faced a similar situation to that of the late-2000s recession. With the outbreak of pandemic Coronavirus (COVID-19), there has been a ban in travels and tourism, frequent lockdown in different countries due to risk of transmission. It resulted in substantial reduction in passenger travel by air and sea and contributed to a sharp decline in tourism activity. Despite the decline in inflow and outflow of tourists, the evidence suggests that tourism as a global phenomenon reflects no signs of substantially long term effect of the pandemic. Moreover, it has been suggested that travel is essential to maintain relationships, as social life is increasingly networked and conducted at a distance (UNWTO, 2020). ARIMA (0, 0, 0) (1, 1, 0)12 is found to be the best model to forecast international tourist visits to Bhutan from Jan 2017 to Jun 2017 with 91% accuracy (Choden & Unhapipat, 2018).

The model of A.R.I.M.A.(1,1,1), as most suitable for forecasting, has shown a 13.9% increase in international tourist arrivals is expected by 2018 in F. Y. R. Macedonia (Petrevska, 2017). Based on the review of the literature as discussed above, the objectives and methods are formulated accordingly.

Materials and methods

Data collection

This study has used the secondary data on ITA obtained from MoCTCA (HMG, 2001, Government of Nepal, 2019). It has also obtained data on RPCITR of Nepal along with other countries and world for the period of 1995-2018 (only available) from the World Bank (WB) data portal published in the Yearbook of Tourism Statistics (WTO, 2020).

This study has used a different period of data on the basis of its availability. For instance, the data for ITA is available from 1962 to 2019. However, the data on RPCITR are not available from 1962-2019. All the data can be made available on demand. In order to go into deep insight of ITA and RPCITR, index-ITA is generated in terms of percentage by dividing the ITA of all the years of 1995-to 2018 by the ITA of the year 1995 for all the nine countries.

Likewise, index- RPCITR is generated in terms of percentage by dividing the RPCITR of all the years of 1995 to 2018 by the RPCITR of the year 1995 for all the nine countries.

Graphical and time series analyses are carried out for indices of ITA and RCPITR using the annual data from 1995 to 2018 on the basis of the data availability for all the nine countries. For Nepal, ARIMA models are carried for ITA using the annual data from 1962 to 2019 and for RCPITR using the annual data from 1995 to 2018. The different time period used here is due to the availability of data for the target variables ITA and RCPITR.

Limitation of the study

There are some limitations of the study. They are outlined below.

- Time-series data consists of four component, namely secular trend, seasonal variation, cyclical variation and irregular variation. Use of annual data has prevented computation of the seasonal pattern of the tourist arrivals and tourist receipts. However, the cyclical variation may be minimized when the differenced data on ITA and RCPITR are carried for their time series analysis.
- There are impacts of some irregular variation like the political movement (Maoist Insurgency) and the earthquake on the tourist arrival. This is not incorporated in the study.
- The forecast of the tourist arrivals and real per capita international tourist receipts may not be so accurate while applying ARIMA model due to the effect of the irregular variation as well as inherent variability that cannot be minimized to zero.
- Selection of the length of the time-series may affect the model calibration and hence, the prediction too. Similarly, there may be several features that may impact the fluctuation of the tourist arrivals and RCPITR. This study only considers year as an explanatory variable.

Despite these limitations, the better fit of the models to the tourist arrival and RCPITR data can give a reliable insight of the tourist arrivals pattern and tourist receipts in near future when the time-series models are used along with their accuracy measures, validation technique and diagnostic tests (Gujrati, Porter, & Gunasekar, 2012).

Data analysis and methods

The ITA for a country works as a good indicator of the role of tourism in the economy both in terms of GDP and foreign exchange generation. Likewise, RCPITR can indicate that tourism is beneficial for a country as it can provide useful information about the contribution of each tourist in real, i.e. deflated terms (Paptheodorous & Song, 2005). In order to assess this economic behavior of the tourism business in a country, this study is going to apply the methods that may assess the past and present trend, and its future scenario. The methods are (a) simple trend analysis, and (b) the possible ARIMA models (Gujrati, Porter, & Gunasekar, 2012).

Graphical as well as quantitative methods are employed to assess the pattern of the variables of interests. The assessments were carried out for simple trend analysis using (i) simple line graphs, and (ii) simple linear regression applied just to compare the growth rate of the trend lines.

The ARIMA model will require the steps (i) identification, (ii) estimation, (iii) diagnostic checking, and (iv) forecasting. The proposed model will look like ARIMA (p, d, q), popularly known as the Box-Jenkins (1976) methodology (Gujrati, Porter, & Gunasekar, 2012). Here, p stands for a number of auto-regressive terms, d for the number of times the series has to be different before it becomes stationarity, and q for the number of moving average terms. A general forecasting equation of ARIMA model is specified as follows in terms of y_t:

$$\hat{y}_t = \mu + \emptyset_1 y_{t-1} + \cdots + \emptyset_p y_{t-p} - \theta_1 \varepsilon_{t-1} - \cdots - \theta_q \varepsilon_{t-q}$$

$$\hat{y}_t = \mu + \emptyset_1 y_{t-1} + \cdots + \emptyset_p y_{t-p} - \theta_1 \varepsilon_{t-1} - \cdots - \theta_q \varepsilon_{t-q}$$

Before identification or specification of the model, there are several methods available to check whether there is a stationarity in the variable of interest, say, y_t. One of the methods is the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979) and is used to determine the order of integration of the time series (Song & Witt, 2000). The ADF test sets the null hypothesis as the series has a unit root. This test uses the following equation to identify the presence of the unit root in the given series.

$$\Delta y_t = \alpha_0 + (1 - \rho)\alpha_1 T - \rho y_{t-1} + \sum_{i=1}^{p} \gamma_1 \Delta y_{t-1} + u_t \rightarrow [1]$$

$$\Delta y_t = \alpha_0 + (1 - \rho)\alpha_1 T - \rho y_{t-1} + \sum_{i=1}^{p} \gamma_1 \Delta y_{t-1} + u_t \rightarrow [1]$$

In the above equation, y_t is the time-series of the variable of interest (In this study, it may be ITA and RPCITR); T for a linear deterministic time trend; p is the order of augmentation of the test; ut is a white noise error term. The t-statistic is applied to decide whether the p^{th} order ADF test has a unit root (or non-stationarity) of the annual tourist arrivals.

Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) are applied to identify the suitable equation of the ARIMA model models (Gujrati, Porter & Gunasekar, 2012).

There may be several possible ARIMA models to be calibrated using the data of different time periods. This is usually practiced to identify the best model among them so that prediction or forecasting of the tourist arrival will be precise and reliable. The study has applied the goodness-of-fit criteria like R-Square, or Akaike Information Criterion AIC (Gujrati, Porter, & Gunasekar, 2012) to find the best model among a set of models. Further, diagnostic checking is also used. Then the final model is applied for forecasting the future tendency of the variable of interests (ITA and RPCITR).

There is a facility to perform ARIMA automatically in the econometric software, EVIEWS 10.0 (Evaluation Version) (Quantitative Micro Software, 2010). The following sections provide the results along with discussion.

Findings/results/discussion

Graphical analysis

Figure 2 demonstrates the line graphs of time-series of index of international tourist arrivals (ITA) for the period from 1995 to 2019.

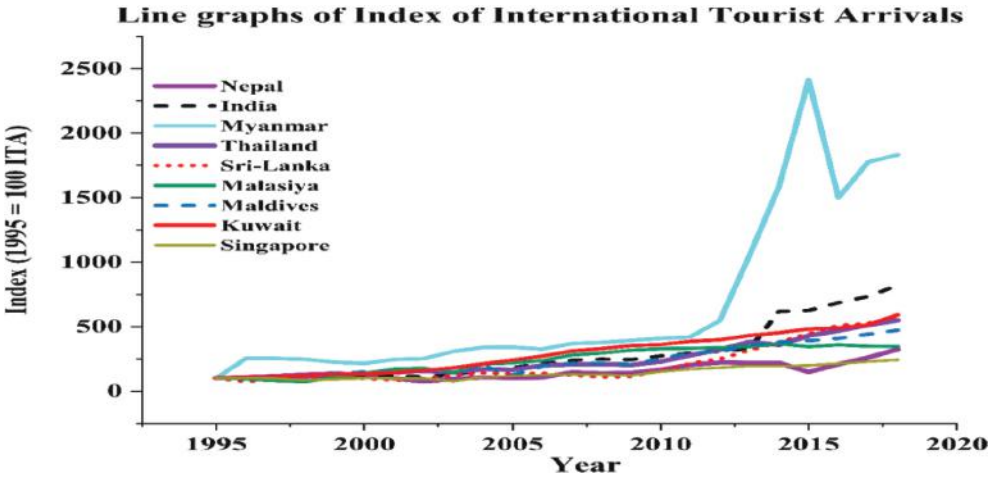

Figure 2: *Trend lines of index of ITA for nine countries*

This shows simply the trend of the indices of nine countries for 23 years starting from the base index of 100. The different color in the legend indicates the different countries. With reference to Nepal with pink color, Myanmar has a greater tendency of international tourists' arrivals. The year 2015 is the peak year for the outbound tourists in Myanmar. This index shows the dramatic growth of ITA throughout this period at the regional level. The highest index-ITA has reached about 2500 across all other eight countries in 2015. It was followed by India (more than 500 in 2018), then by Kuwait and Sri-Lanka. The position of Nepal (less than 500) is slightly higher than Singapore. Malaysia has seemed to meet Nepal in 2018. The discriminations seen among the nine countries may have consequences of different factors to increase or decrease the index-ITA. Malaysia has a smooth tendency in upward direction. But Kuwait is showing a declining pattern and after 2015, gained some stable rise.

Nevertheless, the growth patterns of all the countries are apparent throughout this period despite the growth rate being different. The factors like rise of disposable income, establishment of paid vacation, reduction of travel time and costs and less bureaucratic impediments are among the well-known factors that account for this growth. Besides these, there may be some other factors like air-connectivity to a larger number of countries, the area/size of the country, tourist destinations, purpose of visits, a greater number of tourists attraction, etc. play crucial role in increasing the outbound tourists in the country (Papatheodorous & Song, 2005).

Data on RPCITR can provide a useful insight by showing the contribution of each tourist in real, i.e. deflated terms. A high RPCITR means that tourism is beneficial for a country as it is associated with quality and high expenditure tourists and potentially a high tourism multiplier. On the other hand, a low RPCITR may be related to low income mass tourists; if the number of the latter is substantial, then a destination is likely to suffer from a lethal combination of low returns and high arrivals – this may prove unsustainable and lead to the eventual decline of tourism. On these grounds, RPCITR can offer a useful indicator for policymakers. Interestingly, however, RPCITR appears very rarely in tourism publications.

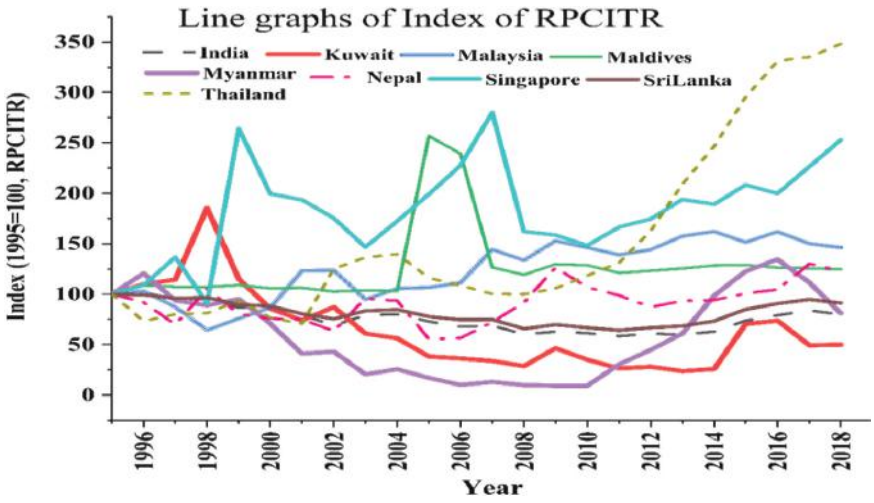

Figure 3: *The line charts of index of real per capita international receipts at the regional levels*

Figure 3 presented below a rather rosy aspect of international tourism evolution. From an economist point of view, however, it is important to gain insight on the real financial benefit of tourism. On this ground, the graphical analysis focuses on deflation most importantly on a per capita basis. Figure 3 shows the evolution of regional RPCITR from a relative index perspective. In this context, Thailand has performed slightly better than Singapore after 2010. The unstable patterns of Maldives and Singapore show signs of reversion to the initial 1995 value, while Nepal, Sri Lanka and India stabilize after the 2007 respectively.

Time series regression model

The econometric model is built using a time series regression model. It is necessary to carry out a stationarity test before carrying out the regression analysis because Granger and Newbold (1974) found that regression models for non-stationary variables give spurious results.

Stationarity test

Table 1: Augmented Dicky-Fuller test for stationarity

Period	Dependent variable	ADF test statistic (t-Statistic)	P-value
1995-2018	D (Index-ITA-India, 1)	-4.213085	0.0019
1995-2018	D (Index-ITA-Kuwait, 2)	-4.929697	0.0039
1995-2018	D (Index-ITA-Malaysia, 1)	-5.087899	0.0026
1995-2018	D (Index-ITA-Maldives, 1)	-5.465149	0.0013
1995-2018	D (Index-ITA-Myanmar, 2)	-6.666629	0.0002
1995-2018	D (Index-ITA-Nepal, 1)	-3.636494	0.0497
1995-2018	D (Index-ITA-Singapore, 1)	-4.879732	0.0040
1995-2018	D (Index-ITA-Sri-Lanka, 2)	-5.164957	0.0024
1995-2018	D (Index-ITA-Thailand, 1)	-6.235714	0.0002

Note: D (Index-ITA, 1) is the first differenced. D (Index-ITA, 2) is the second difference.

Table 1 has been depicted as a test for stationarity test by applying ADF test. India, Malaysia, Maldives, Nepal, Singapore, Thailand have shown significant stationarity at their first or second differenced values of index of ITA. On the other side, Kuwait, Myanmar and Sri-Lanka have also shown significant stationarity but at their second differenced values of index of ITA. Now the time series regression has been carried out for each country using the first differenced index of ITA in order to make uniformity and comparable. The results are presented in Table 2. The coefficients of the regression models are comparable across themselves. However, this model does not use some explanatory variables as they are not available for this study. The pattern of index-ITA of the line graphs in Figure 2 is relatively supported by the results of simple linear time series regression in Table 2. Out of nine countries, only three countries India, Thailand and Singapore have significant coefficients. Myanmar has the greatest coefficient (7.307) among them. It is followed by India (3.98), Thailand (1.954), Maldives (1.704), Nepal (1.372), Kuwait (1.252) and Singapore (0.737), and they all have positive coefficients. This implies that each of these countries has an increasing rate of international tourist arrivals. Nepal has the fifth position among them.

Table 2: Summary results of simple linear regression models for differenced index of International Tourist Arrivals

Country	Regression coefficients	F	R^2 (%)
India	3.98**	5.257*	20.1
Kuwait	1.252	8.377*	28.5
Malaysia	-0.3921	0.5978	1.34
Maldives	1.704	2.129	9.20
Myanmar	7.307	0.566	2.62
Nepal	1.372	2.334	10.0
Singapore	0.737**	4.629**	18.0
Sri-Lanka	-0.165	0.042	0.21
Thailand	1.954*	8.878*	29.7
Dependent variable: Index-ITA. Independent variable: Year *P-value is significant at less than 1%. ***P-value is significant at less than 5%.			

However, the result shows that Malaysia (-0.3921) and Sri-Lanka (-0.165) have a decreasing rate of ITA. Furthermore, Malaysia is relatively showing a decreasing rate of ITA. It is followed by Sri-Lanka. Myanmar has sudden jump in ITA between 2010 and 2015. This is because it possesses great tourist potential and attractions in many respects; much of the industry remains to be developed. After the junta transferred power to the civilian government, the tourism sector saw an increase in tourism arrivals, and in 2012, tourist arrivals surpassed the one million mark for the first time. In 2013, the Tourism Master Plan was created, targeting 7.5 million arrivals (Mon, 2014). Tourism has been developed mainly by Myanmar's government, which has encouraged tourism since 1992. Private enterprises also exist, catering to a wide range of tourists. Further it has been promoted by advocacy groups. The group has provided economic benefit to Burmese civilians, and to avoid isolating the country from the rest of the world (Pills, 2019). In common practice, a sizable ITA can be a good indicator of the role of tourism in the economy both in terms of GDP and foreign exchange generation.

Table 3: Augmented Dicky-Fuller test for stationarity

Period	Dependent variable	ADF test statistic (t-Statistic)	P-value
1995-2018	D (Index- RPCITR –India, 2)	-4.850011	0.0046
1995-2018	D (Index- RPCITR –Kuwait, 1, 2)	-3.803436(-6.413566)	0.0371(0.0002)
1995-2018	D (Index- RPCITR –Malaysia, 1,2)	-4.230848(-7.430721)	0.015(0.0000)
1995-2018	D (Index- RPCITR –Maldives, 1,2)	-4.950773(-4.950773)	0.0038(0.0038)
1995-2018	D (Index- RPCITR –Myanmar, 1,2)	-4.948437(-7.430721)	0.0035(0.0000)
1995-2018	D (Index- RPCITR –Nepal, 2)	-5.276939	0.0019
1995-2018	D (Index- RPCITR –Singapore, 1,2)	-6.264250(-9.180727)	0.0002(0.0000)
1995-2018	D (Index- RPCITR -Sri-Lanka, 2)	-2.071514	0.5294
1995-2018	D (Index- RPCITR –Thailand, 2)	-5.280775	0.0021

Note: D (Index- RPCITR, 1) is the first difference. D (Index- RPCITR, 2) is the second difference.

This helps policymakers subsequently convince them to assist tourism development and increase profitability from tourism activities, further able 5 has been depicted as a test for stationarity test by applying ADF test. Kuwait, Malaysia, Maldives, Myanmar and Singapore have shown significant stationarity at their first differenced values of index of RPCITR. On the other side, India, Nepal, Thailand and Sri-Lanka have also shown significant stationarity but at their second differenced values of index of RPCITR. Sri-Lanka has not shown even significant stationarity at second difference values. So, a time series regression is not possible to carry out as it may give spurious results in trend detection for Sri-Lanka. Now the simple time series regression has been carried out for each country using the second difference index of RPCITR in order to make uniformity and comparable. The results are presented in Table 4.

Table 4: Summary results of simple linear regression models for differenced Real Per Capita International Tourist Receipts

Country	Regression coefficients	F	R^2 (%)
India	-0.3615	0.8323	0.39
Kuwait	1.3291	0.6479	0.31
Malaysia	0.3933	0.2711	0.13
Maldives	-0.4468	0.0466	0.23
Myanmar	1.667	9.271	32.0
Nepal	1.315	1.217	5.73
Singapore	-1.630	0.251	1.24
Sri-Lanka	None	None	None
Thailand	-0.633	0.552	2.82
Dependent variable: Index-RPCITR. Independent variable: Year. *P-value is significant at less than 5%			

Table 4 shows the coefficients of the regression models. All the models have insignificant coefficients. When all the coefficients are compared, Myanmar (1.667) shows the greatest

value. It is then followed by Kuwait (1.3291), Nepal (1.315) and Malaysia (0.3933). They all have positive coefficients with varying values. This indicates that RPCITR has a good status in those countries. In this regard, Nepal has attained the third position achieving better RPCITR.

On the other hand, the pattern of India, Maldives, Sri-Lanka and Thailand is a negative sign in their coefficients. This implies that each of them has a downward tendency of RPCITR. Thailand has the least RPCITR compared to all the countries.

ARIMA model

Under this section, several ARIMA models are calibrated on the basis of identification of the models. Among them, the best one is selected for forecasting purposes. The target variables ITA and RPCITR are considered instead of index-ITA and index-RPCITR since the ARIMA model is only built for Nepal. The results of the stationarity test are carried out for the variables ITA and RPCITR for calibration ARIMA model (See Table 5).

Table 5: Augmented Dicky-Fuller test for stationarity

Period	Dependent variable	ADF test statistic (t-Statistic)	P-value
1962-2019	D (ITA, 1)	-8.088532	0.0000
1962-2018	D (ITA, 1)	-7.573104	0.0000
1962-2017	D (ITA, 1)	-8.473981	0.0000
1995-2018	D (RPCITR, 1)	-4.485292	0.0097

In Table 5, the p-values of the variables ITA and RPCITR are significant at 1% level of significance. Thus, the time-series of those variables are all stationary. This condition provides suitability to build the ARIMA model. Four steps are carried to build and use the model. They are identification, estimation, diagnostic checking and forecasting. However, Eviews 10.0 (Evaluation Version) (Quantitative Micro Software, 2010) offers an automatic ARIMA forecasting series procedure that allows a user to quickly determine an appropriate ARIMA specification and helps use it to forecast the series into the future. This method includes identification, estimation, diagnostic checking and forecasting at the same time.

In order to build a parsimonious forecasting model for the ITA, the time period 1962-2019 is divided into three different periods, viz. 1962-2017, 1962-2018, and 1962-2019. When the model is run for these different periods, the software has automatically produced sixteen different possible models for each period. So, there are altogether $3 \times 16 = 48$ possible ARIMA models. Figures 4, 6 and 8 show these models (see Appendix). Using minimum AIC, three best ARIMA models are selected and displayed in Table 6. Among these three models, the best of the best models is ARMA (0, 1) (0, 0) of the period of 1962-2017 since it has the smallest AIC (25.38) and the significant smallest SigmaQ (5.32E+09). It has no AR terms but has two MA terms MA (1) and MA (2) with the significant coefficients. Although the model ARMA has covered a longer period of 1962-2019, it contains only a constant term but no AR and MA terms. It means that it cannot capture the process of Differenced ITA behavior. It has forecasted the ITA with a constant increasing rate for the period of 2019-2022 with the forecasted ITA between 11 lakhs and 15 lakhs. It's AIC and SigmaQ are more than that of the model ARMA (0, 1) (0, 0) of the period of 1962-2017. The best ARIMA model has the forecasted ITA between 8 lakhs and 10 lakhs (see Figures 5, 7 & 9 at Appendix).

Table 6: Summary results of ARIMA models for Idifferenced ITA and Rdifferenced of log of RPCITR

Period	Model	AIC	C	AR(1)	AR(2)	MA(1)	MA(2)	SigmaQ
I1962-2019	ARMA(0,0) (0,0)	25.51	20894.95**					
I1962-2018	ARMA(2,2) (0,0)	25.53	18884.81***	1.1691*	-0.9439*	-1.3710	0.9999	5.26E+09
I1962-2017	ARMA(0,1) (0,0)	25.38	15365.15*			-0.3108*	-0.2233***	5.32E+09*
R1995-2018	ARMA(2,0) (0,0)	0.126	0.04997	-0.0352	-0.4222***			0.046426**
R1995-2018	ARMA(0,2) (0,0)	0.134	0.051123			-0.05225	-0.4305	0.0464267*
R1995-2018	ARMA(0,0) (0,0)	0.059	0.050665					

Dependent variable: ITA/RPCITR. Independent variable: Year.

*, **, *** P-values are significant at less than 1% or 5% or 10%.

I indicate ARMA models for Differenced ITA.

R indicates ARMA models for Differenced log of RPCITR

Table 7: Actual and forecast for International Tourist Arrivals from ARMA (0,1) (0, 0) using the period of 1962-2017

Year	Actual	Forecast	Percent of absolute forecast error	Remarks
2018	1173072	879638.3	25.01	Actual ITA was impacted by COVID 19 during 2019-2020.
2019	1197191	860459.0	28.13	
2020	*230085	875824.1	287.33	
2021	None	891189.3	None	
2022	None	906554.4	None	

* Source: www.nepalisansar.com for ITA in 2020.

Table 8: Forecast for RPCITR from ARMA (2,0) (0, 0) using the period of 1995-2018

Year	Actual	Forecast
2019	None	687000000
2020	None	727000000
2021	None	807000000
2022	None	845000000

Table 7 demonstrates actual and forecast of ITA along with percent of absolute forecast error. The errors for 2018 and 2019 are about 25-28 percent. But that error in 2020 is dramatically larger (287.33%). This is due to the fact that the ITA was much affected by COVID-19 during 2019-2020. The forecast of ITA would be 891189.3 and 906554.4 in 2021 and 2022 respectively if there were no impact of the second and third wave of COVID-19 and other adverse factors.

Similarly a parsimonious forecasting model is built for the RPCITR using the time period 1995-2018. When the model is run using the software, there are automatically produced

sixteen different possible models (see Figure 11 at Appendix). From Table 6, on the basis of minimum AIC, the best ARIMA models are found to be ARMA (2, 0) (0, 0). It has two autoregressive terms, AR (1), not significant, and AR (2), significant with the significant lowest sigmaQ. Table 10 demonstrates the forecast of RPCITR in dollars for four periods. The forecast of RPCITR is 687000000 in 2019, 727000000 in 2020, 807000000 in 2021, and 845000000 in 2022. These forecasted RPCITRs are expected to be precise if there is or will be no impact of the factors like COVID-19, WAR, etc.

Conclusion and recommendation

Graphical illustration shows that the position of Nepal is slightly higher than Singapore. In international tourist arrivals during the period of 1995-2019, the simple regression analysis has also supported the same scenario for Nepal. Nepal has the fifth position among them. Myanmar has the greatest coefficient (7.307) among them. It is followed by India (3.98), Thailand (1.954), Maldives (1.704), Nepal (1.372), Kuwait (1.252) and Singapore (0.737), and they all have positive coefficients. This implies that each of these countries has an increasing rate of international tourist arrival.

Graphical illustration shows that Nepal, Sri Lanka and India stabilized in the index of RPCITR after 2007 respectively in the period of 1995-2019. Then after, the index of RPCITR of Nepal is slightly increasing. It is also supported by the results of time series regression analysis. Nepal has attained the third position in the increasing rate of index of RPCITR among nine countries. However, Myanmar has attained the highest position in this regard.

ARMA (0, 1) (0, 0) of the period of 1962-2017 is the best model for forecasting the international tourist arrivals in Nepal. It has forecasted 879638.3 in 2018, 860459.0 in 2019, 875824.1 in 2020, 891189.3 in 2021, and 906554.4 in 2022.

ARMA (2, 0) (0, 0) of the period of 1995-2018 is the best model forecasting the real per capita international receipts in dollars The forecast of RPCITR are 687000000 in 2019, 727000000 in 2020, 807000000 in 2021, and 845000000 in 2022. The forecast of ITA and RPCITR for 2020 or 2021 may not match due to the impact of the world-wide pandemic of COVID-19.

The results of this study have recommended that Nepal has to give more efforts for tourist attraction. Then it can be expected that Nepal will gain substantially more growth in ITA and RPCITR. Consequently, this improvement and development in tourism in Nepal will contribute more to the gross domestic production as an indicator of economic growth of Nepal.

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Appendix

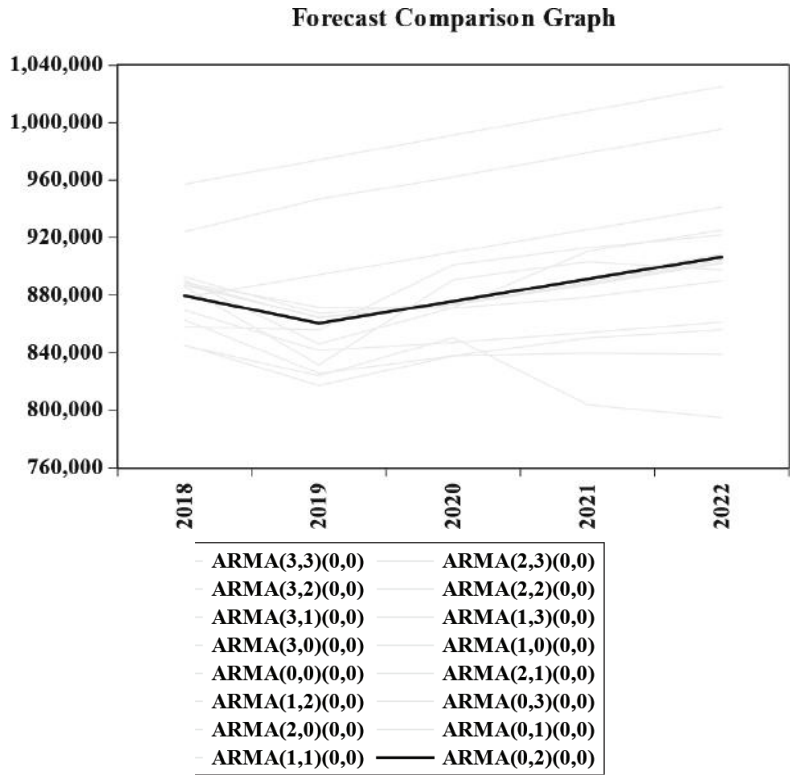

Figure 4: *Sixteen different ARIMA models with the best model of ARMA (0, 2)(0, 0) for the period: 1962 - 2017*

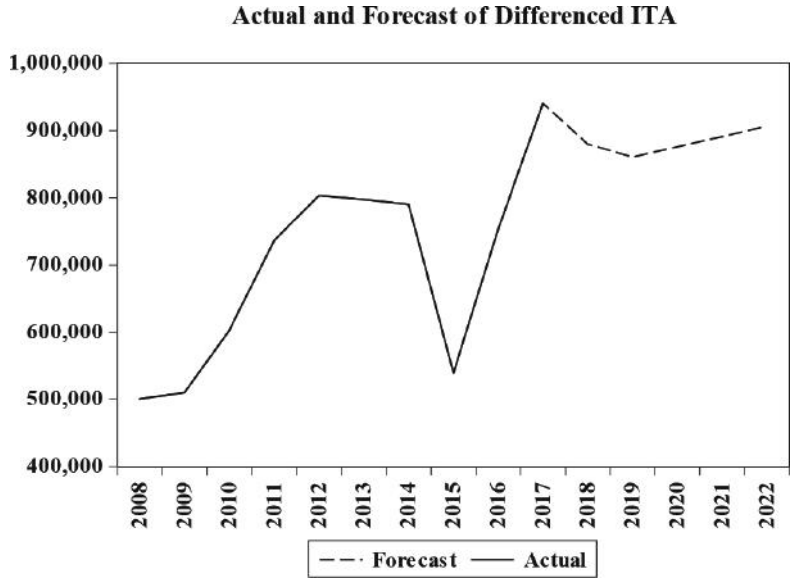

Figure 5: *Forecast of differenced ITA from ARMA (0, 2)(0, 0) for the period: 1962 - 2017*

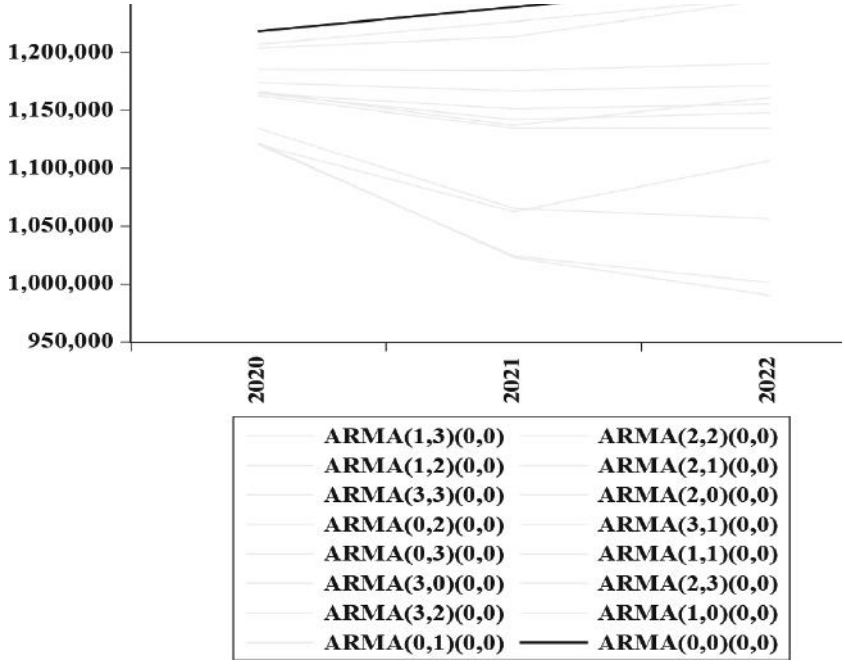

Figure 8: *Sixteen different ARIMA models of differenced ITA with the best model of ARMA (0, 0)(0, 0) for the period: 1962 - 2019*

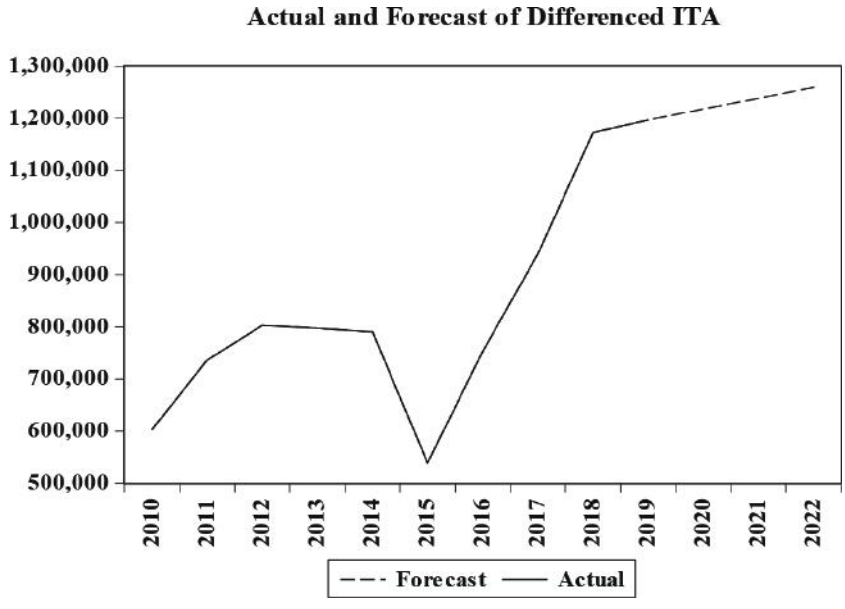

Figure 9: *Forecast of differenced ITA from ARMA (0, 0)(0, 0) for the period: 1962 - 2019*

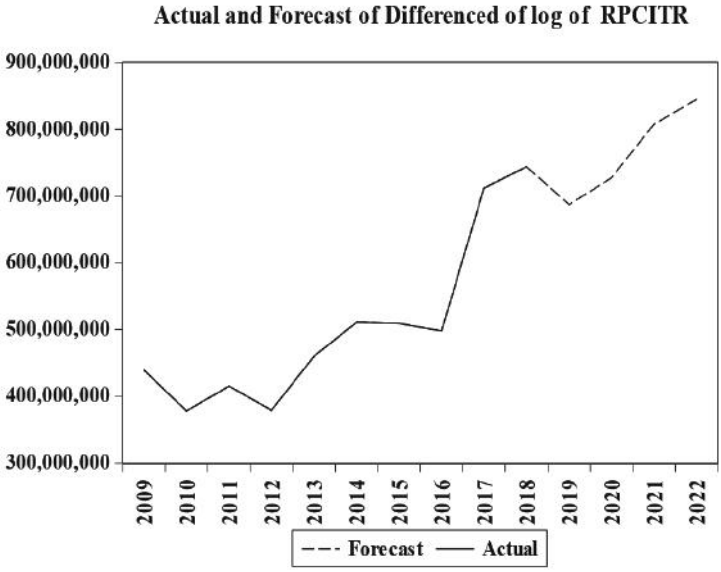

Figure 10: *Forecast of differenced of log of RPCITR from ARMA (2, 0)(0, 0) for the period: 1995 - 2019*

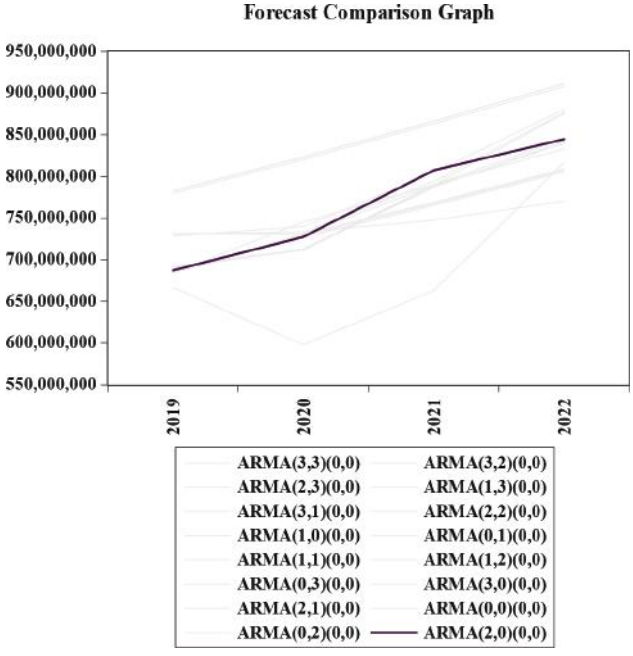

Figure 11: *Sixteen different ARIMA models of differenced of log of RPCITR with the best model of ARMA (2, 0)(0, 0) for the period: 1995 - 2018*

Climate Change and Possible Impacts on Travel and Tourism Sector

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Abstract

Nepal is a diverse country with lowlands of Terai to the highest mountains attracting many tourists and visitors to make visits. So, the tourism in Nepal is primarily nature-based as tourists are mostly attracted by the spectacular landscapes, majestic mountains, glaciers, lakes, rivers and biodiversity across its diverse ecological gradient. Mountaineering, trekking, whitewater rafting and jungle safari tours are the main forms of nature-based tourism activities in our country. Climate change is affecting Nepal in a number of ways and the travel and tourism sector cannot remain untouched. Various studies on climate change shows increased weather uncertainties and extremities resulting into long dry period and intense rain during monsoon leading to increased water induced disasters like floods, inundation, landslides, cloudburst floods, and glacial lake outburst floods (GLOFs) which are projected to continue in future as well. This has affected natural landscapes, and Himalayas influencing every walk of life and livelihood options. Though the impacts of climate change can be observed in the whole world, poor country like Nepal is likely to suffer most due to limited resources to cope with and adapt to the effects of climate change. In this paper, an effort has been made to review the impact of climate change on the travel and tourism sector in Nepal through the study of previous literatures on climate changes.

Keywords: Climate change, eco-tourism, nature-based tourism, travel and tours

Introduction

Climate change is one of the all-encompassing global environmental changes likely to have deleterious effects on natural and human systems, economies and infrastructure (TERI, 2007). Climate change is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (UNFCCC, 1997). Both developed and developing countries have been threatened by climate change in recent times. Climate change is making weather less predictable, rains more uncertain and heavy storm rainfalls more likely and this will continue with an adverse trend in the future too (Adger et al., 2003).

Earth's temperature has increased by 0.85°C (0.65°C to 1.06°C) from 1880 to 2012. However, the increase in temperature for the past 15 years (1998–2012) is 0.05°C (–0.05°C to 0.15°C) per decade (IPCC, 2014). Climate change is mainly observed by the alteration in the temperature and precipitation (Blast, 2013). Though developed countries are mainly responsible for the GHGs contribution, the impact is felt by the entire global community. Climate change has wide spreading effects on the environment and socioeconomic sectors including water resources, agriculture and food security, human health, terrestrial ecosystem and biodiversity, and coastal zones. As the world today is 1.1°C warmer than in pre-industrial times, the consequences of this warming are enormous, observed by the increase in intense

floods and fires, and extreme weather events in the past decade (UNFCCC, 2020). Rising sea levels, retreating ice caps and dying coral are the most visible impacts of a warming planet (UNFCCC, 2020).

Changing rainfall patterns is likely to lead to severe water shortages or over flooding. Melting of glaciers can cause flooding and soil erosion. Rising temperature is causing shifts in crop seasons affecting food security and shifting disease vectors putting more people at risk. Temperature increase of 2o C potentially affects the extinction rates of many habits and species by up to 30%. The United Nations estimates that 1 million species are on the brink of extinction owing to human activity as temperatures have risen so quickly that myriad species, already weakened by habitat loss or pesticide overuse, cannot adapt to new conditions quickly enough (UNFCCC, 2004). In this paper, an effort has been made to review the impact of climate change on the travel and tourism sector in Nepal.

Climate change and variability in Nepal

Hindu Kush Himalayan region has observed severe impacts of climate change and Nepal cannot be the exception with altitudinal variation and fragile geographic structures. Impacts of climate change in Nepal can be observed through escalated natural hazards, rise in temperature and change in rainfall patterns, shifting of tree line and unfavorable weather change phenomena (K.C. & Ghimire, 2015). The warming trend that has been observed in Nepal is higher than the global average. Temperature is noticeably increasing across the country with higher rate in the high altitude and urban areas (Baidya et al., 2007).

In Kathmandu, the annual rate of temperature increase is 0.05°C with an increasing seasonal and decadal trend. The rate of change is higher in winter season (Agrawala et al., 2003; Baidya et al., 2007) which is getting cooler and summer is getting warmer (Eugenio-Martin & Campos-Soria, 2010) with increased warm days and nights; but decreased cold days and nights (Shivakoti et al., 2015). Based on data from 1971 to 2014, Department of Hydrology and Meteorology has shown that warming trend in annual maximum temperature in Nepal is significantly positive, at 0.056°C/yr (DHM, 2017), a similar finding was found by Shrestha et al. (1999) for temperature trends between 1971-1994. The average temperature rise is estimated at 0.5°C per decade, which is very high, compared to several other developing countries (Shrestha, 2000).

The rainfall is inconsistent with intense rain in few days creating long drought (Malla, 2008). Baidya et al. (2008) reported an increasing trend in both the total and heavy precipitation in Nepal over the period of 1971-2006 with more weather-related extreme events such as floods and landslides. DHM (2017) too had similar findings where seasonal and annual precipitation trends throughout Nepal showed decreasing precipitation in all seasons with the highest decreasing trend (-0.3 mm/yr) in the post-monsoon season. Annual decrease in precipitation in Nepal is 1.3 mm/yr. various researches show that precipitation trend is less clear in comparison to temperature trends to study climate change.

Climate change affects everyone but the poorest and most vulnerable people in every society are affected the most as they least likely to have the means to adapt to its impacts in Nepal, being the poor country is likely to suffer from climate change most due to limited resources to cope with and adapt to the effects of climate change (Regmi et al., 2010). The effects are now visible in Nepal's tourism sectors.

Tourism in Nepal

As per United Nations World Tourism Organization (UNWTO) tourism is a social, cultural and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes. These people are called visitors and tourism has to do with their activities, some of which involve tourism expenditure (December 15, 2020). Simply put, tourism means travelling and staying away from home to a different place for the purpose of business, vacation and other activities. Tourists throughout the world spend their vacation in mountain areas for trekking and mountaineering, ocean beach for recreational activities and watching diversity of flora and fauna.

For most of the developed and developing countries of the world, tourism is the main source of income for sustaining livelihood. It has an impact on the environment, economy, cultures, traditions and physical infrastructures.

Nepal is a small country which covers an area of 147,181 sq. km. which is just 0.1% of the area of the planet; still it contains 3.2% of known plants, and 1.1% of animals (Ollerton, 2020). Our country is rich in biodiversity and this diversity attracts tourists from all over the world. Tourism plays a crucial role in employment and income generation for Nepal with three groups having comparative advantage i.e. sceneries and natural beauty, trekking and adventure, and pilgrimage, art and sculptures which are unique in Nepal (Sharma & Pyakurel, 2012). In 2019, contribution of travel and tourism to GDP for Nepal was 7.9% (Knoema data sheet, 2020). The total number of tourists to Nepal in 2019 totaled 1.17 million, a slight downfall over the 2018 number of 1.52 million. Nepal's tourism is primarily nature-based, as tourists get attracted for its spectacular landscapes, majestic mountains, glaciers, lakes, rivers, and its biodiversity across its diverse ecological gradient that is conserved by an extensive network of protected areas. Mountaineering, trekking, whitewater rafting and safari tours into the jungles are the main forms of nature-based tourism activities in Nepal. Of the total number of tourists visited in the year 2018/2019, an estimated 65% of the tourists visit Nepal for pleasure while 16.52% for mountaineering and trekking and 14.6% for pilgrimage (MoCTCA, 2019).

As per the report of MoCTCA, 2019, there has been the slight increase (8.6%) in the tourists who prefer to visit National Parks and Wildlife Reserve in the year 2019 as compared to that of 2018 while tourist who preferred trekking has shown decrease of 15.15 % in the year 2019 in comparison to 2018 (details in Table 1). With the international borders being shut down and national lockdown due to Covid-19 pandemic, tourism for the year 2020 has been halted and conditions still remain the same as of March, 2021.

Table 1: Comparison of tourist flow in two years for different purposes

Tourism activities	Year 2018	Year 2019	% Change
National Parks and Wildlife Reserve	395791	429764	8.6
Trekking (Manasalu, Mustang, Upper Dolpa, lower Dolpa, Kanchanjunga, Humal)	25081	21280	-15.15
Religious sites (Lumbini and Pashupati Nath which excludes Indian toursit)	332491	345020	3.76

Source: MoCTCA, 2019

Climate change impacts in Nepal

Agriculture, hydropower, tourism and livelihood of local people have been severely affected by climate change in Nepal (Sharma, 2009). The discharge of snow-fed rivers is declining (WWF, 2005). Changes in water supply and demand, and resources availability are some impacts of climate change on water resources (Nicol & Kaur, 2009). By impacting water availability, it is hindering agricultural productivity and causing malnutrition, and human health and sanitation problems; while too much water during wet season has devastating impacts on human settlements, infrastructure, and agricultural land (MoE, 2010).

Nepal having extreme climatic variation with steep topography and fragile geology, the impact of climate change is serious. In the mountains, there is less snowfall with retreating glaciers; in the mid-hills, water sources are drying up, and in the plains, people experience greater flooding and unexpected cold (Regmi et al., 2010). The country is experiencing impacts on biodiversity, water resources, forestry, agriculture, and health (Karki, 2007) along with its impact on the cryosphere (Karki, 2009). The Global Climate Risk Index 2014 has identified Nepal as the 14th most vulnerable country to the risk of climate change (Kreft et al., 2015) even though contribution of Green House Gases (GHGs) emission of Nepal is very low i.e. only 0.027% (MoPE, 2016). Glacier retreat for Everest Region was found to be 10-60 m per year (Bajracharya et al., 2008).

The rapid melting and recession of many Himalayan glaciers due to climate change is leading to the formation of new glacial lakes. Even though the total glacial area had decreased by 24% in Nepal between 1977 and 2010, while the number of glacial lakes had increased by 11% (Bajracharya et al., 2014). Nepal is ranked 6th out of 200 countries that will suffer from climate change impacts and climate change will have a significant role in the tourism industry (Bhandari, 2014).

Climate change impact on tourism in Nepal

Tourism is usually for recreational purposes. Thus, the existence of a natural disaster threat or presence of an emergency situation in a touristic destination will lead tourists to consider other touristic destination alternatives to maximize their utility that they receive from tourism activity (Genc, 2018).

Climate change will have visible impacts on the travel and tourism sector as it can impact the natural environment that attracts tourists (Bhandari, 2014). Nature based tourism is highly dependent on natural resources which are affected by climate (Scott et al., 2007). Climate is one of the most important considerations for a range of activities tourists desire as change in temperature and humidity may cause discomfort to the tourists leading to change in their plans.

Climatic change in the form of heavy precipitation and temperature variations even will increase the frequencies of landslides and flood; other adverse effects from monsoons will, in turn, create serious consequences for tourism, as the disasters often block roads and trails (Nyaupane & Chhetri, 2009). It has in a way positively promoted tourism by reducing barriers for trekking tourism in the winter season. However, it has even caused the loss of natural scenic beauty. Slightest changes in the characteristics of the climate in the Himalayas could reduce the tourism flow negatively by altering the perceived attractiveness of the Himalayas environment as clouds can block the views of mountains and reduce the aesthetics of various

destinations and attractions.

Avalanches and glacial lake outburst floods predominate in high elevations in eastern Nepal; landslides, debris flows, and flash floods are common in the hills; and floods are frequent in lowland Terai. With limited opportunities for tourism infrastructure development in the Himalayas, such destruction can have a significant effect on the tourism industry (UNEP/ ICIMOD, 2002). Untimely and high intense rainfall and snowfall had caused serious threat to the mountaineers, trekkers and travellers in the mountainous region. Bad weather had stopped flights in Everest region for several days in November 2010 stranding more than 1000 tourists in Lukla region (altitude of 2500 m above sea level) due to thick fog generation and wind. This had caused havoc among tourists that time (Sangraula, 2010).

More than 32 people were killed by sudden snowstorm in Annapurna Conservation Area of western Nepal leaving hundreds of trekkers trapped at more than 5000 m altitude from sea level in Thorong La Pass area in October 2014 (Burke & Walker, 2014). Avalanche in the trekking route of the same conservation area in January 2020 had left 7 personnel: 4 Koreans and 3 Nepali missing. Happening of such incidents time and again will negatively affect the tourists who have keen interest in trekking.

In some touristic areas like Muktinath, Kagbeni, Puthang, Marpha, and Lete of Mustang district, it has been reported that hotel owners are affected due to water scarcity caused by decreased snowfall, melting of the snow and glaciers, and increased evaporation. Besides, drying of existing water sources is compelling the local communities to bring water from new sources which are far away and has added additional burden to hotel owners (Lama, 2010). Furthermore, it has also been reported that even the camping activity in the mountain region has been affected due to water scarcity. Gössling and Hall (2006) stated that tourists' consumption of fresh water supplies in areas where such resources are scarce further competes with the needs of other livelihood practices such as farming and household water usage, and thus increases the inter community conflict. Looking at the brighter side, locals of the same area had perceived a warm and dry winter which too has promoted tourism by reducing barriers for trekking tourism in the winter season but has increased the loss of natural scenic beauty of the place (Lama, 2010).

Based on meteorological data of Jomsom from 2002 to 2004 period, Dahal (2007), revealed a decrease in winter precipitation in the form of snow and an increase in rainfall after the winter. This has already affected traditional flat-roofed houses made of mud and stone as roof leakage and wall erosion problems in the homes, tea shops and hotels have experienced.

According to Bajracharya et al., 2020, there are 2070 glaciers lakes in Nepal, of which 21 are listed as potentially dangerous. The warming at higher altitudes has accentuated rapid glacier melt and reduced glacier mass and area, promoting occurrence of multiple hazards such as floods, avalanches and GLOFs. Glacier retreat contributes significantly to stream flow variability in the spring and summer, while flooding risk has increased as glacial lake outbursts have become more likely with rising temperatures. Rapidly melting glaciers means more seasonal variation in river flow resulting in more floods and droughts in the country. An increase in temperature of 3-40C could result in the loss of 60-70% of snow cover from the Himalayas (Alam & Regmi, 2004). The precipitation is decreasing at the rate of 1.46 millimeters (mm) per year in the Higher Himalaya in Nepal from 1971 to 2014 (DHM, 2017). Lesser precipitation along with warming will reduce precipitation in the form of snow, thus, reducing the volume of snow affecting the beauty of the mountains (Bajracharya et al., 2020).

As tourists are attracted to our mountains rather than the city infrastructure such as malls and buildings, losing the scenic beauty of our snow-capped mountains may adversely affect the flow of tourists.

Nepal is a home to 118 ecosystems along with endangered species, such as the snow leopard, one-horned rhinoceros, Royal Bengal tiger, Asian elephant, Red panda, and some 850 species of birds, the region offers abundant diversity in fauna and flora, which enhances the region's stature in nature-based tourism. Being rich in biodiversity, Nepal is attracting tourists from all over the world. Climate change will pose a threat to the ecosystem and biodiversity across the Himalayas. Although some species may proliferate, warming leads to extinction of most plant and animal species as 2.45% of species are on the verge of extinction annually (Alam & Regmi, 2004).

Forest fires caused by unusually high temperatures and prolonged drought in Nepal may threaten extinction of many endangered species such as Red pandas, leopards, monkeys, deer, bears, etc. (Lal et al., 2001). Nature-based tourism is closely associated with biodiversity and the charisma of a rich and varied environment. The decline in biodiversity in the ecosystem, thus, means a potential loss of tourism in the Himalayas (Nyaupane & Chhetri, 2009). Decrease in natural scenic beauty along with biodiversity loss will distract the visitors and compel them to look for alternative destinations (KC, 2017).

Tourists who visited Nepal solely for trekking were not bothered by rise in temperature but rather with irregular rainfall as it directly affects their trekking schedule. Most of the nature-based tourism activities in the Himalayas are weather-sensitive so rain and foggy conditions significantly decrease the quality of the trekking experience in the Himalaya. Tourists prefer to change their destination if weather continues to disappoint them (Rayamajhi, 2012). Even though rise in temperature has positively affected the tourism industry as it has made trekking much easier, but in a long run, climate change will have negative impact on tourism sector with scarce in water availability, onset of climate induced disasters as well as unfavorable weather changes (KC & Thapa Parajuli, 2014).

Conclusion

Unique natural features, including the highest peak in the world, biodiversity and natural landscapes, have made the Himalayas a major tourist destination. Climate has an immense role in attracting tourists. As tourism is basically for recreation purposes, they will always weigh on fine weather rather than the unfavorable one. Countries heavily dependent on tourism for their economy will be hit hard with the lesser number of footfalls of the tourist as climate sensitive tourism i.e. trekking and mountaineering will be severely affected by even the slightest change in climatic scenario. Climate change may have positive benefits for the present with more water availability downstream as well extended trekking season but in the long run, water scarcity in the downstream, less snow cover as well as losing the scenic beauty of our mountains will negatively impact our tourism sector. This will compel tourists to choose better alternatives as they value their money.

Very limited research has been conducted to study the impacts of climate change on the tourism industry and hence we need to address this issue as it is indeed a nexus between climate change and the tourism industry.

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Mountain Peaks of Nepal Himalaya

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Abstract

Nepal is a mountainous country with numerous peaks and pinnacles. It is shaped by tectonic movement, the action of gravity, and erosion. It is a gradual transition process from plain to mountain terrain. The present study explores the peaks of the Nepal Himalaya and visualizes the peaks as open sources for mountaineering. The height of Nepal Himalaya is derived from 'Nepal Himalaya Inventory' Gurung (1994), 'Inventory of Nepal Himalaya' (CDG, 2002), and 'Spot Height Shapefile' (DOS, 1998). The total number of peaks opened and mountaineering royalty are derived from the Department of Tourism. The spot height and administrative boundary are derived from the Department of Survey (DOS, 1998 & 2020). Shapefiles and Google Earth are used to map the distribution of the Himalayan peaks of Nepal, and the height categories are based on mountaineering royalty reports. This study also discusses some essential aspects of royalty generation and seeks a better understanding in exploring and identifying peaks for further mountaineering activities.

Keywords: Himalaya, Himalaya ranges, mountain peak, mountaineering, royalty

Introduction

The Himalaya uplifted when the Indian subcontinent started pushing northward against the Eurasian plate for the past 40 million years (Molnar & Tapponnier, 1977), whereas USGS claims that it has been uplifted since 50 million years ago (USGS, 1990). The tectonic movement, gravity, and erosive forces shaped the mountain peak feature on the Earth's surface (Brondon & Printer, 2005). It is a gradual transition process from plain to mountain terrain. Mountain peak regions consist of rugged terrain, a low-temperature climate regime, steep slopes, and remoteness. Kapos has used (as cited by Vivirol, Du¨rr, Messerli, Meybeck, & Weingartner, 2007) criteria based on altitude and slope in combination to represent the world's mountain environments. Kapos Goudie (1985) defines mountains as ''substantial elevations of the Earth's crust above sea level resulting in localized disruptions to climate, drainage, soils, plants and animals (Vivirol, Du¨rr, Messerli, Meybeck, & Weingartner, 2007). The word 'Himalaya' is derived from two Sanskrit words,- "Hi-ma' snow, and "a-la-ya," abode; and it means abode of snow. The Himalayan range is in the south and east of Asia, separating the plains of the Indian subcontinent from the Tibetan plateau, which is 2400 km long and 200 to 300 km wide (Yang & Zheng, 2004). According to geographical location, the Nepal Himalaya lies on the Eastern Himalaya (WWF, 2021) of the Asian continent, which separates the Tibetan plateau and Ganga plain. Apollo (2017) classified the Nepal Himalaya as central Himalaya based on the longitudinal division of Himalayas. Similarly, based on climate-ecology and phytogeographical division, the Nepal Himalaya lies on the eastern part of the Kumaun Himalaya (Kumaun to Kali Gandaki) and the western part of eastern Himalaya (Kaligandaki to Satlaj River) (Gurung, 2004).

Nepal is a mountainous country with numerous peaks and pinnacles. Its surface configuration consists mainly of mountains, hills, plateaus, basins, valleys, and plain/Terai of varying altitude and magnitude. It is home to the world's highest peak, Sagarmatha (Mt. Everest) 8848.86 m asl (MoCTCA, 2020), as well as a number of 8000 meters exceeding snow-capped mountains. Other highest eight-thousanders also lie within Nepal's territory: Kanchenjunga, Lhotse, Makalu, Cho-Oyu, Dhaulagiri, Manaslu and Annapurna exist in Nepal. These mountains are often called nature's water towers so that these are sources of freshwater. About half of all humankind directly depends on mountain resources, primarily water (Sharma, Molden, Rahman, Khatiwada, Zhang, Singh, Yao, & Wester, 2019).

The Nepal Himalaya is home to 26.5 million people (CBS, 2014), and it serves the downstream large population of the world because the ecosystem of the region depends on the Himalaya system. Its scenic beauty and adventurous attractions magnetize the world's tourists and mountaineers/ mountain enthusiasts (Howard, 2016). According to Pomfret and Hales (cited by Musa, James, & Anna, 2015), mountaineering is mountain-based adventure tourism. It has gained immense worldwide popularity. The high water towers (Himalayan water reserves) attract many people for cultural reasons as well. Mountaineers devotedly offer prayers and prayer flags at the top. According to Buddhism and Hinduism, the mountains are considered sacred places of the divine presence.

In 1590, Antonio Monserrate accurately sketched the Himalaya ranges, and in 1733 a French geographer, Jean-Baptiste Bourguignon d'Arville, compiled the first map of Tibet and the Himalayan range based on systematic exploration (Britanica, 2021). In the mid 19th century, Nepal and Indian mountains were measured by the systematic trigonometric survey, and during this time, the highest peak of the world was named Sagarmatha (Mt. Everest) after Sir George Everest in 1865. In Nepal, the first efforts were carried out to mapping peaks in the Nepal Himalaya in 1994 (Gurung, 1994) based on available topographic maps. Central Department of Geography (CDG) of TU prepared an inventory of mountain peaks of Nepal Himalaya in support of Nepal Tourism Board (CDG, 2002) and Survey Department, Government of Nepal, publishing spot heights including Himalaya peaks of Nepal (DOS, 1998). The total number of Himalayan peaks varies with different studies. So, the present study explores the peaks of the Nepal Himalaya as open spots for mountaineering.

Method and materials

The distribution of the Himalayan peaks of Nepal is presented based on secondary data. The heights of Nepal Himalaya are derived from 'Nepal Himalaya Inventory' (Gurung, 1994), 'Inventory of Nepal Himalaya' (CDG, 2002), and spot height shapefile (DOS, 1998). The study of Gurung is based on Indian topo-sheet and the scale is 1:50000. The study of CDG is based on a topo-sheet of the eastern part to the Annapurna range. Rest of the database is based on an Indian topo sheet, boundary map between Nepal and China. The spot height is based on a 1:50000 map scale. The total number of peaks opened and mountaineering royalty in 2015 are derived from the Department of Tourism. The spot height and administrative boundary is derived from the Department of Survey (DOS, 1998 & 2020). Shapefiles and Google Earth are used to map the distribution of the Himalayan peaks of Nepal. The Himalayan peaks' height categories are based on mountaineering royalty report (DOT, 2015). The Himalaya ranges and peaks are visualized using Geographic Information System (GIS).

Table 1: Sources of Nepal Himalayan peaks

S.No.	Publication	Types of Data	Source
1	Nepal Himalaya Inventory	Hard Copy	Gurung, 1994
2	Inventory of Nepal Himalaya	Hard Copy & Digital Shapefile	CDG, 2002
3	Spot Height	Topographic map & Digital Shapefile	Dos, 1998

Result

Origin of Nepal Himalaya

According to USGS (1999), 3 billion years ago, all the present continents were in one place called Pangaea. Extreme heat from lava and magma inside the Earth flowed in and out of the earth, causing continental reclamation. In the course of continuous flow, the Asian and Indian plates collided with each other (the Tethys Sea between the Asian and Indian plates, (See Fig 1) and the Himalayas first raised about 650 million years ago, the Mahabharata (mountainous terrain) and the Chure mountains about 600 and 250 million years ago respectively. The movement of continental plates of the Earth's surface follows the thermodynamic principle. This sequence is still continuous, and thus the present Himal, Mid Hill, Mahabharat, and Chure originated (See Fig 2).

The mountains and hills of Nepal occupy 77 percent, and single high mountains occupy 25 percent (Gurung, 2004).

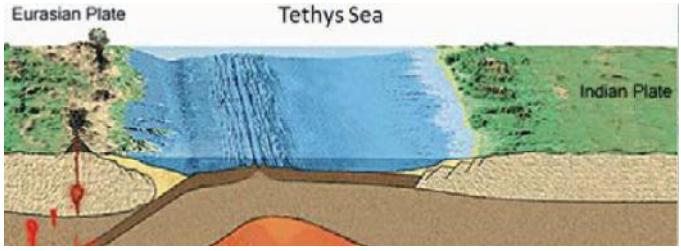

Figure 1: *Tectonic plate*
Source: After USGS, 1999

Figure 2: *Himalaya ranges*
Source: Google earth, 2020

Nepal Himalaya ranges

The erosive power of perennial snow-fed rivers dissected the Himalayas and formed the Himalaya ranges. Gurung (1994) has listed 28 Himalaya ranges with native names and sub-ranges of some main ranges. The highest peak, Sagarmatha, lies on Mahalangur Himalayan range. The above 8000-meter height peaks lay on Kanchanjunga, Manaslu, Annapurna, and Dhaulagiri Himalayan ranges.

Table 2: Himalayan ranges

S. N.	Himalayan ranges	Highest peak	S. N.	Himalayan ranges	Highest peak
1	Kanchenjunga	8586 m	15	Damodar	6701 m
2	Janak	7462 m	16	Nilgiri	7063 m
3	Umbek	6430 m	17	Annapurna	8093 m
4	Mahalangur	8848.86 m	18	Dhaulagiri	8169 m
5	Rolwaling	7140 m	19	Mustang	6372 m
6	Pamari	6160 m	20	Gauttam	6142 m
7	Jugal	7462 m	21	Palchung	6160 m
8	Langtang	7227 m	22	Kanjiroba	6885 m
9	Ganesh	7422 m	23	Kanti	6817 m
10	Sringi	7187 m	24	Gorakh	6258 m
11	Kutang	6498 m	25	Changla	6721 m
12	Manaslu	8163 m	26	Chandi	6249 m
13	Peri	7140 m	27	Nalakanker	6369 m
14	Lugula	7035 m	28	Gurans	7132 m

Source: After Gurung, 1994

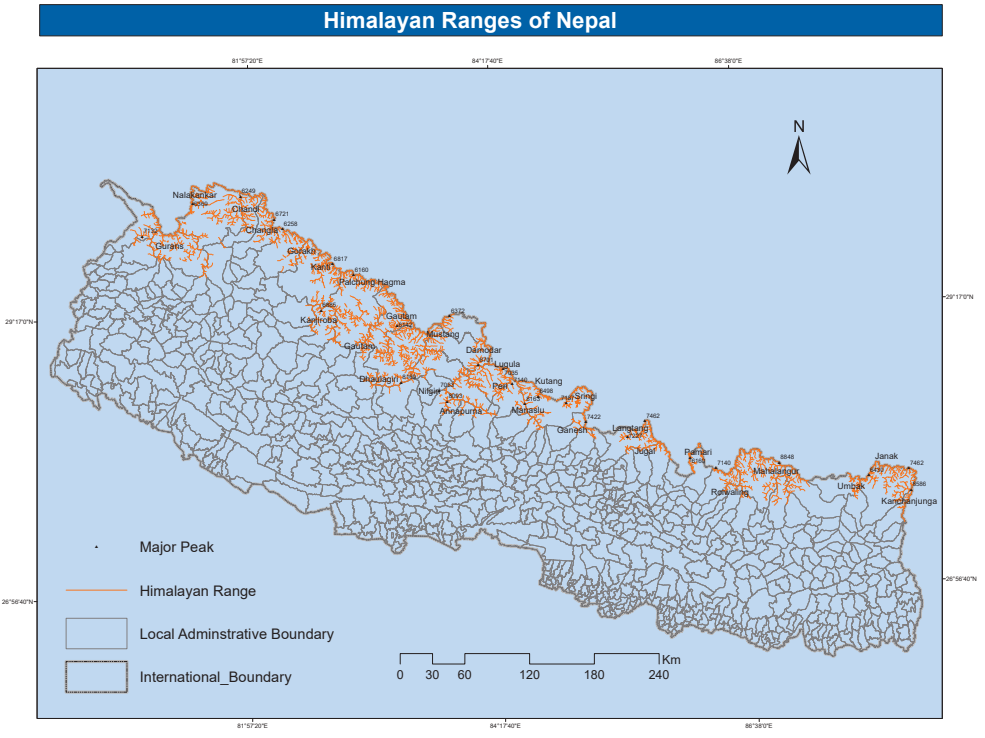

Figure 3: *Himalaya ranges of Nepal*
Source: CDG, 2002

The Highest peak of Jank, Umbek, Rolwaling, Pamari, Jugal Langtang, Ganesh, Sringi, Kutang, Peri, Lugula, Damodar, Nilgiri, Mustang, Gauttam, Palchung, Kanjiroba, Kanti, Gorkha, Changla, Chandi Nalakankar, and Gurans are 7462 m., 6430 m., 7140 m., 6160 m., 7462 m., 7227 m., 7422 m., 7187 m., 6498 m., 7140 m., 7035 m., 6701 m., 7063 m., 6372 m., 6142 m., 6160 m., 6885 m., 6817 m., 6258 m., 6721 m., 6249 m., 6369 m., and 7132 m. asl respectively.

Distribution of mountain peaks of Nepal Himalaya

Gurung (1994) lists out a total of 1310 mountain peaks of Nepal above 6000 meters based on a survey of India topographic sheets at a scale of one inch to a mile (1:63360) and maps prepared for the Sino-Nepal Boundary Agreement of 1979. There are 17 peaks above 8000 m height, including the Sagarmatha (Mt. Everest, 8848.86 m), the highest peak of the world (MoCTCA, 2020). The mountain ranges from 7501 to below 8000 meters and ranges from 7000 to 7500 meters constitute 40 and 87 number peaks respectively. There are 301 (23 percent) and 865 (about 66 percent) peaks that range from 6500 to 7000 meter and 6000 to 6500 meter, respectively (see table 1). About 20 percent of the peaks are identified with specific names.

Table 3: Inventory of Nepal Himalaya

S. No.	Categories	No. of Peaks	Percent
1	>= 8000	17	1.3
2	7501 - 7999	40	3.05
3	7000 - 7500	87	6.64
4	6501 - 6999	301	22.98
5	6000 - 6500	865	66.03
	Total	1310	100

Source: Gurung, 1994

CDG (2002) listed 1792 mountain peaks of Nepal above 5000 meters based on the topographic map prepared by the Department of Survey from Kanchanjunga to Annapurna range and Nepal, and the Sino-Nepal Border map was used for the rest of the western Himalayan ranges. The study finds out there are 15 peaks above 8000 meters, including Sagarmatha (Mt. Everest). The peaks below 6500 meters occupy 82.48 percent. Above 7500 to 8000, 7000 to 7500, 6500 to 7000, and below 6500 meters heights peaks are 29, 73, 197 and percent share 1.62, 4.17, 11 and 82.48 percent respectively (See Table 3).

Table 4: Inventory of Nepal Himalaya

S. No.	Peak Categories	No. of Peaks	Percent
1	>=8000	15	0.84
2	7501 - 7999	29	1.62
3	7000 - 7500	73	4.07
4	6501 - 6999	197	10.99
5	<=6500	1478	82.48
	Total	**1792**	**100.00**

Source: CDG, 2002

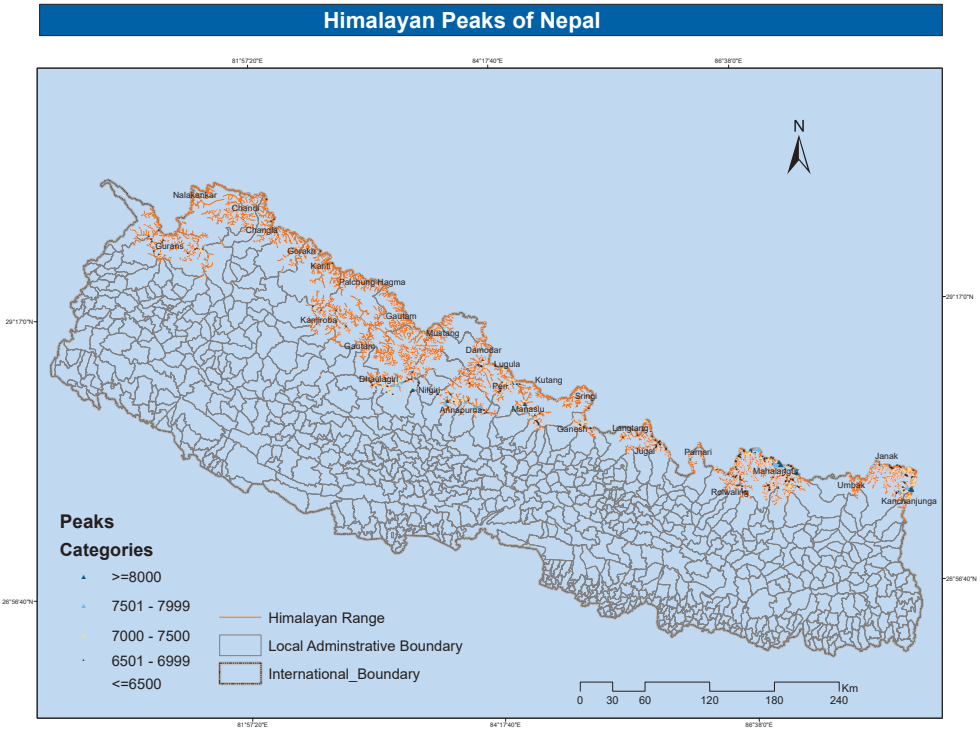

Figure 4: *Himalaya peaks of Nepal*
Source: CDG, 2002

The spot height and peaks' height of Nepal are published from the Survey Department of Nepal in the form of hardcopy and digital shapefile (DOS, 1998). There are 9321 spots and heights mapped in the topographic map of Nepal. There are 23 places greater than 8000 meter, and 57 places are more than 7500 meters to 8000 meters which share 0.25 percent and 0.61 percent, respectively. There are also 7000 m to 7500, 6500 m to 7000 and less than 6500 m ranges; peaks and spot heights comprise 115, 364 and 8762 numbers respectively and 1023, 3.91 and 94 percent share respectively (See table 4).

Table 5: Spot heights

S. No.	Peaks categories	No. of Peaks	Percent
1	>=8000	23	0.25
2	7501 - 7999	57	0.61
3	7000 - 7500	115	1.23
4	6501 - 6999	364	3.91
5	<=6500	8762	94.00
	Total	**9321**	**100.00**

Source: DOS, 1998

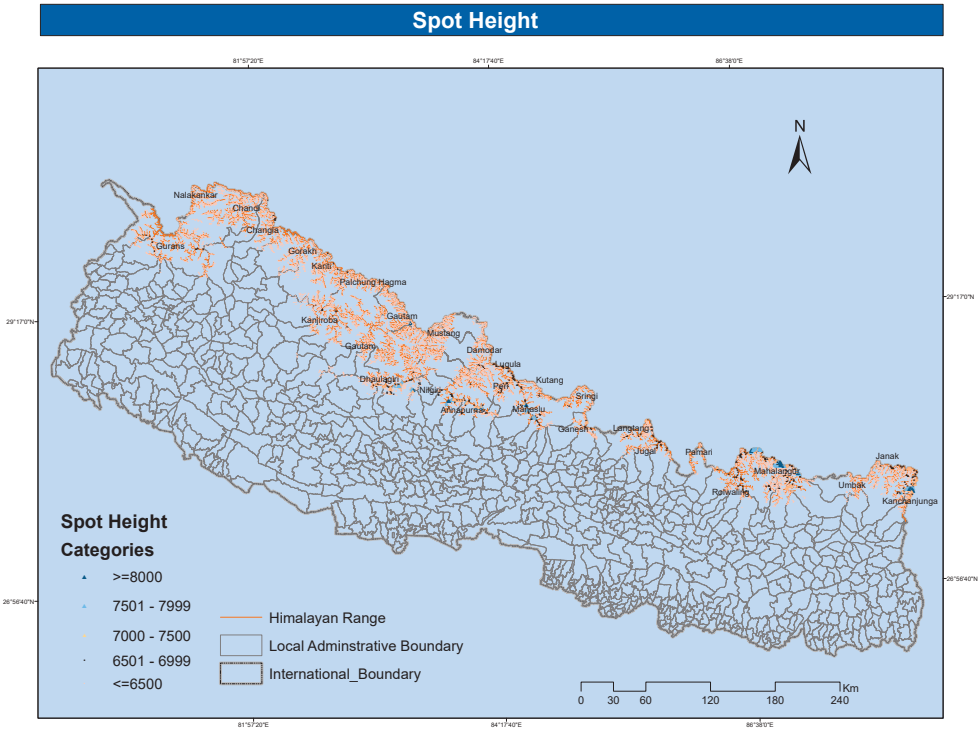

Figure 5: *Himalaya peaks of Nepal*
Source: DOS, 2002

Peaks open for mountaineering

Department of Tourism (2015) opened altogether 411 peaks for mountaineering where 14 peaks are greater than 8000 meters asl, including Sagarmatha. Out of the total, 24 peaks range from 7500 m to 8000 m asl. Similarly, 7000 m to 7500 m, 6500 to 7000 m, and less than 6500 m range peaks are 47, 138, and 188 in number, respectively. 45.74 percent peaks are up to 6500 m for mountaineering. 33.58 percent peaks are open in ranges from 6500 m to 7000 m asl.

Table 6: Mountain peaks open for mountaineering

S. N.	Peak Categories	No. of Peaks	Percent
1	>=8000	14	3.41
2	7501 - 7999	24	5.84
3	7000 - 7500	47	11.44
4	6501 - 6999	138	33.58
5	<=6500	188	45.74
	Total	**411**	**100.00**

Source: DOT, 2020

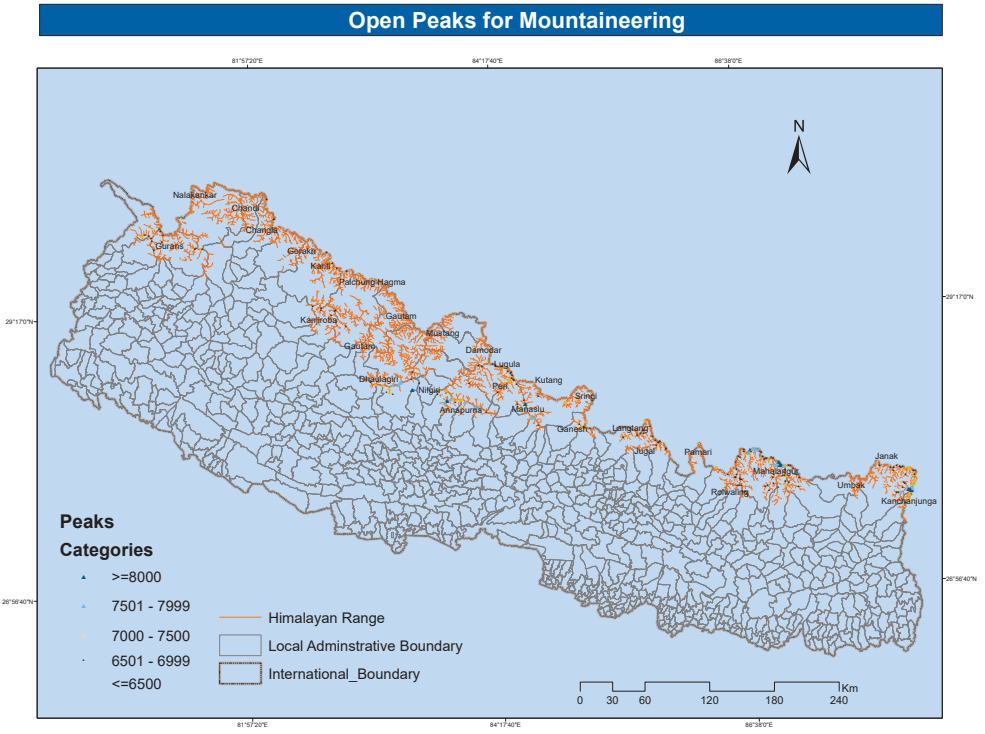

Figure 6: *Himalaya peaks of Nepal*
Source: DOT, 2002

The Department of Tourism, Government of Nepal, fixed the mountaineering royalty for foreign climbers under the height of peak, season, and route. The Sagarmatha regular route's (South Col route) royalty for spring season is 11000 US$ and autumn season is 5500 US$. The royalty for another route of Sagarmatha for the spring season is 10000 US$ and the autumn season is 5000 US$. The other eight-thousander peaks' royalties are 1800 US$ for spring and 900 US$ for autumn season. The mountain peaks ranging from 7500 m to 8000, 7000 m to 7500 m, and 6500 m to 7000 m height's royalty for spring season are 600 US$, 500 US$ and 400$ respectively and for autumn season's royalty are 300 US$, 250% and 200 US$ respectively. In the case of Amadablam, the royalty for spring and autumn season is 400 US$. The mountain peaks range below 6500 m height's royalty is 250 US$ for spring and 125 US$ for autumn season.

Table 7: Mountaineering royalty for foreign climber per person in American Dollar (US$)

S. N.	Peak Categories	Spring Season	Autumn Season
1	Everest Normal route	11000	5500
2	Everest Other route	10000	5000
3	Other Mountain Peaks >=8000	1800	900
4	7501 - 7999	600	300
5	7000 - 7500	500	250

6	6501 - 6999	400	200
7	Mt. Amadablam (6812M)	400	400
8	<=6500	250	125

Source: DOT, 2020

The mountaineering royalty in Nepali rupees for Nepali climbers also varies with the height of peaks, seasons, and routes (See table 6).

Table 8: Mountaineering royalty for Nepali climber per person in NRP

S. N.	Peak Categories	Spring Season	Autumn Season
1	Everest Normal route	75000	37500
2	Everest Other route	600000	30000
3	Other Mountain Peaks >=8000	10000	5000
4	7501 - 7999	8000	4000
5	7000 - 7500	6000	3000
6	6501 - 6999	5000	2500
7	Mt. Amadablam (6812M)	8000	8000
8	<=6500	4000	2000

Source: DOT, 2020

Discussion

Traditionally trigonometric land survey was an effective tool for measuring and mapping height of mountains (Punmiya, 1995). Before that, travelers used to sketch the mountain ranges pretty accurately. Sir George Everest scientifically measured the Himalayan peaks, including Sagarmatha (Mt. Everest), the highest peak (8848.86 m) of the world, from 1830 to 1843 (Smith, 1999), and in 1961, this region was mapped by the Royal Geographical Society (Ward, 2013) based on stereo photogrammetric expeditions. Gurung (1994), DOS (1998) and CDG (2002) mapped Himalayan peaks of Nepal based on the aerial photo using the stereo-photogrammetric method. Gurung (1994) listed out Himalaya peaks based on topographic maps (Nepal west sheet 1967 and Nepal east sheet 1969) by the UK Ministry of Defense and Sino Nepal border Map 1962. DOS (1998) worked on a topo map of Nepal with spot heights, including Himalaya peaks and place heights. CDG (2002) mapped Nepal Himalaya peaks based on a topographic map published by DOS for the eastern part of Nepal and rest of the peaks were done using the Sino-Nepal Border Map 1962.

The table shows the list of peaks opened for mountaineering. Out of the total peaks greater or equal to 8000 meters asl, 14 (88 percent) peaks are opened for mountaineering. Similarly, the peaks range from 7501 m to 7999 m, 7000 m to 7500 m, 6501 m to 6999 m, and 6000 m to 6500 m are open 70, 59, 58, and 17 percent respectively. There are the highest peaks opened for mountaineering in highest percent.

Table 9: Nepal Himalaya peaks and open peaks for mountaineering

S.N.	Categories	No. of Peaks			Peaks Open for Mountaineering
		Gurung 1994	DOS 1998 (Including spots height)	CDG 2002	
1	>= 8000	17	23	15	14
2	7501 - 7999	40	57	29	24
3	7000 - 7500	87	115	73	47
4	6501 - 6999	301	364	197	138
5	6000 - 6500	865	8762	1478	188
	Total	**1310**	**9321**	**1792**	**411**

Source: Gurung, 1994, DOS, 1998, CDG, 2002 & DOT, 2015

Advancement of space science and technology, Digital Elevation Model (DEM) data and technique automatically detect the mountain peaks and terrain features (Graff & Usery, 1993). Global Navigation Satellite System (GNSS) is also a recent advanced space technology for mapping Himalayas and mountains. Recently, the Department of Survey, Government of Nepal, measured Sagarmatha's height using GNSS (DOS, 2020). DEM and GNSS techniques will be the supportive tools for detecting Himalaya peaks and terrains in detail.

Conclusion

Nepal is a mountainous country with numerous peaks and pinnacles. There are different facts and figures about the number of Himalayan peaks with height and name. Although there is an inverse relationship between the number and height of peaks, the Department of Survey has digitized more peaks and pinnacles but needs more detailed work to separate peaks and spot heights. The Nepal Himalaya peaks opened for mountaineering are concentrated in the eastern part of the country. This study concludes that the needed amount of detailed study lacks appropriately due to the shortage of technical expertise and sources. So, detailed research activities are requuired to explore unidentified and unnamed mountains and potential mountaineering using DEM and GNSS space technology. These methods also support exploring physical characteristics of Himalaya like rock type, slope, aspect, slope and height which help to find alternative routes to promote mountaineering in all seasons and all parts of the Nepal Himalaya and develop mountaineering sustainably. It also supports the determined scientific mountaineering royalty based on mountaineering techniques.

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Conservation of Gosainkunda and Associated Lakes: Morphological, Hydrochemistry, and Cultural Perspectives

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Abstract

In this paper, we present the current situation of the Gosainkunda and associated lakes based on the preparation of an inventory of lakes using the Google Earth Engine and 2020 Sentinel 2A satellite imagery. Furthermore, we discuss the hydrology, hydrochemistry, and cultural significance of the lakes based on the systematic review of available literatures. In 2020, there are 22 lakes along with Gosaikunda (12.7±0.4 ha) in the Upper Trishuli watershed (59.2 km2), extending from 1274 to 4993 m elevation and covering a total area of 80 ha. The largest lake is *Bhairabkunda*, with an area of 15.5±0.5 ha. The water bodies in the region are drying, and some of the lakes have already disappeared from the region. But some lakes in the region are evolving as temporary water bodies. The high-altitude lakes are sensitive indicators of anthropogenic disturbance and changing climate. Though the lakes have better hydrochemical quality than the urban lakes located in the southern part of the country, the evidence shows increasing local and long-range transport and deposition of the pollutants in the lake water. The presence of chemical constituents of anthropogenic sources in the water of oligotrophic lakes is possibly evidence of the long-range transport of pollutants. Considering the cultural importance of the region, the number of visitors is increasing annually. Increasing human activities in and around the lake, long-range transport of pollutants, and changing environment in the area are demanding for the lake's conservation. We suggest regular monitoring of the high-altitude lakes to understand the ongoing climate change and anthropogenic impacts.

Keywords: Alpine lake, Himalaya, hydrochemistry, satellite imagery, surface area

Introduction

Lakes (stagnant water bodies including pond or *kunda* in Nepali) are considered a suitable indicator for evaluating climate change impacts at high elevations (Salerno et al., 2014; Shijin & Tao, 2014; Salerno et al., 2016). Nepal Himalaya is home to a large number of lakes. Nepal's high altitudes (>3000 m) host more than 1,500 lakes that have originated from the melting of snow and ice (Khadka et al., 2018). In the high-altitude lakes, direct anthropogenic impacts are expected to be minimal, and the natural geochemical processes seem to control the chemistry (Bhatta et al., 2014); however, mountain lakes located at the high elevation are more susceptible to atmospheric pollutants than lowland lakes due to their typical climate, shallow soil layers, small watersheds and rapid flushing rates (Lami et al., 1998). Changes in the distribution and number of lakes have implications for hydrology and the ecosystem (Shrestha et al., 2019). Previous studies have indicated that the alpine environments experience increased human disturbances, changes in the temperature and precipitation pattern, increased solid and atmospheric pollutants (Salerno et al., 2016; Salerno et al., 2015; Sharma et al., 2015).

Remote sensing is commonly used techniques for the study of high-altitude and remote lakes since it can easily provide knowledge on evolution of lakes, their morphological characteristics, potential hazard or risk without the need of extensive field efforts. Despite this capability, it has not been used and generated the basic knowledge about the abundance of lakes in the remote mountain watershed of Nepal which is important to unravelling the status and knowledge on the small-scale variability of the lakes. Several different lakes are located at high-altitude, including those glacial lakes. Gosainkunda and associate lakes are extra glacial lakes (Petrov et al., 2017) which are not directly connected with the glacier ice, but contributed by the melted water from the snow and ice. This paper aims to present the current situation of Gosainkunda and associated lakes based on remote sensing observation in the high mountains of central Nepal Himalaya. Furthermore, we discuss the morphology, hydrochemistry, and cultural significance of the lakes based on the systematic review of the literature.

Study area

Gosainkunda and associated lakes are situated in the upper Trisuli River watershed of Nepal (Figure 1). It is an essential source of water for the Trishuli River. The lakes are located in Ward Number 5 of Gosaikunda Rural Municipality, previously Dhunche and Syafru Village Development Committees, in the Rasuwa district of Bagmati Province. It is located about 30 km north (aerial distance) of Kathmandu valley and is about one and a half days walk from Dhunche, the headquarter of Rasuwa district.

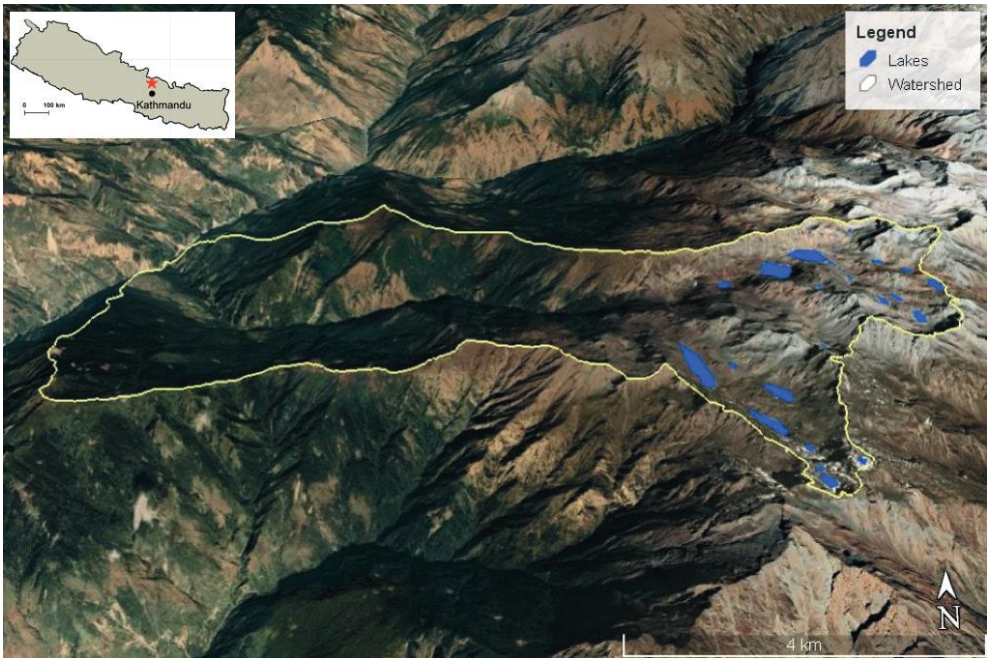

Figure 1: *Location of the study area: the upper Trisuli Watershed. The inset map of Nepal shows the study site, marked by a star sign.*

Geographically, the freshwater wetland lies in a U-shaped valley above 4000 m on the lap of hill Gosai, from where it burrows its name (Bhatta et al., 2018; Upadhaya et al., 2009). Gosaikunda is suggested as the largest lake among all lakes in the Gosaikunda lake system,

with a mean depth of about 12 m. The lake's surface area is 13.8 ha, and the maximum depth is 24.1 m, reported by Rupakheti et al. (2017). It is an alpine freshwater oligotrophic lake; however, nutrients and dissolved organic carbon concentration is high near lakeshore (Bhatt et al., 2014). The lake has 35 liters/sec water input from the inlet and consists of 1.472 million m3 water volume and discharges 60 liters/sec of water through the outlet. It is reported that the entire lake system comprises 108 different-sized lakes with an area of 10.30 km2 (Bhatt et al., 2014). The region comprises land without trees but with sparsely distributed shrubland, rocky slopes, and pasture. The area is culturally recognized, biologically rich, inhibiting much vulnerable flora and fauna (Shrestha et al., 2020).

Gosaikunda and associated lakes: A Ramsar site of international importance

Nepal currently has ten sites designated as Wetlands of International Importance (Ramsar Sites; Figure 2), with a surface area of 60,561 ha. Gosaikunda and Associated Lakes, located in the Langtang National Park, is one of the Ramsar Sites. Gosainkunda complex was designated in the Ramsar site (Ramsar site no. 1693), covering 1,030 ha on September 23, 2007 (Karki et al., 2007; Upadhaya et al., 2009). It was designated as the Ramsar site due to the presence of the IUCN Red-listed endangered and vulnerable species of fauna and flora. Furthermore, the site has religious associations for Hindus and Buddhists and is the center of the *Gangadashahara*, a Hindu festival celebrating the *avatarana* (descent) of the Ganges, and *Janaipurnima*, a sacred thread festival of Hindu. Human uses include grazing during summers, and there are also hotels with campgrounds for trekking groups and pilgrims. Solid waste pollution due to a large-scale gathering of humans during the festive seasons and the long-range transport and deposition of the pollutants on waters have been threats to the site.

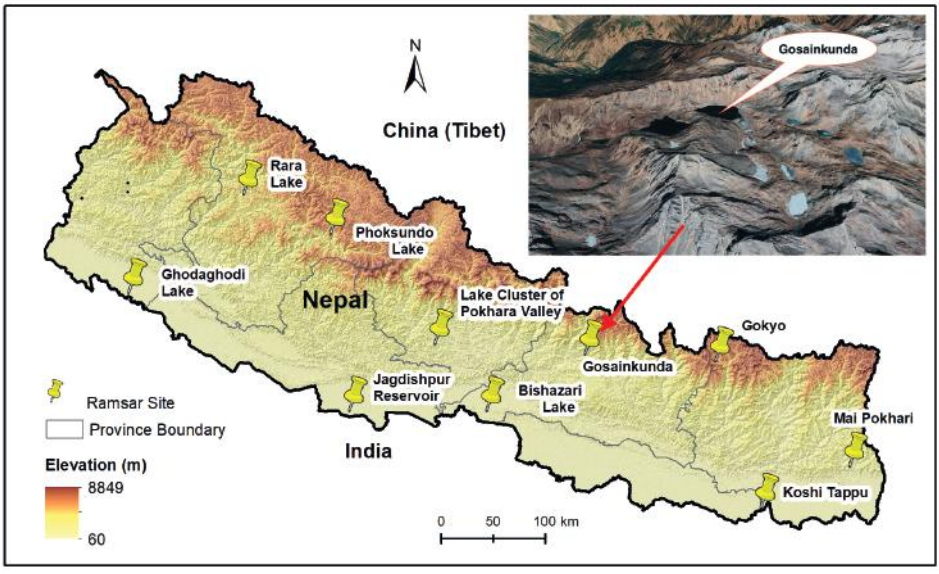

Figure 2: *Location of Gosainkunda and associated lakes, and other 9 Ramsar sites (wetlands) of international importance of Nepal.*

Data and methods

The Google Earth Image (GEI) and Sentinel image of December 11, 2020 (Scene ID: S2A_

MSIL1C_20201211T050211) were the primary data source for preparing an inventory of the lakes. Initially, lakes were identified and digitized in the GEI and exported as a KML file. We used ArcGIS10.7 for further processing of the data. We used Advanced Spaceborne Thermal Emission and Reflection Radiometer Global Digital Elevation Model (ASTER GDEM; a product of METI and NASA) of 30 m resolution for extracting the river, and watershed boundary. To validate the lake inventory, we compared GEI lake inventory with the Sentinel satellite image and Nepal's official topographic map (1992) and also compared the dimensions (area, perimeter) of selected large lakes. The volume of each lake was estimated using the empirical equation based on the surface area of the lake. We used the equation successfully applied by Khanal et al. (2015) in the Poiqu/Bhote Koshi/Sun Koshi River basin, a similar geographic and climatic region located close to the current study site. This equation was proposed based on the trend line derived from the area and volume of high altitude lakes in the Hindu-Kush-Himalaya region.

The equation is represented as,

Volume of the lake (m^3) = $0.0578*A^{1.4683}$

Where, A = surface area of the lake.

Furthermore, we used the Web of Science database and Google Scholar to search the literature. We reviewed the existing hydrological, hydrochemical, morphological, climatic and cultural studies of the Gosainkunda and associate lakes. We found only a few articles published in these areas, and all of them were focused on the Gosainkunda. No hydrochemical and morphological studies available for other associated lakes.

Results and discussion

Morphology of the lakes

The study area, the upper Trisuli watershed, covers about 59.2 km2 of the Narayani River system (Figure 3). The watershed extends from 1274 to 4993 m. A total of 22 lakes, with a total surface area of 80 ha in 2020, were identified within the watershed, ranging from 0.2 to 15.5 ha in size (Table 1; Figure 3). We estimated the water volume at 1805,000 m3 of the Gosainkunda. An estimated 9,491,000 m3 of water volume available on the surface as the stagnant water body in the watershed.

Table 1. Lakes and their morphological characteristics in the upper Trishuli River Watershed.

Lake Number (LN)	Latitude (°N)	Longitude (°E)	Elevation (m)	Lake Name	Perimeter (m)	Surface Area (ha)	Volume (linear scaling) x1000m^3
LN1	28.080	85.400	4095	Saraswotikunda	747	2.3±0.2	146
LN2	28.080	85.407	4315	Bhairabkunda	1861	15.5±0.5	2416
LN3	28.083	85.414	4383	Gosainkunda	1520	12.7±0.4	1805
LN4	28.081	85.417	4379	-	409	0.8±0.1	30
LN5	28.079	85.417	4382	-	170	0.2±0.0	3
LN6	28.077	85.418	4388	Dudhkunda	313	0.6±0.1	20
LN7	28.086	85.421	4609	-	332	0.5±0.1	16

LN8	28.078	85.422	4562	-	429	1.1±0.1	51
LN9	28.076	85.425	4600	Nilkunda	460	1.4±0.1	68
LN10	28.071	85.422	4477	Chandrakunda	577	1.7±0.1	92
LN11	28.070	85.419	4493	Ragatkunda	695	2.0±0.2	121
LN12	28.066	85.423	4517	Amakunda	844	3.8±0.2	312
LN13	28.073	85.411	4572	-	433	0.8±0.1	29
LN14	28.061	85.407	4464	Batas Kunda	315	0.6±0.1	21
LN15	28.061	85.389	4185	Lamu Kunda	2191	16.4±0.5	2615
LN16	28.059	85.393	4313	Rani Kunda	368	0.7±0.1	28
LN17	28.054	85.398	4342	Rajakunda	1128	5.8±0.3	577
LN18	28.050	85.395	4236	Naukunda	1416	7.5±0.4	838
LN19	28.045	85.398	4278	Chherakunda	449	1.1±0.1	48
LN20	28.040	85.398	4406	-	481	0.7±0.1	27
LN21	28.039	85.398	4408	-	737	2.7±0.2	188
LN22	28.040	85.402	4556	-	672	1.0±0.2	41

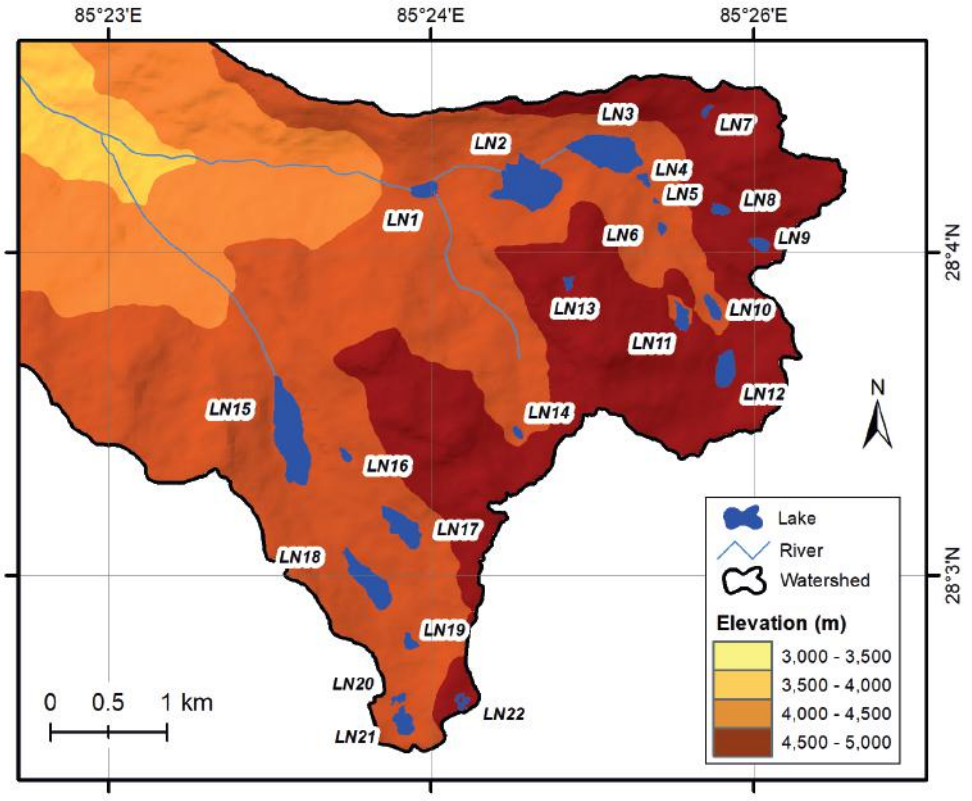

Figure 3: *Mapping of the lakes: Gosaikunda and associated lakes in the upper Trishuli watershed of Nepal. The elevation represents the ASTER-GDEM 30 m resolution.*

Hydrology and hydrochemistry

Gosainkunda and associated lakes are located in the Rasuwa district in central Nepal. Trishuli River, one of the seven tributaries of the Gandaki River, originates from *Gosainkunda* (Figure

4). Gosaikunda and associated lakes remain frozen nearly for six months during the winter season. Precipitation occurs mainly as snowfall except during summer monsoon season (Bhatt et al., 2014; Khadka et al., 2020). From the meteorological data from the nearly Kyangjing station (28.21°N; 85.61°E; elevation: 3920 m), for the last three decades, shows that the annual rainfall varies from 600 mm to 900 mm, the mean temperature is around 5.5°C with minimum temperature -12°C to maximum temperature 20°C. Thapa et al. (2020), studying the climatic and hydrological trends in the Langtang Basin, shows that the total precipitation decreases in the winter season and increases in the monsoon and post monsoon seasons, with an annual precipitation increase of 5.7 mm yr^{-1}. The mean temperature is in rising trend in all seasons and annual scale from 0.040 to 0.068°C yr^{-1}. The snow cover from 2001-2017 in the same basin had significant decreasing trends in the winter (1.24 km^2 yr^{-1}) and the monsoon seasons (1.17 km^2 yr^{-1}). As a consequence, the river discharge in the basin is in a significant increasing trend in all seasons. Hotels and residents nearby and downstream of Gosainkunda use lake water for drinking and household purposes (Rupakheti et al., 2017). Downstream communities also depend on this water source for sanitation, agriculture, industries, and hydroelectricity generation. Furthermore, it supports aquatic life and ecosystems.

Figure 4: *Gosainkunda, the main lake in the area with hydrological and cultural significance.*

Different lake watershed and lake water processes, like sedimentation, deposition, resuspension, and flushing, determine the pollution level. Different studies considered the physico-chemical analysis of the Gosainkunda lake water (Raut et al., 2012; Bhatta et al., 2014; Sharma et al., 2015; Rupakheti et al., 2017). The Ca^{+2} (64%) is the dominant cation, and Cl^{-} (49%) is the dominant anion of the lake water (Raut et al., 2012). The order of cation

concentrations in the lake was $Ca^{+2} > Mg^{2+} > Na^{+} > K^{+}$ (Raut et al., 2012). In contrast, Begnas lake, located in the lower urbanized area, had slightly higher concentrations of Na^{+} than that of Mg^{2+} (Khadka & Ramanathan, 2012). Higher concentrations of major solutes appear at the northern lakeshore near the trail areas due to human and livestock influence (Bhatt et al., 2014).

Based on the water quality index (WQI), high-altitude lakes (e.g., Lake Gosainkunda) were found to have better water quality than the urban lakes (e.g., Lake Phewa). WQI suggests an excellent water quality of the Gosainkunda lake due to its remoteness and less direct contact from human activities (Rupakheti et al., 2017). The high-altitude lakes are helpful in detecting anthropogenic disturbance as they can serve as an indicator. A previous study based on water chemical constituents' analysis shows the increased anthropogenic disturbance in the lake. The Mercury concentration is reported higher in the Gosainkunda lake compared to low altitude Phewa lake, possibly due to long-range transport of pollutants and partially contributing from the natural geological sources. Further, the trace element constituents of water such as Ni, Cu, Zn, Cd, and Pb in the water contributed to anthropogenic sources (Sharma et al., 2015).

Cultural perspective

Gosainkunda and associated lake areas, one of the holiest and sacred lands in the country is an alpine freshwater oligotrophic lake series formed by glacial water and remains frozen for at least six months of the year (Lacoul & Freedman, 2005; Shrestha et al., 2020). Langtang is a place of pilgrimage for both Hindus and Buddhists. More than 10,000 people visit Langtang to take a holy bath at Gosainkunda (Koju & Chalise, 2012). The number of pilgrims has increased from nearly 5,000 in 1999 (Basnyat et al., 2000) to more than 20,000 during the 7 days around the Janai Purnima festival in August 2017 (Bhandari & Koirala, 2017).

Every year on the day of the *Janai Purnima* and *Dashain* festival, thousands of national and foreign pilgrims climb up the hill and take a bath in this holy *Kunda* (lake). Socio-cultural significance Hindu mythology mentions Gosaikunda as a residing place of Hindu deities like the Lord Shiva and the Goddess Gauri. Hindu scriptures like *Bhagawat Gita* and *Bishnu Puran* and Hindu epics like *Rāmāyana* and *Mahābhārata* mention *Samundra Manthan* (Sea exploring), which is directly related to the origin of Gosaikunda. It is believed that the lake originated when the *Trishul* (trident) threw by the Shiva pierced the wall, and *Gangajal* (supposely holy water) filled the pond. The holy water of Gosaikunda is used during *Gangadashahara* and *Janai Purnima* by thousands of people visiting the place from Nepal and India to celebrate the festival. People believe that after bathing in the lakes one's' ancestors and one can go to heaven. The area is culturally rich, with Tamang as a major ethnic group (Upadhaya et al., 2009). The site is equally famous for Yak cheese. About 25-30% of the tourist visiting Langtang National Park visit the Gosaikunda area.

Emerging issues of the lakes

Disappearance of the lakes

The Gosainkunda lake and its surroundings were expected to have 108 lakes, but some of the lakes have already disappeared/dried at present. Several lakes have become ephemeral. In Figure 5, we compare the images of different years to demonstrate the changing status of the lakes in the region. The figure shows that the lakes are disappearing from the region.

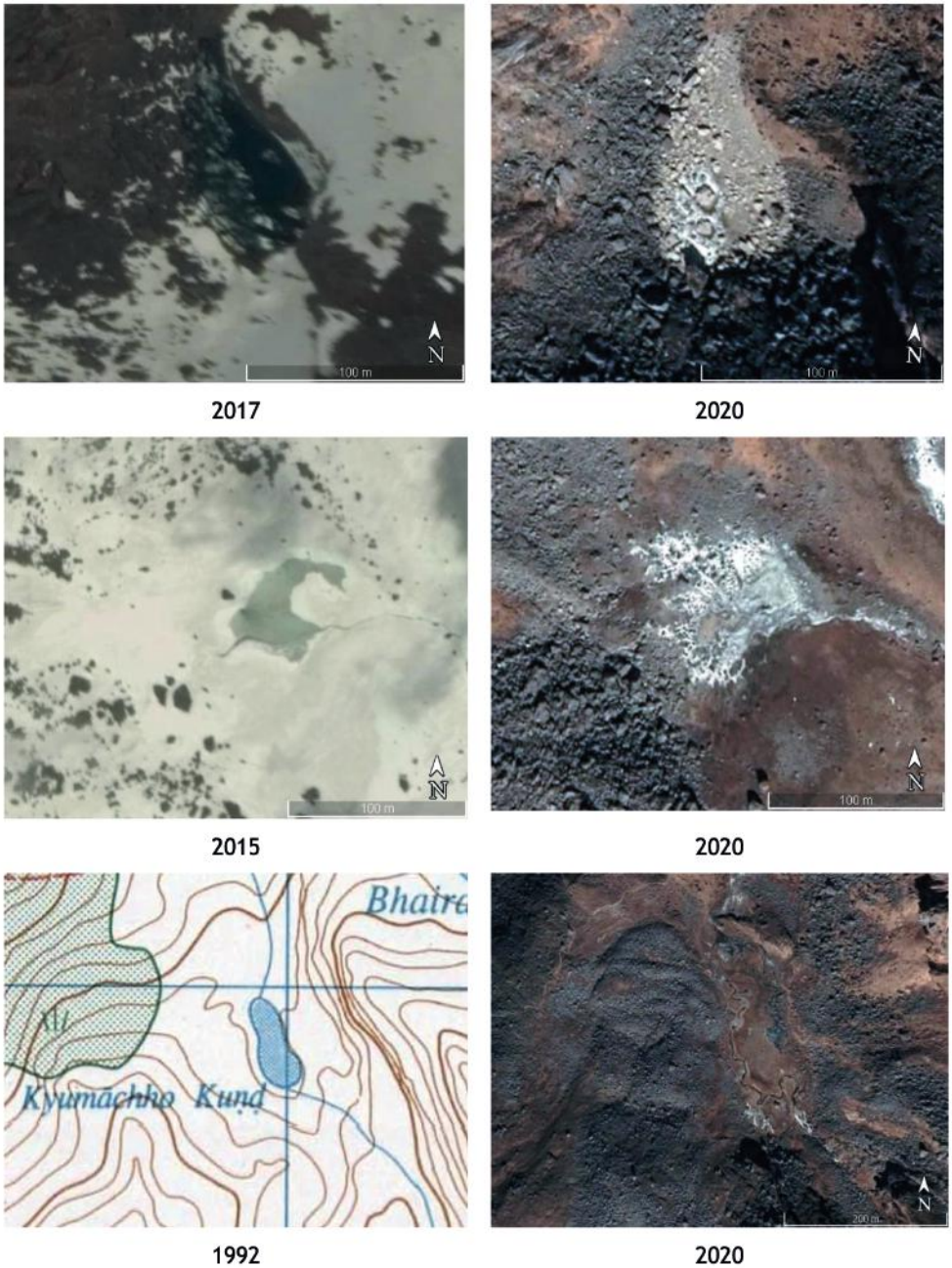

Figure 5: *The lakes are disappearing in the region, and some of the lakes have become seasonal. In the first column of the figure, the lakes were present, but they disappeared/dried in the inventory year 2020.*

High altitude lakes: An indicator of climate change

The maximum temperature of Nepal increased by 0.45 °C/decade and the minimum temperature by 0.09 °C/decade from 1976-2015 (Thakuri et al., 2019). Further, the diurnal air temperature range has increased by 0.034 °C per year in the same period. The average rate of

temperature change in Nepal is higher than in other regions due to the elevation gradient of Nepal. The high mountain areas are more rapidly warming compared to the southern lowlands of Nepal. In areas above 1000 m elevation of Nepal, the maximum temperature has increased by 0.072 °C per year, while in the areas below 1000 m, the maximum temperature has only increased by 0.028 °C per year in the last four decades (1976-2015). Elevation-dependent warming can accelerate the rate of change in mountain ecosystems, cryospheric systems, hydrological regimes, and biodiversity. Rising temperature causes fluctuation in the rainfall, snow cover in the high mountains, which are important sources of water for the downstream population and ecosystems. Salerno et al. (2016) confirmed that glacial melting and precipitation trends could be detected by surface area changes of the Himalayan lakes. Thus, the lakes are a good indicator of precipitation and temperature change.

Salerno et al. (2014) demonstrated that the alpine ponds shift upwards as average temperatures increase. Increasing temperature enhances the glacier and permanent snowmelt process and creates a favourable condition for the formation of the lakes in high altitudes. Increased evaporation/precipitation ratio associated with climate warming can be the possible cause for the disappearance of the lakes. Salerno et al. (2015) showed the weakening monsoon precipitation in the Nepal Himalaya since the early 1990s.

Increasing pollutants

Though the high-altitude lakes have better water quality than the urban lakes located in the southern part of the country, the evidence shows increasing local and long-range transport and deposition of the pollutants in the lake water. Increasing human activities in and around the lake, long-range transport of pollutants, and changing environment in the area are demanding for the lake's conservation.

Conclusion and way forward

Lakes are under increasing pressure due to changing climate and the human disturbances through local and long-range transport of the pollutants. The upper Trishuli River watershed has 22 lakes, extending from 1274 to 4993 m elevation and covering 80 ha. The water bodies (lake) are drying in the region. Some of the lakes have already disappeared from the region and some are evolving as temporary water bodies. The reported chemical constituents of anthropogenic sources in the lake water of oligotrophic lakes is possibly evidence of the long-range transport of pollutants.

The number of visitors are increasing annually considenting the cultural importance of the region. Due to increasing human pressure in and around the lake, long-range transport of pollutants, and issue of the climate changes in the area are possibly threatening the existence of the lakes and appealing for their conservation needs. For effective management of the lakes, information on the status is inevitable, which can be achieved through regular monitoring. Monitoring of physico-chemical parameters, nutrient dynamics, primary productivity, community structure is helpful for detecting the ongoing changes. The field-based measurements of the lakes will be the next step for the quantification of water volume, quality, and detailed morphometric assessment of the situation. Nepal tourism board identifies this region as one of the tourist destinations in the country and promotes trekking and cultural tourism at the national and international markets. In this regard, we should ensure lake conservation and sustainable use. The wetland policy of Nepal also envisioned their conservation and wise use. Nepal adopted the national wetland policy in 2012. National

Biodiversity Strategies and Action Plans also recognize the importance of such wetlands.

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Local Porters[1] in Nepal: Acute Mountain Sickness and Load Weight of Cargo Carrying

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Abstract

Local porters who haul burdens for trekkers are understudied and underappreciated for the labour they do in Nepal. Their susceptibility to Acute Mountain Sickness (AMS) along with the weight of the loads they haul and carry in return for meagres payment, contribute to the difficulties of their very austere and under-resourced employment. They are frequently underpaid for their efforts. Acknowledgement by government organizations and trekking business owners could make their employment more viable by giving them a higher wage in spite of their occupation struggles. Data was gathered from 31 porters completing instruction at a Nepali Porters' training establishment, based in Kathmandu, Nepal. The research used semi-structured in-depth interviews. Participants participated in a 45-60-minute interview, which was recorded at the field site. All the interviews were documented and then transcribed into English by a bilingual Nepali PhD student. The data was coded using a hierarchical, thematic coding structure approach. Findings showed that porters knew about and had experienced AMS, and that their work of carrying heavy cargoes for trekkers and trekking companies were often not compliant with prescribed kilogram load limits.

Keywords: Local porters, trekking, acute mountain sickness, cargo/load carrying weights

Introduction

Within Nepal, local porters are load carrying individuals from underprivileged economic circumstances who support trekking or expedition groups in carrying their cargo. They are the mainstay of the remote region economy as they are the key form of haulage across the mountain areas of Nepal. They provide rudimentary requirements for their extended family from the income secured by lugging the large and considerable gear of trekkers (Upadhayaya & Upreti, 2008b) and others.

In many provinces of the Nepal Himalayas, portering of burdensome loads has not been a volunteer form of livelihood, but rather, has been imposed upon a number of inhabitants by "power and poverty" (Bellows, 2014; Malville, 2005; Campbell, 1995). Prior to 1950, for instance, the Trisuli Tamangs living adjacent to Kathmandu in north-central Nepal were not authorised to sign up to the Gurkha corps, but were obligated by the Rana administration in Kathmandu to be responsible for labour exacted in lieu of taxes by public authorities, carting loads and conserving tracks on the trans-Himalayan trade route linking Kathmandu and Tibet (Campbell, 1995). A further cultural group in Kathmandu who were once compelled to convey burdens for the palace and the army are the Duyiaa (or Duhim); a low caste of the Newari, who now function as agricultural workhands and as incognito entertainers in religious festivals (Bellows, 2014; Malville, 2005; Bista, 1971).

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1 According to MoCTCA (2020) "Local porter" means the porter who carries the cargo of the trekking or expedition team to and from the Base Camp, and other places in between (2020, p. 457).

Local porters are inclined to travel together in extensive, interdependent clusters of networks and relations from comparable or nearby communities. In contrast to trekking and team porters, these porter groups are self-controlled and self-regulated. The bulk of the porters (70%) belong to cultural hill tribes of Tibeto-Nepali descent, but all of the main castes and cultural amalgamations of the eastern hills are found in fluctuating numbers (Malville, 2005; Malville, 1999; Bista, 1971)[1].

Despite being the mainstay of the Nepali trekking industry, porters are missing in policy and academic discourse (Hardwell, 2014). Furthermore, it is only after disasters and natural catastrophes that porters unify and co-operatively negotiate with policymakers to enhance their working conditions and reimbursement levels (Khadka, 2015). Adding to the literature and research on this significant topic will help to inspire the Nepali government (and in particular, the Ministry of Culture, Tourism, and Civil Aviation (MoCTCA)), the Trekking Agencies' Association of Nepal (TAAN) and policymakers to acknowledge the difficulties of these industrious workers, and lobby for change, acknowledgement and appropriate safeguards for them within their occupation (Shrestha, 2018a; Shrestha, 2018b; Khadka, 2015).

Objective

The focus of the research was to investigate how local porters in Nepal experience portering as a member of a trekking or mountaineering team in the Himalayas. Specifically, how local porters succumb to and experience AMS was the first variable to be identified and investigated for the research. Secondly, how porters cope with carrying the oftentimes oversize cargo for the trekking and mountaineering teams who employ them was also explored. Interviews with training porters were undertaken to find out their perspectives on their situations concerning AMS and load carrying weight. The overall health of porters has endured neglect both in the cited texts and in everyday conditions in situ. Many Nepali porters have been regarded with little importance by operators, proprietors and travellers within the tourism industry in Nepal (Law & Rodway, 2008). Thus far, there has been little data collection concerning the effects of AMS and load carrying kilogram weights of these essential workers in this industry. This study investigates these important issues about the individuals involved in an important growth industry in Nepal.

Literature review

Similar to the research conducted and outlined here, other research carried out by Lama (2006) in Sagarmatha National Park (SNP) suggests that the real benefit porters' gain from tourism in Nepal is still in doubt. His research findings draw attention to major problems faced by porters while undertaking their specialized work in the mountains of Nepal. These problems include issues such as the difficulty of securing appropriate lodgings in trekking areas, a lack of available treatment in case of an accident while travelling, inadequate wage rates, unsatisfactory clothing and gear, no accident insurance, and bias or prejudice of trekkers towards them. Indeed, this current inquiry also suggests that it is difficult for porters to obtain adequate clothing when undertaking trekking employment, as clothing is expected to be provided by the porters themselves. As the porters do not have the financial means to acquire this necessary equipment themselves, they just use what they have to hand; or seek out the

1 Indeed, the author has experienced this first-hand when undertaking the Everest Base Camp trek.

assistance of porters' charitable and training organizations such as the Porters Clothing Bank[2], based in Thamel, Kathmandu.

According to this research, and in line with Upadhayaya and Upreti (2008a), and Lama (2006) the dilemmas encountered by porters in mountain tourism and associated pursuits; additionally need support for the design of broad training and knowledge programs for themselves from within porters' associations; design of specialized education curricula for porters, and a distinct need for mobile instruction in remote regions, predominantly concentrating on individual cleanliness, elementary fitness, acute mountain sickness, simple interaction proficiencies, and appreciation of prospective risks and safety perspectives; erection of porter lodgings in diverse encampment locations; and a revision of the establishment of wages for porters according to the altitude (Barott, 2018; Bellows, 2014; Upadhayaya & Upreti, 2008a).

Parajuli (2009) contends that only a small sector of porters (23%) have information about different organisations operating for their wellbeing. The current research also found, and in line with Parajuli (2009), that a preponderance of porters (80.5%) were content with their employment and reimbursement and will keep on working as a porter even though they believe their job is hazardous. On the other hand, and according to Malville (2005), apart from their physically challenging livelihood, the porters exhibit no suggestion of enduring medical ailments that may be attributed to the continuous transport of burdensome freight (Barott, 2018; Bellows, 2014; Devkota, 1995; see also Malville, 2005; Malville et al., 2001; Malville, 1999; Devkota in Dixit, 1995).

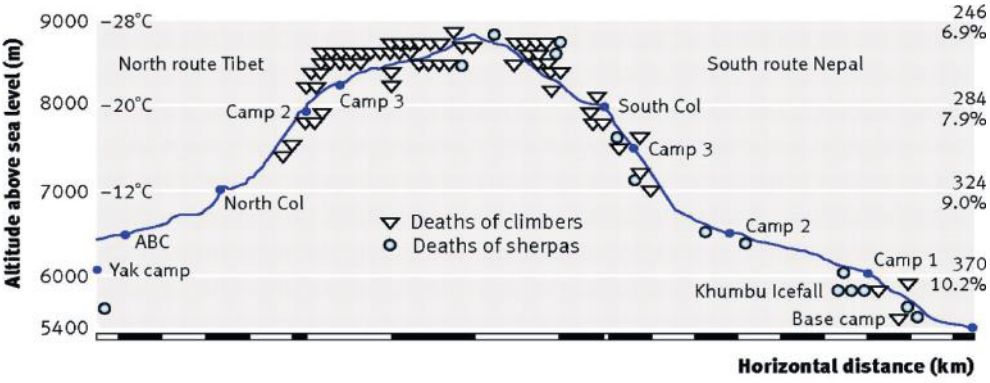
The elemental reason for undertaking this research is highlighted by Basnyat (2007), who has argued that no adequate research has been undertaken on porters. In a private discussion, he indicated that "this (Nepal) is not a documenting society", which has made plain why there are not many dependable documents about porters and why verification of how their lives have altered is not well represented. Basnyat reported that there is no verification that portering in reality injures porters' bodies (personal communication, April 30, 2007); in effect, he cited a project of 102 porters that was well-known for the non-existence of musculoskeletal troubles (Basnyat & Litch, 1997). Basnyat accepts that the recommended maximum of 30 kg per porter is practical and that they could carry such loads actively without enduring substantial difficulties associated with this form of labour. He did not reject that porters confront wellbeing crises - for instance, he has witnessed several porters suffering from frostbite (Barott, 2018; Law & Rodway, 2008; Basnyat & Litch, 1997). The current inquiry also found that porters wore inadequate clothing, particularly adequate footwear when carrying trekking group loads in the mountains.

According to Dawadi, Basnyat and Adhikari (2020), all Sherpa porters are not from lofty elevation locations. In effect, a considerable percentage of them are from diverse ethnic origins and inhabit low elevations and only journey to lofty elevation locations for employment (Barott, 2018; Koirala et al., 2018; Newcomb et al., 2011; Malville et al., 2001). Consequently, they are also susceptible to AMS similar to other trekkers. This vulnerability is contrary to the porters from lofty elevations who may be innately more acclimated to high altitudes (Droma et al., 2008). The Sherpa porters have now commonly been replaced by other valley

2 The Porters Clothing Bank, is operated by the Kathmandu Environmental Education Project (KEEP), based in Thamel, Kathmandu. According to the CEO, Ian Wall: "KEEP provides the services of an un-biased visitors' trekking advice centre, Porter Clothing and Porter Welfare Centre, and, an organisation with an environmental purpose" (https://www.theintrepidfoundation.org/kathmandu-environmental-education-project).

dwelling ethnic cultures such as Chhetris, Bahuns, Limbus and Rais (see Parajuli, 2009), who are in all probability more susceptible to struggle with altitude linked complications. These porters, consequently, experience the same risk of AMS as any trekker would do (Bellows, 2014; Basnyat & Le Master, 2001). An absence of familiarity about the indicators, preclusion, and hesitancy to register any signs of AMS may explain the frequency of the condition in porters (Newcomb et al., 2011). The reality that porters are also in danger of risk of AMS is very significant for trekking cohorts, businesses, and tourists to identify as there is frequently a fictitious presumption that porters working at lofty elevation locations all come from lofty elevations and are, consequently, comparatively resistant to AMS. The research presented here found that it is vital to recognize that this is not the situation and awareness has to be devoted to the porters touring with any given trekking or mountaineering group (Dawadi, Basnyat & Adhikari, 2020; Bellows, 2014). Indeed, it is quite difficult to acquire statistics concerning the deaths of porters/Sherpas when climbing or trekking to high altitudes. The following Table (Table 1 – see below) shows mortality rates for porters/Sherpas, climbers and mountaineers between 1921 to 2006 on Everest. Overall, this research can report that, death rates, particularly for Nepali nationals are underreported and many times, deaths tolls for porters are never recorded.

Table 1 – Mortality on Everest 1921-2006



Route	Mountaineers	Death rate during descent from summit (%)	P value*
North	Climbers Sherpas	3.4 <0.2	0.0001
South	Climbers Sherpas	1.7 0.4	0.02
Combined north and south	Climbers Sherpas	2.5 0.2	0.0001
North	Mountaineers	2.0	0.1
South	Mountaineers	1.1	

Source: Firth et al., (2008, p. 1431)

Methodology

Data was collected from 31 porters undertaking training at a Nepali Porters' training organization, based in Kathmandu, Nepal. The project used semi-structured in-depth interviews to interview the participants on the topic of the 'acute mountain sickness and weight of cargo inconsistencies'. Participants were involved in a 45-60-minute interview,

which was recorded in situ. The interviews were semi-structured so that a lot of the questions – or at any rate themes – were prepared ahead of time, but areas of inquiry were followed within the interview, so as to focus on interesting and unexpected possibilities that emerged. The interviews for this study were undertaken in both Nepali and English. Some of the porters preferred and asked to be interviewed in English, so they could practice their language skills with the author and interviewer for improvement purposes when interacting with English speaking trekkers. Some of the interviewees did not feel confident enough to develop an interview in English (at this stage in their training), so they were interviewed in Nepali. All of the porters interviewed were male and ranged from twenty to forty years of age. Throughout all the interviews, a male Nepali interpreter was present in order to help with language nuances, cross-linguistic anomalies and to clear up any misunderstandings regarding the interviews and their purpose. All the interviews were recorded and then transcribed into English (if they were not already in English) by a bilingual Nepali PhD research student. The data was coded using a hierarchical, thematic coding structure approach.

Question triggers that concentrated on length of time as a porter, training undertaken for portering, hours of work and types of articles carried, risk and safety issues, injuries and length of time able to work in this occupation were asked of each participant. Further, basic demographic queries relating to their age and place of birth were also mentioned. All questions were formed through engagement with the literature on porters in Nepal, their health and other relevant issues for working in the Himalayas. However, the dialogues and discussions with the male participants were wide-ranging, exchanges co-produced between the interviewer and participant to inspire the porters to present their own lived experiences of their portering encounters.

Findings/discussion - results

The local porters in this study were employed by carrying heavy loads for tourists in the mountains. Many of them were attracted to the work because they could be relatively well paid for their short-term hauling duties, rather than the lower returns they would receive if they stayed on the family farm and grew food. Many reported that they were in good health before they went to the mountains, and that they did not suffer from any health problems before going to the mountains. Many porters appeared happy carrying loads for others; but some reported carrying much more than the thirty-kilogram limit prescribed for them. The research studied what the porters carried by weight, and in kilograms. The themes to emerge from the research were AMS and "weight of loads or cargo" in kilograms. In the next section, AMS is discussed first, followed by a subsequent section on carrying of cargo or loads by porters.

Acute Mountain Sickness (AMS)

The mountaineering, hiking, trekking, rafting, canyoning, bungee jumping and climbing industries, i.e., tourism, are a main source of earnings for Nepal, and the appeal of a higher seasonal wage reward entices many valley dwelling Nepali to toil as porters (Kharel, 2017). They transport substantial consignments and are frequently inadequately prepared and insufficiently advised of the hazards of high altitude. AMS in climbers and journeying to high altitude continues to be a widespread dilemma (Hillman, 2019; Dubowitz & Miller, 2001; Hackett, Rennie & Levine, 1976) and much investigation has been aimed at its avoidance. Nepali porters are as prone to AMS as climbers and hikers (Hillman, 2019; Basnyat & Litch,

1997), and over the years, it has been found that an excessive frequency of AMS (37%) has been present in non-Sherpa Nepali porters (Hillenbrand et al., 2006; Basnyat & Le Master, 2001).

AMS is the riskiest malaise that can be contracted while travelling in the mountains. When asked about AMS, participant 1 responded that if he felt sick, "I would go down if I feel that sickness". Participant 12 added that, "I am not feeling that … because I stay in that kind of area from childhood and do not feel difficulties while trekking". This is similar to the arguments made by Carod-Artal (2014) in a journal article on high altitude headaches and AMS. But participant 12 also added when asked about AMS that he had:

Heard (of) some other people of different groups feel that kind of situation and some problems like asthma (sic). But their guides are very good and follow precautions before getting those problems. They would already prepare to handle that situation.

Participant 14 related that he sometimes contracted AMS, even though this was due to individual capacity while trekking, and that if he were unlucky enough to fall ill that he would, "had some medicine (sic), garlic soup[3] and go down". Additionally, when participant 7 was asked if he ever fell ill during a trek, he answered:

I feel weak and some friends have experienced headaches and altitude sickness. My company had guides with first aid trekking and we didn't have any problems. Above 5000 m, I experienced headache and sleeplessness. I used medicines like Paracetamol; and using Diamox may lead to diarrhoea, and my guide asked me to go for garlic soup, enough to eat and sleep.

According to Bellows (2014), and Basnyat and Litch (1997), the occurrence of AMS is influenced by personal predisposition, the altitude attained and the pace of ascent amongst other things. A gradual ascent pace is probably a significant component in the lesser occurrence of AMS. In Hackett et al. 's (1979; 1976) research on the occurrence of AMS in Nepal, participants were recorded as ascending over time frames of between 2 and 14 days. It should also be highlighted to trek managers and medical doctors that not all the Nepali workforce inhabit high altitude locales, predominantly the porters, and are likely to be as predisposed to AMS as Western trekkers (Basnyat & Litch, 1997). The research reported in this article found that many of the porters did experience varying levels of AMS, and most responded to various well known and widely used local and general treatments, such as drinking a lot of water, eating garlic soup; and taking paracetamol and Diamox[4]. Participant 6 also added some interesting facets to the risk of being a porter and related about a time he contracted AMS; and also, what has happened to other porters:

At that time, I drink a lot of water first and garlic soup and during the day I do not sleep. And going around 100 m up and down. And I go down… I use a lot of Diamox. Sometimes a lot of porters die during trekking. They had many problems. In one season, 5 to 8 porters died. But sometimes very few would die. It is due to altitude sickness and a lot of alcohol drinking.

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3 See Koirala, P., Wolpin, S. E., & Peterson, J. T. (2018). High altitude illness: Knowledge, practice, and attitudes of porters in Nepal. Wilderness & environmental medicine, 29(4), 431-436, for a full discussion regarding the benefits of garlic soup as a remedy for AMS.

4 Most Diamox (Acetazolamide) tablets come in 500 mg doses. Taking this twice per day for at least two days before the high-altitude trek begins, during the trek and also on the return journey appears to be a lot of Diamox but is the recommended dose for most people. However, the dosage can be adjusted to suit individual circumstances (see https://www.rxlist.com/diamox-sequels-drug.htm for further information on dosages of Diamox).

Many Sherpas died during Mt. Everest avalanche. That kind of terrible incident happened in Manaslu too… I have been to Manaslu, Kanchenjunga, Makalu, Everest Base Camp, Langtang and Upper Mustang.

From the research stated here, it can be ascertained that a considerably greater quantity of porters with AMS problems have been evacuated than tourists. These results are comparable with earlier information, which also established a larger quantity of porter evacuations when compared to other staff and tourists (Basnyat & Litch, 1997). When tallied, the data indicate that when porters describe AMS problems, they are more acute than those experienced by tourists (Drew et al., 2011). Thus, high altitude employment (portering) in the Himalaya is conceivably the most precarious of all practices of mountain tourism (Shrestha, 2020; Bott, 2009). The findings of this research regarding porters and AMS can thus be related to the notions of porters wanting to do as many portering trips as possible during the tourist "on season" in Nepal. In turn, this enables them to develop a higher income and more affluent lifestyle. However, it also highlights the fact that their lives are put at risk in order to gain a sturdy and financial status and lifestyle for themselves and their families.

Carrying of cargo and loads by porters

Investigations of the working conditions of porters in Nepal, particularly those who participate in non-qualified trekking tourism external to the Solukhumbu area of Nepal are mainly unaccounted for amongst the tourism literature. Academics who have written about the topic have used Kilimanjaro in Africa as an illustration, where they have recorded significantly risky and unequal working conditions (see Melubo, 2015; Peaty, 2012). When discussing the weight and safety of loads they carried as porters, participant 11 recounted that, "we will carry bandages or some medicines for such emergencies". Participant 2 also responded, "Normally, I carry bags like trekking bags and backpacks, sometimes but we have to request to get permission to do those things". Participant 13 also said that he carried "Tourist bags and my own stuff".

The research on the impediments and facilitators to porter susceptibility to AMS and the weight of loads they are employed to carry, indicates that working conditions for the porters are frequently grim. Regularly conveying burdensome loads with improper equipment, porters have been exposed to severe work-related perils attributable to their physically strenuous occupation in a perilous landscape. Financial arrangements have also aided difficulties; enticements for conveying weightier burdens, provincial price increases, and economic reliance on guides and trekking organisations have all impacted to shape portering into a harsh vocation where wellbeing is forfeited over income (Barott, 2018).

Indeed, when asked about the things he carries as a porter, participant 4 said that "I carried a backpack when being porter (sic) and during the trekking to Nagarkot". However, when asked the same question, participant 6 added "It's not heavy, up to 30 kg". But participant 17 related that "It's up to 35 kg, but generally less than 30. These are stuff like bags, backpacks and sometimes baskets". Participant 8 also confirmed this by adding, "It's backpacks, bags and baskets sometimes".

Self-regulated exertion is the solution to appreciating the burden haulage capability of the porters. By relaxing regularly and advancing gradually at their own rate, the porters are able to control work strength (cargo and load carrying) and persist within their own physical constraints while achieving duties that a good number of well-built men would be incapable

of achieving (Bellows, 2014; Malville, et al., 2001). So, this research supports the notion that porters need to develop personal strategies around the weights they are willing to carry; and also, the physical exertion and energy they are willing to expend working as porters in order to provide a better living standard for their families and themselves.

Many tourists who partake in trekking engage the services of Nepali residents, for instance, local porters. Contrasted with other Nepali staff, porters are frequently from humbler social environments, live at lower altitudes in the "off season", and are paid lower amounts when compared to guides, for their trekking expertise. Additionally, cultural disparities in illness and ailment communication may mean that international trekkers are less equipped to protect their workers because they are ill informed about medical complications (Barott, 2018; Drew, et al., 2011).

Conclusion and implication

The researcher has shown how Nepali porters live with and sustain health with regards to AMS and load carrying issues while undertaking employment in the mountainous regions of Nepal. Porters are contemporaneously organising themselves and their industry, so that they are no longer vulnerable within the trekking industry. This research will assist in understanding how Nepali porters prevail over their situational health and cargo or load hauling capacities while assisting international tourists and others on treks in the Himalayan regions of Nepal.

Porters who transport loads for tourists are under researched and under recognised for the job they do in Nepal. Their susceptibility to AMS, along with their compliance to carry heavier weights than are permitted are issues that need more research to ascertain discrepancies in these areas. Porters are absent in policy and academic dialogue (Hardwell, 2014). Moreover, it is only after tragedies and natural disasters that porters unite and cooperatively collaborate with policymakers to augment their working conditions and compensation levels (Khadka, 2015). A large number of the participants in this study reported that their health was good, and that they did not struggle with AMS or numerous other injuries. The Nepali porters in this study are perceived as underprivileged uneducated labourers. Contrasted with other Nepali employees, porters are often from unprivileged social environments, live at lower altitudes in the "off season", and are compensated with minimal pay rates (Barott, 2018; Bellows, 2014). A more sustained recognition of porters would contribute to better health outcomes with regards to AMS, and improved weight carrying ratios for them employed on treks in the Himalayas. Their wellbeing is dependent upon others. If a national policy were implemented regarding their employment circumstances, which could lead to improved reactions to health conditions, such as AMS and lighter loads; then, Nepali porters would experience an overall lifestyle improvement.

Limitation

There were some limitations to the research identified by the author. These included that the research did not really address the fact that porters are poor. A further limitation to the research was the fact that only male porters were interviewed.

Future research

With regards to future research, the benefit of this research has been to provide data about how Nepali porters manage their susceptibility to AMS and load or cargo weights throughout remote regions in Nepal. The work will add value to the policy debate on these issues in the

trekking industry, and Nepal. The data and consequent outcomes will form the basis for a larger project on this area of concern. Including female porters in subsequent studies would also highlight the issues discussed here from an inclusive perspective.

Final comment

Finally, there is still a considerable vacuum that needs to be examined concerning wisdom about health and load carrying capacity dilemmas in porters. Straightforward worksheet records of porter wellbeing difficulties by the current remote high-elevation health posts would be very beneficial to discern the scope of the dilemma. Rudimentary fundamentals of schooling and improved socioeconomic conditions are needed to progress Porter's improved health outcomes. Trekking organizations and companies need to appreciate and observe dependable trekking.

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Book Review

Adventure Tourism: The new frontier
A Critical Review

Writers: John Swarbrooke, Colin Beard, Suzanne Leckie & Gill Pomfret

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This book represents a very ambitious project! It is an attempt to explore the growing, but broad and "ill-defined", phenomenon of adventure tourism. At the same time, the sub-headings of the book reflect the authors' view that adventure tourism represents a 'new frontier' in tourism in several ways.

First, in many ways the changes that have taken place in adventure tourism in recent years appear to illustrate and support the idea that the world is witnessing the transition from 'old tourism' to 'new tourism'.

Second, in terms of the geographical dimension of tourism adventure tourists are pushing back the frontiers, making destinations of the last wildernesses on earth, and even of space!

Third, in many types of adventure tourism the industry is seeing new forms and variations on a theme, which are shifting 'the frontier' in the different sectors of tourism.

Finally, the adventure and general travelers are living and experiencing in a time where 'classic' natural wilderness adventure travel is being complemented by adventure experiences in man-made artificial environments, often in urban areas.

The authors are determined to try to present as holistic a view as possible of adventure tourism. In most texts adventure tourism is seen as a physical phenomenon, involving tourists undertaking physical activities in unfamiliar and often inhospitable environments. However, there is also a non-physical dimension to adventure tourism in two ways. In the first place, physical adventure activities have a strong non-physical element in the emotion of fear and, taking mountaineering as an example, in the almost spiritual feeling experienced when standing alone on one of the highest points on earth.

The authors have added a little more academic stuffs in their scholarly pursuit where they argue that more fundamentally, though, there are forms of adventure tourism that are largely or wholly non-physical in nature. Non-physical adventure tourism can, perhaps, be divided into different types, namely:

- Intellectual adventure, such as travelling for mental self-development
- Emotional adventure, for example gambling or hedonism
- Spiritual adventure, where people travel in search of spiritual enlightenment

The inclusion of non-physical adventure tourism in this book has made it almost unbearably difficult to write, because non-physical adventure has received much less attention from academics than its physical counterpart. As a result, there is little theoretical literature in this

field, and very few data exist for many forms of non-physical adventure tourism. For this reason, non-physical adventure tourism receives less coverage in this book than the more traditional physical forms. However, the authors wish to stress that this imbalance is mainly as a result of the lack of data and theoretical literature, and it in no way reflects their view of the respective importance of the two forms of adventure tourism.

It became clear to the authors very early on that adventure tourism is a diverse field. Even physical adventure is highly heterogeneous. The breadth of physical adventure tourism today was clearly illustrated in a small book given away free in 2002 with Global magazine in the UK. This listed 'Great Adventures for 2002', includes:

- Trekking holidays in Morocco and Asia
- Bike-riding adventures in South Africa
- Diving trips to the Red Sea
- Whale-watching in Norway
- Swimming amongst sharks in South Africa
- Cheetah-watching in Namibia
- Dog-sledding and reindeer expeditions in Lapland
- Sailing tall ships across the Atlantic
- White-water rafting in Turkey
- Surfing in Cornwall, UK
- Riding the full length of the Trans-Siberian railway
- Taking part in charity challenge adventures, including the 'Vietnam Life
- Cycle Challenge' and the '2002 UK Challenge Series'
- Going on a polar cruise to either the Arctic or Antarctica
- Going on holiday and paying to work on conservation projects in the UK
- Micro-light flying in the UK
- Taking part in the 'running of the bulls' in Pamplona, Spain
- Sky-diving in Spain and Florida
- Driving a Formula 1 racing car in the UK
- Practicing falconry in the UK
- Taking a motorcycle tour of the South Island, New Zealand
- Training with Thai boxers in Thailand
- Horse-trekking in Kyrgyzstan
- Participating in the Outward Bound 2002 Expedition.

Non-physical adventure tourism is also a very diverse field, encompassing everything from gambling trips to hedonistic sun, sand, sea and sex vacations to journeys in search of spiritual enlightenment.

What is clear is that adventure is not an absolute concept that is the same for everyone. The concept of adventure is highly personal, and means different things to different people. Something that is quite every day or mundane for one person can be a rare adventure for

another: depending on experience and personality.

Sadly, this is just one of the areas in which the writing of this book was constrained by the lack of empirical data on many aspects of adventure tourism. Hence in Chapter 12 the authors have made an impassioned plea for more research to be conducted in adventure tourism.

Having talked a little about the aims of the book, and the problems experienced in writing it, it is time to tell the reader a little about its structure.

Part A sets the scene with the following traditional yet obviously necessary academic components 'Introduction, definitions and typologies' followed by 'Historical themes in adventure tourism' contents.

Chapter 1 makes an inviting attempt to introduce the concept of adventure tourism and offers some key definitions and typologies, while chapter 2 puts adventure tourism into its historical context.

The adventure tourist is the focus of Part B. Chapter 3 concentrates on individual tourists and their characteristics and motives, while Chapter 4 analyses the scope and nature of the global adventure tourism market.

In Part C we turn our attention to the supply side of adventure tourism. Chapter 5 looks at destinations and views, while Chapter 6 looks at the structure of the adventure tourism industry.

Part D explores three key aspects of the management of adventure tourism. Chapter 7 concentrates on the marketing of adventure tourism, while Chapter 8 covers the crucial subject of risk management. In Chapter 9, the highly topical issue of ethics is examined.

Part E features two chapters on important and rapidly developing sectors of adventure tourism; wildlife tourism (Chapter 10) and artificial environment tourism (Chapter 11).

In Part F, the authors endeavor to look into the future and predict how adventure tourism is going to develop over time.

Part G is a very important section because it consists of real case studies, drawn from many different countries, which illustrate many of the points made in the text.

Finally, there is a detailed bibliography to help those who want to do further reading.

Despite the authors' humble request to take their efforts positively and encourage them further in serious academic pursuits, they have quite successfully produced an academic work that can benefit college students and other interested beginners. Their arguments about adventure tourism have huge potential for all daring and imaginative enthusiasts in their doings. It's aptly described how the adventure tourism sectors produce real life heroes and also notable writers. The travel writing according to the authors is "The expression of the restless soul. For a small number of people, adventure tourism or travel is an outlet for the restless spirit unable to fit in to conventional society" (46). This very aptly fits the story of Jon Krakauer's *Into Thin Air* which is a personal account of the Mt. Everest disaster. The book is a 1997 bestselling non-fiction book and it details Krakauer's experience in the 1996 Mount Everest disaster, in which eight climbers were killed and several others were stranded by a storm. Adventurers in other parts of the world have also penned their travel accounts including... "Lawrence of Arabia in the Middle East and Matisse in the South Sea Islands"

(46), for example.

The book opens up discussions on very modern and contemporary themes like '180° Adventures', 'Space tourism', 'Adventure travel writing today' , 'Adventure travel as television entertainment', and 'Personal adventures and the holiday postcard'. The book has tried to cover many interesting issues that can bemuse readers. When enthusiasts come to ponder on the sections like 'Sex tourism' or 'Hunting' we are enticed for further readings and encouraged for future self-explorations!

One of the inviting sections of the book is the case studies which contain interesting topics for college students' writing projects like 'Women backpackers', 'Disabled people and adventure travel', 'Walk on the wild side – travelling to the world's most dangerous places', 'Rock climbing', 'Backpacking across Asia' just to name a few.

However, this is not a book that is well polished, nor does it provide comprehensive coverage of the subject, and it offers very few answers. Instead, as the authors have admitted, it is in many ways "untidy and selective", and it "raises far more questions than answers". This may well be due to the authors' limitations as authors, but it also reflects the complexity of the field, its rapidly changing nature, and the very ambitious goals we set for ourselves. It is a classic case of 'work in progress', and the writers hope that this book will be a catalyst for other, more gifted, people to become interested in researching aspects of adventure tourism.

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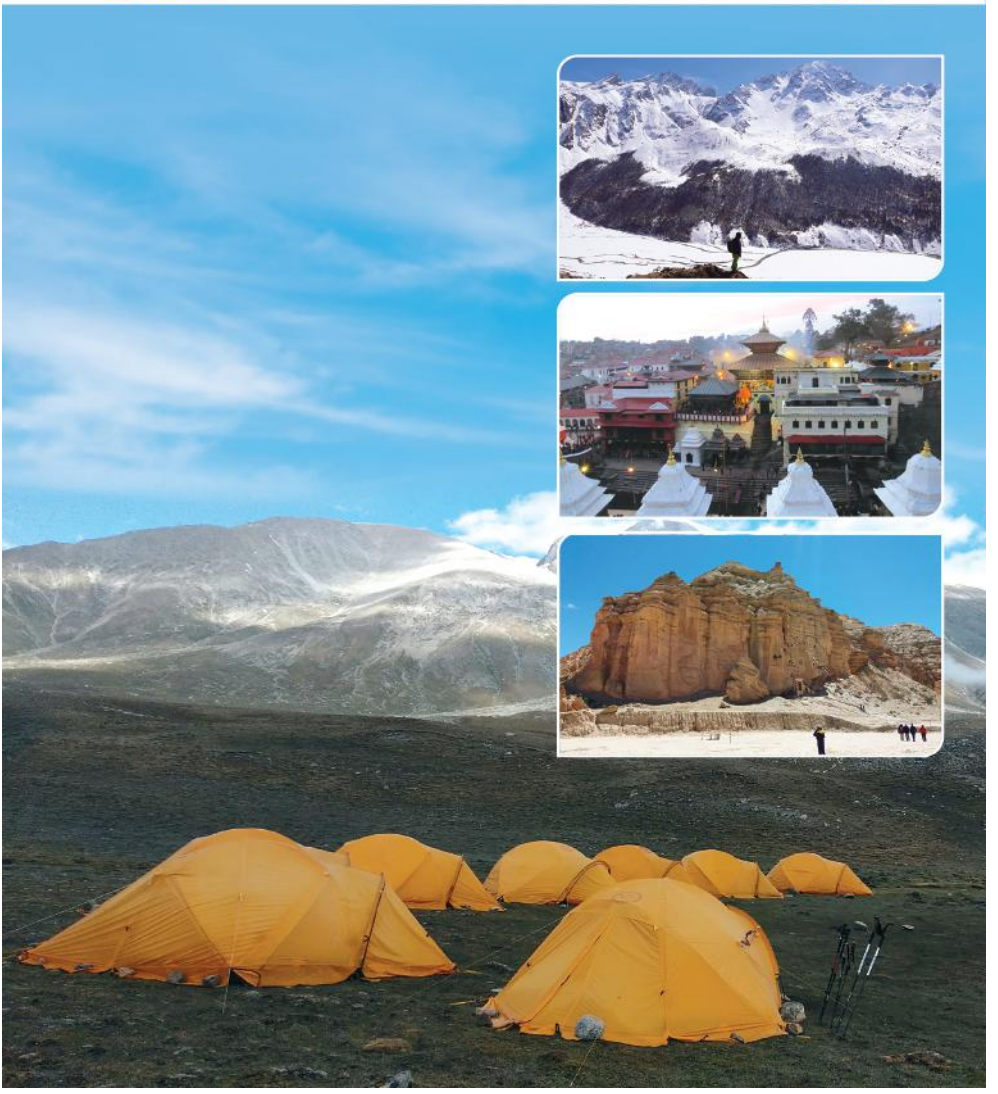

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