Ecotourism, Environmental Impacts and Sustainability in the Himalayan Settlements: Study of Sagarmatha (Mt. Everest) National Park, Nepal

Kishan Datta Bhatta[1] and Roger C.K Chan[2]

[1]School of Engineering, Far Western University, Mahendranagar, Nepal

[2]College of Professional and Continuing Education, Hong Kong Polytechnic University, Hong Kong, HKSAR

E-mail: *dbkishan76@gmail.com*

Abstract

Nepal has advocated for ecotourism as a strategy to support community development vis-a-vis environmental protection in the Protected Area settlements. In this context, considering the case of settlements along the Everest trail in the Sagarmatha (Mt. Everest) National Park, this paper aims to critically examine the environmental impacts of ecotourism, local community's perceptions towards ecotourism development and its contribution towards achieving sustainability in the region. It has adopted case study as a research strategy and used qualitative approach for detailed investigation. It adopted multiple sources of data collection such as key informants interview, household's survey, participant observation and archival research. This study concludes that current approach of tourism development and planning does not satisfy the objectives of ecotourism development. It has neither equitably benefitted local residents nor significantly reduced the use of forest resources, environmental degradation, and deterioration of cultural and built heritage. It will further continue inducing impacts on local environment, culture, and communities heading tourism and the destination towards unsustainability. A sustainable approach to ecotourism is needed that integrates local knowledge, skills and cultural values that support conservation agendas, and encourage inclusive participation of communities, stakeholders and promote sustainability.

1. Introduction:

Tourism has become a global phenomenon, and demand for leisure time and travel is increasing day by day, and will be continued in future [1]. Tourism is a key provider of jobs, a leading industry in service sector at global level, and a significant generator of foreign exchange at the national level. The travel and tourism has contributed to 10.4% of the total GDP and generated 319 million jobs (1 in 10 jobs) in 2018 [2]. Given the exponential increase in international tourists, and their potential contribution to environmental protection, foreign exchange earnings and employment opportunities; alternative approaches to tourism such as ecotourism has been extensively promoted in the developing countries to achieve sustainable development goals. Portrayed as a benign approach, ecotourism is supposed to provide economic benefits to local community, protects local environment and cultural heritage and

contributes to sustainable development of the destination [3]. Nepal has advocated for ecotourism as a strategy to support community development vis-a-vis environmental protection in Protected Area settlements [4], [5]. In this context, considering the case of settlements along the Everest trail in the Sagarmatha (Mt. Everest) National Park, this paper aims to critically examine the environmental impacts of ecotourism, local community's perceptions towards ecotourism development and its contribution towards achieving sustainability in the region.

1.1. Tourism and Environmental Impacts in the Protected Areas:

The potential impacts of tourism on the environment, and their relationship in the course of development is highlighted by several scholars. There exist possibilities of three different 'states' in tourism's relationship with environmental conservation, such as coexistence, conflict and symbiosis [6]. It is argued that as tourism expands in the PAs, it may initially have coexistence with conservation, but with passage of time, it expands resulting into an unavoidable effect on the resources upon which it is relied, and the relationship then moves towards conflicts [6]. Symbiosis, although difficult to achieve, may exist in a condition if tourism supports conservation of resources, and conversely resources provide quality experience to the tourists and also benefit to local people. The World Commission on Protected Areas (PAs) stressed that tourism in and around PAs must be designed as a vehicle for conservation of biodiversity, ecological integrity, and cultural heritage while also raising awareness of many important values of PAs including ecological, cultural, spiritual, aesthetic, recreational and economic [7]. Tourism specifically ecotourism is promoted in the PAs to establish mutually beneficial relationship between local people, park authority and tourism [8]. Along with conservation, development of local people is also inevitable to sustain tourism development and achieving the objectives of the PAs. As infrastructure development and tourism impact local communities and the environment [9,10], community participation and their perceptions and attitudes towards the impact of tourism

development remain crucial to enhancing the sustainability of tourist destinations [3, 11, 12].

From an ecological perspective, Buckley [13] argued that environmental impacts of ecotourism depend on the ecosystem as well as the activity of tourists. Different activities under various management regimes cause different impacts in different ecosystems and the ecological significance of the impacts differs greatly among ecosystems. These impacts can be classified by many different criteria such as: by the type of activity such as hiking or helitouring; by the type of ecosystem such as forest and field mark; by ecosystem component such as wildlife or water quality; or by the scale, duration and significance of impact. The type and degree of these impacts however depend on a range of factors such as: number of people, group size, activity, equipment, minimal impact skills and practices, ecosystem, season and management regime [14]. Ecotourism is often anticipated to offer motivation and incentives for pres¬ervation of natural areas [15]. More specifically, natural conservation, rational utilization of resources, maintenance against environmental degradation, improvement and protection of biodiversity, maintenance and creation of tourism infrastructure and facilities are the few examples of what ecotourism strives to achieve in coherence with needs of people particularly for the areas in which it operates [15,16,1].While on the other hand, inap¬propriately planned tourism may become environmentally disruptive [6, 17] and can undermine the concept of sustainability [15]. Scholars such as Tribe et.al. [18] and Newsome et.al. [19] highlighted that there was a range of issues related to the negative impacts of tourism such as: pollution, crowding and congestion, destruction of heritage resources, land use loss, ecosystem effects, and loss of flora and fauna. Unplanned or ill planned tourism development in the PAs is considered responsible for the problems of environmental degradation, waste generation, pollution, and loss of socio-cultural values, tradition and heritage [20, 21, 22, 4].

1.2. Ecotourism, Local Communities and Protected Areas: Issues of Sustainability:

The livelihood of indigenous communities living in or around the PAs largely depends on the resources of the PAs. These communities are

usually disadvantaged who cannot afford to be conservationist [23], and if resources are to be conserved sustainably, ecotourism must provide socio-economic benefits to them [24]. In this regard, ecotourism is theoretically conceived as a tool through which PAs can support local livelihoods by stimulating economic activities for local residents as well as enhancing conservation of resources [25]. However, to materialize these benefits, specific attention needs to be paid to empower and involve local people in the planning and policy-making process [24, 3]. This concept is essentially guided by the notion of sustainable development where the underlying rationale stems from the belief that rural communities could not afford long term conservation of resources if their daily survival is uncertain, and their participation is not ensured [1].

Considering parks and people relationship, Scheyvens [25] revealed that traditionally, many governments and conservation authorities adopted "exclusionary approach" which pushed off the local people away from parks that eventually led to increase in anti-conservation attitude among residents. In such situation, conservation of PAs will not be feasible [26], because local people may not support resource conservation unless they are ensured to benefit economically by the responsible authorities. The conservation approach that excludes local communities is, in fact, a type of "Fortress Conservation" which Scheyvens [25] argued as the "western notion of conservation" imposed on less developed countries when park and reserves were planned. The externally imposed rules and regulations limited the local people's accessibility to resources, sometimes relocated or displaced them, and created conflicts between park authorities and local people [27, 28, 29]. In many cases, it has undermined the livelihoods of local people [30], and therefore is criticized for being an ineffective, unethical, unfeasible and non-local oriented [31, 32]. While on the other hand, PAs in developing countries are facing financial shortage to manage them sustainably [33, 34]. The conventional approaches are not able to solve the real world complexity, which calls for a greater attention to local needs through 'community-based approach' to protected area planning. This approach stresses on inclusion of local communities in its planning

and management whereby ecotourism is one of its key development strategy [25, 35]. It is widely advocated as an appropriate approach to maintain mutually beneficial relationship among local people, eco-tourists and PAs. Ashley and Roe [36] noted that local people are motivated towards community-based conservation [or ecotourism development] because of the promise of jobs, new business opportunities, and skill development as well as the chance to secure greater control over natural resource management. In practice, it is essential to find possible linkage between socio-economic activities and conservation of resources, and make it visible to the local communities. Alternatively, local beneficiaries need to be empowered to face possible challenges of ecotourism as well as to receive maximum benefits from it. Failing to address community concerns in ecotourism may contribute to the destruction of environmental resources, and drive the local communities deeper into the poverty [37].

With emphasis on sustainability, Ross and Wall [38] argued that ecotourism should integrate environmental resources and local communities into a symbiotic relationship by protecting natural resources through generation of revenues, environmental education, and involvement of local people in the decision-making process and sharing of benefits. This framework seems useful as it demonstrates the function of ecotourism and emphasizes on what it wants to achieve, such as protection of natural areas, production of revenue, education, and local participation. It considers conservation of resources at one hand and development of local community on the other, whereby local control on the development and stewardship towards conservation are advocated as crucial to promote sustainability. Assuming an ideal condition, Ross and Wall [39] further suggested that sustainability could be achieved if the resources (PAs), local communities and tourists can positively contribute to others in an interdependent way. The role of organizations, policies, and planning is vital to advance such relationship. The notion of symbiosis among three key actors is similar to the notion of "win-win-win scenario" suggested by Nepal [40]. According to him [40], symbiosis would be achieved once ecotourism would be able to enhance management

capability of PAs, and conversely better tourism facilities and services are created, and local communities benefit from tourism activities and also support for conservation of PAs.

2. Methods and Data Collection:

This research employs case study as an attempt to explore ecotourism impacts on environment and its contribution towards sustainability in the Sagarmatha National Park (SNP) of Nepal. The SNP represents the most adventurous trekking trails of the world, commonly known as the Everest Trail (ET). The major settlements along the trail include Lukla, Chuarikharka, Phagding, Namche, Khumjung and Tengboche (See Fig. 1a).

It usually starts from Lukla (2860 m), the gateway to the Mt. Everest, and passes through Namche (3,440 m) the tourist hub in the Everest region, and finally to the Mt. Everest base camp (5364 m) and the peak (8848 m). As a main access to the park, the Lukla-Namche corridor is the most heavily used route [1]. There are 7000 people now live in 20 villages within SNP's 1148 km^2 and adjacent buffer zone (SNPBZ) [41]. The Sherpa people, the major ethnic group in the region (90% of the resident population) were believed to be migrated to the region from eastern Tibet in the late 1400s to early 1700s [42]. Other ethnic groups include Tamang, Magar, Rai, Chhetri, Damai, Kami, and Gurung constitute the minorities (10%) who were migrated from southern Nepal specifically for economic opportunities. In recent years, increasing number of Sherpa and non-Sherpa renters seasonally inhibited the region typically to work in tourism sector [43]

Besides farming and animal husbandry, Sherpas traditionally participated in trading activities with Tibet and lowlands of Nepal mostly as a middleman [44]. The incorporation of Tibet into China in 1951 and the subsequent closing of borders between Nepal and Tibet disrupted the centuries old trans-Himalayan trade between Tibet and Everest (Khumbu) region. It directly affected the Sherpa livelihood; some Sherpa then moved to Darjeeling in India to work in tourism industry while some moved to low land of Nepal to support their livelihood. The declining economy of Sherpa community soon started to rejuvenate with introduction of mountaineering expeditions and development of trekking tourism

in the region particularly after 1960s. Spoon [45] pointed that trekking tourism initially took a form of 'tent-to-tent' led by the Sherpa and supported by staff (mostly the Sherpa) that helped for everything from portering supplies to cooking. Tourism then gradually became a vehicle to integrate Sherpas into global market economy which, over the time, profoundly reshaped their way of life and activities.

The settlements along the Everest Trail (ET) such as Lukla, Chheplung, Ghat, Phakding, Monjo, Namche, and Tengboche were selected for empirical investigation. These settlements along the trail have been transformed from the agrarian economic base to the tourism-oriented service based economy with significant changes (impacts) in their local economy, resources and socio-cultural attributes. Ecotourism impacts on environment have been examined empirically with regard to (i) biodiversity and local environment (ii) solid waste disposal (iii) sanitation and water quality (iv) deforestation (v) tourism infrastructure and (vi) environmental education, awareness and local support for conservation. To understand local context of the study area, a primary field survey was conducted during February 2012, and for detail empirical investigation, an in-depth field survey was conducted during September to November 2012, the peak seasons for tourists in the Everest region. In addition, a weeklong site visit to Everest region was again conducted on September 2015 and 2019 to explore new development and impacts in the settlements. Due to heterogeneity of the activities the households (residents) are engaged in, a stratified random sampling was considered appropriate to explore community views on ecotourism impacts and its development process. During the selection of survey unit, stratification criteria such as location of households, type of enterprises, use of the buildings, and the households' activities were used. Considering the spatial context, households were selected from the major trail as well as from off-the major trail (branch streets in the settlement). These were selected as survey unit through systematic and stratified random sampling. The approximate distance of a peripheral household from main trail is supposed to be 500 meters (maximum). Altogether 195 households were surveyed, of

which 70.3 % (n=137) are living along major trail (most of the households in Lukla and Namche belong to this group), and 29.7% (n=58) are living off-the major trail. Majority of respondents depend on tourism either fully (74.4%) or partially (20%).
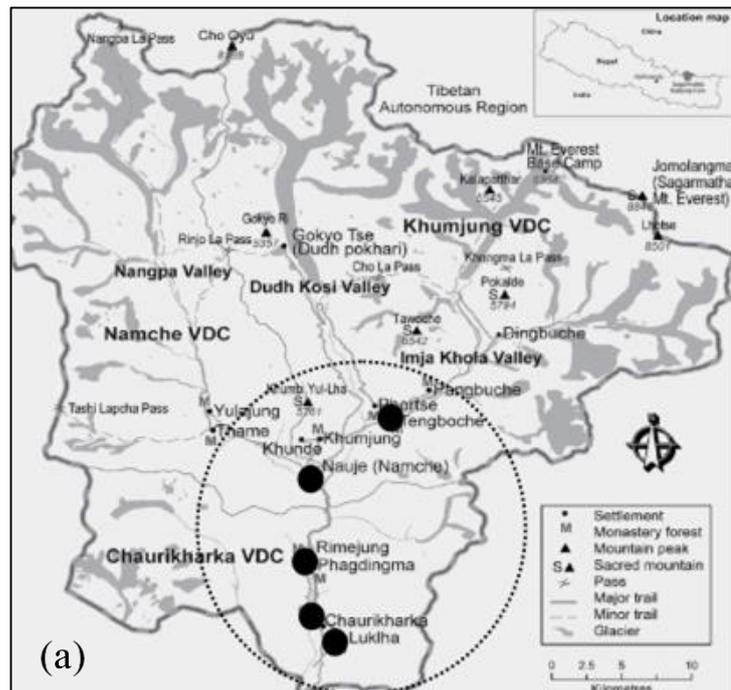

Figure 1: (a) Map showing the settlements in Sagarmatha (Mt Everest) National Park (Source: ICIMOD)

In addition to spatial location, type of use of the buildings and the engagement of households in specific activities were considered as criteria for selecting household as survey unit. Attempts were made to seek maximum responses from different group of people engaged in different types of activities. The selection of survey units (households) was conducted in a proportional manner such as sample size covers at least 20% of the total strata that helped to validate the survey process a reliable and justifiable. Multiple methods of data collection including structured questionnaire survey with households, semi-structured interview with key informants, participant observation, informal discussion, and documentation analysis was employed for empirical investigation. The set of questionnaires were designed with open and close ended questions that provided respondents an opportunity to express their opinions and suggestions. Five-Point Likert scales ranging from strongly agree (1) to strongly disagree (5) has been used to evaluate perceived impacts of ecotourism on the environment. Questionnaires were completed through face to face interview at the workplace and residence. Respondents were asked about their perceptions towards environmental impacts of ecotourism. Because of lower literacy rate, questions were frequently asked in a simplified way so that respondents could understand questionnaire clearly. In addition to resident's survey, interview with key informants (n=10) including local political leaders (n=2), tourism entrepreneurs (n=4), officials of Park authority and Buffer Zone Management Committee (n=3), and non-governmental organizations (n=2) was conducted to explore key issues of tourism development and environmental impacts in the Everest region.

3. Result and Discussion:

The unique geography, biodiversity, and local culture have made the Everest region one of the most popular destinations for trekkers, mountaineers, and ecotourists. The number of tourists to the region increased from 5836 in 1980 to 52,424 in 2019 [46]. It posses both opportunities and challenges for sustainable development. Majority of tourists stay in lodges, and their purpose of visit are primarily for

trekking, mountaineering, enjoying the scenery, viewing wildlife and Mt. Everest and exploring local culture, lifestyle and heritage. Significant numbers of local residents have been involved in tourism industry specifically nature-related tourism activities (76.9% of respondents). Local residents involve as trek guides, porters, tourism entrepreneurs, skilled trekking/mountaineering professionals, and employee of community-based organizations and INGOs. In addition to local residents, migrants have also been engaged in tourism activities. The empirical findings of environmental impacts of ecotourism in the region are discussed below through the lens of community perceptions and sustainability.

3.1. Biodiversity Conservation and Environmental Protection:

One of the key goals of ecotourism development is to foster biodiversity and environmental protection in the PAs. The park authority in the Everest region advocated ecotourism as a strategy to protect local environment and biodiversity of the region specifically through implementation of environmental protection regulations, investing tourism revenue on the conservation activities, and creating environmental awareness and education to all stakeholders including local residents and tourists [1]. Households' survey revealed that majority of resident's, although, perceived tourism as a positive force bringing environmental awareness among stakeholders, they are also conscious about its negative impacts on the environment. Nearly half of the respondents (48.7%) mentioned that environmental condition of the trail is now in 'average' condition and remaining (15.9%) mentioned as 'bad'. With regard to villages, majority (61%) acknowledged it is in good condition, while 37.9% perceived 'average' and remaining (1%) as bad. Comparatively, higher proportion of respondents in MT (68.6%) supposed environmental condition of the village as good than that of OT (43.1%). More than half of the respondents in OT (55.2%) perceived environmental condition as average; whereas it is only 30.7% in MT. Local communities essentially believe that tourism had induced severe environmental problems in the past; however in the recent years, educational awareness and management policies have reduced impacts

significantly. Most of the respondents (64.7%) agreed that natural environment is now relatively in better condition than the past.

More than half of the respondents (59.5%) agreed that local people are more educated about environmental protection and biodiversity conservation issues. Comparatively, higher proportions of respondents in MT (63.5%) were found positive with the statement than that of OT (50%). Majority (73.8%) also replied that local people are now more dedicated towards protection of environment. Respondents in MT (76.7%) were more likely to agree with this statement than that of OT (67.2%). On the contrary, the staff of the park, community organizations, I/NGOs and key informants admitted that tourism has added serious environmental problems such as increase in non-biodegradable wastes which is difficult to manage with local resources and knowledge. Like tourists, residents are also equally responsible to the degradation of environment and biodiversity. Environmental condition of the villages usually depends on how effectively the residents involve and implement environmental protection guidelines. The inadequate sanitation practices; grazing of fragile shrubs; excessive use of firewood and timber; soil erosion along the trails; and extensive non-biodegradable litter are the key environmental challenges of tourism in the region. Community surveys and local interviews indicated an overwhelmingly positive satisfaction level with tourist flows and a general desire for even more tourists. On the other hand, there is a significant increase in crowding and congestion in the trails and villages (99% of respondents). Crowding and congestion affect convenience of both tourists and locals and also induces environmental impacts. Respondents are more concerned of proper maintenance and widening of trails to make tourist flow easier and comfortable. It also suggests that local residents in the destination tend to grab tourism's economic benefits and also attempts to reduce environmental and crowding problems. Implementation of conservation policies has, to some extent, enhanced the educational awareness and conservation of bio-diversity and local environment in the region. Educational and awareness programs conducted by Park Authority; Sagarmatha Pollution Control Committee (SPCC); and I/NGOs is considered a

strong base for conservation efforts in the region, which has contributed in the reduction of deforestation and degradation of resources, and loss of wildlife in the recent years. The survey results also demonstrate that tourists are not usually harmful to wild animals; most of them advocate for preservation of mountain environment and biodiversity. However, some migrant labors posed threat and disturbance to wildlife (14.9% respondents). Local community reported occasional threats from wildlife to local people such as destruction of local crops and killing of livestock. As Buddhists, Sherpas interpret the Everest region as a sacred place [47], and their indigenous natural resource management has been a major contributing factor to conserving the region [48]. Educational awareness and campaign for environmental and biodiversity protection among local residents, employee, tourists and other stakeholders would have indeed contributed towards environmental protection [49].

3.2. Managing Solid Waste Disposal:

Tourism in the Everest region is the largest direct and indirect contributor to waste generation. Although different initiatives have been implemented to improve the condition of solid waste disposal in the Everest region; the combined impacts of more than 60000 tourists in a year and almost twice the number of supporting staff (porters & guides) along with more than 7000 local population have created serious waste management problems [50]. Survey findings revealed that majority of respondents (86.7%) perceived increase in littering along the trail and villages. The efforts of garbage management from SPCC, Park Authority, and Community organizations have contributed reducing tourism-induced pollution to some extent, however waste management is still based on the displacement of waste from one place to another [51].

It is perceived that trekking trails and tourist spots are now cleaner than the condition prior to 1990s (44.6% of respondents), when the SPCC was established. Local people generally have positive attitudes towards tourists as they believe tourists are much aware of proper disposal of garbage. They (92.9%) agreed with the statement "tourists are more likely to follow pollution reduction rules

and codes of conduct". During an interview, one of the key informants also commented that:

"Most of the tourists are well disciplined and aware of proper disposal of garbage they produce. They generally do not throw rubbish along the trails or streams, rather put on the proper container or carry with them to dispose properly at right place. Some of them also involve in garbage management campaigns in the settlements, which have made local residents, porters and members of expeditions aware of environmental protection and proper garbage disposal. Compared with pre-1990s period, when the trails and settlements in the Everest were dirtier and facing severe environmental problems; there has now been significant improvement in the environmental condition specifically because of the environmental education and awareness activities conducted to manage waste properly".

The staff of local organizations (SPCC & Youth Clubs) acknowledged that tourism not only has improved livelihoods of local residents; but also induced several environmental challenges that are not yet completely solved by local efforts. Although, garbage collection containers (119 bins) have been placed along the trails by the SPCC; some of its methods for disposal is still traditional as pits are generally used to burn and bury the garbage. Garbage disposal regulations have not been yet strictly implemented resulting to several environmental challenges. Most of non-biodegradable wastes collected from lodges, hotels, mountaineering expeditions and local households are usually dumped in open place. Waste management was identified as a strong negative impact in all community and individual surveys, and respondents strongly emphasized the need for a more comprehensive waste management solution [1, 52].

Certainly, concentration of visitors in the Everest has contributed to alarming levels of garbage pollution despite several efforts from government and I/NGOs to clean up the Everest region. During 1980s and 1990s, several appalling labels such as the 'world's highest junkyards'; 'the garbage trail', and 'the vanishing Shangri-la' were given to the Everest. It received international media attention including The Economist and Time magazines, which

compelled to initiate several Everest clean-up campaigns and expeditions. In 2019, about 11 tons of garbage and 4 dead bodies were collected from Mt. Everest through the 'Mt. Everest Cleanup Campaign" [49]. Nepal [54] mentioned that an average trekking group of 15 generates 15 kg of non-biodegradable and non-burnable garbage in 10 trekking days. The Everest Base Camp Site and Namche and its surrounding areas have the highest concentration of garbage with over 12 tons per kilometer followed by Lukla-Jorsalle route with 4 tons per kilometer [54]. Generation of garbage is usually correlated with number of visitors and population of the area. About 251 tons of garbage was collected in FY 2018/19 from Namche, Lukla and surrounding trails [49]. Byers et.al. [50] highlighted that more than 1000 tons of solid waste is now generated in the park and buffer zone each tourist year, with nearly all of it ending up landfills. Lodges, restaurants, bakeries, tea shops and grocery shops are established in almost every settlement which produces tons of waste. Sagarmatha Next [55] mentioned that the composition of waste in Khumbu region is 40% organic waste, 22% paper, 14% plastic, 8% PET bottles, 5% metal, 5% glass, 4% textiles, such as tents, and 2% aluminium. Organic waste is fed to cattle or composted for the fields, but plastics, glass, and metals are collected but need more effective separation, handling, and treatment. A study on Solid Waste Management [56] revealed that the waste composition in the garbage bins consisted of 26% plastics, 6% rubber, 11% aluminum, 5% paper,41% heavy and light iron, and 5% textile. During the trekking season, about 790 kg of waste is left each day in the Khumbu Valley [55] of which non-degradable categories are often burnt in dumping pits during low tourist seasons or disposed in open areas [55, 53]. This contributes significantly to local and regional air pollution and poses a significant hazard to human and animal health [50, 57]. Additionally, black carbon soot emitted from burn-pits and fuelwood contributes directly to increased glacial melt [58]. There is currently no comprehensive system to collect and dispose of hospital waste or other toxic substances [59]. Electronic waste such as batteries, computer parts, and old household appliances is increasingly found in the landfills, as is medical waste in the vicinity of health clinics

[60,56, 61]. Open and unsightly landfills in the vicinity of villages along the main trekking routes are creating serious public health and environmental concerns, primarily because of their routine burning, resultant release of toxic chemicals, and contamination of groundwater supplies [50].

Table 1: The garbage generated by expedition groups at Everest, Lhotse, Nuptse, Amadablam, and other mountains (FY 2016/2017 and 2017/2018) [53].

Waste components	Amount of waste generated	
	FY-2016/2017	FY-2017/2018
Burnable garbage	17703 kg	25599 kg
Human waste	4716 kg	12995 kg
Kitchen waste	3595 kg	4010 kg
EPI gas (stoves)	1728 pcs	1735 pcs
Batteries	1513 pcs	2179 pcs
Tin	1263 kg	2537 kg
Glass bottle	668 kg	763 kg

The park management has introduced a number of rules to ban glass beer bottles and plastic bags; however, they are found in commonplaces. The SPCC has been engaged in regular collection of garbage from expeditions and hotels, lodges, and households; however it alone cannot solve the complex problems of waste management. With the implementation of new policy in 1992 that requires all mountaineering team climbing Everest to deposit US$ 4000 or equivalent in convertible currencies as a guarantee of proper environmental practices has although reduced garbage accumulation in the Mount Everest [62], the uncontrolled and unplanned growth of tourism has still posed environmental threats to the Everest region. Regardless of waste reduction strategies and continuous efforts of SPCC, limited numbers of containers are placed along the trail and in the settlements. In addition, there were 75 unhealthy and active open landfill pits within the SNPBZ [50]. Local residents also complained that negligence of migrant porters and tour guides are relatively less educated and less conscious about environmental issues, and are the most responsible for littering problem. Along with growth of tourism, consumption of canned foods and use of mineral water bottles, rubber goods, and plastics increased significantly accelerating the generation of non-biodegradable

waste. While the green campaigns, such as use of paper bags instead of plastics, have been conducted in the region by different organizations; these efforts seem as piece meal approach. Implementation of integrated ecotourism policy is crucial to manage solid waste, protect local environment and promote sustainability.

3.3. Improving Sanitation and Water Quality:

While local residents normally do not agree that tourism has affected water quality and sanitation along the Everest Trail; interview with key informants both at local and central level however revealed tourism's negative impacts on sanitation and water quality. Most dump sites are located close to rivers that are prone to regular flooding during monsoon, thereby directly contaminating river water [63]. In the past, toilets were not usually constructed in the region and human excreta polluted water source such as rivers and lakes along the trails. Sheedy [1995, as cited in 54] reported that 83% of visitors to the park were concerned with its sanitation problem. Streams were contaminated with plastic bottles, bags, chocolate wrappings, and papers. In addition, some of the lodge owners also complained that human excreta transported from high altitude camps is being buried to open field or adjacent to streams and lakes every year. In the recent years, construction of toilets is increased along the major trail, however some of them are with open pit system dug with shallow hole and located near to streams contribution to water and environmental pollution. Sewer lines are also not constructed in the region; use of septic tanks would possibly contaminate the water. Along with the widespread problem of leaking septic tanks from lodges [50], landfill seepage has been also linked to an increase in the incidence of gastrointestinal diseases among tourists and local people [64,65]. A staff at Park authority commented that "problem of water contamination and environmental pollution is widespread in the base camp areas, the staff of trekking and mountaineering groups and sometimes tourists do not use toilets of their tent pitch". The improper treatment of garbage along the trails and villages also polluted streams and ground water. In this regard, although residents do not generally agree that tourism has increased sanitation problems in the Everest region; problems are still prevalent in the villages, campsites and along the trail, which need to be addressed to improve environmental condition.

3.4. Reducing Deforestation:

In addition to solid waste disposal, deforestation was reported as one of the major tourism -induced environmental challenges in the region. The extensive deforestation in the region specifically after 1960s was believed as a result of uncontrolled cutting of trees to supply firewood for the lodges and hotels to cater increasing numbers of tourists, for campfires of mountaineering expeditions and trekking groups, and for local fuel wood and timber needs. Deforestation received heightened attention during 1970s and 1980s when tourism growth took place exponentially in the Everest. Although deforestation was initially thought as a result of tourism growth; some scholars argued that the accounts of extensive deforestation in the post 1960s had been greatly exaggerated as the tourism impacts on vegetation were much more localized and small scale than were assumed [66]. Certainly, tourism was thought as an instigator of deforestation although in a varying scale, which significantly influenced early national park policies including strict forest use regulations such as banning of fuel wood by trekking and mountaineering expeditions in 1979, and the introduction of alternative source of energy such as use of hydroelectric and solar power in lodges and hotels.

The influx of tourists accompanied by several guides and porters has induced significant pressure on forest resources because most of the lodges and hotels depend largely on firewood as the main source of fuel. Nepal [54] reported that there was a threefold increase in fuel wood consumption during 1976 to 1988. The number of visitors reached at least 10 to 12 times the local population that required higher consumption of energy than that of local needs. Significant numbers of lodges and hotels are still using fuel wood for cooking and heating purpose. Rapid increase in the construction of building such as lodges, hotels, and tea houses in the park have also escalated the demand of timber. There are now over 450 lodges in the park . In average, each

lodge used 43 kg of firewood per day [54]. Comparatively, lodges along Lukla-Namche section of the trail used highest amount of firewood (54.6 kg/day) by each lodge followed by the lodges in Namche and its vicinity (49.3 kg/day) [54,1]. Sun and Watanabe [46] surveyed 318 lodges, of which 63 (19.8%) lodges had plans for expansion which further leads to consumption of timber. The settlement of Namche and Lukla share almost 33 % of the daily fuel wood consumption in the region [1]. It is because higher numbers of residents are involved in the lodges, hotels, and restaurants, and tourist's concentration is also higher in the settlements, which require higher consumption of energy per day. One of the key informants stressed that trekking and expedition groups consume three to four times more energy than independent groups. The PA authority, although, restricted the use of fuel wood by the organized trekkers and expeditions; it does not apply to local lodges, hotels, teashops, and porters whose consumption is not usually monitored. Over the years, despite conservation regulations and educational awareness, deforestation is still continued whereby tourism is one of the key reasons.

Acknowledging rapid degradation of local resources including forests, several alternative energy programs such as use of solar power, hydroelectricity, kerosene, and energy efficient instruments were introduced in the region through various I/NGOs in cooperation with Park authority and local communities. Local communities are provided educational awareness for environmental protection and biodiversity conservation. Sherpas have also developed strong conservation values, institutions, and communal practices that contributed towards wise use of forest resources. Conservation efforts have reduced use of fuel wood to certain extent; however its full substitution is unlikely to happen with increasing tourism growth. Majority of respondents (65.1%) also agreed that "use of firewood has been increased due to tourism development". Comparatively, higher proportion of respondents in MT (69.3%) agreed with the proliferation of use of fuel wood than that of OT (55.2%). With regard to the use of alternative energy sources, almost all respondents in ET (99.5%) acknowledged that there has been significant increase in the use of alternative energy technologies. The operation of Thame-Namche hydro electricity project (620 Kw) provides electricity to 660 customers in the 14 villages of the region [54]. Other micro-hydro plants have been operated in Tengboche, Monjo and Lukla area. Some lodges and teashops use animal dung as a source of energy while others use kerosene and liquefied petroleum gas (LPG). The daily consumption of kerosene per lodge was highest in Namche and its vicinity while the number of solar panels per lodge is comparatively higher in Lukla-Namche section of trail followed by Namche and its vicinity [54]. Entrepreneurs now use energy saving appliances such as low wattage cookers, solar water heaters, and back boilers instead of fuel wood. Increase in income has made many entrepreneurs able to use alternative energy sources. Certainly, significant progress in the use of energy specifically from forest-based sources to the hydroelectricity and solar power has been achieved in the region.

On the whole, although use of alternative source of energy has increased; local lodges and hotels still use firewood as their main source of energy. Fuel wood is still the cheapest form of energy in the region. Residents, largely from peripheral region, also involve in collection and selling of firewood to tourism entrepreneurs specifically to support their livelihoods. Forested areas outside the park are also increasingly under pressure to meet growing demands of firewood and timber. Tensions between locals and Park administration exist occasionally particularly because of the strict regulations for using forest resources which once were managed by locals. It makes residents sometimes passive towards forest conservation. These issues further pose serious challenges for conservation of biodiversity, forest resources and local environment.

3.5. Promoting Eco-friendly Tourism Infrastructure:

Planning of ecotourism requires development of basic tourism infrastructure to satisfy tourist's need and support local livelihoods without adversely impacting on the environment. In the Everest region, significant development of tourism infrastructure such as hotels, lodges, trekking trails, airstrips, museum, information

center, and other tourist facilities are constructed since 1960s. Survey findings revealed majority of respondents in the region (overall 64.6%; MT 56.9% and OT 82.7%) perceived that physical condition of the trekking trails, viewing spots, and tourism infrastructure has improved significantly because of tourism development. Tourism infrastructure is developed exponentially in comparison to pre-1980s; although poor maintenance and repair, and excessive flow of tourists and livestock during the peak seasons have damaged the trails and bridges in several places. Excessive soil erosion along the trail is also reported as a problem in the region.

About 44.6% respondents perceived that trekking trails and tourist spots are now cleaner than pre-1990s (establishment of SPCC). Additionally, while asked about eco-friendliness of infrastructure, only small proportion of respondents (4.6%) has positive response. The lodges, hotels, and residential buildings are constructed with multi-storey floors with large glass window, colored asbestos roofing, and reinforced cement concrete (RCC) technology which are not eco-friendly in the region. One of the BZMC staff and lodge owner commented that:

"*Tourism has significantly transformed the built environment of settlements along the trail, where several new buildings have been constructed recently for the purpose of providing services to tourists. These new types of buildings, for example, hotels, lodges, and commercial and residential buildings do not seem to be climate responsive like the traditional Sherpa houses which are relatively warmer. The new buildings are although spacious; they neither reflect the traditional architectural style of Sherpa house nor designed in an energy efficient way. With their large glass windows, asbestos roofing, and spacious rooms, these buildings are comparatively colder and consume higher amount energy for heating the rooms. In addition, as most of the building materials are imported from outside the region; construction of buildings is too costly. So, the tourism infrastructure does not seem to be eco-friendly*"

Park authority often stresses on protection of biodiversity and environment; however strict guidelines for the construction of eco-friendly buildings and infrastructures have not been yet implemented. Haphazard growth of infrastructures has exacerbated deforestation, soil erosion, and environmental degradation in the region.

3.6. Enhancing Environmental Education, Awareness and Local Support for Conservation:

As most of the environmental problems in the region are induced by rapid development of tourism; awareness campaigns operated in the region aim to disseminate information about practice of ecotourism and protection of environment and biodiversity. It has helped change community perceptions and motivated them for active involvement in biodiversity and environmental conservation activities [1]. Survey results also supported this argument; about 59.5% respondents in Everest Trail (63.5% in MT; and 50% in OT) believed that local people are now more educated and aware of the significance of local environment and biodiversity. Majority of respondents (84.6%) agreed that local people are more likely to follow environmental protection regulations. It means environmental campaigns and programs have become instrumental to enhance awareness among local people about ecotourism and local resources. Residents however admitted that porters and trek guides, the migrant labors, do not care of proper disposal of garbage and environmental protection.

With regard to built environment, residents seem less aware of tourism impacts on built environment. Nearly one third of respondents were unsure (33.8%), and similar disagreed (33.9%) that condition of built environment is now in better condition. In addition, survey results revealed that only 30.2% respondents agreed with the statement "local people care more about protecting built environment"; one third (33.8%) were unsure and rest (35.9%) fully disagreed. Tour companies and service providers are not regulated through accreditation and certification programs, which made them less responsible towards promoting sustainable ecotourism practices. About half of the

respondents (50.8%) fully supported this statement, while 47.7% did not know about it. Although environmental awareness of local residents is believed to be increasing; only 28.2% respondents agreed that residents are proactively engaged to enforce biodiversity conservation policies and regulations, whereas 30.8% disagreed and rest (41%) were unsure. Interview with Park authority also revealed that illegal use of forest resources and killing of wild animals is sometimes reported. In this regard, although there is significant increase in the positive environmental changes in the recent years; significant proportion of respondents in Everest trail (45.6%) yet perceived that tourism development within current management system would destroy the destination resources in the future. Emphasis needs to be given towards planning, policies and extensive educational awareness programs to contribute in the promotion of ecotourism and sustainable development.

3.7. Summary of Perceived Environmental Impacts of Tourism:

Tourism, although, considered as a driving force to introduce alternative energy sources in the region, it has been criticized for bringing environmental problems and challenges. Deforestation, increase in littering and non-biodegradable waste, and poor sanitation are still prevalent in the region, though in a smaller scale than the past. Haphazard construction of hotels; lack of environmental awareness among stakeholders such as porters and trek guides; and lukewarm environmental protection policies and initiatives has contributed in environmental degradation. Local ecological knowledge, skills, and attitudes of residents towards tourism and environmental protection affect the sustainability of tourism and community development; exploring community perceptions and attitudes is thus indispensable to explore whether the current practice of tourism is contributing towards sustainability. With regard to stakeholder's care and awareness towards environmental and biodiversity conservation; survey findings revealed that local residents perceived different stakeholders differently.

Most of the respondents perceived that tourists, local residents, local tourism entrepreneurs (owners of hotel, lodge and restaurant), Park authority, and I/NGOs usually take care of environmental and biodiversity protection but with varying degree such as from 'caring a lot' to 'caring a little'. Of the total respondents, overall 63.1% perceived that tourists 'care a lot' for environmental protection, while rest (36.9%) perceived they 'care a little'. Similarly, 13.8% believed that local residents 'care a lot' while majority (85.1%) believed they 'care a little'. With regard to tourism entrepreneurs, 14.4% respondents perceived that entrepreneurs 'care a lot' for environmental and biodiversity protection, while 84.6% perceived they 'care a little'. Similarly, majority of respondents appeared to be positive towards Park authority for its care towards environmental and biodiversity conservation (65.6% rated 'care a lot' & 33.8% rated 'care a little'). The role of SPCC and international organization in the protection of environment was perceived positively by the residents. Majority of respondents in the ET (68.2%) believed that I/NGOs 'care a lot' for environmental protection, while 31.3% respondents believed they 'care a little'. Conversely, majority of respondents in the region perceived porters, trek guides, and operators negatively for their care towards environmental protection. Interview with key informants also revealed similar findings. Overall, slightly more than one third of respondents in the Everest (34.9%) perceived trek guides and operators indifferent towards environmental issues, whereas 29.2% replied that they 'don't care' at all. About 35.9% believed they 'care a little'. With regard to porters, majority perceived them negatively such as, 57.9% believed that porters don't care about environmental protection, while 24.1% perceived them indifferent. Nevertheless, lack of environmental education, awareness and trainings to the porters, tour guides, and operators is one of the key factors for their carelessness towards proper garbage disposal, and biodiversity conservation.

3.8. Measures for Reducing Environmental Degradation:

It seems that the settlements in the Everest region have been facing irreversible environmental

degradation. Immediate actions and measures needs to be implemented to foster environmental protection. A holistic approach to settlement planning with specific focus on participatory and collaborative tourism development should be adopted. The tourism plans and policies should encourage all the stakeholders' including porters and guides to engage in environmental protection activities. In addition, education and awareness programs about biodiversity conservation and environmental protection need to be provided to stakeholders including local people and tourism employees. Specific attention must be given to 3R (Reuse, Reduce and Recycle) principles of solid waste management, along with implementation of use of alternative energy appliances in the region. Tourism entrepreneurs should also be provided skill development trainings specifically to make them able to operate their business with good hospitality. A sustainable approach to ecotourism is essential that integrates local knowledge, skills and cultural values, especially those that support SNP conservation agendas, and encourage inclusive participation of communities and stakeholders and promote sustainability.

4. Conclusion:

Tourism has brought major economic changes to the Mount Everest region, leading to prosperity for local people, but also inducing impacts on resource management and increasing pressures on high-latitude resources and environment. From the study, it is arguably concluded that current approach of tourism development and planning does not satisfy the objectives of ecotourism development. It has neither equitably benefitted local residents nor significantly reduced the use of forest resources, environmental degradation, and deterioration of cultural and built heritage. Although there has been a significant increase in the use of alternative energy sources; use of firewood is still dominant in the region. The problems of poor sanitation, pollution, crowding, soil erosion, littering, and non-biodegradable wastes are prevalent in the region. Despite its contribution towards community livelihoods and economy; tourism has yet induced severe impacts on the environment, culture and biodiversity of the region. The extent of these impacts is different

with difference in the location of households; their level of interaction and exposure with tourists; their knowledge, skills, education and awareness about ecotourism, entrepreneurism and hospitality; their financial resources and the capacity and power to involve and influence the participation and collaboration process. Lack of capacity, knowledge and leadership skills of local residents (porters, farmers and non entrepreneurs) have also largely hindered their benefits from tourism development because they could not effectively participate and influence decision-making process as well as collaborative efforts. Acknowledging these problems and challenges, it is concluded that current approach of tourism development continues inducing impacts on local environment, culture, and communities heading tourism and the destination towards unsustainability. A sustainable approach to ecotourism is essential that integrates local knowledge, skills and cultural values, especially those that support SNP conservation agendas, and encourage inclusive participation of communities, stakeholders and promote sustainability.

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